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ENERGY AND CLIMATE POLICIES –

"WHOLE LOTTA SHAKING" GOING ON!

HONORABLE READERS,

I am pleased to introduce you to this year's edition of the ENERGY AND CLIMATE DIPLOMACY JOURNAL, issued by the Bulgarian Diplomatic Institute to the Minister of Foreign Affairs! Let me underline how grateful I am to the Institute for its active work and devotion throughout the years, continuing to focus on the energy and climate topics, via different formats incl. with the current publication!

Few words on the background

In this context, please, note that the current edition is framed along the topic ***"The EU Energy and Climate Policies – Trends or Needs for a Change in the European Perspective".*** Thus, the articles you will find in it, address issues, linked to steps both at European and national level as to overcome concrete and general energy challenges – and the latter, although changing their nature, are abundant!

In line with the established tradition via the previous editions, a whole set of topics and views are presented by the authors of the relevant articles. The approach indicates that in certain cases the readers can note inter alia different – and sometimes even contradictory – views on same issues; thus, they are most welcome to make their own judgements. Nonetheless, I want to thank all authors for their professionalism– regardless whether me or you share the relevant positions they have expressed partially or as a whole.

In general terms, this year we all are noting ongoing changes, which jump well beyond average predictions – and I think the name of the famous song from the 50s "Whole lotta shakin' goin' on" seems most appropriate to give sense of what people throughout the world witness. The mix between politics and policies is stronger than ever – and the energy and climate spheres make no exception. Thus, both the challenges and the changes have substantial background mostly in their international dimension – and, as it seems, the European, the regional and national aspects rather follow them.

Therefore, what I think wraps up all these aspects, is increased dose of uncertainty, which we all have to both face and find a way to overcome.

On this ground, I would like to once again express my gratitude to our authors - in my view they have reflected their professional understanding on both the status quo and the trends concerning the further developments.

And some points on the substance

In fact, what makes the edition exciting is that you will find articles, united by this political and policy dynamism, but on the ground of the expert views. Certainly, along the commonalities, they have different focus, related inter alia to energy and climate topics, dealing with them in the context of:

- Geopolitical and geostrategic views within an internationally valid frame;

- The fact finding and the conceptual developments in the EU policy frame, incl. EU climate ambitions and industrial realities, the EU energy transition etc.;

- Concrete aspects of international relations, involving the EU, within a broad geographical scope – from Latin America to China, the whole of Europe, the Black Sea Region etc.;

- Sectoral analyses, concerning coal, nuclear, renewables, electricity and gas;

- Concrete policy aspects – competitiveness, compensations and prices in electricity; regulatory aspects; economic security and energy market liberalism;

- The role of science in the context of the policy changes etc.

Without any doubt, all these aspects are equally important – in fact, I think they are definitely interlinked! And this connection is immediately evident in any of the articles, regardless the concrete topic. In practical terms, this fits quite well within the different educational background and the area of authors' professional activities – being they politicians, diplomats, scientists, researchers, representatives of the business etc.

Certainly, the edition only profits from this variety of views.

To wrap it up – any view matters

As already indicated, the major focus of the edition is on the EU energy and climate policies. In this relation, one should note that both the recent developments with worldwide effect (e.g. having President Trump in office and his first economic steps, the quick move of BRICS forward etc.) and analyses (like the Draghi Report etc.) clearly indicate substantial need for reconsideration of the EU policies as soon as possible. However, people and authorities should recall that the EU provides the frame, while the concrete implementation responsibilities are due at national level. Thus, the questions for the readiness to make these responsibilities happen in real life only multiply, but in parallel require speedy answers – neither the business, nor the technological boom will wait; not to mention the peoples as a whole.

Therefore, any opinion matters – and the reactions of you, the readers, are certainly not less important than the expert views of the authors. In fact, I think it would be great if – after reading the edition – you are provoked to express respectively your opinions– even if you strongly disagree with what has been presented to your attention.

And I myself am looking forward to such reaction!

Slavtcho Neykov
Editor-in-Chief
Member of the National Consultative Council
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EUROPE BETWEEN CLIMATE AMBITIONS AND INDUSTRIAL REALITIES: GEOPOLITICAL CHALLENGES AND OPPORTUNITIES

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1. Introduction

Since the 1990s the European Union has gone through a profound transformation in its approach to industrial, climate, and energy policy. From the liberalisation of energy markets and the push for renewables in the early 2000s to the ambitious European Green Deal of 2019, the EU has continuously reshaped its policy landscape in response to economic, environmental, and geopolitical challenges. Now, the latest proposal for a Clean Industrial Deal[1], is the natural continuation of this evolution– a decisive step towards strengthening Europe's industrial base while maintaining its climate commitments.

The Clean Industrial Deal is the EU's recognition that a strong industrial sector and ambitious climate policies are not mutually exclusive but must reinforce each other. The initiative builds on the foundations laid by the Green Deal, ensuring that the transition to climate neutrality avoids deindustrialisation and safeguards economic growth. It is the most practical implementation to date of the motto presented as an underlying premise of the Green Deal - "No one left behind". After the results of the last European election in June 2024, the EU leaders had to quickly understand that in some areas they have strained the cohesion of our societies significantly. That is why instead of "green", the new buzzword in the Brussels for this legislative term became "competitiveness". During my work as shadow rapporteur on the Net-Zero Industry Act[2], I managed to ensure that the Member States have all the tools at their disposal to invest in a strong and socially responsible reindustrialisation. I defended the position that only long-term investments in future-proofed industries can create stable, better paying and quality jobs in the long term. The Clean Industrial Deal is the continuation of what was started last mandate and seeks to stimulate the manufacturing processes in our continent. The idea is to build European capacity for production of key components and entire value chains for renewable energy, nuclear power, carbon capture storage and utilisation, or hydrogen in order to secure Europe's energy future. Only through this can the energy bills for households and businesses be lowered, while rebuilding a competitive industrial base in the EU.

A look back at history reveals why this evolution is necessary. In the 1990s' the EU was transforming itself slowly but surely into the complex and interconnected

[1] https://commission.europa.eu/document/download/9db1c5c8-9e82-467b-ab6a-905feeb4b6b0_en?filename=Communication%20-%20Clean%20Industrial%20Deal_en.pdf
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52023PC0161

supranational and intergovernmental organisation observed today. Its focus was on climate targets and following up the commitments of the newly signed Kyoto Protocol. The main policies were targeting climate commitments by pursuing reduction of greenhouse gas emissions (GHG) and setting targets to promote the adoption of renewable energy sources. During that time industrial and energy policies were also shaped by the liberalisation of markets, with the goal of fostering competition and reducing state intervention. While this approach led to efficiency gains, it also exposed vulnerabilities, particularly in energy security and strategic industries. In the 2000s and 2010s, climate change emerged as the dominant driver of policy, culminating in the 2019 launch of the European Green Deal. This landmark initiative set Europe on a path to net-zero emissions by 2050, but it also introduced stringent regulations and ambitious targets. Without complementary industrial policies there is a concrete risk of putting European industries at a competitive disadvantage.

The urgency of securing Europe's industrial future has been underscored by the economic fallout of the COVID-19 pandemic, global supply chain disruptions, and the energy crisis triggered by the war in Ukraine. All of these events showcased Europe's dependence on external energy sources and foreign-manufactured industrial components. They made it clear that without a robust industrial strategy, the continent would struggle to maintain its economic sovereignty. The Clean Industrial Deal is the EU's latest response to this new reality. It acknowledges that Europe cannot afford to rely solely on one pathway to climate neutrality but must instead adopt and implement diverse range of energy solutions to ensure energy security and price affordability in order to rebuild the European economy. In the current context the Green Dean and the Clean Industrial Deal can also be perceived as two consecutive steps in a well-created economic model aimed to achieve sustainability and competitiveness.

This policy also comes at a time of intensifying global competition. The previous administration of President Biden introduced the Inflation Reduction Act in the United States - a massive program of tax benefits and subsidies designed to attract energy investments to the US. China also continues to dominate key industrial supply chains, from batteries to solar panels. If the EU wants to remain an economic powerhouse, it must ensure that its industries are supported by all means necessary, so they can become competitive at the ever more fragmented global market. This means supporting innovation, scaling up production, and providing clear incentives for companies to invest and retain their factories in Europe.

It is important to note that EU companies were the front runners for the development of renewable technologies in the 1990s. However, China chose to invest strategically in those technologies and deployed massive government subsidies to reach industrial overproduction. This is the main reason why photovoltaic panels are now experiencing a 90% reduction of their price, compared to the one 15 years ago. In the early 2010s' the EU launched several trade disputes with China which were later on settled but the end result is that almost all solar panels that are used in the EU today are

manufactured in China. One of the main economic benefits, which is expected from the Net-Zero Industry Act and the newly presented Clean Industrial Deal, is to bring the manufacturing of the new energy technologies and many more innovative projects back to Europe.

This is precisely why the Clean Industrial Deal is not about abandoning climate goals but about making them economically viable. A successful green transition must be one that creates jobs, drives investment, and leads to lower costs for consumers and businesses. This requires a pragmatic approach that includes renewables alongside nuclear energy, energy efficiency measures alongside hydrogen and carbon capture, and a regulatory framework that encourages private-sector investment rather than driving it away.

Bringing the industry back to Europe while ensuring affordable and predictable energy prices is not just an economic necessity but also a political imperative. Without competitive manufacturing and secure energy supplies, the EU risks social unrest and political instability. If climate policies are perceived as driving up costs and pushing jobs overseas, public support for the green transition could erode. The Clean Industrial Deal is an opportunity to align economic, industrial, and climate objectives, ensuring that Europe remains competitive while leading the global fight against climate change.

The EU has spent the past three decades shaping its industrial, climate, and energy policies in response to evolving challenges. Now, it must ensure that these policies work together rather than at odds with one another. The Clean Industrial Deal represents the next logical step in this journey–a policy framework that embraces all available technologies to reindustrialize Europe and secure its energy future. The success of this initiative will depend on the EU's ability to implement it pragmatically, striking a balance between ambition and economic realities. If done right, it will reinforce Europe's global leadership, secure prosperity for its citizens, and demonstrate that the transition to climate neutrality can be both an environmental and economic success.

All of those geopolitical tensions and policy paradigms might sound far-fetched and disconnected from the everyday life, but this could not be further away from the truth. They have a direct effect on countries like Bulgaria. Even though Bulgaria experienced some economic difficulties during the 2009 financial crisis, it did not face any challenges related to our financial system. This allowed us to go rather smoothly through the big turbulence that took the EU in the period 2009-2011, where new institutions for financial supervision were created. This time however, the "green transition" had a direct impact on us - on our mining sector, on our coal power plants and the professionals who keep on providing the basis of our energy security. This is the first time where a big EU transformation is having a direct impact on the livelihood of a big number of Bulgarian citizens and leads to a clear split in the public opinion.

The goal of this article is to provide an in-depth review of the key issues related to the EU's green ambitions, industrial challenges, and the geopolitical

dimensions of its pursuit of a creating a cleaner industrial base. Particular attention will be given to Bulgaria's crucial role in this process and its strategic advantages. This article will examine not only the difficulties but also the opportunities ahead and how Bulgaria can benefit from the processes if it strategically determines its national strengths and interests.

2. EU Climate and Energy Policy–Between Ambition and Reality

2.1 The Green Deal–Foundations and Strategy

The European Green Deal, unveiled in December 2019, was a package of legislative measures and a continuation of the climate and energy policies that aimed at supporting the uptake and investments in renewable energy sources in the EU. It was following in the footsteps of the Renewable Energy Directive, which set the targets, and the financial subsidies that set the ground for the installation of renewable energy sources (RES) across all EU Member States in the early 2010s'. It is the EU's most ambitious policy initiative to date which tried to address climate change and transform the economic model and the energy generation. It is a comprehensive strategy aimed at achieving climate neutrality by 2050 while fostering economic growth, social equity, and energy security. In order to achieve this an intermediate target was set to reduce emissions by at least 55% by 2030 compared to 1990 levels. However, while the Green Deal set the EU on an unprecedented path toward sustainability, it also presented significant contradictions and challenges. The goal of rapidly reducing greenhouse gas emissions (GHG) came with the downside of affecting industrial competitiveness, energy affordability, and exacerbating regional disparities.

The logic behind the Green Deal was easy to understand - create a win-win situation. By fostering technological innovation in renewable energy, battery storage, hydrogen, and sustainable industry the EU wanted to create new competitive advantages for its companies. As a signatory and the main driving force behind the Paris Agreement, the EU was committed to taking a leading role in global climate governance and diplomacy. The logic was that in an era increasingly defined by environmental regulations and carbon-conscious consumer behaviour, EU companies could carve a significant market share in the renewable technologies. This would have resulted in reduced reliance on imported fossil fuels and would have strengthened European energy security and strategic autonomy.

A set of both legislative and non-legislative measures were put in place to achieve this vision. A core component of the European Green Deal was the decarbonisation of the energy sector, which involved a fundamental shift from fossil fuels to renewable energy sources such as wind, solar, hydro and hydrogen. This transition was planned to be supported by extensive energy efficiency measures and the electrification of heavy industries. The idea was to reduce dependence on high-emission energy sources while fostering technological innovation.

In parallel, the Green Deal promoted the development of a sustainable industry and circular economy, moving away from traditional linear

production models toward resource-efficient and waste-reducing practices. By prioritising sustainability, the EU aimed to minimise environmental impact while maintaining industrial competitiveness.

To finance this transformation, the strategy included a significant emphasis on green investment and finance, with plans to mobilise at least €1 trillion over the following decade. This funding was expected to come from a combination of EU funds, national contributions, and private sector investment, ensuring broad-based financial support for green innovation and infrastructure. Additionally, to protect European industries from unfair external competition, the Carbon Border Adjustment Mechanism (CBAM) was introduced. This tariff on carbon-intensive imports from third countries to the EU had to prevent carbon leakage by ensuring that imported goods are subject to the same environmental standards as those produced within the EU. The aim was to safeguard domestic industries while incentivising global sustainability.

There was a recognition that the transition to a low-carbon economy will affect regions across the EU differently. This is why the more socially responsible political groups pushed for the creation of dedicated financial support mechanisms to help the most vulnerable citizens and regions. A dedicated Just Transition Mechanism was proposed to reduce social and economic inequalities and mitigate the effects on the most vulnerable regions. This initiative provided financial support to regions and workers most impacted by the shift away from fossil fuels, particularly those in coal-dependent areas. The Just Transition Mechanism (JTM) had a planned budget of approximately €55 billion for the period between 2021 and 2027 and comprised of several pillars of support. The Just Transition Fund (JTF), with a budget of €19.7 billion, focused on economic diversification and workforce reskilling to help communities adjust to the new labour market demands. The InvestEU "Just Transition" Scheme aimed to mobilise about €10-15 billion in private investments by offering financial guarantees under the InvestEU program, supporting sustainable projects in affected regions. Additionally, the Public Sector Loan Facility, which combined €1.3 billion in EU grants with €6-8 billion in loans from the European Investment Bank, was expected to generate between €13.3-15.3 billion in public investments to support the transition.

The legislative backbone of the Green Deal was the "Fit for 55" package. In July 2021 it introduced 13 legislative and non-legislative measures aiming to align EU policies with the 2030 emissions target. They also had to set in writing the goals of the European Climate Law, which enshrined the commitment to climate neutrality into legally binding obligations. Some of the most important legislative files from that package were the revisions of the Renewable Energy Directive, the Energy Taxation Directive, the Energy Efficiency Directive, the energy Performance of Buildings Directive and the Alternative Fuels Infrastructure Regulation. All of them were supposed to be complementary to each other and to lay the groundwork for the industrial transformation of the European economy over the decades to come. However, upon a closer inspection once the interinstitutional negotiation processes

began it was understood that the EU would need a proper industrial strategy to cope with the proposed changes and to reach the set targets.

Hence, the Net-Zero Industry Act (NZIA) was introduced at a later stage, in March 2023, as part of the Green Deal Industrial Plan. Its primary goal was to increase the EU's manufacturing capacity for clean technologies and reduce reliance on non-EU suppliers. The NZIA promoted strategic industries like solar panels, batteries, wind turbines, components for nuclear power plants, heat pumps and hydrogen production. It set a goal of producing at least 40% of EU's net-zero technology needs domestically by 2030. It also set the first EU target of 50 million tonnes of annual operational CO_2 injection capacity by 2030. This was the first EU target to recognise the need for the technology of Carbon Capture Utilisation and Storage (CCUS).

2.2 Contradictions and Challenges

Looking back over the entire process from the distance of a few years, it can be seen that there have been some drawbacks with the proposed and eventually adopted measures. The EU consists of Member states with different levels of economic development and industrial structures. In wealthy Western states, environmental standards have become the norm, while in Eastern and Southern regions, the economic transition towards a greater cohesion with the Western states still remains a future goal. This economic and social inequality creates significant tensions. Often, the EU's high climate targets are perceived as additional burden by these countries, which rely on traditional industries and coal to produce cheap and reliable energy.

In this regard, one of the most praised decisions that came to support the Green Deal was rather unexpected. The COVID-19 pandemic and the economic downturn that it induced served as an opportunity for the EU leaders to make something unprecedented - take out a common EU loan. What seemed as something unimaginable just a few years ago became possible possible just after Brexit. The NextGenerationEU was created as means to stimulate the economies of all 27 Member States after the COVID-19 economic shock and bring them back to full speed once health measures had been successfully implemented. It consisted of almost €800 billion in the form of direct grants and loans for the Member States to be used primarily for the financing of energy and digital policies.

The centrepiece of this temporary recovery instrument was the Recovery and Resilience Facility (RRF) which made sure every Member State had to create its own national plan of reforms and investments. The instrument was limited in time and aimed to invest these resources by 2026 in order to make EU economies greener, digital and more resilient. However, even though that period is almost at its end, it can clearly be seen that the average EU wide amount of money invested has not even reached 50% of the available resources. This means that even though , the funds were made available to the Member States to help them modernise their economies, the national

authorities did not manage to put them into use in a timely and efficient manner. As it is well known from Aristotle - "nature abhors a vacuum" and the unused funds will most probably be used to finance other EU projects. However, they will most likely not have the same goal in mind - to support investments in domestic manufacturing of clean technologies.

The most obvious and likely beneficiary of these funds will probably be the nascent ReArmEU program which will aim to revitalize the EU defense industry and push for production and procurements of domestic military equipment. I spent all of my efforts as a shadow rapporteur on the NZIA to include a provision in the final text that those unused funds for each single Member State will be left under the control of every national administration so they can invest them in the development of strategic clean technologies. Even though I managed to secure that, a blind eye cannot be turned to the fact that the financing mechanism which was supposed to help the Green Deal underdelivered. As a result, the EU institutions are now looking for new initiatives to strengthen investments in new production facilities and boost domestic European clean technologies.

Another major drawback of the legislative process in Brussels was the discoordination that occurred when all of the legislative and non-legislative files that made up the Green Deal had to go through the ordinary legislative procedure of the EU. Given that it simply would not be possible to work in parallel on all files at once, they started going through the legislative pipeline in batches of files that had complementary characteristics. This was also done so that the files, which had the most synergy, could be subject to the same scrutiny by the European Parliament and the Council and in the end did not contradict each other. In principle, this worked for some number of legislations that were going through the legislative process simultaneously.

I have a first-hand experience in this with my work on the Energy Performance of Buildings Directive (EPBD) and how we managed to align its goals with the Energy Efficiency Directive (EED). However, if we look at the bigger picture, we can see that parts of the Green Deal that were agreed at the beginning made it very difficult to reach an agreement on the later regulations or directives. The fact that some targets and concepts were already pre-agreed in the early stages did not allow for any flexibility in the files that were the last to cross the legislative finish line. As a result many files were perceived as rushed and left the impression that there was no single driving force behind the changes that were introduced in the European normative process. This left some industries with concrete goals that they had to fulfil but without the most efficient and financially backed-up means to actually deliver results. This is precisely why even before the beginning of this mandate 1311 European industrial organisations from over 25 sectors came together and united behind the Antwerp Declaration that called for the creation of a proper Industrial Deal.

3. The Clean Industrial Deal–A New Phase of European Transformation

3.1 From the Green Deal to the Clean Industrial Deal

The EU institutions decided to move to the next stage of the economic model towards competitiveness by introducing the industrial aspect. The EU elections in June 2024 also helped put an emphasis on the need for an overarching industrial policy precisely because our citizens demanded that during the electoral campaign and the politicians had to respond. The results of the report published in 2024 on The future of European competitiveness[3] by the former ECB president and former Italian Prime Minister Mario Draghi, also played a crucial role in showing the need for more targeted measures in the area of reindustrialisation. It highlighted that in order to compete with the other global superpowers like the United States and China, the EU must act together and improve all aspects of its current efforts in bringing back manufacturing capacities in the Member States. Another important factor that also has to be taken into consideration is the current and foreseen long-term tension between the EU and its main supplier of cheap energy sources - Russia. The dynamism of the geopolitical events makes any long-term planning unpredictable at this point. Nonetheless, one thing is certain - EU has to ensure diversification of the suppliers when it comes to strategic energy resources.

As a direct response to all of this, the European Commission introduced in February, 2025 the Clean Industrial Deal (CID). This is a comprehensive strategy designed to build upon the positive traits of the Green Deal and transform its drawbacks and challenges into opportunities for sustainable growth. This policy focuses on more targeted measures to foster access to affordable energy, stimulate demand for clean products, provide financing mechanisms for industrial transformation, promote a circular economy, strengthen global partnerships, and develop the workforce necessary for the green transition.

One of the key priorities of the CID is ensuring affordable access to clean energy, which is essential for maintaining industrial competitiveness. The Affordable Energy Action Plan (AEAP) which was presented jointly with the CID also addresses the need to lower the energy bills for households and industry by streamlining the permitting processes for renewable energy projects, enhancing power grid infrastructures, and promoting energy efficiency measures to reduce consumption. It also aims at completing the internal energy market through improved interconnections between EU member states to create a more resilient and cost-effective energy system. These initiatives are expected to lower energy costs for industries, businesses, and households, supporting the transition to a low-carbon economy.

To strengthen the market for clean products, the CID introduces the Industrial Decarbonisation Accelerator Act, which integrates sustainability, resilience, and 'made in Europe' considerations into public and private procurements. A revision of the public procurement framework is planned for

[3] https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en

2026 to further incorporate these criteria, particularly in strategic sectors. By ensuring strong demand for EU-produced clean technologies, these measures aim to drive innovation, support industrial transformation, and maintain Europe's leadership in sustainable manufacturing.

Financing the clean transition is another crucial element of the CID, which builds upon the lessons learned from the Green Deal with over €100 billion dedicated funds mobilised to support clean manufacturing in the EU. This includes the establishment of a dedicated Industrial Decarbonisation Bank, which will provide targeted funding for decarbonisation projects, leveraging public and private investments. The EU Innovation Fund will also be strengthened to support the development and deployment of low-emission technologies, while amendments to the InvestEU Regulation will increase financial guarantees, mobilising up to €50 billion for clean technology initiatives. These financial instruments are designed to provide industries with the necessary capital to innovate and transition towards sustainable practices.

Recognising the importance of resource efficiency, the CID places significant emphasis on circular economy initiatives to reduce waste and dependency on external suppliers. A key initiative is the establishment of the EU Critical Raw Material Centre, which will coordinate joint procurement efforts for essential raw materials to enhance supply chain resilience. In addition, a Circular Economy Act is planned for 2026, aiming to accelerate the shift to a circular economy with a target of achieving 24% circular material use by 2030. These measures seek to maximise resource efficiency and ensure long-term sustainability.

The CID also acknowledges the need for strong global partnerships to secure supply chains and maintain competitiveness. It builds upon what was already set up in the Critical Raw Materials Act (CRMA) through the Clean Trade and Investment Partnerships. Its aim is for the EU to diversify its supply chains and establish mutually beneficial agreements with global partners. Additionally, the Carbon Border Adjustment Mechanism will be simplified and strengthened to ensure fair pricing of carbon emissions in imported goods. These strategies are set to position the EU as a global leader in industrial decarbonisation while maintaining fair competition in international markets.

3.2 Socio-Economic Impacts

Another crucial element addressed in the proposed Clean Industrial Deal[4] is the necessity to invest in human capital. Something that is well understood by every industry in Europe is given a central stage this time - a successful transition to a low-carbon economy requires a skilled workforce. To address this, the CID introduces the Union of Skills initiative, which will invest in worker training, focusing on competencies in clean technologies, digitalisation, and entrepreneurship. Erasmus+ funding will be enhanced, with up to €90 million allocated to reinforce education and training programmes to address skill shortages in key sectors. These efforts aim to create high-quality jobs and

[4] https://commission.europa.eu/document/download/9db1c5c8-9e82-467b-ab6a-905feeb4b6b0_en?filename=Communication%20-%20Clean%20Industrial%20Deal_en.pdf

ensure that the workforce is adequately prepared for industrial transformation.

To support the effective implementation of these initiatives, the CID also includes horizontal enablers such as regulatory simplification, optimisation of the Single Market, and improved policy coordination between the EU and Member States. By reducing administrative burdens, fully leveraging the scale of the Single Market, and ensuring cohesive implementation of industrial policies, the CID seeks to create an environment conducive to sustainable industrial growth.

The Clean Industrial Deal represents a strategic framework aimed at transforming the EU's industrial landscape by integrating competitiveness with sustainability. Through targeted actions in energy affordability, market stimulation, financial support, resource efficiency, global collaboration, and workforce development, the CID aspires to position the EU at the forefront of global industrial decarbonisation. The success of these initiatives will be crucial in securing Europe's long-term prosperity while ensuring a resilient, sustainable, and competitive industrial sector.

In order to address all of the economic challenges Europe faces today, the European Commission presented at the end of January 2025 the Competitiveness Compass[5]. It outlines a strategic framework to enhance the EU's economic performance over the next five years. The concept emphasizes three transformational imperatives: closing the innovation gap, aligning decarbonisation with competitiveness, and reducing dependencies while enhancing security. To bridge the innovation gap, the EU plans to foster a dynamic environment for startups, promote leadership in emerging technologies, and facilitate technology diffusion across industries. Recognising the importance of security, it incorporates security considerations into economic policies to ensure a stable environment for businesses. The overall goal of the Competitiveness Compass aims to position Europe as a leader in innovation, sustainability, and security in the global market.

In order to ensure the success of building a competitive EU economy, the first step is to resolve the problem of competition among Member states, which is based on the different energy prices across the Union. Hence, the urgent solution is to build a connected electricity grid, which will address the energy price fluctuations between the Northern and the CEE countries. At the moment, the price differences are with a factor of 10x. Only when this is resolved and the prices of energy across the EU are similar, a proper competitive EU economy could be built.

4. Bulgaria's benefits from the push towards a cleaner industry and manufacturing

4.1 Strategic Geographic Location and Energy Connectivity

Bulgaria stands to gain significant benefits from the European Union's push toward a cleaner and more competitive industrial sector, particularly through the newly proposed Clean Industrial Deal. As the EU advances its commitment

[5] https://commission.europa.eu/document/download/10017eb1-4722-4333-add2-e0ed18105a34_en

to industrial decarbonisation and energy transformation, Bulgaria's strategic geographic location offers a crucial advantage for expanding energy connectivity and attracting investments in sustainable manufacturing. It still has some of the most attractive conditions for EU companies as well as a large pool of qualified talent. Bulgaria can position itself as a regional energy hub and foster new investments in modern industries. It is necessary to move beyond the era of the initial investments right after we joined the EU back in 2007, which went primarily in the real estate sector and in large commercial buildings and malls. Bulgaria can enhance its economic resilience, create well-paid jobs, and secure long-term economic growth. This will also help us move beyond the cliché advertisement that Bulgaria can attract investments with low wages and taxes. If we manage to bring large-scale manufacturing investments in innovative technologies, we can focus on building a high-value economy.

One of the most promising opportunities for Bulgaria lies in its role as a key player in the EU's efforts to improve energy connectivity across the continent. The geographic location of the country allows steps to foster and benefit from greater regional cooperation with its neighbours. Bulgaria can become integral part in connecting the energy infrastructures of the countries form South-Eastern Europe. Situated at the crossroads of Europe, the Middle East, and Asia, Bulgaria is uniquely positioned to facilitate the transport and distribution of renewable energy between Eastern and Western Europe. There are already two major projects for the East-West and South-North electricity connections, which can cross-wire our continent, and Bulgaria can benefit from both of them.

It is also important to note that we have the raw materials, the facilities and the expertise necessary to do that. Bulgaria ranks sixth in Europe in the production and processing of non-ferrous metals - lead, copper and zinc, which will be crucial for the development and production of those new technologies. Enhanced energy infrastructure, including modernised electricity grids and expanded interconnections with neighbouring countries, can provide Bulgaria with a competitive edge in the EU's single energy market. By investing in cross-border energy projects and reinforcing transmission networks, Bulgaria can secure more stable and affordable energy supplies, reducing dependency on fossil fuel imports while supporting the broader EU objective of energy security and sustainability. The European Grid Package, which is part of the CID is expected for the first quarter of 2026 and we should work very deliberately on all levels of EU coordination in order to benefit the most from it and renovate our electrical grids.

In addition to energy connectivity, the Clean Industrial Deal presents Bulgaria with an opportunity to attract substantial investments in new manufacturing facilities focused on clean technologies and low-carbon production processes. With targeted incentives and public-private partnerships, we can foster the development of new factories producing components for electric vehicle, renewable energy technologies, and sustainable construction materials. We have the track record of already producing similar technologies, and with the

adequate support, we can position ourselves as a highly competitive player in these markets. These investments will not only modernise the country's industrial base but also create high quality, well-paid jobs, boosting incomes and improving our overall living standards.

4.2 National Challenges

In a paradoxical way, Bulgaria's primary challenges stem from one of its biggest strengths - its heavy reliance on coal-based energy. We have one of the most balanced energy mixes because our power generation is almost equally derived from coal power plants, nuclear energy and renewable sources. While this provides stability to the energy system, the uncertainty about the future of coal power generation in the EU puts new challenges ahead of us. Coal-dependent regions like Stara Zagora, Pernik and Kyustendil require real targeted policies for economic alternatives.

We need new nuclear power plants in order to secure the baseload power generation we will need in the near future. I fought hard in the previous mandate to make sure that the European Union recognises nuclear energy as a strategically important and sustainable resource in the green transition. Today this decision is a fact and it is crucial for countries like Bulgaria in order to enable them to secure funding from the global capital markets for the construction of new nuclear power plants. Yet, despite all of this, we are the only country in the world that has a licensed nuclear power plant site in Belene but the project is left unfinished. We have already purchased parts of the equipment and we have companies and international partners ready to finalise the project but we create politely uncertainty and send mixed messages that put off any major international company to invest here. If we manage to overcome those hurdles and invest in ourselves, we can transform our economy and find our niche in the new division of labour and supply chains in the European common market.

6. Conclusion

Europe stands at the threshold of a new era where it has to rely more and more on ourselves. In this new uncertain international environment, one has to build up the industrial base and overcome dependencies. The goal of developing a strategic autonomy is already a necessity in order to further build on top of our industrial achievements from the past. The Green Deal outlined the path toward a more sustainable economy but the Clean Industrial Deal provided the blueprint for how this economy can be realistically achieved. The success of this transition depends on the ability of European leaders to balance the environmental ambitions with industrial realities while safeguarding the economic and social interests of our citizens.

In this context, Bulgaria has a unique opportunity to become a key player in Europe's transformation. The transition to a cleaner industrial model, supported by EU funding mechanisms and financial incentives, provides Bulgaria with a unique opportunity to accelerate its economic transformation and catch up even quicker to the average living standards and quality of life in the EU. By prioritising

energy connectivity and industrial investments, Bulgaria can reinforce its position as an integral part of the EU's sustainable growth strategy. With the right policies in place, the country can emerge as a regional leader in quality manufacturing while securing long-term economic prosperity and energy independence in an increasingly competitive European market. This is a herculean task, which requires at least several governments to work consecutively in order to transform our society and to be prepared for the economy of the future. All Bulgarian institutions should work together at the EU level if we want to get the maximum out of the opportunities that are presented before us.

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In the 2019-2024 mandate, she played a pivotal role in advancing legislation and initiatives aimed at bolstering the European Union's industrial competitiveness, energy security, and innovation landscape. Penkova worked on the Updated New Industrial Strategy for Europe, Net-Zero Industry Act, Energy performance of Buildings Directive, the EU Data Act, the Establishment of the Public Sector Loan Facility under the Just Transition Mechanism. She initiated an own initiative report on the need to increasing innovation, industrial and technological competitiveness through a favourable environment for start-ups and scale-ups in the EU.

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THE NEW DIMENSIONS OF GEOENERGETICS IN THE EU

Prof. Nina Dyulgerova, DSc

Introduction

At the beginning of the 21st century, new challenges and configurations have emerged, shaping the geopolitical contours of the forming new world. The power-based and ideological parameters of societal polarization from the 19th and 20th centuries are left in the past. The world once again lives in an atmosphere of confrontation, constantly changing in nature and direction – from global terrorism to civilizational choices to energy interdependence. Without eliminating the first two elements of conflict, the third – energy capabilities and choices – cannot be overlooked, as it determines current and future changes in global and regional dynamics. It is an undeniable fact that the world is now developing under new rules. These define international stratification not so much through the traditional parameters of previous centuries, but through the vision and actions of old (from the bipolar world) and new (Eurasian tigers) players in the energy sector, with its expanding possibilities for dynamic repositioning.

The 21st century is shaping up to be marked by an energy transformation that determines political alliances, economic confrontations, and military conflicts. The past decades have demonstrated the far-reaching dimensions of the economy-politics dichotomy. Increasingly, geopolitical decisions on both global and regional levels are becoming a natural expression of the intensifying competition for reserves, transit of conventional raw materials (oil and gas), and the assertion of spheres of influence in the implementation of renewable energy sources (RES). Politics, economy, and the social sphere have become sustained hostages to transnational corporate interests.

Energy is becoming a fundamental corrective in the relations between states and international organizations. Furthermore, it is increasing its influence on the stratification within dominant international systems so far led by the USA – such as the UN, NATO, OSCE, and the European Union. The geographic discourse of energy, influencing more and more the new situational, and possibly strategic, configurations globally and regionally, brings forth other key points. One highlights the growing interdependence of energy resources with the integrity and security of producer, transit, and consumer countries of oil and gas The second increasingly affirms the international legal principles and mechanisms of action that had become almost an axiom during the Cold War years. Geo-energetic processes are becoming a universal model of global and regional energy transformations.

The EU and geoenergetics – common frameworks and individual approaches

Europe continues to serve as a testing ground for experiments, mainly aimed at restructuring the energy space. A consistent and methodical energy transformation of the Old Continent is underway. A convenient pretext for this process is the conflict in Ukraine, which began in February 2022 and has become both a slogan and a tool for Europe's liberation from Kremlin energy dependence.

The geopolitical model used to implement this idea is based on sanctions in various areas of economic and trade cooperation with Russia, delivering questionable results for European businesses. Since early 2022, Washington, leveraging Europe's Euro-Atlantic dependency, has been effectively working to undermine the European economy, national security, and statehood.

The overall policy of European sanctions is subordinated to the idea of weakening Russia's economic base by depriving it of key technologies and markets and significantly limiting its ability to wage war in Ukraine. The EU's sanctions policy poses serious challenges for Russia's European partners.

One of the most significant restrictive measures against Russia is the ban on the purchase, import, or transit of crude oil and petroleum products. The list of these products is published in Annex XXV of Regulation (EU) No 833/2014 of 31 July 2014, last amended on 4 December 2022. One of the latest restrictions includes a price cap of up to USD 60 per barrel on crude oil and petroleum oils and oils from bituminous minerals of Russian origin, effective from 5 December 2022[12]. However, EU countries may grant derogations for the transport of humanitarian aid, medical, pharmaceutical, and food products.

After the destruction of the Nord Stream 1 pipeline, various scenarios have emerged regarding the revival of Nord Stream 2 in the context of Russian-American peace talks on Ukraine. The prevailing option is for the pipeline to operate with American investment and control but with Russian gas[3]. The U.S. interest is driven by fears that Russia could use natural gas as a geopolitical tool due to its dominant position as the EU's main supplier. These American plans are part of Washington's longstanding aim to eliminate Russian oil and gas from the European energy market. Unsurprisingly, in April 2025, President Donald Trump firmly declared that Europe should only buy energy from the USA.

The dynamics of Europe's geo-energetic transformation are impressive. The numerous restrictions tied to decreasing Russian oil and gas supplies run parallel

[1] Council Regulation (EU) No 833/2014 of 31 July 2014 concerning restrictive measures in view of Russia's actions destabilising the situation in Ukraine, https://eur-lex.europa.eu/legal-content/BG/ALL/?uri=CELX%3A32014R0833

[2] Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC (Text with EEA relevance), https://eur-lex.europa.eu/legal-content/bg/TXT/?uri=CELEX%3A32009L0073

[3] Khokhlov, O., N. Batalov, Are the USA and Russia reviving "Nord Stream 2"? What is known, Deutsche Welle, 6 March 2025, https://www.dw.com/bg/sas-i-rusia-vzrazdat-severen-potok2-kakvo-se-znae/a-71846318

to the growing construction of various liquefied gas platforms. Transitioning to this form of meeting Europe's energy needs is seen as a victory for the economic goals pursued by the U.S. through a series of political decisions.

Adaptation to the new political processes, related to a strengthening anti-Russian policy with clearly defined energy components, has shaped Brussels' new policy for the energy transformation of the Old Continent. Its specific dimensions include a series of European initiatives dating back to 2015.

In 2015, the European Commission launched the Energy Union concept, combining five dimensions – energy security, integrated market, energy efficiency, decarbonization, and innovation. This later evolved into the legal package "Clean Energy for All Europeans" (2018)[4], including updated RES and efficiency directives and a new Governance Regulation[5], requiring member states to prepare National Energy and Climate Plans (NECPs) for 2021–2030 – a mechanism for monitoring and synchronization.

Key elements of the energy framework include the **European Green Deal**, the **Fit for 55** legislative packages, the **Energy Union strategy**, and new initiatives like **RePowerEU**.

The **European Green Deal** is central, integrating various aspects of climate change policy. Introduced by the European Commission in late 2019, it aims for the EU to become the first climate-neutral continent by 2050 (Planète Énergies, 2023b)[6]. The Green Deal covers not only energy but also transport, industry, agriculture, circular economy, and biodiversity. It recognizes energy sector decarbonization as key to achieving net-zero emissions. The goal is to eliminate net CO_2 emissions by mid-century while ensuring economic growth "decoupled" from resource use and a "just transition" so that no community is left behind[7] [8]. The Green Deal led to the **European Climate Law** (2021), legally enshrining the target to cut emissions by at least 55% by 2030 compared to

[4] Clean energy for all Europeans package https://wayback.archive-it. rg/12090/20241209144917/https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en

[5] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652, and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (Text with EEA relevance.) https://eur-lex.europa.eu/legal-content/bg/TXT/?uri=CELEX%3A32018R1999

[6] The European Green Deal - Striving to be the first climate-neutral continent https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en#:~:text=ensuring%3A

[7] The European Green Deal - Striving to be the first climate-neutral continent https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en#:~:text=,and%20no%20place%20left%20behind

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1990 and to reach climate neutrality by 2050[9]. The goals define the European politics in the energy sector.

To align European legislation with the new target of reducing emissions by 55% by 2030, in July 2021 the European Commission proposed the large-scale legislative package "Fit for 55." The package includes reforms to the Emissions Trading System (ETS), which is the EU's most important tool for reducing emissions from the energy and industrial sectors. It is the world's first major cap-and-trade mechanism, covering power plants, energy-intensive industries, and, since 2012, aviation. As of 2027, the ETS will expand to include shipping, buildings, and transport (ETS2)[10], meaning that practically all EU emissions will have a price.

The EU enacts binding legislative acts–directives–that require results but allow flexibility in implementation, thereby advancing a sustainable policy for renewable energy and energy efficiency. A series of directives have been adopted to regulate and expand the energy mix through renewables. These renewable energy directives require each country to contribute through its own National Energy and Climate Plan (NECP) to overcome barriers to the development of renewables. They call for streamlined grid connection procedures, support schemes, open markets for community energy, and more.

The "Fit for 55" package essentially translates the European Green Deal into concrete obligations for Member States. Under the 2030 renewable energy directive, each country has indicative national targets–targets that Sweden and Denmark will easily exceed, while slower-moving countries will need to step up their efforts to meet them. "Fit for 55" is essentially a roadmap for transforming the EU's energy, transport, and industrial policies in line with its new climate goals. As a result of intensive negotiations, the core of the package was adopted in 2023, demonstrating Europe's political will to stay the course.

Following the outbreak of the Russia-Ukraine conflict and the ensuing energy crisis, the EU proposed **RePowerEU** in May 2022 – a roadmap to achieve energy independence from Russia before 2030. It includes around €300 billion for urgent actions on energy savings, accelerating RES deployment, and diversifying supplies. The main pillars of RePowerEU are the diversification of supply (seeking alternative gas suppliers, accelerating the construction of LNG terminals and interconnectors), energy saving as a short-term measure to reduce gas and electricity consumption, and most importantly, the accelerated deployment of renewable energy sources and substitute technologies.

RePowerEU includes the introduction of a requirement for solar panels on

[9] The European Green Deal - Striving to be the first climate-neutral continent https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en#:~:text=The%20European%20Commission%20has%20adopted,on%C2%A0Delivering%20the%20European%20Green%20Deal

[10] U-turn on EU's Emissions Trading System for road transport and buildings carries huge environmental, social and economic price tag https://carbonmarketwatch.org/2025/01/24/u-turn-on-eus-emissions-trading-system-for-road-transport-and-buildings-carries-huge-environmental-social-and-economic-price-tag/#:~:text=U,The%20Emissions%20Trading%20System

the rooftops of new buildings[11], as well as increasing energy efficiency. It also promotes the use of renewable hydrogen and biogas to replace part of the fossil gas. The plan includes measures to protect vulnerable consumers, such as the option for temporarily regulated gas prices and coordinated actions to diversify imports–such as signing new LNG supply agreements with the U.S., Qatar, and others–as well as the creation of a joint gas purchasing platform for interested countries (BIA, 2022). In essence, RePowerEU acts as an accelerator of the energy transition. It combines the objectives of the Green Deal with the imperative of energy independence. The expected outcome is twofold: to completely eliminate imports of Russian fossil fuels by 2027, while simultaneously speeding up the transition to clean energy (BIA, 2022).

These pan-European policies are implemented nationally through legislation, strategies, and investment programs. The European Commission plays a central role in setting targets, monitoring, and launching new initiatives. National governments also develop country-specific strategies:

– **France (2021)** adopted a Climate Law with efficiency and transport measures;

– **Germany** revised its climate strategy to reach neutrality by 2045;

– **Denmark and Spain** set ambitious 100% renewable electricity goals by 2030 and 2040, respectively;

– **Poland** plans to phase out coal by 2049 and develop nuclear power.

Despite the common framework, countries in Europe start from different baselines and apply diverse approaches to the energy transition. The energy mix varies significantly across countries depending on available resources and historical decisions. In Poland, coal remains the dominant component of the energy mix. Over 70% of its electricity is generated from coal-fired power plants, making it one of the most carbon-intensive economies in the EU. France, on the other hand, maintains a share of over 50% nuclear energy in its primary energy mix and around 70% in electricity generation. The country has traditionally relied on nuclear power to achieve energy independence and low carbon emissions. Germany, home to the EU's largest economy, follows a mixed approach. In response to the Fukushima nuclear disaster in 2011, Germany fully phased out its nuclear power plants by 2022. Berlin has been actively investing in renewable energy sources. Until recently, Germany also relied on cheap natural gas from Russia to balance its energy system. However, the war in Ukraine has disrupted this formula, forcing Berlin to abruptly halt gas projects with Russia–such as Nord Stream 2–and temporarily increase coal production, while accelerating the deployment of renewables and seeking alternative gas supplies.

Besides those, other countries bet on diverse energy tendencies. The

[11] RePowerEU Plan : Joint European action on renewable energy and energy efficiency, International Energy Agency https://www.iea.org/policies/15691-repowereu-plan-joint-european-action-on-renewable-energy-and-energy-efficiency

Scandinavian countries (Sweden, Denmark, Finland) are pioneers in the green transition. Sweden and Norway generate almost all their electricity from carbon-free sources such as hydropower, nuclear, and wind energy. Denmark, on the other hand, is a global leader in wind energy. These countries traditionally have strong environmental policies and broad public support for them.

Southern Europe (Spain, Portugal, Italy, Greece) has seen a rapid increase in solar and wind energy over the past decade, thanks to abundant resources of consistent solar energy, wind corridors, and improved technologies. Italy, although still importing significant amounts of gas, is also investing in renewables and has introduced the "Superbonus" program for building energy efficiency. On the other hand, southern countries also face challenges such as energy poverty and the need to modernize their grids.

Eastern European countries like Bulgaria, Romania, and the Czech Republic have a historical legacy of coal mining and heavy industry and are now trying to balance modernization with maintaining energy security. Some, like Bulgaria, continue to rely heavily on coal but are planning a gradual phase-out. Others, like Romania, have a more diversified mix, including a share of nuclear energy (Cernavodă Nuclear Power Plant) and potential for renewables. These countries advocate for a transition pace that considers economic realities and is supported by EU solidarity mechanisms, such as the Just Transition Fund, which is aimed at supporting the transformation of coal regions.

A wrap – up

Evidently, a universal strategy does not exist. Each country chooses its own mix of policies. Nevertheless, the general direction is similar: the gradual displacement of fossil fuels through a combination of renewable sources, increased energy efficiency, and, where applicable, low-carbon base power such as nuclear or gas with carbon capture. Differences are observed in the share and sequence. Some, like Germany, shut down their nuclear power plants first; others, like Poland, are building them - -the country plans its first nuclear power plant around 2033. Countries like Poland and the Czech Republic still mine significant amounts of coal, while others, like Belgium in 2016 and Sweden in 2020, have already completely phased it out. Some, like Denmark, Norway, and the Netherlands, are major oil/gas producers, while most are net importers.

The new dimensions of the geo-energy transformation are manifested in tangible results. Thanks to targeted policies, greenhouse gas emissions in the EU-27 in 2021 were about 30% below 1990 levels[12], meeting and even exceeding the goal of a 20% reduction by 2020. The share of renewable energy sources has grown significantly, and investments in clean energy in Europe amount to hundreds of billions of euros annually. Through the Green Deal Investment Plan and funds like the Innovation Fund, financed by revenues from emissions trading, the EU supports the deployment of new technologies such as large-scale

[12] European Environment Agency, Renewable Energy https://www.eea.europa.eu/en/topics/in-depth/renewable-energy#:~:text=,the%20transport%20sector%20by%202020

green hydrogen production, carbon capture, batteries, and more. Additionally, research and development are guaranteed by programs like Horizon Europe, which include specific streams focused on energy.

The geo-energy transformation is expressed through a set of legal instruments–economic tools like the ETS, command-and-control measures such as goal-setting directives, and market instruments like competition and trade rules. This combination has demonstrated its effectiveness by reducing emissions and increasing the share of clean energy. The guarantee for an effective energy transformation lies in the enforcement of laws and oversight of their implementation. European experience shows that a solid regulatory framework provides investor security and fairness, both necessary for a large-scale transformation of the energy system.

The EU's political model today represents an integrated complex of goals and measures that affect the entire chain of the energy system. The European Commission and other institutions act as drivers and coordinators of these efforts, but their implementation depends in practice on the member states, their governments, local authorities, businesses, and civil society. Despite the differences, European countries share a vision for climate neutrality and work together toward it, which is evident in the fact that even during the energy shock of 2022, the EU managed to remain united in its actions, creating solidarity mechanisms for gas, coordinated storage refilling, electricity sharing during crises, and more. The transformation of Europe's energy sector serves as a reference point for the negative processes within European society, which are far from pragmatic but closely aligned with Euro-Atlantic political correctness. The national element of energy efficiency is gaining strength, considering the geographic specificities of each country.

The geo-energy transformation of the 21st century necessitates new models involving enhanced legal regulation and the search for effective means to yield positive results in the triangle of energy production, transit, and consumption. The transformation of the political, economic, and social model of modern societies is determining the intensifying competition, which presents serious challenges for political elites, states, and international organizations. The pursuit of energy unity is still subject to competition and unsuccessful attempts at energy efficiency and cooperation through military confrontation.

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THE EU ENERGY AND CLIMATE POLICIES AMIDS UNPRECEDENTED GEOSTRATEGIC UPHEAVAL

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The Competitiveness Compass and the Clean Industrial Deal spur economic reform

INTRODUCTION:

It was at the start of her first mandate when the EU Commission President,

Ursula von der Leyen, substantiated the need for a "geopolitical Commission" and claimed Europe urgently needed one. She saw the Union as a champion of multilateralism and believed that countries from East to West, from South to North, needed Europe to be a true partner. "We can be the shapers of a better global order. This is Europe's vocation. And it is what European citizens want", stated at the time the newly elected Commission President. [1]

Most Member States appreciated the idea of a geopolitical Commission, one of the reasons being the European Green Deal's intended global implications. However. the state of the Union - affected by developments such as Brexit, COVID, illegal immigration, growing Euro-scepticism and foreign cyber interference - failed to inspire a more resolute common action to propel the EU as a global player. The geopolitical intent of the European institutions remained largely aspirational.

At the start of von der Leyen's second term, the EU Commission's geopolitical

credentials are not a matter of choice but of necessity: they are now an imperative and a matter of strategic foresight. Practically all political, economic and societal vectors important to the smooth running of the European project have acquired a strategic dimension, mostly under the influence of external developments. The Union has suffered the negative consequences of Russia's aggression against Ukraine on, among others, energy markets and the disruption of vital supply lines. It continues to experience unfair competition from subsidized imported clean technology and other industrial goods. The EU is also coming to grips, lately, with the need to tackle both known and unexpected new acts of encroachment on European security, democracy, values and open markets, which leaves it with no other choice but to reorient its policies towards building an assertive geopolitical and geoeconomic stance.

This approach seems to have readily found government and public support, judging from the almost unanimous approval of the Conclusions of the March 2025 European Council on Ukraine and European defence as well as subsequent media and citizens' reactions. The Joint While Paper for European Defence

Readiness 2030 develops the EU's approach to security, defence and resilience. [2]

The issue of common EU defence is not new: following previous attempts, in March 2022, the Conference on the Future of Europe, representing Europe's citizens and youths, recommended the establishment of "united armed forces of the European Union" as well as an "urgent" deepening of the European integration in energy, defence and migration". [3]

The March 6th European Council Conclusions and the While Paper are much more than an expression of shared public aspirations. They are acts of EU's resurgence and integration maturity at a time of unprecedented geostrategic quakes. The European leaders openly state that "Russia's war of aggression against Ukraine and its repercussions for European and global security constitute an existential challenge for the European Union". [4] The Union will accordingly reinforce its overall defence readiness, reduce its strategic dependencies, address its critical capability gaps and strengthen the European defence technological and industrial base accordingly across the Union. This will also contribute to boosting European industrial and technological competitiveness. High Representative Kaja Kallas expressly stated that the measures, envisaged in the Whie Paper, are not intended for the Union to fight but to defend and deter, to "prepare for the worst". [5]

There are several formulations in the Council Conclusions of March 6th, which point to a nexus and synergies between, in particular, security and defence, on the one hand, and energy and climate policies, on the other hand. The need to "reduce EU strategic dependencies" transcends several sectors, most acutely felt in defence, energy and technology. By aiming to "strengthen" the European defence technological and industrial base "across the Union" the Council believes that "this will also contribute to boosting European industrial and technological competitiveness" – a process considered vital to enhancing EU's energy transition and implementing the Clean Industrial Deal.

The White Paper says that the rest of the world is engaged in a race towards military modernisation and technological and economic advantage. "Technology will be the main feature of competition in the new geopolitical environment", continues the Paper. A handful of critical and foundational technologies like AI, quantum, biotech, robotics, hypersonic [and cleantech] are key inputs for both long-term economic growth, and military pre-eminence. The Paper also raises the attention of Member States to the challenges of "minimising the potential for the weaponisation of dependencies or economic coercion"; establishing "dual-use frameworks"; and identifying possible "immediate and future energy supply bottlenecks" together with relevant partners, in particular NATO.

European politicians and diplomats know too well that both the EU institutions and the Member States, perhaps in varying degrees, have allowed the destructive effects of failings in the above areas to continue for too long. As a result, the EU security, energy and technology adoption policies have retarded to a point of mediocracy. The European leaders and the European

Institutions are now set to overcome past inertia and mistakes, acting together with the leaders of non-EU like-minded countries.

For the next five to ten years, perhaps more, a managed interplay and synergy between a set of political, economic and technological factors will require heightened attention and will have to be at the centre of EU politics and economic activities. These refer, inter alia, to security and defence, energy and climate, STEM-based technical education and quality skills, data centres and AI, innovation, clean technology (both marketed and yet to be invented), circularity and diverse re-industrialization – including the capital flows involved thereof, etc. Implementing such a policy course successfully will create a more robust and sustainable economic and social base of the European Union, which will allow it – through further struggle and reform – to take its rightful leading global role and offer better opportunities to the European citizens. In this array of challenges, EU's energy and climate policies, and the associated resource base, supply chains and net-zero industries, will continue to be a major force, however with a new emphasis on aligning both national and common undertakings in this field with the Union's overarching security, defence and resilience strategies. Commission President Von der Leyen called competitiveness and defence the two sides of the same coin. [6]

A reinvigorated, way more specialised and strategically oriented EU economic, energy and climate diplomacy - as part and parcel of the overall European external action - will be essential to the success of this endeavour. All these aspects, however, need to be reconsidered and turned into common action along a rapidly changing global environment.

ENERGY AND CLIMATE: A DISHEARTENING GLOBAL PICTURE

To all those who have followed the dynamics of the global fight against climate change and the undelaying energy transition, mitigation and adaptation measures, the current discouraging state of affairs should not come as a surprise. The last three COPs, in Sharm El-Sheikh, Dubai and Baku, while trying to keep the flag of green transition flying, have, in fact, led to larger or smaller withdrawals from what was always intended as a widespread, conscientious and coordinated collective effort to reduce emissions in earnest - a commitment over 190 countries took in Paris in 2015. Global greenhouse emissions have in effect continued to rise since 2015, with no major country currently on track to meet its nationally determined contribution (NDC) goals for emissions reduction by 2030. [7] Without the US, which demonstratively withdrew from the Paris Agreement for the second time, the chances of countries raising their NDC targets to put the world on track for a 2 °C pathway or lower ahead of COP30 in Brazil later this year will be remote, observes a team of top international experts. Each of the three COPs mentioned above delivered relative "achievements", too. For example, the recent one in Baku, COP 29, issued a call on all Parties...to scale up financing to developing countries for climate action from all public and private sources to at least USD 1.3 trillion per year by 2035. [8] A welcome

ambition in terms of volume of financing but obviously far detached from the need to make haste because of increasing climate catastrophic events.

The cumulative impact of the outcomes of the last three COPs amounts to a resigned global tolerance for concurrent use of both fossil and renewable energy sources for the foreseeable future. This is a substantial step back from the prevailing readiness, demonstrated at COP 26 in Glasgow in 2021, to start leaving behind the most polluting fossil fuels.

The "tolerance" or disregard for the increasing evidence, in both frequency and size, of climate change-related disastrous phenomena all over the world already costs humankind enormous damages. That's the warning coming recently from, among others, the Institute and Faculty of Actuaries and the University of Exeter in a new report published in January 2025, calling for "accelerated action by political leaders to tackle the climate crisis". [9] The EU's Copernicus Climate Change Service in its turn showed the annual global temperature had broken the internationally agreed 1.5C target for the first time in 2024, earlier than predicted. NASA finds global sea level rose faster than expected last year. The largest number of people ever were displaced in 2024 due to climate change events. Scientists are clear that exceeding the 1.5C temperature limit could trigger multiple "tipping points". Crossing these irreversible boundaries risks permanent damage to the Earth's systems, supercharging extreme weather events. Medical studies of children and young people, having experienced climate change catastrophic events and living with fear of them, underline the importance of recognising the need to prepare for the psychological effects of climate, not just environmental, in low- and middle-income countries in particular. [10]

It is therefore understandable why climate activists the world over never give up. At the time of writing, they gave their full support to the 16th Petersberg Climate Dialogue (PCD) on 25-26 March in Berlin. As 2025 is a decisive year in the fight against climate change (the 10th anniversary of the Paris Agreement and the deadline for submitting the next round of NDCs), action must be doubled to keep 1.5°C within reach. The year has, however, begun with geopolitical turbulence and widespread cuts in the Official Development Aid (ODA). To ensure COP30 reinvigorates ambition and kickstarts a decade of climate action, activists stated that the Petersberg Dialogue should focus on: commitments to increase NDCs; building confidence and delivering international climate finance; implementing the Global Stocktake – including energy; making adaptation a priority; and showing the international climate regime, under COP30 Presidency, can deliver real progress and reform. [11]

THE NEW US ENERGY AND CLIMATE POLICY: INTENTIONS AND EFFECTS

At the end of 2019 the European Green Deal was launched - and with it the first science-based, long-term and comprehensive strategy to tackle climate change was set in motion. It also helped to induce big and small emitters throughout the world to follow suit – most did, including the two biggest, China and the USA. The continued reliance on fossil fuels and the sweeping,

climate-unfriendly, energy policies of the second Trump administration have, however, changed the dynamics of the global process of energy transition, clean-tech adoption and fighting climate change.

For three years until the end of 2024, the European Green Deal, the US Reduction of Inflation Act (IRA), and the 14th Five-Year Plan of PR China were at the centre of global efforts - including dozens of other developed and developing countries - to accelerate energy transition and decarbonisation. At some point along the way the EU Commission recognised that while it had shared with the world Europe's conceptual approach to tackling climate change, the Union nonetheless found itself lagging behind both China and the US. The EU failed in particular to develop its own clean-tech manufacturing capacity commensurate with the Union's decarbonisation ambitions. Hence, a number of corrective initiatives were put in place - starting with the REPowerEU plan and culminating in the Competitiveness Compass and the Clean Industrial Deal.

President Donald Trump's decision to withdraw (again) from the Paris Agreement has been met with dismay in Europe. "It is unfortunate because we are talking about the largest economy across the globe," Wopke Hoekstra, the European Commissioner for climate action, told Euronews. "When there is a vacuum, others will fill it – and that holds goods for us.", he added defiantly. [12]

In 2023, the US already produced more crude oil than any other country for the sixth year in a row and continues to hold this record. Yet, on assuming office, President Trump declared an "energy emergency" to boost America's fossil fuel production, with a view, in conjunction with other measures, to cutting energy prices by 50 %. The US President claims that the country needs to tackle high energy prices and to prepare for increased demand from "the next generation of technology".

Less than a month before President Trump's inauguration, the US Department of Energy released a report, produced by Lawrence Berkeley National Laboratory (LBNL), which found that data centres consumed about 4.4% of total US electricity in 2023 and are expected to consume approximately 6.7% to 12% (or 580 TWh) of total US electricity by 2028. Meanwhile, the International Energy Agency (IEA) estimates that electricity consumption from data centres worldwide could double by 2026, from 460 terawatt-hours (TWh) in 2022 to more than 1,000 TWh. On launching the report, former US Energy Secretary Jennifer M. Granholm stated: "The United States has seen an incredible investment in artificial intelligence and other breakthrough technologies over the last decade and a half, and this industrial renaissance has created greater demand on our domestic energy supply. We can meet this growth with clean energy" (!). [13]

Richard Haass, Honorary President of the US Council on Foreign Relations, shared his impressions of a totally different approach: "I just got back from Houston, where I attended and spoke at CERA Week, an annual gathering of some ten thousand people interested in energy policy. You had the new U.S. secretaries of energy and interior, any number of CEOs and investors, academics

and journalists. The paradigm change was obvious. Make Energy Great Again (MEGA) was the ubiquitous mantra in the crowded meetings. It was "fossil fuels are good." Those advocating for mitigating climate change as a policy priority appear to have entered the Witness Protection Program. Instead, the predominant argument was that climate change itself is an unavoidable side effect and a necessary trade-off of using fossil fuels, which are needed to bolster economic growth worldwide. Natural gas is the new favourite fuel. [14]

On the political level there is clearly a huge discrepancy in the respective assessments by the two US parties, Democratic and Republican, of the overall electricity demand in the US economy and, more importantly, on the kinds of energy sources identified as the appropriate technical and market solutions to ensure the sufficiency of domestic energy supply. Then, there is the belief of the new Administration that it can slash energy prices. Cutting energy prices by 50% would almost certainly leave oil companies unable to make a profit, something they are unlikely to accept. According to coincidental opinions, the estimated minimum price per barrel of oil at which companies can drill and still make a profit in the US is $45 to $50. On the day this paragraph was written the price of a barrel of Brent oil was $72.14, and a barrel of WTI $68.27. Halving these prices would put them well below this threshold. If increased drilling causes oil and gas prices to drop, fossil fuel companies are then discouraged from drilling as it isn't profitable. Lack of supply drives prices back up. Other countries are also likely to cut their production, reducing overall supply and increasing prices to keep the market stable. It is a boom-and-bust cycle the fossil fuel industry is all too familiar with, writes J. Liboreiro. [15]

It would however be wrong to conclude that the US is done with renewable energy, regardless of politically correct slogans. Two years after the IRA had been enacted it was estimated to have brought $493bn of investment to US green industry, according to Clean Investment Monitor, a think-tank. Here comes the interesting part: as a policy of his predecessor, and one that is so obviously pro-climate action, President Trump has been vocally opposed to maintaining the IRA. But "its success in red states" means that many Republican senators have been trying to convince the President to keep it in some form in his proposed "big, beautiful bill" - the plan to pile all of Trump's main policy goals into one mega-bill (possibly enveloping IRA policies under a reformulated Republican legislation?).

In the last 18 months Republican-held states had received 77% of the IRA investment. MIT's Dr Knittel says for states like Georgia, which has become part of what is now known as the "battery belt" (created by Biden's IRA), the tax credits are crucial for these industries to survive. He adds that failure to do so poses a real political threat for US representatives who are up for re-election in less than two years. If Trump loses even just one seat to the Democrats in the 2026 mid-terms, then he loses the house majority - limiting his ability to pass key pieces of legislation. [16]

A deeper analysis shows that the Trump Administration is faced with a real-life dilemma. On the one hand, the Inflation Reduction Act has indeed

stimulated a vibrant US cleantech industry. Investors have shown trust in the IRA. Solar capacity installations have more than doubled, from 22 GW to 50 GW annually between 2020 to 2024, while battery storage installations have jumped 148% since 2022 to 12 GW. The growing needs for data centres electricity supply 24/7 can be met too, by "a combination of solar, onshore wind and battery storage".

On the other hand, the politically motivated resort to fossil fuels reveals the fact that the currently available volumes of natural gas on the US market - the only other energy source capable of substituting the renewable power envisaged for US data centres – are insufficient for such a great demand. The US has of course practically infinite deposits of natural gas but drilling (fracking) and delivering the additional volumes is bound to increase the price of natural gas. What is more, building new gas-powered plants turns out to be an even bigger obstacle. "If you don't already have a turbine manufacturing slot, the earliest you will get a new combined-cycle power plant online – assuming everything goes perfectly – is Q4 2029, with costs up by 40% from a few years ago". [17] In other words, energy market fundamentals do not seem to favour the intended pivot to a "fossil fuels are good" policy, which means that compromises with IRA proven solutions will likely have to be made. Under the circumstances, the American entrepreneurs obviously have to be flexible.

Lately, the US has witnessed "greenhushing", the inverse of "greenwashing": companies are devoted to combating climate change yet reluctant to publicize their climate efforts. President Donald Trump has gutted many of the Biden administration's climate policies, sending a chilling effect to businesses that develop or deploy climate-friendly solutions. In response to the changing political landscape, many executives in corporate America are dropping the mention of "climate change" in meetings. Instead, they start to highlight non-climate benefits of their work, such as job creation and economic growth. In 2024, 67 out of the 100 largest publicly listed and private firms in the US under-promoted their work on environmental protection, resorting to greenhushing. [18] The amount of "sustainable" bonds issued in 2024 was $1 trillion, fuelled by record green sustainability note sales. President Trump is making the outlook for US clean technology manufacturers more challenging. Most analysts expect the Republican-controlled Congress to preserve Biden-era manufacturing tax credits but they also recognise that Trump's anti-clean energy agenda is weighing on the sector. His pledge to rescind EV tax credits and freeze new permits for offshore wind projects has dented demand for both technologies. A number of CEOs have opted to wait and see. [19]

It is too early in the mandate of the new US Administration to make conclusions on the Administration's long-term plans and chances of success. There are indications that the US is offering to cooperate with Russia on LNG supply but to what markets and at what price it is not yet clear. President Trump has expressed interest in acquiring foreign lands and/or signing contracts for US companies to mine, and possibly produce, rare earths and critical minerals. It is a clear indication of grand designs in advancing US

space and defence industries but also AI and clean technology on a big scale – in parallel with an intended massive boost to fossil fuels. The problem is that fossil fuels affect adversely the planet's health, and both policy streams (renewables and fossils) are pursued by the new administration often in a manner that disregards, or at the expense of, other nations' core interests, including those of allies and friends.

CHINA CONTINUES WITH ITS GLOBAL AMBITIONS

China, EU's other major competitor, does not seem to have doubts as to its chosen climate-friendly policy course. Indeed, some observers believe that because China dominates clean technology and there is a slowdown in the Chinese economy, the country will be left with a surplus capacity to ship solar panels, batteries, EVs and other green products around the world. As China is rapidly decarbonising, the IEA expects that China could choose to pursue its own path of decarbonising its economy, leveraging its competitive advantages in solar and EVs. The country could, in this projection, announce a 30% emissions reduction by 2035 in the next NDC submission and it might even bring forward its net zero pledge to 2050, thus taking global leadership in the quest for net zero. The reality check will occur at the upcoming in November 2025 COP 30 in Belem, Brazil.

The recently held Chinese National Assembly heard a boastful report on, among others, "vigorously promoting the construction of green certificate and green power market", promoting also "market-oriented reform of electricity price" as well as "the in-depth implementation of China's innovation-driven development strategy". China claims that the number of "high-value inventions and patents per 10,000 people has reached 14", a notable achievement by UN standards. This is due to "new steps in the promotion of education, science and technology and human resources as a whole". Other achievements include: a third-generation autonomous superconducting quantum computer has been put into operation; and the world's largest unmanned cargo airplane was assembled and launched. The total volume of data and the total scale of computing power in China "have steadily ranked second in the world". The data industry has emerged, giving rise to a number of new products and services with digital applications, for example in the design of "smart agriculture". Beijing aims to accelerate the "development of emerging industries and the orderly layout of future industries" with a view to integrate and "cluster develop" strategic emerging industries. [20]

On the eve of the National Assembly the Party Advisory body met to consider "China's slowing economy and Trump's new 10% tariffs". The country is already struggling with a chronic lack of domestic consumption because of an ongoing property crisis, unemployment and other economic and social problems. The US tariffs will additionally hurt exports, the crucial factor in China's growth. The National Assembly "set a growth target of around 5%" (4,8%) for 2025. To achieve this, the Party has promised an increase in government spending and, above all, huge investment in what President

Xi Jinping calls "high-quality development": that is renewable energy and artificial intelligence. The long-term aim is to become a world leader in these industries and, in time, become less vulnerable to American measures such as tariffs.

In the short-term though, China knows it has its own problems to fix, with or without US tariffs. But the tariffs certainly make that harder to do. [21] On the other hand, President Donald Trump, despite slapping tariffs on China, has communicated a desire to ease tensions with Beijing. [22]

The US levy will sting, writes Laura Bicker, BBC China correspondent – especially because it adds to a slew of tariffs Trump imposed in his first term on tens of billions of dollars of Chinese imports. And China's population is already concerned about their sluggish economy. Beijing and Washington have gone toe-to-toe on tariffs before. But a lot has changed since Trump 1.0. For one, the Chinese economy is not as reliant on the US as it was back in 2020. Beijing has strengthened its trade agreements across Africa, South America and South East Asia. It is now the largest trading partner of more than 120 countries. A deal could still be in the offing but the additional 10% may not offer the leverage that Trump wants, says Chong Ja Ian from Carnegie China. [23]

THE GAMECHANGING NATURE OF THE COMPETITIVENESS COMPASS AND THE CLEAN INDUSTRIAL DEAL

By all accounts, the EU is undergoing - through its own design and under pressure from unprecedented geopolitical disruption - a profound change in its economic model. EU climate and energy are so important to this process because for at least two decades their core and direction depended on strategically unviable international agreements and contracts on the importation of energy, from Russia, and clean technology, from China. The artificially created energy crisis in 2022, the weaponisation of energy, in particular natural gas, and the disruption of certain supply chains, served only to expose the strategic weaknesses in the European economic model, including innovation, manufacturing and defence procurement.

The Mario Draghi Report, a collaborative effort, (as well as the Enrico Letta Report), has provided blueprints for many of the new EU Commission's reformist policies. Above all, it identified three main areas for action to reignite sustainable growth.

First – and most importantly – Europe must profoundly refocus its collective efforts on closing the innovation gap with the US and China, especially in advanced technologies. Second, the EU needs a joint plan for decarbonisation and competitiveness - which we already have in the form of the Compass, the Clean Industrial Deal and several other related "flagship plans". However, the Report warns that if Europe's ambitious climate targets are matched by a coherent plan to achieve them, decarbonisation will be an opportunity for Europe. But if we fail to coordinate our policies, there is a risk that decarbonisation could run contrary to competitiveness and growth.

Third, the EU should act to increase security and reduce dependencies. In this setting, we will need a genuine EU "foreign economic policy" to retain our freedom – a so-called statecraft. The EU will need to coordinate preferential trade agreements and direct investment with resource-rich nations, build up stockpiles in selected critical areas, and create industrial partnerships. [24]

The Report addresses practically all problem areas. One finds a substantiated analysis of the systemic constraints in EU's energy sector. Chief among them are probably the electricity prices, being historically two to three times higher than those in the US (with gas prices 4 to 5 times higher). The Report's recommendations are valuable because they also address possible remedies to the current state of the EU energy markets. For example, the report puts an emphasis on developing "locational price signals in electricity markets", reflecting the local value of energy. In addition, price formation should in future better reflect the underlying network constraints, rather than national borders: a recommendation which is relevant to the regional markets in South East Europe, among others.

The report further recommends to decouple the remuneration of renewables and nuclear from fossil-fuel generation through long-term contracts (PPAs and 2-way CfDs- "contracts for difference") in order to limit the impact of natural gas on electricity prices. In doing so member states should build on the tools introduced under the new Electricity Market Design, again using PPAs and two-way CFDs. Moreover, they should develop an enabling framework to progressively extend PPAs and CFDs to all renewables and nuclear assets in a harmonised way. While this sounds commendable, and for South East European energy markets most useful, the reality is, as pointed out in the Clean Industrial Deal, that just seven member states have transposed the Directive that specifies the new, consumer and business-friendly, Electricity Market Design.

The above examples point to integration management and governance issues, which lie outside the Compass and the Deal but are crucial to their implementation. In introducing the Competitiveness Compass Ursula von der Leyen underlined that "unity and speed" is necessary for the success of the new economic policy. Unity in this case should mean, among other things, coordination, or better still, coordinated implementation across the Union. Political will has to be combined with technocratic skills and enforceable standards.

The Compass and the Clean Industrial Deal – including the simplification Omnibuses, Action Plan for Affordable Energy and "Road to the MFF" – have received both positive and critical comments.

Greg Van Elsen, Policy Lead on Clean Industrial Deal at CAN (Climate Action Network), Europe, said: "A compass is only useful if it is calibrated and points to the right destination. It is a fact that Europe urgently needs an industrial transformation that builds future-proof industries within planetary boundaries. This requires a coordinated industrial strategy at the EU level. The Competitiveness Compass recognises the problem–fragmented national policies–but fails to provide an ambitious, coordinated and sustainable

solution. If the EU wants to lead in the net-zero economy, it must recalibrate and back its progressive industries, including grid manufacturers, battery producers, and green steel, with a clear plan: joint investment, smart regulation, energy transition and strong climate targets. A blind deregulatory drive won't get us there."

In her turn, Isabelle Brachet, Fiscal Reform Policy Coordinator, added: "The EU and member states cannot be handing out public money to companies that make profits without giving anything in return. Accessing public funds must go with the responsibility to generate positive outcomes for the climate, the environment, workers and society at large. On top of that, the upcoming Omnibus legislation attacking corporate accountability is just unacceptable. We must not allow the simplification agenda to translate into cutting down the social and environmental legislation, which is unfairly blamed as a blocker to European competitiveness."

Commenting on the proposed additional annual investment needs at €800 billion, or about 5 percent of EU GDP, an article sponsored by the Center for Strategic and International Studies, Washington, reads that while this topline figure is widely accepted by economists, it remains unclear whether there will be enough viable investment projects to absorb this funding. Financing these investments will require more private resources, which necessitates developing European capital markets and completing the Banking Union, along with greater public resources for joint projects funded by joint European debt, a contentious and politically divisive issue. [25].

In a rather comprehensive and informed briefing paper, Sandra Tzvetkova and Pepe Escrig, of E3G Consultancy, comment on the Compass and the CID, providing insights and critical remarks. Referring to "a series of flagship plans intended to boost the EU's economy in difficult times", the authors generalise to say that "so far" they add up to a "mixed overall strategy". In more concrete terms, the authors observe that while some pieces provide strong and logical links between decarbonisation and competitiveness, their ambitions lack fresh sources of funding or a credible mechanism for joint EU action. Meanwhile, the first "simplification" effort delivers deregulation and uncertainty. This "shaky start" leaves multiple politically charged decisions for the remaining days of the second von der Leyen Commission.

Tzvetkova and Escrig find that the batch of policies – notably the Competitiveness Compass, Clean Industrial Deal, simplification Omnibuses, Action Plan for Affordable Energy and the "Road to the Multi financial framework" – give shape to Europe's effort to support its economy, stake out a stronger position on the global scene, and ensure that households reap benefits along the way. "Yet the difficult questions that sit at the heart of the puzzle, such as how to effectively coordinate the bloc or increase EU-level funding, remain unanswered".

While the two authors' observations, including the moderate criticism, are

in order, fairness requires us to note that the EU Commission is at the very start of its 5-year term, the external environment is unprecedented, and there are obviously internal management issues to be sorted out. The various new concepts in these "flagship plans", and there are plenty of them, need careful and precise interpretation in the form of Directives and Regulations, which the Commission cannot afford to present in inadequate terms, moreover that it works with demanding, often contradictorily thinking, member states.

It is noteworthy that the two authors sum up their review in a positive and encouraging tone: "the Competitiveness Compass and the Clean Industrial Deal (CID) both signal that Europe will stay the course by accelerating action towards a decarbonised, clean and circular industry as the EU's core strategy to delivering competitiveness and prosperity, and reducing dependencies". [26]

In a broader context, such affirmative opinions support a growing awareness among European businesses and citizens that the tendentious predictions throughout 2024 for a collapse of the European Green Deal proved wrong. The deregulation acts were moderate and to the point, and did not in any major way upset the strategic parameters and goals of the Green Deal. As Euro News reported on the day Prime Minister Donald Tusk delivered that fiery speech in support of the EU but criticising the European Green Deal, Commission President Ursula von der Leyen, a close ally of Tusk's, promised to take decisive action to decrease energy prices for Europeans. She has also said that the original targets of the Green Deal would be maintained, given the severity of the climate crisis. "We must bring prices down while we complete the phase-out from Russian fossil fuels. Both objectives are important, and they should go hand in hand". [27]

A PROFOUNDLY CHANGING EU ECONOMIC MODEL AND EU GLOBAL OUTREACH NEED A MATCHING ROBUST DIPLOMACY

The recommendation for the EU to increase security and reduce dependencies, now embodied in landmark Council Conclusions and Commission policy papers, amounts to the formulation of a "genuine foreign economic policy", rated as a "statecraft". The EU will need to coordinate "preferential trade agreements and direct investment with resource-rich nations, build up stockpiles in selected critical areas, and create industrial partnerships" to secure the supply chain of key technologies. "Only together can we create the necessary market leverage to do all this".

The EU has a formidable team of External Action officers, over a hundred

Representations around the world, and the national diplomatic corps of member states with whom the EU officials in Brussles or in the field interact. Whether this administrative arrangement and the coordination mechanisms that the Commission and the 27 member states employ will be enough to perform the above challenging tasks is for the European Council and the Commission to say. In view of the speed with which the Commission and the member states are ready to work to vastly improve security, defence,

infrastructure, economic reform, energy transition and decarbonisation, both the European institutions and the member states would probably prefer to make use of the existing administrative framework and the existing number of officials, without having to make changes to the legal body of the Union.

Even under a "conservative" approach to institutionalising a new phalange of highly specialised and hands-on European diplomats, the necessary personnel and quality skills standards could be ensured through quiet but thorough talent-spotting, long-term specialisation, and promotion schemes. The world-renowned diplomatic academies, think-tanks and post-graduate training centres that a good number of member states have should be involved as soon as possible to advise and assist in this process.

From the point of view of the challenges to a set of reinvigorated EU energy and climate policies, highlighted in this article, the case can be made that building a yet more specialised and motivated EU energy and climate diplomacy is a priority. It is indeed, but under the new geopolitical setting and in view of the nexus and synergies between EU policies on security, defence, energy, climate, AI, cleantech and their respective resource bases and supply lines, a certain number of the European diplomats - in Brussels, in member states' capitals and EU representations and delegations – will have to receive additional training, acquire negotiating skills and experience, and build strong features of endurance and self-confidence. These will be diplomats who would specialise in what can generally be described as "strategic aspects of international relations", energy, climate and strategic resources fundamentals to feature prominently in it.

In the diplomatic profession, very much like in the medical profession, one begins to be sure of oneself and feel capable of delivering for one's country, in this case one's Union, after many years of experience and continuous study. The EU cannot of course depend on mature age officers only. It needs to build generations of broadly qualified men and women. A solution might lie in developing a college of "special envoys" for the various strategic portfolios, with the professional skills and personal qualities described above, around whom teams of younger and less experienced diplomats will work. Such special envoys would better be under the Commission President – for authority and presentation purposes on foreign missions – and could be selected on a permanent or ad hoc basis from among the directors general or other senior Commission staff, and the national governments. Preferably, the special envoys should work on their specific tasks independently from an administrative point of view while members of their teams could serve "in dual capacity" in the Commission or Council Directorates or other offices.

The learning and requalification process will be long and hard: the sooner the EU institutions and the member states start thinking about this issue the better.

Ambassador Peter Poptchev, *PhD, a career diplomat, has held rank-and-file and Head of Mission posts at the Bulgarian Embassies and Permanent Representations in Lagos, Geneva (Disarmament), Brussels (NATO), Dublin and Vienna (UN, OSCE, IAEA). Between 1988 and 1991 he was head of MFA's Disarmament and Arms control Division. In the same year he was the first Bulgarian diplomat (Minister Plenipotentiary) to be appointed representative of the Bulgarian Minister of Foreign Affairs to NATO Secretary General. P. Poptchev worked on UN and Disarmament matters in national and international capacities for altogether twenty years. He was elected chairman of several key multilateral negotiations, which matured into international treaties, conventions and protocols. Ambassador Poptchev represented Bulgaria in EU and NATO formats, and served as a "qualified expert" of the UN Secretary General. In 2007 he was appointed Bulgaria's first Ambassador-at-large for energy security and climate change, and also acted as advisor to four successive ministers of economy and energy. The author of books and articles, Ambassador Poptchev, now retired, writes, lectures and consults on foreign and security policy, the rules based global order, transatlantic relations, European integration, the European Green Deal, the Clean Industrial Deal, the ReArm Europe Plan, cybersecurity, AI, hybrid warfare, great powers competition, Russia's aggression against Ukraine, mining and rare-earth minerals, and net-zero industries. In 2020 he founded and heads Net Zero Foundation International Climate Network, whose whole team works pro bono.*

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AXIOMATIC ANALYSIS OF THE EU ENERGY TRANSITION

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1. Problems with understanding the modern energy transition

The EU's energy transition is facing serious tests and challenges of an economic, geopolitical, diplomatic, internal political, social and even military nature. The last five years have been very complex for the EU since the adoption of the European Green Deal (EGD)[1], through the pandemic, the first global energy crisis[2], the war in Ukraine, domestic political fragmentation to the uncertainty of Trump 2.0 policy and partnership relations with the US. All of these developments have shown that the climate and energy transition goals of Europe cannot exist in a vacuum[3], but coexist with other objectives - competitiveness, economic development and growth, energy security, technological and geo-economic competition. And without the findings of the Draghi Report[4], it has become apparent that the EGD was not planned for the current extremely deteriorated domestic environment and rising global tensions. High energy costs and energy uncertainty are damaging competitiveness, hampering growth and limiting investment. Insufficient global efforts to decarbonise and global economic and technological confrontation[5], the exploitation of interdependencies and distortions of international trade, the new wave of industrial policies in the world, require profound changes through a strategic rethinking and repositioning of European energy and climate policy. The way the EU moves forward in the face of successive and overlapping crises will directly affect its short and long-term energy security, its competitiveness and the speed of the European energy transition.

An important part of the iterations on the strategic rethinking and repositioning of Europe is answering the question - how do European politicians, business leaders, analysts, the scientific community, civil society and environmental activists assess the course charted by the EGD so far and how do they perceive the new Clean Industrial Deal (CID) [6],in the context of the global energy transition and its multi-scale effects. It is in the multi-dimensional aspects of the energy transition and its multi-scale impacts that the problems and challenges for Europe are embedded, due to the shallow, superficial, simplistic, fragmented and straightforward perception and lack of knowledge

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[2] Yanakiev. Y., The impact of the energy transition and the global energy crisis on EU technology leadership policy in Energy and Climate Diplomacy 2023, Diplomatic Institute Ministry of Foreign Affairs of he Republic of Bulgaria.
[3] Yergin D., Orszag P., Arya A., The Troubled Energy Transition, How to Find a Pragmatic Path Forward, Foreign affairs, https://www.foreignaffairs.com/united-states/troubled-energy-transition-yergin-rszag-arya
[4] https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en
[5] Molhova M, Ivanov I. Disruptive Technologies-Technological Change Driven Conflicts. Journal of isk & Control. 2023 Jan 1;10(1).
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of its nature, as it has not only energy, technological and climate dimensions[7].

In Europe, the energy transition is widely identified, interpreted, misrepresented with the so-called "green transition", "green transformation", "decarbonisation", Green Deal, "green project", as well as with clichés related to the phase-out of carbon fuels and their replacement with renewable energy sources (RES). The nature of the energy transition as a historical process of natural technological and economic evolution and its associated developmental principles, interrelated and interdependent processes and effects are ignored. This has led to the fetishisation and hyperbolization (in positive and negative ways) of the energy transition and, on this basis, the adoption of strategic policy documents with unrealistic expectations that ignore technological, economic and social realities. The identification of the EGD with the energy transition, as well as the lack of a thorough understanding of its nature and the displacement of its real content, have turned it into a vague ideological construct burdened with political, corporate and social expectations, which hinders objective analysis and balanced strategies. The real cost of the fetishization and hyperbolization of the energy transition has led to ineffective solutions, misguided policies and public disillusionment.

The current energy transition has acquired considerable academic, practical and policy relevance, leading to a surge in research and studies devoted to its various aspects[8]. Much of this is limited to looking at different types, forms and structures of energy consumption (the widespread adoption of a particular type of new energy or the modification of energy mixes and the sequence of transformations in the structures of energy production and consumption), but does not comprehensively cover the complex transformations occurring within energy policies, infrastructural landscapes, socio-technical systems and societal practices. This further leads to a lack of a unified definition, fragmentation of previous analyses and data, use of over-idealised models that do not reflect real technological and market constraints, making integrated analysis difficult. There is a critical need to study the energy transition from an interdisciplinary perspective with an adequate methodological toolkit that comprehensively reveals that it is a highly socialised process driven by many intertwined factors (technological innovation, market mechanisms, political arrangements and socio-cultural factors) causing profound socio-economic and environmental consequences and effects. Along with the synergetic and conflictological approaches already proposed to study the energy transition, an axiomatic

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[8] Yanakiev, Y., Energy Transition – Geopolitics and Energy diplomacy, S., University for National and World Economy, 2022.; Smil V., Energy Transitions: History, Requirements, Prospects[M] Praeger, Santa Barbara (2010); Smil V., Examining energy transitions: a dozen insights based on performance Energy Res. Social Sci., 22 (2016), pp. 194-197; Yergin, D., The return of energy security, https://www.spglobal.com/en/research-insights/featured/special-editorial/look-forward/the-return-of-energy-security; R. Fouquet, Historical energy transitions: Speed, prices and system transformation Energy Res. Social Sci., 22 (2016), pp. 7-12.

approach can be added to propose an ideal model of the energy transition and, on this basis, an axiomatic analysis of EGD and CID.

2. Axiomatic analysis and ideal energy transition model

The axiomatic approach[9] to the European energy transition provides a robust theoretical framework that addresses key issues in the study of this process. It allows for a more objective, systematic and interdisciplinary analysis, overcoming the limitations of fragmented, ideologised and technologically limited models. Through its application, it attempts to create a unified framework for analysis that brings together economic, technological, historical, social and geopolitical factors. Through the integration of historical experience in terms of technological and economic development, ideological distortions are reduced by preventing the favouritism of one technology at the expense of another, and social effects are analysed. All this provides a basis and allows scenarios to be modelled that change according to new technological and economic realities.

The Ideal Energy Transition Model[10] is a conceptual framework based on 13 axioms that set the logical, economic and technological principles for a successful and sustainable energy systems transformation. The ideal model can be defined as a conceptualisation of the axioms into a working system. It is not just a political strategy or a technological scenario, but a scientifically and historically grounded structure that provides guidance for the management of the actual process, defines the boundaries, the main drivers and the critical dependencies. If the ideal model is the "pure" theoretical form of the energy transition, the real transition is its empirical realisation - burdened by a multitude of real factors. The ideal model of the energy transition is not a fixed scheme, but a flexible concept that provides a methodological basis and what principles need to be respected for the transition to be effective. It defines the strategic objectives and characteristics of a sustainable and competitive energy system. It forms criteria for analysis and assesses the progress and realism of specific policies. The ideal model links historical experience with future challenges by limiting interpretations, political and media distortions. The aim of the model is not to impose a single template, but to provide a robust framework for analysis and adaptation of actual policies and strategies.

Analysis and argumentation of the 13 axioms of the energy transition

The 13 axioms[11] suggested below present a multidimensional, systematic and

[9] The axiomatic method uses a set of basic, self-evident propositions (axioms) that are assumed to be true without proof as, by logical deduction, corollaries are derived and an overall theoretical framework is constructed. With respect to the energy transition, these strictly defined basic principles (axioms) describe the immutable regularities, constraints and dependencies that determine its dynamics.

[10] The ideal model is an abstract framework that describes how an optimal, logically sustainable and efficient energy transition would take place. In reality, the energy transition is always influenced by political, economic and social constraints, but the ideal model serves as a starting point for analysis and adjustments.

[11] In forming the energy transition axioms, we use the following criteria: historical validity- whether the axiom has manifested itself in previous energy transitions; technological neutrality

balanced foundation, forming a robust, logical and comprehensive framework for energy transition analysis. They are internally consistent, empirically grounded and practically applicable, taking into account the technological, economic, geopolitical and social aspects of the process, and avoiding one-sided or ideologically driven interpretations. They are sustainable, empirically proven and applicable in a global context.

Table 1: **Argumentation of the energy transition axioms**

Axiom	Evaluation of the axiom
1. Energy transition is irreversible	**Fundamentality**: High. Historical analysis of energy systems shows that each new energy paradigm does not completely replace the previous one, but leads to transformations that are difficult to reverse. Humanity is invariably moving towards more efficient technologies and sustainable energy sources. Once started, this process cannot be stopped, only accelerated or slowed down by technological, economic and political factors. **Operationality:** Medium - the axiom can be used as a modelling assumption, but there are cases of regression when political or economic crises return countries to older energy technologies. **General applicability:** High. **General validity:** Historically observed during transient energy transitions. **Consistency:** does not conflict with other axioms - the transition itself may slow down, but not stop. **Formal sustainability:** valid regardless of political regimes because the process is driven by economics and technology.
2. Energy transition is economically sound and unavoidable	**Fundamentality:** High. The long-term competitiveness of new technologies is a key driver of the energy transition. Change in the energy mix is driven by economic logic and through market mechanisms: new sources must be competitive with previous ones to be permanently adopted by industry and society. Policies can accelerate or modify the transition, but they cannot impose it without an economic basis. No new energy technology is permanently imposed by policy decisions unless it is economically viable. States and companies cannot subsidize inefficient technologies for long. **Operationality:** High. The axiom can be proved by econometric models and cost analysis. **General applicability:** Medium - some countries still subsidize uneconomical energy sources for political reasons. **General validity:** Every industrial revolution is the result of the competitiveness of new technologies. **Consistency:** Complementary to the other axioms - economic benefits are a key driver of change. **Formal sustainability:** Even with government subsidies, new technologies must prove cost-effectiveness.

- the axioms are valid regardless of the specific technologies; geopolitical sustainability - to apply regardless of political regimes and international alliances; economic logic - to reflect real economic principles; social relevance - to take into account the social effects of the energy transition. Each of the axioms describes a fundamental principle that is embedded in the ideal energy transition model. Their validity and reasonableness were assessed according to the criteria of: fundamentality - whether the axiom expresses a universal principle that is independent of a particular technology or policy framework; Operationality - whether it can be used to analyse, model and predict the energy transition; General applicability - whether it is relevant to different countries, economic systems and energy models; General validity - whether it applies in different historical, geographical and political contexts; Consistency - whether it is logically consistent and does not conflict with other axioms; Formal sustainability - whether it remains valid despite technological, economic and political changes.

3. Energy transition is non-linear and adaptive	**Fundamentality:** High. The history of technological innovation confirms that transitions are not smooth and do not follow a linear path of development, but are subject to cycles of breakthroughs, crises and adaptations. Different regions develop at different speeds depending on available resources, policies and socio-economic factors. **Operationality:** High - used in scenario modelling. **General applicability:** High. **General validity**: Transitions in history have always been chaotic and dependent on multiple factors. **Consistency**: It does not contradict irreversibility - the transition goes through multiple bifurcation points. **Formal sustainability**: Valid regardless of time horizon - chaos and non-linearity are natural laws.
4. Diversification is a key principle	**Fundamentality:** High. Historically, no new energy technology has completely eliminated previous ones; there is always a mix where different sources coexist and complement each other. **Operationality:** High – can be used for optimization models. **General applicability:** High. **General validity**: Each country applies a mix of energy sources according to its resources. **Consistency**: Fully compatible with other axioms – new technologies do not lead to rapid replacement. **Formal sustainability**: There will always be a need for energy security through a balance of different energy sources.
5. Energy transition is the result of technological, economic and geopolitical synergy	**Fundamentality:** High. Transition is not driven by technological advances alone, but by complex interactions between markets, policies, and international dependencies. New technologies alone are not sufficient for transition – it is driven by global economic trends, industrial strategies, and geopolitical configurations. Historically, there has been no technological change without economic and geopolitical impact. The development of new technologies determines the speed of the energy transition and its direction. **Operationality:** Medium – difficult to measure, but valid as a concept. **General applicability:** High. **General validity**: It applies to all countries that develop technologies according to their strategic interests. **Consistency:** Compatible with all other axioms. **Formal sustainability:** Even new technologies like hydrogen or thermonuclear fusion will follow this model.
6. Energy transition cannot compromise energy security	**Fundamentality:** High. If an energy transition creates supply uncertainty, it is unsustainable. Any successful energy transformation must ensure reliable supply, affordable prices and strategic autonomy. The goal of the energy transition is affordable, secure and clean energy, not just reducing emissions. Every country must ensure reliable energy supplies, as dependence on uncertain technologies or external resources collapses socio-economic systems. New energy models must be cost-effective to be sustainable. **Operationality:** High. **General applicability:** High. **General validity:** Every country builds its energy policy around security. **Consistency:** Supports diversification and technological neutrality. **Formal sustainability:** Even with new technologies, this principle remains valid..

7. Environmental sustainability is not the only driver	**Fundamentality:** High. While climate policies are a strong catalyst, the real transition depends on technological progress, industrial efficiency and economic benefits for consumers. Real industrial transformations are driven primarily by economic logic, not just environmental considerations. Without economic benefits, environmental policies cannot be sustainable. Decarbonisation must be compatible with industrial development. **Operationality:** High. **General applicability:** High. **General validity**: Applies to all industrialized countries. **Consistency**: It does not deny the environmental factor, but places it in a real economic context. **Formal sustainability**: Policies change, but the economic logic remains.
8. Nuclear energy and new technologies are critical for long-term sustainability	**Fundamentality:** High. Without stable baseload power, energy systems are vulnerable. Without nuclear power or new technologies such as hydrogen and fusion, the transition may remain unsustainable. Nuclear technologies (including future fusion) will play a key role in the stability of energy systems. **Operationality:** Medium – the future of nuclear technology is uncertain. **General applicability:** Medium – some countries reject nuclear energy. **General validity:** Developed economies use nuclear power or are considering this option. **Consistency**: Fully compatible with other axioms. **Formal sustainability**: Long-term valid, especially with advances in nuclear technology.
9. Technological neutrality as a fundamental principle	**Fundamentality:** High. History shows that monopolizing a technology is risky. Policy decisions should not preemptively eliminate technologies before their real potential has been proven. A sustainable transition requires openness to different energy solutions and the avoidance of dogmatic policies that favor one technology over another. No technology should be favored without economic justification. **Operationality:** High. **General applicability:** High. **General validity**: Every successful transition strategy allows for different solutions. **Consistency**: Supports diversification. Complements the other axioms. **Formal sustainability**: There will always be competition between energy technologies.
10. Energy transition is not an end in itself, but a tool for a better quality of life	**Fundamentality:** High. Energy transition policies should improve economic and social conditions, not just reduce emissions. If the transition worsens the economic situation of citizens and does not improve their lives, it is unsustainable and will encounter resistance. The ultimate goal of the energy transition is not simply to replace one energy source with another, but to provide more affordable, reliable and cleaner energy for industry and society. **Operationality:** High. **General applicability:** High. **General validity**: The social effects of the transition are multifaceted. **Consistency**: Complements the remaining axioms. **Formal sustainability**: Political regimes change, but this principle remains.

11. Energy transition is conflictogenic	**Fundamentality:** High. Historically, all significant energy shifts have created geopolitical tensions and economic conflicts. Any change in the energy model leads to economic, geopolitical and social conflicts. The shifting of energy industries and resources creates tensions between states, corporations and social groups, which requires strategic risk management. The energy transition redistributes resources, economic opportunities and geopolitical influence, which inevitably leads to conflicts related to changes in resources, technologies and markets. **Operationality:** Medium - difficult to measure. **General applicability:** High. **General validity**: Every region or country undergoing an energy transition experiences economic and social tensions. On a global scale, competition for technological leadership is also a form of conflict. **Consistency**: The axiom does not contradict the others, but complements them – the axioms of the nonlinearity of the transition (No. 3) and technological neutrality (No. 9), since the very differences in technological strategies create points of conflict. **Formal sustainability**: Conflicts arising from the energy transition will continue to manifest themselves in the future, regardless of the specific technologies that dominate.
12. Every country has its own specific energy transition	**Fundamentality:** High. There is no universal model for all countries. Universal models do not work because countries have different resources and capabilities. The energy resources, geographical location, industrial structure and political priorities of each country shape a specific transition trajectory. Energy policies and solutions must be adapted to national conditions and take into account local resources, economic structure, industrial traditions and geopolitical dependencies. **Operationality:** High. **General applicability:** High. **General validity**: The fact that there is no single global formula for energy transition is visible in the differences between the strategies of the US, China, the EU, India and developing countries. **Consistency**: This axiom complements the axioms of diversification (No.4) and technological neutrality (No.9). Different groups of countries will choose different paths to decarbonization depending on their advantages and constraints. **Formal sustainability**: As long as there are countries with different economic, natural and political conditions, this axiom will remain valid.

13. Energy transition forms new nonlinear and dynamic relationships between geopolitics, industrial policy, technology, economics, and the social system of society	**Fundamentality:** High. The energy transition is not an isolated process, but transforms the entire economic and social structure. Technology, economics and politics are interconnected. The energy transition changes not only the energy sector and the energy mix, but also the entire economic structure – it transforms industries and markets, and influences geopolitical balances. It causes social transformations and changes social employment patterns. The modern energy transition creates new supply chains for critical minerals that rearrange geopolitical relations. The dynamics between energy policy, economics and geopolitics are constantly changing. The success of the transition depends on the integrated management of all these factors. The energy transition cannot be planned in isolation – it requires systemic thinking and an integrated approach. **Operationality:** Medium – difficult to quantify. **General applicability:** High. **General validity**: Every economy undergoing an energy transition experiences changes in its industrial model – some positive (development of new technologies), others negative (deindustrialization). Leading countries in the world use the energy transition as a tool for economic and geopolitical dominance. **Consistency**: The axiom fits logically into the others – about the economic inevitability of the transition (No. 2), its nonlinearity (No. 3) and its conflict-generating nature (No. 11).. **Formal sustainability**: This axiom will remain valid in the future, because all major technological transformations lead to large-scale changes in society and the economy.

From the proposed axioms, as a result of an analysis of literature on the history of technological revolutions and energy transitions of human civilization, we can propose a concept of an ideal model of energy transition[12]: the energy transition is a natural long-term, non-linear, non-deterministic, multidimensional and complex transformation process in which, under the influence of scientific and technical progress and the complex development of new technologies, a shift is made from relatively less efficient energy resources and sources to highly efficient ones. This process leads to profound and fundamental changes in the energy foundations of society, involving long-term, complex and multidimensional reconfigurations of the energy system, including associated technologies, policies, infrastructure, scientific knowledge and social culture.

The transformation encompasses all levels and stages of the energy production chain, the balance between supply and demand in global and regional energy markets, actors and their behaviour, financial and business models, existing policies, regulations, etc. The energy transition is profoundly changing existing economic and trade patterns and affecting the interstate balance of power, which inevitably leads to changes in the configuration of existing political, economic and trade alliances and to the emergence of new ones. It forms non-linear and dynamic interrelationships between geopolitics, national security strategies, foreign policy and energy diplomacy. An important feature of the energy transition is its conflictogenicity: it generates multiple conflicts, delineates a number of conflict situations and conflict zones, reveals new conflict factors, creates an environment with significant conflict potential[13].

[12] Yanakiev, Y., Energy Transition – Geopolitics and Energy diplomacy, S., University for National and World Economy, 2022.

[13] Yanakiev. Y., Conflictogency of the global energy transition and the challenges facing the EUEnergy and Climate Diplomacy 2024, Diplomatic Institute Ministry of Foreign Affairs of the

3. Axiomatic analysis of the European Green Deal

The EGD is the EU's framework for achieving climate neutrality, but its implementation reveals structural weaknesses and conceptual inconsistencies with the realities of the energy transition. Table 2 assesses, against certain criteria[14], the extent to which the principles of the EGD are consistent with the ideal energy transition model.

Table 2. **Axiomatic analysis of EGD**

Axiom	Compliance with EGD
1. Energy transition is irreversible	**Theoretical compliance**: Coincidence. The EGD is entirely based on the understanding that the energy transition is irreversible and will be a major factor in Europe's future development. The 2050 climate neutrality target reflects the view that the clean energy transition is a long-term trend and aims to accelerate this process in Europe. There is also a partial discrepancy, as the EU's energy transition is taken for granted and treated as a political act rather than an evolutionary process. **Practical implementation**: Policies are trying to accelerate the transition with administrative measures instead of market mechanisms. Artificial deadlines (2030, 2050) are imposed without realistic adjustment mechanisms. Investments in traditional energy sources are stopped before reliable alternatives are available.. **Problems**: EGD relies on administrative and political decisions that attempt to artificially accelerate the transition, without always taking into account economic and technological readiness. **Risks**: Potential energy crises if alternative technologies fail to replace fossil fuels in time. Social resistance – with high prices for electricity and energy resources. Although the EU is on the path to an irreversible transition, short-term political and economic shocks could slow it down.
2. Energy transition is economically sound and unavoidable	**Theoretical compliance:** Discrepancy. EGD claims that decarbonization leads to economic growth and new jobs, but its implementation is implemented through regulations, subsidies, restrictions and centralized policies. Market mechanisms and technological progress are not the basis of the transition. **Practical implementation**: Lack of sufficient evidence of real economic profitability – new technologies are not yet cost-competitive in some sectors. Lack of flexibility in EGD mechanisms has led to inefficient allocation of resources and artificially high energy prices. The EU has an economic motivation for the transition, but industry struggles with high costs. Artificial subsidization of RES, without a clear strategy for long-term economic sustainability. **Problems**: Unclear economic model for decarbonization, due to high level of regulations, subsidies and restrictions, rather than natural economic logic. Carbon tax and renewable energy subsidies artificially alter market signals. Expensive energy transition subsidies leading to inflation and industrial disruption. **Risks**: Loss of industrial competitiveness – EU finds itself at a disadvantage compared to the US and China. Deindustrialization and energy poverty if costs continue to rise.

Republic of Bulgaria.

[14] Methodology of the axiomatic analysis of EGD. We compare each axiom with the key policies and measures in EGD and evaluate: Theoretical compliance – to what extent does EGD formally recognize the principle; Practical compliance – how EGD is applied in practice; Problems – where are the deviations and weaknesses and what are the consequences; Risks – the potential (negative) consequences of non-compliance.

3. Energy transition is non-linear and adaptive	**Theoretical compliance:** Discrepancy. EGD sets strict deadlines (2030, 2050), without considering that the energy transition depends on dynamically changing technologies, resources, social and geopolitical factors. Policies that are not adaptive can lead to destabilization (deindustrialization, social protests). **Practical implementation**: Strictly fixed targets (2030, 2050), without a mechanism for flexible adjustment in times of crisis. EGD is based on a dogmatic approach to RES, without adaptation to market realities, with overly ambitious expectations for technological development (hydrogen, batteries, energy storage). **Problems**: EGD relies on a predetermined timetable and fixed goals, which does not reflect the real non-linear nature of the transition. It lacks flexibility in the face of economic and geopolitical shocks, given the fixed deadlines and strict regulations. **Risk**s: Difficulties in adjusting policies in the event of economic or energy crises. Unforeseen social and geopolitical tensions. The EU adapts its policies, but the lack of long-term stability hinders business.
4. Diversification is a key principle	**Theoretical compliance:** Coincident, but with reservations, as systems with low diversification are unstable. EGD emphasizes renewables but recognizes the need for energy diversification, including nuclear, green hydrogen, and advanced storage technologies. The focus on eliminating fossil fuels does not fully recognize the role of transitional technologies. **Practical implementation**: EGD favors renewables and batteries, marginalizing other technologies (nuclear, carbon capture). Underestimating the risk of increasing dependence on China for critical minerals (lithium, rare earths), batteries, and solar panels. **Problems**: EGD strongly favors electrification and renewable energy, ignoring natural gas, nuclear power and potential new technologies (carbon-neutral fuels), which limits the possibilities for adaptation. **Risks**: Over-favoring one technology (RES) creates vulnerability. The EU diversifies its domestic mix but remains dependent on imports. Vulnerability of the EU to geopolitical shocks if supply chains for RES materials are disrupted.
5. Energy transition is the result of technological, economic and geopolitical synergy	**Theoretical compliance:** Partial coincidence. Synergy is limited due to EGD's focus primarily on climate, ignoring economic and geopolitical realities. **Practical implementation**: Ignoring geopolitics is critical, as the EU does not have its own reserves of critical resources. **Problems**: Insufficient attention to geopolitical risks and industrial policy. EGD relies mainly on regulatory mechanisms and not enough on technological breakthroughs and industrial innovation. Europe risks losing competitiveness as it is overtaken in green technologies by the US and China. **Risks:** The EU is lagging behind in technological autonomy.

6.Energy transition cannot compromise energy security	**Theoretical compliance:** Discrepancy. Initially, the EGD did not take into account geopolitical risks – the EU's dependence on Russian natural gas and the constraints in global supply chains. Only after the global energy crisis in 2022 did policies begin to adapt (REPowerEU), but there is no clear mechanism for energy security in the rapid transition to renewables. **Practical implementation**: EGD created uncertainty through a sharp rejection of traditional energy sources, with policies implemented within its framework leading to energy shortages and high prices in 2021-2022. Insufficient attention to the role of baseload capacity (nuclear power, gas power plants), which undermines energy security. **Problems**: The EU's policies to rapidly phase out coal and limit natural gas are leading to a reliance on imported renewable energy technologies and batteries, mostly from China. This increases the strategic risks for Europe related to import dependence on critical materials and the instability of renewables. Lack of realistic scenarios for energy security in the event of instability of renewables. **Risks**: Energy shortages due to unpredictable weather conditions. Rising energy prices leading to public discontent. The EU guarantees its energy security, but at a high cost to industry.
7. Environmental sustainability is not the only driver	**Theoretical compliance:** Partial coincidence. EGD emphasizes environmental sustainability, but the economic and industrial dimensions are not so clearly linked. **Practical implementation**: Dominant climate motivation, without sufficient economic logic. The EU uses EGD as an industrial tool to reduce its dependence on energy imports, but lacks coherent and solid industrial policies **Problems:** EGD largely ignores economic realities and social impact by placing an excessive focus on climate goals. **Risks**: The existing imbalance between environmental sustainability and industrial dimensions can lead to economic, political and social upheavals and conflicts.
8. Nuclear energy and new technologies are critical for long-term sustainability	**Theoretical compliance:** Partial coincidence. Although nuclear energy is included in the EU taxonomy, it does not receive the same strategic attention as renewable energy. **Practical implementation**: For a long time, nuclear energy was marginalized, despite its low-carbon nature. In 2023, the EU begins to rethink the role of nuclear energy. Lack of large-scale investment in SMRs (small modular reactors). **Problems**: The EGD ignores nuclear energy, even though it is the most reliable clean energy source. Nuclear energy is a divisive factor in the EU. **Risks**: Without a nuclear component, the EU risks losing energy stability. The lack of clearly defined investment incentives for nuclear energy could call into question the stability of Europe's future energy mix.

9. Technological neutrality as a fundamental principle	**Theoretical compliance:** Discrepancy. The EU does not fully implement the principle of technological neutrality. The EGD recognizes in principle different technologies for decarbonization, but in reality supports and favors specific technologies (solar, wind, green hydrogen) over others (nuclear, carbon capture). This limits market choice and technological competition, which can make the transition slower and more expensive. **Practical implementation:** The EU only supports certain technologies (RES) but refuses to subsidize nuclear and natural gas in the long term. Market distortion through subsidies for RES without a clear assessment of their market efficiency. Gas and nuclear technologies are limited and carbon capture and storage (CCS) technologies are neglected. **Problems**: EGD favors specific technologies instead of creating a market-based mechanism to stimulate innovation. Overexposure to renewables and electrification, without effective alternative solutions. **Risks**: Limiting innovation in more efficient technologies. Monopolization of the market by a few technologies, making the system vulnerable. Increased dependence on China, which controls key materials for renewables and batteries.
10. Energy transition is not an end in itself, but a tool for a better quality of life	**Theoretical compliance:** Coincidence. The EGD aims to reduce carbon emissions and improve quality of life through clean energy, a healthy environment and economic transformation. The EU takes into account the social impact, but the high costs of the transition create risks of social and economic inequalities, especially in regions dependent on coal and industrial jobs. **Practical implementation**: The costs of the energy transition have been passed on to households and industry, leading to higher electricity prices, job losses in traditional industries, rising social tensions and protests against high costs.. **Problems**: Many of the measures in the EGD increase costs for households and industry without ensuring more affordable energy. This fuels discontent and creates lasting social tension. **Risks**: Political turmoil as a result of radicalization of society and resistance to "green policies". Increasing energy poverty in Europe – low incomes cannot compensate for high costs. Deindustrialization – companies are exporting to regions with cheaper energy (USA, China).
11. Energy transition is conflictogenic	**Theoretical compliance**: Coincidence. EGD recognizes that the transition changes economic and social structures, which has caused political, economic, social and geopolitical conflicts. **Practical implementation**: The EU is experiencing strong social, industrial and geopolitical conflicts. The EU's energy policy has led to a sharp strain in relations with Russia (before the war in Ukraine). Economic and technological competition with the US and China. Through the Inflation Reduction Act, the US is attracting European companies, while the EU still lacks a strong industrial response. Internal political tensions in the EU - different countries have disagreements on the pace of the transition. Conflict between industry and climate goals - the European steel and chemical industries are threatened by high energy costs. **Problems**: The EU is not managing these conflicts well enough, leading to division and the rise of Eurosceptic parties. It creates tensions between different economic and social groups. **Risks**: EU loses geopolitical autonomy – dependence on new suppliers (China for rare earths, US for LNG). Widening social divide between pro-green governments and affected industrial and agricultural groups.

12. Every country has its own specific energy transition	**Theoretical compliance:** Discrepancy. Centralized EGD decarbonization policies and programs and unified regulations do not fully take into account the differences between countries, the specificities of their energy mix, and the different starting positions for energy. **Practical implementation**: Imposing the same regulations on all countries, without taking into account national differences. Countries with different energy strategies are forced to follow the same policy. European regulations (ETS – Emissions Trading System) increase the costs of industries, regardless of the national context. **Problems**: EGD is trying to impose a uniform energy transition model on all countries, without taking into account national energy specificities. **Risks**: Uneven economic development, which could lead to a "dual Europe" - rich and poor energy regions.
13. Energy transition forms new nonlinear and dynamic relationships between geopolitics, industrial policy, technology, economics, and the social system of society	**Theoretical compliance:** Partially. Insufficiently integrated approach – EGD focuses mainly on climate policy. The energy transition leads to a complete rearrangement of geopolitical and economic balances, which creates unpredictable effects. **Practical implementation**: The EU underestimated the geopolitical and industrial consequences of EGD and did not foresee the new industrial competition with the US and China. The US offered better conditions for clean industries, which led to the withdrawal of companies from Europe. China controls critical raw materials for renewables, which makes the EU dependent. The protests against EGD showed that societies are not fully prepared for high energy costs. **Problems**: Accelerated decarbonization makes Europe more dependent on China for key technologies, and the slowdown in industrial investment leads to deindustrialization. **Risks**: Loss of industrial capacity as the EU does not offer sufficient competitive conditions for new technologies. High energy costs can lead to social tensions and energy poverty.

Conclusions from the axiomatic analysis of EGD

The EU is in the early stages of a comprehensive transformation towards climate neutrality, driven by European and national policies and significant investments in renewable energy, energy efficiency and sustainable technologies. The EGD is in line with the axioms and the ideal model of the energy transition in terms of its irreversibility, necessity, long-term goals and strategies, energy diversification and environmental sustainability, improving quality of life through clean energy. The EGD is a positive step to reduce the EU's energy dependence and is used as an industrial policy tool. The EU is one of the few global actors that is purposefully investing in an accelerated energy transition. The short-term costs are high, but the long-term benefits bring energy independence, reduced healthcare costs and new green industries.

The axiomatic analysis of EGD shows that there are also significant discrepancies with the axioms and the ideal energy transition model, of which we can highlight the following: Criticisms of EGD often do not go into depth because it is seen as an end goal rather than a tool. The EC has largely turned the EGD into an objective in itself and a dogma, failing to adapt and integrate greater technological, geopolitical and economic flexibility in its implementation, which is in fact slowing down the energy

transition; Policy intervention through a direct administrative and directive approach does not take into account real market dynamics and does not stimulate market-based mechanisms for innovation; Overly ambitious deadlines and expectations without realistic adaptation mechanisms, such as the drive for rapid decarbonisation, threaten Europe's industrial competitiveness; Fixed vision and politically favored technology choices violate the principles of technology neutrality and flexibility; Economic inefficiency due to the neglect of economic logic through the large-scale subsidization of RES. Restrictions on traditional energy sources and over-regulation lead to high energy costs for consumers and businesses, loss of economic and industrial competitiveness, political instability and social conflict; Political vulnerability of EGD as it depends on political cycles and public perception. Lack of adaptability to crises, and adaptability and integration of geopolitical and industrial realities[15]; Underestimation of the risks to energy security through the rapid closure of traditional capacities without alternatives, which threatens energy security, in the absence of a phased transition with backup capacities and hybrid solutions; EGD does not sufficiently take into account the geopolitical reality, in particular geopolitical uncertainty and dependence on external factors and resources (China, USA), which creates new strategic risks.

4. First step (iteration) for axiomatic analysis of Clean Industrial Deal (CID) [16]

We live in a challenging time for Europe's energy transition. The EU is at a critical juncture and must urgently address decarbonisation, industrial and technological competitiveness, and dependence on critical raw materials. The EU CID is a major strategy to transform European industry through decarbonisation, reindustrialisation and innovation. It is at a very early conceptual stage and contains a list of forthcoming major legislative and regulatory initiatives, proposals and accompanying measures that the EC plans to submit for discussion to be adopted at a later stage. The axiomatic analysis proposed below is the first iteration of an initial assessment of the alignment between the 13 energy transition axioms and the principles set out in the CID primary document. It should be stressed that this analysis is the basis for much more serious subsequent iterations of this work, which will continue in the future. The results of the first iteration of the CID axiomatic analysis are shown in Table 3.

[15] Ivanov I. The Green Deal Industrial Plan for the Net-Zero Age–challenges for the Bulgarian Industry. In SHS Web of Conferences 2023 (Vol. 176, p. 02009). EDP Sciences.

[16] Evaluation criteria: Theoretical relevance – the relationship between the concept of the axiom and the principles of CID and how much it supports the axiom; Practical implementation – the realisticness of the application within the framework of CID; Problems – potential inconsistencies or limitations; Risks – potential challenges and threats.

Table 3. **Axiomatic analysis of the Clean Industrial Deal**

Axiom	Compliance with the Clean Industrial Deal
1. Energy transition is irreversible	**Theoretical compliance**: CID sees decarbonization as a driver of competitiveness, reaffirming this principle through the ambition of climate neutrality by 2050 and the intermediate target of a 90% reduction in emissions by 2040. **Practical implementation**: The transition is possible, but it depends on access to cheap clean energy. Plans for large-scale investments and subsidies support the irreversibility of the transition. **Problems**: The possibility of political and economic deviations could slow the process. **Risks**: High costs and geopolitical dependencies can create barriers and slow down the energy transition.
2. Energy transition is economically sound and unavoidable	**Theoretical compliance**: CID combines decarbonization with economic security and places industrial competitiveness at the center of the transition. **Practical implementation**: It depends on the availability of funding and stable regulatory frameworks. **Problems**: The need for huge investments may lead to delays in implementation. **Risks**: Energy insecurity and/or high energy costs may limit efficiency. Possible loss of competitiveness if the EU imposes too strict regulations that its trading partners do not accept.
3. Energy transition is non-linear and adaptive	**Theoretical compliance**: CID recognizes the need for adaptability through market stability mechanisms and includes crisis management measures. CID accepts that industrial technologies develop at different speeds and includes flexible support mechanisms. **Practical implementation**: It depends on coordination between Member States. **Problems**: The regulatory framework may be too slow in responding to changes. **Risks**: Slow adaptation to geopolitical or economic crises.
4. Diversification is a key principle	**Theoretical compliance**: Diversification is included in industrial policy. CID promotes diversification through a circular economy and access to critical raw materials. **Practical implementation**: Requires large investments and strategic partnerships. **Problems**: The EU depends on imports of rare earth elements and components. **Risks**: Dependence on unstable foreign markets.
5. Energy transition is the result of technological, economic and geopolitical synergy	**Theoretical compliance**: CID supports innovation, strategic investments and global strategies, as well as recognizing geopolitical risks and the need for energy independence.. **Practical implementation**: Depends on policy coherence. Supports the development of strategic supply chains in Europe. **Problems**: Insufficient integration of industrial policies, as well as lack of sufficient local resources of critical materials. **Risks**: Divergence between industrial and environmental interests.
6. Energy transition cannot compromise energy security	**Theoretical compliance**: CID recognizes the importance of stable energy supplies and considers energy security as a key factor. **Practical implementation**: It depends on investments in flexible technologies and storage. The CID includes measures to decarbonize industry, but does not provide a clear mechanism for balancing the energy mix. **Problems**: The focus on decarbonization ignores the need for base load capacity. **Risks**: Insufficiently rapid development of infrastructure for alternative sources.
7. Environmental sustainability is not the only driver	**Theoretical compliance**: CID balances environmental and industrial priorities and places industrial competitiveness alongside environmental goals. **Practical implementation**: It depends on the mechanisms for financing industrial policies to achieve climate goals. **Problems**: In some cases, environmental regulations can limit economic growth. **Risks**: Potential conflicts between environmental and economic goals.

8. Nuclear energy and new technologies are critical for long-term sustainability	**Theoretical compliance**: Nuclear energy is part of the EU's low-carbon mix. CID acknowledges the role of nuclear energy, but the main focus is on renewables. **Practical implementation**: Depends on political support and regulatory framework. Includes financial support for innovation, but priority remains on renewables and hydrogen. **Problems**: Lack of equal support for nuclear technologies. **Risks**: Insufficient funding and long construction timelines for nuclear capacity. The EU could lose technological and market share in nuclear energy if it does not invest in small modular reactors (SMRs).
9. Technological neutrality as a fundamental principle	**Theoretical compliance**: The EU is striving for a diverse energy mix, with CID supporting innovation but favoring certain technologies. **Practical implementation**: It depends on policies to incentivize all low-carbon technologies. **Problems**: The choice of favored technologies can lead to market distortion. **Risks**: Over-reliance on subsidized technologies. If the EU does not support different technologies evenly, some strategic industries may move outside Europe.
10. Energy transition is not an end in itself, but a tool for a better quality of life	**Theoretical compliance**: The CID prioritizes the social dimension of the transition and includes social protection mechanisms. **Practical implementation**: It depends on the effectiveness of social policies. Uneven distribution of financial support can exacerbate regional imbalances in the EU. **Problems**: High household costs may limit public support. **Risks**: Unequal distribution of economic benefits.
11. Energy transition is conflictogenic	**Theoretical compliance**: CID recognizes the potential social and economic conflicts. The social effects of the transition are the subject of political discussions. **Practical implementation**: Depends on the degree of social dialogue. **Problems**: Lack of mechanisms for effective mitigation of industrial disputes. **Risks**: Protests and political tension over job losses.
12. Every country has its own specific energy transition	**Theoretical compliance**: The EU applies a common framework with national variations. The CID allows some flexibility in national strategies. **Practical implementation**: It depends on the political will of the Member States. **Problems**: Uniform regulations sometimes do not take into account the specific needs of individual countries. **Risks**: Division between countries with different energy strategies.
13. Energy transition forms new nonlinear and dynamic relationships	**Theoretical compliance**: CID attempts to synchronize industrial and climate policy and sees these interlinkages as critical to the success of the transition. **Practical implementation**: It depends on the flexibility of the regulatory framework and the mechanisms for creating intra-European supply chains. **Problems**: Lack of a fully integrated coordination mechanism between sectors. **Risk**s: Potential conflicts between different priorities of member states. Possible crises in industrial sectors if trade conflicts with China and the US intensify.

CID and the 13 axioms share common goals, but there are key differences in how they are implemented and prioritized. CID offers a pragmatic but in many cases limited approach that is dependent on political, economic and technological factors. For the transition to be successful, the EU needs to adapt CID to achieve greater technological neutrality, energy security and socio-economic sustainability. The main correspondences between the axioms and the CID relate to: irreversibility of the transition - the CID supports the EU's long-term climate goals; economic rationale - the deal emphasises competitiveness but with major investment challenges; adaptability - the CID includes flexible mechanisms but implementation is difficult; diversification, which is supported in principle but dependence on imported resources remains an issue; technological, economic and geopolitical synergy - the CID

recognises this aspect but lacks clear coordination between sectors.

The biggest discrepancies between the axioms and the CID are in terms of: technology neutrality - the CID favours certain technologies (renewables, hydrogen); energy security - the CID focuses on decarbonisation but does not provide sufficient guarantees for stable energy supplies; social impact - the CID provides for social protection mechanisms but does not address the long-term implications of rising household costs; conflictogenicity - CID does not fully address the social and industrial tensions associated with transition; National differences - CID relies on a common framework that does not always match the specific needs of individual member states.

Conclusion

The axiomatic analysis of the European Energy Transition Policies - EGD and CID showed that the EU is still in the early stages of a comprehensive transformation towards climate neutrality. The results, findings and conclusions confirm that the EU energy transition faces short-term difficulties and long-term challenges. Expectations of a linear energy transition following a one-size-fits-all prescription and prescriptions towards a carbon neutral economy are currently untenable. The EU's energy transition has proved to be more complex than anticipated, and perceptions, understandings and approaches to it need to be updated in order not to lose touch with economic historical experience and reality. Faced with increasing geopolitical tensions, slow economic growth and technological competition, the EU aims to strengthen its resilience and security by accelerating decarbonisation, reindustrialisation and innovation. In response to these challenges, the new Commission is taking steps to modernise its energy policy, again environmentally ambitious but also economically sustainable, secure and competitive. There is a need for a new vision with a greater sense of pragmatism and of realism, for a pragmatic and balanced management of the transition - without ideologization, but with realistic economic strategies subject to the principle of technological neutrality.

The global energy transition will happen regardless of the EU's political decisions. Whether Europe will lead or simply follow depends on political and economic trade-offs, as well as on its ability to balance ambition with economic logic, to rethink what energy transition means under economic stress, and to find a way to remain competitive in the new energy order.

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SCIENCE, DIPLOMACY AND POLICY IN THE EUROPEAN ENERGY AND CLIMATE AGENDA

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INTRODUCTION

Science and research progress are the driving force behind the development of humanity. Scientific approaches are at the core of technological advancement, gradually building the foundations of social and technological development. Every aspect of human daily life - communications, transport, energy, healthcare and others - relies on longstanding scientific developments that have contributed to the evolution of modern society.

In times of rapidly changing geopolitical circumstances in Europe and globally, new challenges arise that require adequate and timely solutions for the creation of technological innovations and for the prevention of future crises. This is especially true in the field of international relations and the legislative initiatives of the European Union (EU). The findings in this regard are not only visible but are also directly linked to the competitiveness of EU. Thus, in the "Draghi Report" from September 2024[1], titled "The Future of European Competitiveness", a general conclusion about the role of science is presented. According to the text (p. 28) "...There are not enough academic institutions achieving top levels of excellence and the pipeline from innovation into commercialisation is weak.... Universities and other research institutions are central actors in early-stage innovation, generating breakthrough research and producing new skills profiles for the workforce. Europe has a strong position in fundamental research and patenting: in 2021, it accounted for 17 % of global patent applications versus 21 % for the US and 25 % for China. However, while the EU boasts a strong university system on average, not enough universities and research institutions are at the top....."

The conclusions, presented in the report, serve as further illustration that political attitudes are subject to continuous change - whereas the results of objective scientific research remain durable, subject to ongoing refinement and play an indisputable role in fostering economic progress. In this context, science emerges as a stabilizing force in the advancement of modern society, with its significance equally pronounced in the domains of energy and climate change mitigation.

[1] https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en#paragraph_47059; p.28

Within this framework, the present analysis examines the interplay between science and politics, with particular attention to the priorities and challenges shaping energy and climate policies at the European, regional and national levels.

SCIENCE IN THE FIELD OF CLIMATE AND ENERGY – SEVERAL PRINCIPAL ASPECTS

Scope and boundaries

Modern scientific research and development can be divided into two main categories: fundamental and applied. Fundamental research lays the groundwork for the creation and advancement of innovative processes and technologies. Its contribution is particularly evident in the energy sector, where scientific discoveries lead to technological breakthroughs. Today, this is clearly seen in the expanded use of photovoltaic power plants, wind farms, smart energy grids and other innovations, which not only change the energy market but also influence its future development.

Applied science, on the other hand, is based on the implementation of new and innovative products/technologies in existing and/or previously unexplored areas. In this context, fundamental research leads to useful practical solutions that are applicable across the spectrum, from small and medium-sized enterprises to large corporations in the energy sector. These scientific advancements provide direct scientific and technical support, facilitating the transfer of knowledge and technology between the research community and industry, which are especially important for key areas such as energy and climate.

One of the most defining characteristics of science is its ability to transcend national boundaries. This universality not only encourages but also necessitates active international collaboration, a factor of crucial importance for the development of high-quality research and its application in different fields.

Currently, the scientific community benefits from well-structured networks for knowledge exchange, which connect institutions at the European and regional levels. These include leading research centers at universities, privately funded laboratories and international scientific consortia, all of which contribute to the expansion of the global database of knowledge and skills, particularly in fundamental research and innovations in key areas such as climate and energy.

Some fundamental challenges

The relationship between science and the formulation of European policies in the field of energy and climate encounters a number of objective and subjective difficulties. Some of these difficulties, inter alia, are outlined below for illustration. Certainly, when discussing them more specifically, it should be recalled that - under the Treaty on the Functioning of the EU (particularly Article 6 and related texts), the role of member states and, respectively, of

national policies in the field of science is particularly important.

• "Scientific eclipse" in policy making

Among the main problems is the phenomenon known as "scientific eclipse" – a situation in which scientific expertise is partially or completely ignored in the key stages of the creation of regulatory documents and strategic EU directives. This leads to the adoption of policies that are not entirely based on proven and balanced scientific arguments.

Despite the efforts of European and national institutions to limit such cases, examples of "scientific eclipse" can be found in various areas, e.g., in relation to energy and climate policies, by ignoring the role of consultations with the expert scientific community. In reality, cases where these consultations with the scientific community have been incomplete or insufficient are not rare, which leads to practical difficulties in their implementation.

• Lack of expertise and the effect of public campaigns

The shortage of highly specialized research experts in certain fields opens the door for the emergence of phenomena such as pseudo-experts, individuals with limited understanding who nonetheless gain high public and social status, whose messages often stand apart from the real scientific situation.

• Inadequate funding and ignoring long-term scientific data

Another pressing issue is the underfunding of strategic scientific initiatives in the fields of energy and climate change, particularly at the national level. Thus, regardless of the formal requirements for greater attention in these sectors, laid down in strategic EU documents, as well as in European legislation, the national approach does not always meet expectations. At the same time, although there are well-established networks for international funding and transfer of research results, in the preparation of some fundamental concepts, science seems not always to be at the forefront.

A notable example is the case of biodiesel from microalgae. Despite the fact that over nearly 15 years of research, not enough reliable and comprehensive data was collected on its economic and energy efficiency, the technology was included in framework documents such as the Renewable Energy Directive[2]. This led to the spread of partially false or misleading claims about the profitability and applicability of this type of biofuel. As a result, a number of countries today face serious difficulties in meeting the relevant requirements at regional and national levels, as the preliminary projections do not correspond to the realities in the sector.

• Consequences of neglecting the scientific community

Neglecting specialized expertise in the development of key policies for

[2] https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

decarbonization and the transition to low-carbon economy leads to the creation of documents with unrealistic goals and vague implementation mechanisms. This creates uncertainty and results in situations where instead of sustainable solutions, even more questions without clear answers arise. A telling example is the so-called European Green Deal, against which more and more voices are calling for a revision of the approach it imposes, and these voices are not only from outside the EU[3].

On this basis, other main characteristics of the European and national scientific frameworks that are directly related to energy and climate will be outlined below. Before that, however, it is necessary to place the topic, concerning the role of science in the context of energy and climate development, within the context of scientific diplomacy.

THE LINK BETWEEN "SCIENCE, SCIENTIFIC DIPLOMACY AND POLICY" IN THE FIELD OF CLIMATE AND ENERGY

Science has always accompanied human development and technological progress, shaping political and social processes throughout human history. Over time, the demand for scientific advancements and innovations has intensified, and modern societies increasingly pay attention to the research outcomes when making strategic decisions. Moreover, in recent years, a new and increasingly influential approach to international cooperation has emerged –" scientific diplomacy". This contemporary tool builds bridges between countries, based on scientific achievements and expert knowledge. Scientific diplomacy represents a stable strategy for the development and improvement of international relations, which can serve as a regulatory mechanism in the formation of policies with long-term significance for the EU. It contributes to more effective decision-making in areas such as energy and climate, where science-based data are particularly important for the sustainable development of society.

At its core, science diplomacy promotes the presentation of objective and verified facts, based on years of systematic research across diverse scientific domains. It excludes political pressure and aims to provide a reliable foundation for the creation and implementation of adequate policies. In this regard, scientific diplomacy is a guarantor that strategies related to climate and energy policies, including those of the EU, will not be distorted or compromised when transferred to regional and national levels.

The consistent implementation of policies based on scientific data is a key element for effective political commitment of EU member states. One of the key benefits of scientific diplomacy is that it supports not only the assessment of the scientific landscape in the EU but also its better integration at international and regional levels through the creation of stable networks for scientific cooperation.

[3] See e.g. the position of the European Economic and Social Committee from September 2024 - https://www.eesc.europa.eu/en/news-media/news/eesc-calls-recalibration-eu-green-deal-address-emerging-challenges and many others

The long-standing and consistent EU policy in these directions has led to the establishment of sustainable frameworks for climate protection, ecological balance and development of energy in a sustainable and environmentally friendly way not only at European but also at global level. Among the most notable outcomes of this effort are the United Nations Framework Convention on Climate Change (1994) and the Kyoto Protocol (1997).

Today, international relations are in close cooperation with the scientific community both regionally and globally. Science is an indispensable element in the modern policy development and increasingly recognized as a key factor in strategic decision-making. Technological progress, as a product of scientific progress, dictates new rules for policy formation, especially in areas such as energy, climate and sustainability.

The introduction of science-based approaches in policy formation would facilitate investments in scientific approaches, an area where European research institutions face urgent needs. In turn, these institutions would generate added value in the form of innovations, technologies and know-how, vital for the EU long-term strategic goals.

Unfortunately, at present there is no comprehensive framework program for the integration of research results into political processes. All scientific publications are systematized in global databases, but there is no effective expert platform to facilitate their direct use in policymaking at the EU and member state levels.

Regardless of the above, more and more countries are already introducing scientific diplomacy as a tool for making informed administrative decisions. Within this practice, important sectoral policies undergo consultations with specific scientific units and experts. In many countries, this process is institutionalized through national scientific councils and independent expert bodies that prepare analyses and recommendations on important aspects of EU policies.

Looking from today's perspective, it is evident that the EU has an urgent need for stronger inclusion of science as a corrective and advisor – and this is absolutely valid especially under the current conditions of geopolitical instability and increased need for measures in the field of defense and security. This is particularly true for the energy and climate policies related to these areas, where the scientific approach can guarantee sustainable and well-balanced solutions. As stated in the aforementioned "Draghi" Report (p. 35): „... It is also essential to establish and consolidate European academic institutions at the forefront of global research. The European Research Council (ERC) has been crucial to the competitiveness of European science but many promising proposals remain unfunded owing to a lack of financial resources....".

AND MORE ON THE EUROPEAN PERSPECTIVES

In recent decades, the EU has seen increased activity in research

developments related to energy and climate protection. A prominent example is research related to the development of green energy and the transition to a low-carbon economy. Numerous fundamental scientific developments have provided innovative solutions for the transition to low-carbon emission technologies and sustainable energy models. Examples of this are the widespread deployment of wind energy installations, pumped-storage hydroelectric power plants, photovoltaic systems and installations for environmentally friendly hydrogen production. And in this respect, it is worth remembering that just 30 years ago, such installations and technologies were considered as hypothetical.

In this regard, the EU has initiated a procedure of administrative mechanisms to accelerate the development of innovations in energy and climate at the European level. Further, apart from the Draghi Report on the future of EU competitiveness, it is worth recalling the latest strategic document related to EU competitiveness, known as the "Competitiveness Compass", which also has explicit references to the role of scientific research, including in the context of the so-called "investing in new growth engines"[4]. A similar emphasis can be seen in Enrico Letta Report from April 2024, entitled "Much more than a market", which is specifically devoted to "Empowering the Single Market to deliver a sustainable future and prosperity for all EU Citizens"[5]. In the context above, the report states the following: "To accelerate innovation, tackle societal challenges, and bolster European competitiveness, the EU must actively encourage public-private partnerships in strategic areas focused on knowledge exchange and innovation uptake, with targeted support for SMEs and startups. A comprehensive Open Science framework is needed, incentivizing researchers to make their work openly accessible while fostering data sharing and collaboration. The ethical dimensions of AI and big data use must be central to this framework to ensure responsible technological advancement"(page 20).

Thus, the cited documents emphasize the particularly important role of science while presenting the real situation regarding industry, European and international markets, and the possibility of increasing the competitiveness of EU Member States. It is evident that beyond the general framework, a special emphasis is placed on the strategic perspectives for the development of technologies and innovations in the green and energy sector, with the aim of improving the climate.

As already noted, the European framework related to encouraging the role of science in strengthening EU competitiveness - especially in the context of energy and climate trends - is of very high importance. **In practical terms, however, the national approach remains leading for achieving tangible results in the respective member state.** This also implies special attention to what is happening precisely at the national level. In this context, some basic findings with Bulgarian dimensions that have a direct relation to the topics

[4] Page 7 - https://commission.europa.eu/document/download/10017eb1-4722-4333-add2-e0ed18105a34_en

[5] https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

of energy development and climate change are presented in the following section.

NATIONAL ASPECTS IN BULGARIA

Most Bulgarian scientific institutions, including the Bulgarian Academy of Sciences (BAS), state universities and private research centers, actively contribute to international and European policies in the field of climate change, energy innovation and the development of green technologies. Some key examples in this regard are presented below[6].

- **Research in climatology and water resources**

Specialized research units at BAS conduct fundamental and applied research on climate change, including a set of specific analyses. These concern inter alia: analysis of urban, coastal and mountain climates; studies of physicochemical processes in the atmosphere and their impact on air quality; assessments of water resources and development of strategies for their rational management; focus on the possibility for complex and rational use and protection of water resources; planning and management of water systems in a changing climate from the perspective of sustainable development and environmental protection, etc.

- **Energy research and innovations**

Research units at BAS play a key role in the development of renewable energy sources and increasing efficiency in the use of conventional energy resources. Among the advanced developments in this area are research and innovations in solar energy, including new technologies for photovoltaic panels with higher efficiency; development of energy-efficient buildings and smart grids for energy consumption management; research and implementation of technologies for the production and storage of green hydrogen; optimization of the use of biofuels and other alternative energy sources, etc.

- **Additional research directions**

The outcomes of the relevant research activities, developed by BAS, are successfully applied in other areas that have a direct or indirect relation to topics connected with energy and climate. These include information and communication sciences and technologies; nanosciences, new materials and technologies; biodiversity, bioresources and ecology, etc.

In addition to climatology and energy, BAS develops innovative solutions in some research fields that have a direct or indirect relation to sustainable development and the green transition, e.g., information and communication technologies, including modeling of climate scenarios; nanosciences and new materials for energy-efficient technologies; biodiversity, bioresources and ecology, aimed at the adaptation of ecosystems to climate change, etc. All

[6] Concrete and detailed information on any of these aspects is available for the different structures of the Bulgarian Academy of Science at https://www.bas.bg/?page_id=10826&lang=en

these research and development activities fully correspond to the EU priorities in the field of climate and energy policies and contribute to their effective implementation at national, regional and European levels.

- **National research networks**

In addition to active participation in European and regional scientific cooperation, BAS has a well-developed National Academic Network, which ensures effective collaboration between BAS scientific units, higher education institutions, industrial organizations, local authorities and state institutions in the Republic of Bulgaria.[7] As a result of this initiative, Regional Academic Centers have been established in many Bulgarian cities like Plovdiv, Varna, Stara Zagora, Sliven, Burgas, Dobrich, Gabrovo, Shumen, Pleven, Veliko Tarnovo, Ruse, Blagoevgrad, Razgrad, Montana, Vratsa, Kazanlak, Smolyan. These centers have an important role in promoting an interdisciplinary approach in research and education; stimulating applied scientific developments in support of business and industry; providing expert scientific support to local and national administrative structures.

- **International research cooperation**

The Bulgarian Academy of Sciences carries out a great share of the Bulgarian international research cooperation, maintaining long-standing partnerships with leading foreign scientific and educational institutions. BAS conducts an active policy for international scientific partnership, which contributes to the exchange of knowledge, the development of joint projects, and the strengthening of the Bulgarian scientific community at a global level. Among the successful scientific collaborations in the field of climate and energy, partnerships with the following scientific organizations in other EU member states stand out – mostly with the relevant academies of science (Czech Republic, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), but also with institutions like the National Research Center in Italy, the Aristotle University of Thessaloniki in Greece and many others. Through these strategic partnerships, BAS actively participates in international research projects, joint publications, academic exchange and applied innovations, contributing to the establishment of Bulgarian science on a global scale.

In addition to the established network of international cooperation with EU member countries, BAS has developed successful collaborations in the field of energy and climate with various countries outside the EU. Among them are scientific institutions at the relevant level in China, Egypt, Israel, Serbia, Türkiye, Vietnam, etc. These partnerships strengthen the international exchange of knowledge and promote joint research in key scientific areas, including energy and climate change.

- **European programs supporting scientific cooperation**

The implementation of this complex system of international collaborations

[7] https://www.bas.bg/?page_id=85 (in Bulgarian)

in strategic research areas is supported through a range of European programs and funding mechanisms, provided by the European Commission, and/or by independent groups of EU Member States. The specific programs related to the development of energy and climate are as follows:

- **Horizon Europe** (the EU leading research and innovation program for the period 2021-2027, with a budget of 93.5 billion euros; this is the ninth in the series of Framework Programs, which builds upon the preceding "Horizon 2020" program and places a strong emphasis on climate change research and its mitigation; solutions for the sustainable transformation of the energy sector; development of innovative green technologies);

- **The European Innovation Council** (EIC) is another mechanism for supporting the implementation of innovations in various scientific and technological areas, including those directly or indirectly related to climate change and energy][8];

- Another EU financial instrument that supports projects for environmental protection, biodiversity conservation and climate action is the **LIFE Program[9] and others.**

There are also other funding mechanisms, offered by individual EU countries for research and applied activities, such as the European Economic Area (EEA) funds, financed by Iceland, Liechtenstein and Norway[10]. They, for example, provide resources for research in the field of sustainable development and environmental technologies.

It should be emphasized that between 2020 and 2024, the scientific units of BAS have won 81 projects under "Horizon 2020" and "Horizon Europe". In addition, 78 more projects have been approved under other European programs, including Digital Europe, LIFE, Euratom and others. These achievements position BAS as a key player in the European scientific community and demonstrate the ability of Bulgarian scientists to actively support global efforts for sustainable development and green transition.

CONCLUSIONS AND RECOMMENDATIONS

The scientific community in Europe and in particular in Bulgaria, possesses the necessary capacity and expert potential to be a real partner in the formulation and implementation of sustainable climate and energy policies. The transition to a low-carbon economy and the long-term climate goals of the EU cannot be achieved without the active involvement of highly qualified specialists, scientists with extensive expertise in the field of renewable energy sources, biofuels, energy efficiency and environmental protection.

In today's global context, marked by geopolitical instability and an urgent need for enhanced energy security, it is imperative that scientific research

[8] https://eic.ec.europa.eu/eic-funding-opportunities_en
[9] https://cinea.ec.europa.eu/programmes/life_en
[10] https://www.eeagrants.bg/en/programs

deepens and leads to reliable and sustainable results. This will ensure a smoother and socially acceptable transition to decarbonization and will avoid the recurrence of past mistakes, related to hastily made political decisions.

Today, Europe - and not only the EU - requires not only knowledge and innovation but also a better-coordinated system for transferring scientific results into policies. For this purpose, it is necessary to establish functional mechanisms for combining expertise through the building and funding of national and international databases, which would synthesize years of fundamental and applied research and become, forming the basis for future scientific diplomacy. It is only through such an approach that science can effectively fulfill its role as a stable and independent advisor in the formulation of policies upon which the future of European energy security, climate resilience and socio-economic stability is strongly dependent.

On this ground, it is imperative to place science at the heart of political processes, particularly in areas of long-term strategic importance such as energy and climate. This is primarily the responsibility of national governments, which must make more effective use of the already existing European conceptual and financial frameworks. Rather, they are due either to a lack of adequate national vision or often combined with insufficiently effective use of opportunities under already existing European and national mechanisms.

In the context of the ongoing geopolitical crisis and increased threats to European energy security, the need for close integration of science in the processes of developing and implementing policies in the field of climate and energy is becoming increasingly urgent. Scientific diplomacy represents only a first step towards building more effective mechanisms for interaction between scientists and politicians across all levels of governance.

And some recommendations

Given the above, several specific directions for improvement can be formulated at European and national levels.

At European level, it is important to strengthen the participation of the scientific community in the generation and adaptation of strategic documents, including EU level concepts and corresponding European legislation in the field of energy, climate change and environmental protection. In this way, not only will the necessary expertise be provided, but also scientifically unfounded or controversial formulations will be prevented. This is also particularly important in another context - there is a need to ensure a socially sustainable and smooth transition to decarbonization, especially in sectors with high social sensitivity such as energy and transport.

At national level, it is important for scientific experts to actively participate in the stage of transposition of the European acquis into the national legislation of the relevant Member States. Further, they should be

actively involved in the process of formulation of the national position on drafted EU law and strategies.

The substantial increase of funding in research and innovation related to energy and climate change is also of utmost importance. A continuous process of building upon and revising research in these areas is necessary, which will ensure that political decisions are consistent with the most up-to-date scientific knowledge and technological capabilities.

Further, the establishment of an up-to-date centralized database or expert platform at the European level is absolutely necessary. Such platform should be the base where scientific results and expertise in the field of climate and energy are systematized. In this context, it is necessary to also create an effective national mechanism for the use of such a platform. The latter could serve as a tool for making informed political decisions and facilitate access of institutions to objective scientific data.

In parallel, Bulgaria needs to use adequately the flexibility of the European acquis when transposing and implementing it into the national legislation as to adapt the requirements to the real economic and technological possibilities in the country. This will not only ensure a smoother transition but will also contribute for a greater return on investments in new and expensive facilities (e.g., for the production of new-generation biofuels etc.).

Apart from this, it would be appropriate to create a national core that would function as a registry of research achievements and developments in the field of climate and energy. Such body could be structured under the relevant ministries and liaise with international networks for scientific diplomacy within the EU.

Last but not least, the efforts of the scientific community must be supported by more active media and information campaigns that would present to the general public the importance of science-based policies and the benefits of science diplomacy in the conditions of contemporary climate and energy challenges.

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THE ROLE OF LATIN AMERICA IN THE EUROPEAN ENERGY DIVERSIFICATION – A CURRENT ANALYSIS

Iordan Stoitchkov

Latin America's role as a region with engaging political and economic potential is becoming increasingly important, both regionally and now globally. Countries such as Mexico, Chile, Colombia and Costa Rica are members of the Organisation for Economic Cooperation and Development (OECD), while Brazil, Argentina and Mexico are part of the G20 international forum of the world's leading economies. Moreover, the 33 countries of the Latin American region account for 18% of the votes in the UN General Assembly, and 27 of them are members of the World Trade Organization (WTO).

Thus, the growing weight of Latin America in the context of today's geopolitical realities makes it an increasingly desirable and necessary partner to address current global challenges. These facts and the changing international environment have led the European Union (EU) to realize that its international relations with Latin America's countries are lagging behind and need to be reviewed – mainly to strengthen the bi-regional partnership, while reaffirming the importance of effective global governance, upholding cooperation and the foundations of a rules-based global order. The necessity for such approach has been evidenced in a number of documents and statements by European leaders and institutions.[1]

However, this is a goal of gigantic proportions, which the EU can hardly achieve on its own. In parallel, the alliance with Latin America is understood as being strategic, given the latter's high potential to supply key minerals for the European energy diversification. Latin America is crucial to the global supply chains as an indispensable source of natural resources and raw materials. Therefore, the region is a market of strategic importance for the EU and its open strategic autonomy, as a supplier of products and services needed by European consumers.

On this ground, the current analysis focuses on some specific aspects, concerning the relations between the European Union and some countries from Latin America, reviewed within the framework of the energy related international supplies.

Lithium and other "magical" elements

In the energy context, a key role is played by the fact that Latin America's reserves have attracted renewed attention amid demand for critical raw materials, which are increasingly used to power phones, laptops, energy storage systems, and hybrid and electric vehicles. Lithium is a metal abundant

[1] Borrell Josep, "Why Europe and Latin America Need Each Other?", EEAS (2022): https://www.eeas.europa.eu/eeas/why-europe-and-latin-america-need-each-other_en

in Latin America, with Argentina (24%), Bolivia (15%), Chile (14%) and Peru (12%) containing around 65% of the region's proven reserves and producing around half of the global supply.[2] In addition, it is estimated that Latin America could account for 35% of the world's green hydrogen production.

Firstly, given the growing importance of lithium globally, it is natural that the metal should be at the center of the European trade agreements with Latin American countries. For example, the recently updated EU–Chile trade agreement contains chapters specifically aimed at securing lithium supplies for EU Member States, and Argentina is home to the only EU-led lithium project in Latin America, which is expected to produce 20.000 tons of lithium a year. Last but not least, the EU-funded "EU–Latin America Partnership on Raw Materials"[3] aims at promoting and strengthening its cooperation with seven Latin American partner countries – Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay. Certainly, in this aspect one should also recall a general fact – the EU is the third largest destination for Latin American exports, plus its first source of foreign direct investment (FDI).

Secondly, Latin America is one of the world's leading regions in terms of renewable energy production and could play an important role in the international demand for renewable hydrogen. For the EU, the regional dialogue and cooperation in this field is important to ensure convergence of energy markets. Besides, the fossil fuel energy resources in Latin America are significant, although with limited supply to the EU. Thus, e.g., Mexico and Brazil were respectively the 12th and 13th oil suppliers to the EU in 2023; Argentina has the second largest shale oil reservoir in the world; Venezuela has the largest oil reserves in the whole region and ranks 8th in terms of gas reserves.[4]

And these facts should be adequately considered from general policy perspective in different dimensions – Latin America could be an important supplier of energy raw materials to the EU. More than two-fifths of the world's copper and a quarter of the world's nickel show the major role that Latin America can play in diversifying the European supply of raw materials.[5] The case of Brazilian manganese and nickel exports is also similar – it could replace European imports of these materials from China and Russia.

With its "Critical Raw Materials Act"[6], entered into force in 2023, the EU has identified 16 minerals and metals as key raw materials. Those are considered strategic since their projected demand growth compared to current levels of supply – combined with the difficulties of scaling up production – are

[2] Join EIT Raw Materials Summit, "The Lithium Triangle in South America: Race to 2030", Brussels (2025): http://eitrmsummit.com

[3] Mineral Development Network Platform, "Towards sustainable and integrated mineral value chains between the EU and Latin America" (2023): https://www.mineralplatform.eu/about/the-partnership

[4] OECD, "Latin America Energy Outlook" (2023): https://www.oecd.org/en/publications/latin-america-energy-outlook-2023_fd3a6daa-en.html

[5] Ibid

[6] European Commission, Raw Materials Information System (RMIS), "Critical and strategic materials list", Brussels (2023): https://rmis.jrc.ec.europa.eu/eu-critical-raw-materials

likely to create supply risks in the near future. These are: bismuth, boron, cobalt, copper, gallium, germanium, lithium, magnesium, manganese, natural graphite, nickel, platinum, rare earths, silicon, titanium and tungsten. The EU's transition to renewable energy requires a significant amount of these resources, the availability of which, although existing, presupposes also their extraction and processing.

All the data stipulated above clearly indicate the inter-dependence between the EU demand for raw materials and their supply from Latin American countries. In practical terms, this also underlines the role of their governments in achieving strategic objectives beyond simply increasing exports (by Latin America) and access (by the EU) to these resources. In summary, in view of the EU's insufficiency to cover its needs for raw materials – Latin America is strategically positioned as a significant region for diversification.

The transition to renewable energy sources requires a significant amount of these minerals and metals, which is the main reason why demand for them is booming, both globally and within the European Union. Logically, the need to access strategic raw materials explains the tour made in June 2023 by the President of the European Commission, Ursula Von der Leyen, to Argentina, Brazil, Chile and Mexico, on the eve of the EU–CELAC[7] Summit held a few weeks later in Brussels, eight years after the last one.

During her visit to these Latin American countries, President Von der Leyen underlined the EU's desire to build its strategic autonomy by cooperating with reliable economic and political partners. In her speech, she identified achieving this as "A common goal on both sides of the Atlantic, in response to the pandemic and the consequences of war. Above all, the Latin American region has an important role to play in achieving the EU's strategic autonomy as a global power in renewable energy, agricultural production and strategic raw materials", she stated.[8]

The paradigms of the supply chains

The current analysis of the European demand for key raw materials and supply from Latin America reveals clear opportunities for both regions. On one hand, the European countries seek to secure and diversify imports of these goods. On the other hand, Latin American governments aspire to use their natural resources to increase exports, generate higher revenues and strengthen the role of industry in their economies.

However, supply is constrained by two major paradigms – the first one is the European regulatory complication of the extraction and processing

[7] CELAC (Comunidad de Estados Latinoamericanos y Caribeños, or Community of Latin American and Caribbean States is a bloc established in 2010, consisting of 33 countries. It is seen as an alternative to the Organization of American States (OAS), and includes all OAS member states (except the United States and Canada) plus includes Cuba: https://celacinternational.org

[8] European Commission, "New Agenda to strengthen EU's partnership with Latin America and the Caribbean", Brussels (2023): https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3045

industry of raw materials; and the second – this is the social resistance of several Latin American nations to the opening and exploitation of new mines. There are two other aspects, which could be added – the concentration of this kind of production in few Latin American countries and the fact that 60% of the rare earth extraction in the region is currently done by China. This represents a real problem for the EU, as half of its imports of key raw materials come from only five countries (the United States, Russia, South Africa, Brazil and Chile)[9].

In addition, the war in Ukraine – focusing on the main issues of supply disruptions and price rises, as well as the logistical challenges linked to border crossings and airspace restrictions – prompted the European Union to revalue its ties with Latin America. This was reflected in the last EU–CELAC Summit in July 2024, where the EU re-launched its "Global Gateway" strategy and pledged investments of 45 billion Euros for the region. Additional details on this aspect will be discussed later in the current analysis.

Further in this context, it is worth reminding that the European Union is the leading investor in Latin America and is the region's third largest trading partner (behind the USA and China), while Latin America is the fifth largest trade partner for the EU (behind China, the USA, the United Kingdom and Switzerland)[10]. Therefore, it has been some optimism about the bi-regional initiatives and the prospect of deepening relations between the regions. Given its focus on investment and the promotion of a "green and just" transition, the EU seeks to position itself as a leader in industrial and technological development of energy security.

In 2023, the European Commission (EC) announced a new agenda to revitalize its relations with Latin America.[11] The EC notes that the new geopolitical reality reflects a combination of multiple crises – threatening peace, stability and socio-economic progress – and this situation is leading to a new awareness of the need to work together with Latin America's countries. It also underlines the EU's motivation to strengthen its presence in the region, to promote common interests and values at a time of geopolitical turmoil.

The changing geopolitical situation and the resulting circumstances have reinforced the EU's drive for action, based on the idea of cooperation with international and regional partners. The current dynamic environment is in fact a decisive factor in building the EU's so-called "open strategic autonomy", which aims at avoiding forced dependence, increasing economic sustainability,

[9] International Institute for Sustainable Development, "Critical Raw Materials: A production and trade outlook" , Winnipeg (2024): https://www.iisd.org/publications/report/critical-raw-materials-production-trade-outlook

[10] CEPAL, "Investment and cooperation opportunities for Latin America and the Caribbean and the European Union" (2023): https://www.cepal.org/en/publications/48992-investment-and-cooperation-opportunities-latin-america-and-caribbean-and-european

[11] European Commission, "New Agenda to strengthen EU's partnership with Latin America and the Caribbean", Brussels (2023): https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3045

providing European companies with better access to foreign markets, and diversifying Europe's sources of supply.

Thus, strengthening the economic cooperation between the EU and Latin America should also be seen in the context of the EU's desire to create conditions for sustainable development and synergies on issues such as trade with critical raw materials and renewable energy. The EU says it wants to expand in Latin America "the European way", in relation to the attention put on the environmental issue. This means that it would differentiate it substantially from the kind of progress that China offers to the region, mostly regarding the major aspect of the application of the established models of the Environmental Impact Assessment (EIA)[12] process.

Along the general frame, there are many specific characteristics, which individualize the relations between the EU and some of the countries in Latin America from the perspective of the raw materials, linked to the energy sphere, though the environmental protection.

Argentina, the "good bad boy"

Argentina is a good example in this context. The country has several investment projects financed by the EU, and has also signed specific documents on energy cooperation – a topic of major strategic interest to the EU. As noted before, lithium is a key mineral to address the energy transition, hence the great interest it arouses in industrial powers to buy it.

The International Energy Agency estimates that global demand for minerals linked to battery production will increase significantly. According to its projections, the demand for rare earths needed to achieve the targets set out in "REPowerEU" (a set of initiatives to increase EU energy autonomy) is expected to increase fivefold.[13] European demand for lithium to power electric vehicle batteries is projected to be twelve times higher in 2030 compared to today. Similarly, the European demand for gallium (essential for semiconductor production) is expected to be seventeen times higher in 2050 than it is today.[14] In view of this outlook, production has been increasing in Latin America as a result of investments mobilized by North American and Chinese companies.

Nonetheless, the EU is currently absent from the extraction process. The only European project working on extraction is the one developed in the Salar del Hombre Muerto (Argentina).[15] The idea would be to expand the European

[12] European Commission, "Environmental Impact Assessment (EIA)": https://environment.ec.europa.eu/law-and-governance/environmental-assessments/environmental-impact-assessment_en

[13] International Energy Agency, "Mineral requirements for clean energy transitions", Paris (2021): https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/mineral-requirements-for-clean-energy-transitions

[14] Ibid

[15] Panorama Minero, "ERAMINE concreta la primera exportación de carbonato de litio producido en Salta", Buenos Aires (2025): https://www.panorama-minero.com/es/news/eramine-concreta-la-primera-exportacion-de-carbonato-de-litio-producido-en-salta

presence in the industrial process, which is also important for Argentina, because it would allow it to diversify the actors that are investing. Currently the predominant player in extraction in the region is China.

However, as in any discussion around natural resources, questions arise about the impact on industry and local employment, community acceptance and socio-environmental controls. Production has been challenged by communities living near mining operations and civil society organizations that warn about the lack of environmental controls. In addition, there is also an open debate about the contribution of the extractive sector to the rest of the economy, something that Argentina seeks to settle with its new mining strategy.

The EU–Argentina energy dialogue is supported by initiatives, visits, declarations and agreements established in the framework of the "High Level Energy Dialogue"[16]. Concrete examples in this context might be the meeting of the "Twelfth Joint Commission for Cooperation between the EU and Argentina", held in Buenos Aires in June 2022, under the provisions of the "Framework Agreement for Trade and Economic Cooperation" from 2000, etc.

Natural gas also appears in the list of strategic resources, an element that the EU considers to be a transition fuel to achieve decarbonization by 2050. Since Russia ceased to be a natural gas supplier due to the invasion of Ukraine, the EU has multiplied its presence in the Liquefied Natural Gas (LNG) market and is seeking to seal new foreseeable agreements with new "reliable" suppliers. Currently the predominant player in LNG exports from the region is Brazil.

At this point, the agreement signed with Argentina – one of the South American countries that develops plans to supply LNG to Europe – stands out. This agreement is based on the prospect of increasing production from the Vaca Muerta field (located in the province of Neuquén), which is home to one of the world's largest reserves of unconventional oil and gas[17]. The understanding agreement around LNG aroused enthusiasm in Argentina's sector terminals. However, the European strategy at this point is still unclear.

For Argentina, the possibility to become an exporter of liquefied gas to Europe depends on the country having a liquefaction plant, which requires a very large investment. For the EU, it is unclear whether investing in the country's gas will be profitable in the long term, given the fossil fuel phase-out horizon and the risk of stranded assets. The agreement has been criticized by some analysts, who say the EU should focus its investments on supporting the development of renewable energy in Argentina[18].

[16] EU-LAC Foundation, "Revisiting bi-regional relations: the EU-Latin American dialogue and diversification of interregional cooperation", Hamburg (2020): https://eulacfoundation.org/en/new-publication-revisiting-bi-regional-relations-eu-latin-american-dialogue-and-diversification
[17] Reuters, "Argentina's Vaca Muerta gas-export plan is a pipe dream", London (2024): https://www.reuters.com/business/energy/argentinas-vaca-muerta-gas-export-plan-is-pipe-dream-2024-11-21
[18] Climate Action Network, "A deal concluded in secrecy, a tragic blow to the planet and democracy"(2024): https://caneurope.org/eu-mercosur-deal-concluded-in-secrecy-a-tragic-blow-to-the-planet-and-democracy

Chile and the renewable hydrogen

This brings us to the point that renewable hydrogen is another major interest in the long-term energy agenda and Chile is a potential partner of the European Union in this relation, although this is not the only cooperation area.

The EU seeks to position itself as a seller of equipment and technology for the development of this sector in Latin America, which is based on electricity generation through renewable energy to manufacture a "green" fuel. The way in which the EU seeks to reposition itself as an economic actor in Latin America would be through the investment of private companies, which would receive a guarantee from the EU. Thus, e.g., by mid–2024 the EU and Chile have now agreed on new actions, including cooperation between companies in the sector on investment projects and technical assistance in renewable hydrogen.

Here the complementarities and potential of bi-regional cooperation for energy transition go beyond the above mentioned "EU–Latin America Partnership on Raw Materials", including new value chains. Bi-regional agreements provide companies with a stable legal framework that facilitates the establishment of long-term trade and investment relationships. These agreements assure companies that the rules and regulations in their sectors will withstand political changes. For example, the memorandum of understanding signed between EU and Chile in November 2024 focuses on cooperation in this area. Along the same lines, the EU sealed agreements with other mining hubs such as Argentina (June 2023), Namibia and Kazakhstan (November 2022), Ukraine (July 2021) and Canada (June 2021).

Other energy initiatives in Chile, such as the expansion and modernization of the electricity transmission grid and workshops on the certification of renewable hydrogen under the EU's delegated acts for renewable fuels of non-biological origin, will also be carried out. This announcement builds on the already well-established EU–Chile energy dialogue covering, among other things, renewables, energy efficiency and hydrogen.

"Global Gateway" and other initiatives

The "Global Gateway" initiative[19], which was already referred to earlier, is seen by many as a response to China's "Belt and Road Initiative". This gives a different perspective on the European Union's renewed economic and strategic interest in Latin America, amid a wave of new investments that could drive clean energy transitions in both regions, as the European bloc seeks to strengthen its relations and supply chains in a changing geopolitical context.

Renewable energy cooperation is prioritized in the "EU-LAC Global Gateway Investment Agenda"[20] – the EU's global infrastructure investment strategy

[19] European Commision, "Global Gateway": https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en

[20] European Commission, "EU-LAC Global Gateway Investment Agenda": https://international-

between the European Union and Latin America, which was created to foster the so called "green and just transition". The President of the Commission presented the Agenda at an EU–CELAC Business Roundtable in the framework of the already mentioned EU–CELAC Summit in Brussels in July 2024.

The "EU-LAC Global Gateway Investment Agenda" will be implemented in Latin America through "Team Europe" initiatives – the EU, its member states, development finance institutions including the European Investment Bank (EIB), export credit agencies and all other public sources of finance will collaborate in public–private partnerships. At the EU–CELAC Summit it was agreed to establish a permanent dialogue body to discuss issues of international scope where consensus was possible, with the aim of bringing respective views closer together in other international institutions as well.

Additionally, during the EU–CELAC Summit in July 2024, the European Commission announced investments of 45 billion Euros under the banner of the "Global Gateway". More than 130 projects will be carried out in different parts of Latin America over the next four years, focusing on the lithium, green hydrogen, renewable energy, connectivity, transport and health sectors, among others. Some initiatives will also focus on climate change mitigation.

In the economic and trade area, the EU has association and trade agreements with Central America, with the Andean Community and with Chile (recently updated), but is still awaiting positions on the modernization of the agreement with Mexico and – even most strategically important – the ratification by the European Council and the Parliament of the EU–MERCOSUR[21] agreement, signed in Montevideo in early December 2024. Without the implementation of these two agreements, Europe is seriously diminished in its capacity to invest in and export to those two large economy blocs of Latin America.

Another important agreement was initiated in December 2024, within the framework of the "European Union Raw Materials Week"[22] in Brussels – a side event entitled "Raw Materials for a Just Transition in Latin America and the Caribbean" (MinJust), jointly organized by the Economic Commission for Latin America and the Caribbean (ECLAC), the German Federal Ministry for Economic Cooperation and Development (BMZ), and the European Commission through the Directorate General for International Partnerships (DG INTPA). This meeting brought together high-level representatives from governments, the private sector, academia and multilateral organizations to discuss bi-regional cooperation strategies that promote sustainable value chains in

partnerships.ec.europa.eu/policies/global-gateway/eu-lac-global-gateway-investment-agenda_en

[21] MERCOSUR (Mercado Común del Sur, or Southern Common Market is a South American trade bloc established by the Treaty of Asunción in 1991 and the Protocol of Ouro Preto in 1994. Its full members are Argentina, Bolivia, Brazil, Paraguay and Uruguay. Venezuela was a member but has been suspended since December 2016. Chile, Colombia, Ecuador, Guyana, Panama, Peru, and Suriname are associate countries: https://www.mercosur.int

[22] European Commission, "Raw Materials Week High-Level Conference", Brussels (2024): https://single-market-economy.ec.europa.eu/sectors/raw-materials/week_en

critical minerals, highlighting the prospects and successful experiences of collaboration facilitated between Latin America and Europe in the global energy transition and diversification.

In this high-level framework the achievements of the program entitled "Regional Cooperation for the Sustainable Management of Mining Resources in the Andean Countries" (MinSus) were explicitly noted. The program was implemented in cooperation with BMZ between 2014 and 2024 as a platform to promote sustainable governance of mineral resources in the South-American region. Specific set of activities – such as support for legislation on environmental liabilities in Colombia, participatory processes in the Bolivian mining sector and dialogues on circular economy in mining in Peru – were highlighted as well.

China as the main EU's competitor in Latin America

One cannot understand the complex geoeconomic and geopolitical environment in the region without mentioning the influence of the People's Republic of China in Latin America.

China is the main importer of raw materials from Latin America and an increasingly important source of foreign direct investments (FDI), thanks to an effective combination of investment by state-owned enterprises and low-interest long-term loans. In practical terms, China's investment strategy in connectivity and logistics – known as the "New Silk Road" – involves 20 countries in Latin America and the Caribbean, including projects in renewable energy, fossil fuel and mining sectors. Thus, e.g., in the last decade, Chinese state-owned companies have acquired strategic assets in lithium in Chile or molybdenum in Brazil, etc.

Furthermore, China has made its presence felt in Latin America with enormous force and a very well-designed strategy. In the last ten years, its investments have not stopped growing, as well as its import-export trade with most Latin American countries. Its "Belt and Silk Road Initiative" (BRI) aims to dominate most of the trade routes and to secure control of the logistical points of communication. Its investments in strategic sectors of 21st century economies (physical and technological infrastructures, connectivity, energy, mining, etc.) facilitate the installation and expansion of other economic activities. All this, together with the financing of its investment bids and the public debts of many countries, gives to China an enormous political and economic influence in the region.

Latin America's trade with China grew at an average annual rate of 31% in the period 2010-2020, reaching a volume close to 500 billion USD, thus making China the first trading partner of Latin America. China's investment and credit figures in Latin America were also extraordinary in the second decade of this century, at an average of 14 billion dollars per year.[23] Also, China's dominance of mining value chains and their refining (mine-to-metal)

[23] World Economic Forum, "China's trade with Latin America is bound to keep growing", Geneva (2021): https://www.weforum.org/stories/2021/06/china-trade-latin-america-caribbean

ranges from 50% in the case of lithium, to 90% in the case of rare earths value chain.[24]

The Chinese competitive advantage in large public tenders is the volumes of financing, the technology at their disposal and the uniqueness of their bids, because it is a single Chinese company that usually participates in the tenders. The case of the port of Chancay (in Peru), inaugurated just recently, in November 2024, by Chinese President Xi Jinping and Peruvian President Dina Boluarte, is a clear example.

This has generated misgivings in Brussels and Washington, perceiving it as a threat to their security of supply. But also in some Latin American governments, aware of the low added value of these investments and their contribution to economic focused on re-primarization.

On this ground, it remains to be seen whether the EU can sustain long-term investments similar to those of the BRI. At this stage it is also unclear whether China will continue with the same approach, as lending has declined in recent years and domestic economic problems are beginning to be felt. For Latin America itself, however, at a time when the region is looking to address political challenges and in the midst of its own economic difficulties, the European "Global Gateway" initiative may present just a new complement – rather than a real obstacle – to the BRI.

USA presence in the region

As to make things even more complicated, it is important to mention that the United States (USA) also wants to regain ground in Latin America, concerned about the huge dependencies that China is currently creating in its neighborhood. Thus, e.g., Argentina's new President, Javier Milei, agreed to deepen cooperation with President Trump's new administration on key minerals, including lithium. And after taking office, Milei said that "USA companies were extremely interested in Argentina's extraction sector".[25] Apparently, the Argentine President has expressed several times his desire to give this economic sector into USA hands.

However, USA investment program for the region – called "Americas Partnership for Economic Prosperity" (APEP)[26] – does not seem to be so powerful. It is not clear yet whether the new Trump administration will maintain it. So far, its foreign policy in Latin America looks rather non-consistent or even contradictory, suffering from tax barriers, migration agenda and a negative corporate reputation problem as a country.

On the other side, in relation to the fundamental issue in question – raw materials – Latin American governments pursue objectives that transcend the

[24] Ibid

[25] Foreign Policy, "Will Milei's Charm Offensive Work on Trump?", Washington (2025): https://foreignpolicy.com/2025/03/18/milei-argentina-economy-imf-trump-trade-tariffs

[26] U.S. Department of State, "Americas Partnership for Economic Prosperity": https://www.state.gov/americas-partnership-for-economic-prosperity

improvement of their trade balance with the USA. First, several governments have expressed their intention to take advantage of the boom in key commodities to increase public revenues and strengthen the state's influence in the economy. In this relation e.g., the governments of Argentina, Bolivia, Brazil and Chile are discussing the possibility of creating an OPEC–like organization for lithium, with the aim of controlling prices globally. Chile has announced plans to establish a state-owned company dedicated specifically to lithium production[27].

Second, creating jobs and opportunities for the region's companies in this sector is one of the central objectives of several Latin American governments. However, it still remains to be seen if this is an objective of the USA companies as well. The labor force in the region remains relatively unskilled and faces challenges such as a lack of investment in research and development (R&D) and an ever-changing regulatory environment. In 2023, Chile, Mexico, Colombia and Argentina allocated on average 0,3% of their GDP to R&D, compared to 2,7% percent in the OECD. In addition, only 15% of the labor force in the region receives some form of vocational training, in contrast to 56% across the OECD[28].

Third, many Latin American governments are aware of the historical relationship between conflict and commodity exploitation. According to the "Global Atlas of Environmental Justice", since 2000 more than a third of all conflicts related to extractive projects worldwide have taken place in Latin America[29]. In this regard, the Chilean government will require mining companies to use less water-intensive extraction techniques to minimize negative impacts on the communities where they are established. On the other hand, Mexico's new mining law is expected to require companies to allocate 5% of their revenues to the indigenous communities in the areas where they extract raw materials[30].

Latin America's fragmentation and the case of Brazil

An objective look at the complicated process of regional relationships requires taking into account that Latin America has been politically fragmented for many years. This fragmentation is linked to its two main economic (including energy) policy models. The first one is the "neo-extractivist model" – based on the nationalism of natural resources (as in Peronist Argentina, Bolivia, Ecuador, Venezuela). The second one is the so-called "open energy nationalism" – which seeks to preserve control of its natural resources and domestic markets, but also to attract private and foreign investment (as in the cases of Brazil, Chile, and also the path proposed in Mexico's 2015 energy reform, before it being reversed)[31].

[27] The Economist, "The green revolution will stall without Latin America's lithium", London (2023): https://www.economist.com/the-americas/2023/05/02/the-green-revolution-will-stall-without-latin-americas-lithium

[28] OECD, "Latin American Economic Outlook: Financing sustainable development"(2024): https://www.oecd.org/en/publications/2024/12/latin-american-economic-outlook-2024_60523697.html

[29] Global Atlas of Environmental Justice (EJAtlas), Report (2024): https://ejatlas.org

[30] Ibid

[31] Gobierno de México, "Resumen de la explicación de la Reforma Energética", Mexico (2015):

In most cases, Latin America's policies follow hybrid models, where free and intervened markets coexist with public, private and semi-private companies. The key aspect for bi-regional cooperation seems to be a country differentiation, which could reinforce the barriers imposed by the limited Latin American energy integration.

This fragmentation in Latin American energy policies is essential. The implications of the differences between energy policy paths and regulatory frameworks of Latin American countries go beyond classifying them – among renewable leaders (such as Brazil and Chile); countries in intermediate stages of their renewable markets (some in involutionary intermediate stages, such as Mexico); and others far behind (basically mono-producers of hydrocarbons, like Bolivia). CELAC has neither the capacity, nor the legitimacy, to bring together the respective national positions of its members. Even if they try, it would be very difficult, if not impossible, to do so.

The added problem is that regional coordination of dissimilar energy policies makes the market integration difficult. If renewable leaders (such as Chile or Brazil) are a driving force for transition and bi-regional cooperation, the backwardness of other countries is a brake on both. These countries follow more interventionist and less renewable paths (Venezuela, Bolivia, Cuba, and more recently Mexico); and meanwhile in parallel they apply varying degrees to intervened models with a significant presence of the public sector. Along this status quo, the EU may have less leeway and less convergence of preferences with them, hindering not only bi-regional cooperation, but also bilateral cooperation between Latin American and European countries.

The history of energy integration in Latin America is marked by high expectations and meager results, resulting in intermittently underutilized infrastructure, unpredictability, low confidence and a preference for self-sufficiency. An example to this is Brazil, which arguably has never shown much attachment to Latin America's full integration. Nowadays, Brazilian President Lula da Silva is committed more to the BRICS[32] countries and wants to play his own international role, without regional dependencies – like those implicate within MERCOSUR – that limit his freedom of movement in international politics.

The Brazilian steel exports to the EU reached 1.4 billion USD (this represents 4,3% of the total EU imports for 2024)[33]. Brazil also has the world's second largest iron ore reserves. With the support of BRICS, Brazil has the potential to develop a decarbonized metallurgical industry with hydrogen and sustainable biomass, exempt from the EU's "Carbon Border Adjustment Mechanism"

https://www.gob.mx/sener/documentos/resumen-de-la-explicacion-de-la-reforma-energetica

[32] BRICS is an intergovernmental organization constituted in 2009 by Brazil, Russia, India, China, South Africa, with Egypt, Ethiopia, Indonesia, Iran and the United Arab Emirates joining on a later stage. BRICS accounts for 46% of the world's population, 25% of the world's landmass, and share of world GDP at purchasing power parity (PPP) at 35,6%. Currently the Pro-tempore Presidency of BRICS is sustained precisely by Brazil: https://infobrics.org

[33] OECD, "Latin American Economic Outlook: Financing sustainable development"(2024): https://www.oecd.org/en/publications/2024/12/latin-american-economic-outlook-2024_60523697.html

(CBAM)[34]. In the future, the trade within the BRICS member-countries will be most probably extended with many other products and commodities – including mining – and this obviously is not in the EU's best interest.

The fragmentation of Latin America's energy policy, the absence of regional integration and the highly politicized European green protectionism are perceived as the main barriers to cooperation. Although most Latin American countries are natural partners of the EU and potential beneficiaries of the external dimension of the "European Green Pact", the process of complementarity requires long-term efforts and strategies to strengthen common interests and reduce barriers, more that ideological values.

Enhancing the EU–Latin American cooperation

The complex set of relations and developments as outlined above certainly calls for an enhanced EU–Latin American cooperation on friend-shoring. The process must take into account the expectations generated in Latin America around industrialization associated with mining, but also a growing environmental sensitivity. The challenge for the EU is to differentiate itself from other investors and importers by offering sustainable patterns of inter-dependence that generate and effectively distribute the benefits of mining, reconciling sustainability and competitiveness.

As noted at the outset, this renewed interest in closer ties and investment in the Latin America region comes as Europe looks to boost its own diversification to energy sources and realign its international ties and energy security, following Russia's invasion of Ukraine in 2022. It also comes as the bloc is looking to "de-risk" its relations with China, diversifying suppliers and reducing its dependence on the country for critical materials. As the Latin American region seeks to advance its sustainable development, the new European initiative can be understood as both a boost and competition to China's investment there.

It was already underlined several times that Latin America with its vast reserves of raw materials is strategically positioned as a key region for achieving Europe's diversification. In more rhetorical terms, Latin America and Europe share great common causes of international organization, supranational institutions for peace and development, and the economic governance of a globalized world in production, trade and finance.

However, the question that arises is obvious – is it possible for Europe to build common positions with this heterogeneous and in many ways fragmented region? Moreover, is it possible to say that EU is overshadowed by the much more pragmatic China's international policy?[35]

[34] European Commission, "Carbon Border Adjustment Mechanism (CBAM)": https://trade.ec.europa.eu/access-to-markets/en/news/carbon-border-adjustment-mechanism-cbam

[35] EU-LAC Foundation, "Why should the European Union have any relevance for Latin America and the Caribbean?", Hamburg (2023): https://eulacfoundation.org/en/why-should-european-union-have-any-relevance-latin-america-and-caribbean

In fact, the current political and economic developments worldwide raise more questions than answers. They only make it clear that the EU needs enormous efforts to bring Latin America back into the framework of its international policy and to strengthen its economic influence in the region. On the other hand, Latin American countries need to overcome their status as mere extractors and exporters of raw materials and develop their own technological and innovative capabilities, as this will assure that they would be able to participate in other links of the global value chain. Otherwise, the energy transition will be another major missed opportunity for the region.

Mario Draghi's long-awaited report "The future of European competitiveness"[36] also warns that Europe has fallen behind China and the USA in terms of capacity, especially in advanced technologies. The report stresses the need for the EU to develop a genuine external economic policy and to better coordinate preferential trade agreements and direct investments with resource-rich countries, the constitution of reserves in certain critical areas and the creation of industrial partnerships to guarantee the supply chain of key resources.

It is the same finding expressed by Josep Borrell[37] in his last reflections at the end of his mandate as High Representative for European foreign policy: "Under the pressure of major crises, we have made significant progress since 2019 in learning to speak the 'language of power'. However, given the rapid deterioration of our geopolitical environment, there is still much to be done to avert the risk that Europe could cease to be a relevant player on the global chessboard in the future. Regarding European foreign and security policy, we have still a lot of work to do to effectively combine the power of the Member States and the policies managed by the Commission, and close the gap between 'Sunday's speeches and Monday's actions", he said. In short, diversification efforts for energy security seems more challenging and of greater strategic value.

Therefore, the EU's increased interest in the Latin America region in the coming years will be guided by its objectives of moving towards a stronger partnership and tackling global challenges, on the basis of a more realistic approach – one of shared interests, more than of shared values. In this respect, the development of stronger ties between the two regions will face several interrelated complications. One of these is the already described fragmentation of the Latin America region and the tendency in some countries towards policies that privilege national sovereignty.

The growing importance of Latin America in addressing global challenges – not only because of its resources and economic opportunities, but also because of concerns about the international security environment – has led to a new incentive for the European Union to strengthen its cooperation with Latin America. In view of the challenges facing the Latin America region in

[36] Draghi Mario, "The future of European competitiveness", Brussels (2024): https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en

[37] EEAS, "The difficult process of learning to speak the language of power: A window on the World by HR/VP Josep Borrell" (2024): https://www.eeas.europa.eu/eeas/difficult-process-learning-speak-language-power_en

the context of a rapidly changing world order, the EU – motivated by a range of geopolitical and geoeconomic factors – needs to develop more adequate policies towards it. These should promote sustainable investment in the region and support Latin America's governments and societies to strengthen their institutions. The EU should take advantage of the fact that, despite the neglect of its relations with the relevant countries – as in recent years, they are still keenly interested in long-term and reciprocal engagement with Europe.

In its entirety, the situation looks promising, as the EU's approach in deepening the regional partnership has the unique opportunity to be based on a clear strategy and a pragmatic agenda. The latter, however, should take into consideration the current realities, given the political fragmentation in Latin America and the lack of strong mechanisms with prominent leadership for regional integration on the continent.

To succeed in this task, the European Union must not only send a strong message to the Latin American countries, but also make big efforts to give substance to a strategic partnership, shifting the focus of its international relations – while the identification of the problems is combined with the search for joint solutions to common challenges. Only in this way, a genuine association between the European Union and Latin America could be possible.

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8. European Commission, “Carbon Border Adjustment Mechanism (CBAM), Brussels (2023)

9. European Commission, “Environmental Impact Assessment (EIA)”, Brussels (2024)

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13. European Commission, “Raw Materials Week High-Level Conference”, Brussels (2024)

14. Foreign Policy, “Will Milei’s Charm Offensive Work on Trump?”, Washington (2025)

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18. International Institute for Sustainable Development, “Critical Raw Materials: A production and trade outlook”, Winnipeg (2024)

19. Join EIT Raw Materials Summit, “The Lithium Triangle in South America: Race to 2030”, Brussels (2025)

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26. The Economist, "The green revolution will stall without Latin America's lithium", London (2023)

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28. World Economic Forum, "China's trade with Latin America is bound to keep growing", Geneva (2021)

GREEN DIPLOMACY IN THE BLACK SEA REGION - STEPS TOWARDS PEACE, GROWTH AND PROSPERITY

Ellen Wasylina

I. INTRODUCTION

The European Union's move towards legislation on due diligence in supply chains is an important step in creating **sustainable international trade**. It will take the active participation of producers, national regulators, international market regulators, and a broad range of civic society to fill in the blanks. But therein lies the problem: **not all partners are on equal footing.**

The accelerating triple planetary crisis of climate change, biodiversity loss and pollution aggravate existing security concerns from ongoing armed conflicts worldwide[1], compounded by the harm to the climate and the environment, resulting in great human suffering. This might be noted on e.g. in the context of Russia's invasion in Ukraine since February 2022; or in the war between Israel and Gaza , after the horrific October 7, 2023 attacks and kidnapping undertaken by Hamas etc.,.

At the European level, a key question appears - how decarbonisation and major initiatives like the Green Deal, the Competitiveness Compass and the Rearm Europe Plan[2], supplemented by the Mario Draghi Report can all function and are the basic guidelines in them not contradictory. In fact, this question was asked at the press conference[3] that took place on March 9, 2025 to mark 100 days of President Ursula von der Leyen's second mandate.

In parallel, with all the recent events, the dress down of President Zelenskyy in the Oval Office on February 28 by President Trump and Vice-President Vance, clearly have made the European Union rethink its posture and security, not only on rearming Europe, as the United States paused its defense and intelligence to Ukraine, but on energy and other national security parameters such as nuclear, rare earth and renewable energies and their supply chains.

Without any doubt, along this general frame, a Green Diplomacy agenda is needed also for the Black Sea region – particularly when looking beyond the Russia-Ukrainian war, and to push the economies of the countries in the region to the next level, while also avoiding a new Cold War.[4]

The EU has set its Green diplomacy as a political priority and so it should be for the Black Sea countries. It is defined as "accelerating a global just and

[1] https://www.prio.org/news/3532 : in 2023, a record number of 59 conflicts was recorded.
[2] https://commission.europa.eu/topics/defence/future-european-defence_en
[3] https://www.youtube.com/live/WDj7oTfMH1U?si=RS8y2xAXG9PKzAd8
[4] See more details in https://bookstore.emerald.com/the-social-consequences-of-climate-change-hb-9781837976782.html : chapter "A New Cold War is Brewing: Equity and Vulnerability in a Warming World", 11/2024'

inclusive green transition", by the EU Consilium on March 18, 2024,[5] which includes a multilateral approach with partner countries.

On this premise, the current analysis would explicitly deal with policy issues of countries in the Black Sea region. Thus, inter alia, as one of the largest riparian countries of the Black Sea, particular attention would be paid on how Türkiye can use Green Diplomacy as a strategic component of its soft power approach, to build bridges with its neighbors, fostering goodwill, and enhance its influence through environmental sustainability efforts. Another look would be on different Green diplomacy typologies by zooming in on several Black Sea countries, such as Bulgaria, Romania and Ukraine – as they all attempt to address critical global challenges and at the same time strengthen their standing and appeal on the world stage etc.

Certainly, there are risks and challenges, which have European and global dimensions. In this context, e.g., to put a finer point on this new Cold War, it is worth noting the major risks as identified and published by the World Economic Forum's annual Risk report for 2024[6], presented just before the Davos gathering in January 2025. Accordingly, these are the top five of the ten major climate risks:

- In two years, these are the top five risks which have been identified:

1) Disinformation and misinformation[7];

2) Extreme weather events[8];

3) Social polarization[9];

4) Cybersecurity insecurity[10];

5) nterstate armed conflict[11].

- In the next ten years, the picture is rather bleak, and almost all the risks are climate or nature related:

[5] https://data.consilium.europa.eu/doc/document/ST-7865-2024-INIT/en/pdf
[6] https://www.weforum.org/agenda/2024/01/global-risks-report-2024/
[7] listen to my podcast , entitled " Hybrid threats : Security , Stability and Solidarity" following my speech at the annual Stratcom conference in Istanbul, November 24, 2023 : https://open.spotify.com/episode/3HHfIZ2FDjWtXN0QgSUt3d
[8] listen to my conversation entitled "Disaster and Resilience : responding to disasters and emergencies": https://open.spotify.com/episode/0v6nfoLJ2oSC8Jx10xbgZj?si=j0g667IWSyCCmgJCFNM38A
[9] listen to Karim Elgendy on my podcast talk about "The climate agenda in a polarized world": https://open.spotify.com/episode/1VssKv2eMtoZLS4Po9jj9o?si=7gg519sqSU-UpRfe1WU3vg
[10] listen to my speech delivered on December 14 in Istanbul at Stratcom 2024 , "Environmental Social Governance , Cybersecurity and AI" : https://open.spotify.com/episode/30EZMKw1lt9hkUIlKZ5wDZ?si=toEWJux2RxaastzwCtjyqg
[11] listen to my speech form the Istanbul Security Forum , May 3, 2023 entitled "Implications of climate change on global security" : https://open.spotify.com/episode/1x0I6KkFN49fssFTOG19RC?si=7Dpse7g1R_-0RvlpCCBi-w

1) Extreme weather events;

2) Critical changes to Earth's systems;

3) Biodiversity loss and system collapse[12];

4) Natural resource shortage.

Therefore, reaching a consensus on such risks is thus crucial to reaching common agreement on decisions, which would improve their individual and collective resilience, while via green diplomacy best practices could stave, prevent, foresee the upcoming destructive national and regional disasters.

II.GREEN LEGISLATION AND NATIONAL LEVEL POLICIES

The countries in the Black Sea Region have already paid due attention to the environmental and climate concerns in the legislative framework. In fact, from the perspective of the green transition, looking at the countries in the Black Sea region, specific policy and political approaches can be easily identified. This is very clear in several specific areas, illustrated with concrete examples as below – environmental protection, rare earth diplomacy, the nuclear issue, blue - green diplomacy and blue economy.

On environmental protection

Further, one can find few examples on the constitutional framework established by the different Black Sea countries for protecting the environment. In general, many of the constitutions set out to establish the right of their citizens to a clean and healthy environment.

Thus, e.g. the Turkish Constitution of 1982 (Article 56) and the first and most important regulation regarding the environment, stipulates that everyone has the right to live in a healthy and balanced environment. It is the duty of the state and citizens to improve the environment, protect environmental health and prevent environmental pollution.[13]

Historically, the major milestones in establishing Türkiye 's environmental policies, started in the 1970's and continue today, with the most recent development plan, the XII, now in progress, from 2024-2028.

In Bulgaria's constitution of 2003[14], Article 15 ensures the protection and the reproduction of the environment, support and diversity of live nature, and sensible utilisation of natural wealth and resources of the country. Article 18, sections 1 and 2 state that underground resources, coastal beach front, national roadways, as well as waters, forests, and parks, natural archeological reservations ...are the exclusive property of the state. The state also exercises

[12] listen to my podcast , entitled "Biodiversity investment : global security, agricultural resiliency, enhancing the value chain" following my speech at the Sustainability Forum in Baku, November 16, 2023 : https://open.spotify.com/episode/1GSEwevycCpkMuGVDgJuWh

[13] https://dergipark.org.tr/tr/pub/beta/issue/70987/1066582

[14] https://www.parliament.bg/en/const

sovereign rights over the continental shelf and the exclusive economic zone for study, development, utilisation and protection and management of biological, mineral and energy resources of maritime areas ."

In Romania's constitution, Article 35[15] states that "The State shall acknowledge the right of every person to a healthy, well preserved and balanced environment. The State shall provide the legislative framework for the exercise of such right. Natural and legal entities shall be bound to protect and improve the environment.

In Ukraine's constitution of 1996[16], Article 16 states that it is the duty of the State "to ensure economical safety and to maintain the ecological balance on the territory of Ukraine , to overcome the consequences of the Chernobyl catastrophe - a catastrophe of global scale, and to preserve the gene pool of the Ukrainian people..." Article 50 states "that Everyone has the right to an environment that is safe for life and health, and to compensation for damages inflicted through the violation of this right."

In the Constitution of the Russian Federation[17] "everybody has a right to a favourable environment, everybody shall preserve the nature and the environment, carefully deal with the natural wealth being a basis for the sustainable development, life and activities of the peoples inhabiting the territory of the Russian Federation. The present Federal Law lays down a legal foundation for the state policy in the field of environmental protection as ensuring a balanced solution for socio-economic tasks, preservation of a favourable environment, biological diversity and natural resources for the purpose of meeting the needs of the present and future generations, enhancing law and order in the field of environmental protection as well as ecological safety."

Now that we know that these countries are all in agreement to protect their environment, their people and their natural resources, now let's look at concretely how these countries can work together through the avenues of multilateral fora to foster cooperation in Green Environmental Diplomacy.

Here is a concrete example with the Black Sea Economic Council [18]: Bulgaria is currently chairing this action (July 2024- June 2026): "The key priorities concerning the BSEC activities in the field of environmental protection are defined by Goal 5 "Environment and Climate Action" of the "BSEC Economic Agenda: Towards a sustainable future of the wider Black Sea area", adopted in 2023.

The main activities, concerning the promotion of cooperation in the field of environmental protection, are carried out by the BSEC Working Group on Environmental Protection which meets regularly every second year or whenever necessary. The BSEC Ministers in charge of Environment met three

[15] https://www.presidency.ro/en/the-constitution-of-romania
[16] https://rm.coe.int/constitution-of-ukraine/168071f58b
[17] https://www.asser.nl/upload/eel-webroot/www/documents/Federal Law on Environmental Protection Russia_ENG.pdf
[18] https://www.bsec-organization.org/areas-of-cooperation/environmental-protection

times (2006, 2011 and 2012) and adopted important Declarations which serve as guidance for the activities in this domain.

Green Energy Diplomacy

Clean or low carbon Energy is key to our political, economic and social security and stability, and is the lynchpin, la clé de voûte of Green Diplomacy, to accelerate a global just and inclusive green transition, and ensuring a reliable, clean alternative to fossil fuels.

Looking to Türkiye, of particular and strategic interest for the region, would be Türkiye's renewable energy potential (increase from 11 GW in 2023 to 23,9 GW by 2030), LNG terminals and infrastructure, biomass, small hydro and geothermal projects.

A common effort, a multilateral approach is needed to ensure security of supply, prosperity and competitiveness. Together the Black Sea countries need to upgrade their infrastructure, modernize their electrical grids for more effective transmission, electricity interconnections and energy storage, while at the same time bringing affordable energy to the market, and eliminating energy poverty.

The European Energy Union was launched in 2015 and led by Maros Šefčovič and was the precursor of this Energy diplomacy. It stepped into action when it synchronized the electric grids of the Baltic countries (Estonia, Latvia, Lithuania) on February 9, 2025[19]. Then they were finally disconnected from Russia's grid and hooked up to the EU's grid, which took 17 years to achieve.

Another area of cooperation would be developing a Black Sea gas hub, where the potential is huge, given the proven reserves in offshore fields available. Türkiye weighs in with healthy gas reserves estimated at 405 bcm; Romania hopes to achieve 100 bcm with its Neptun Deep; and Bulgaria boasts 60 bcm with its Khan Asparuh.[20] Couple that with the ICGB Interconnector, a true success story , led by Teodora Georgieva [21] and co-financed by the European Energy Union for Recovery program, with a natural gas connector between Bulgaria and Greece. This pipeline is 182,6 km long and can transmit from 3 to 5 bcm per year.

Some recent good news out of Baku in this aspect deserve to be also particularly mentioned: Turkish Minister of Energy Alparslan Bayraktar, together with Minister of Energy of Azerbaijan, Parviz Shahbazov, Minister of Energy of Bulgaria, Zhecho Stankov and Deputy Minister of Economy of Georgia Vahtang Tsintsadze, took the first step in "Green Electricity Transmission and Trade Project" by signing an MOU [22]. This multilateral project will enable cross-

[19] https://youtube.com/shorts/ws1n4cTeGFk?si=LSZqvnE13-9iBGRW

[20] https://www.marshallcenter.org/en/publications/clock-tower-series/new-security-reality-strategic-approaches-wider-black-sea-region/new-security-reality-strategic-approaches-wider

[21] https://www.icgb.eu

[22] post by Caner Can, Advisor to Minister Bayraktar , April 4 on LinkedIn : https://www.linkedin.com/posts/hcanercan_a-game-changer-regional-cooperation-of-activity-7313888550003826688-JLVi?utm_source=share&utm_medium=member_ios&rcm=ACoAAACGF1cBra4veQ95__

border trade of electricity generated from renewable sources, modernize transmission systems and enhance energy efficiency and supply security.

The next step is capturing or reducing greenhouse gas (GHG) emissions by 43 percent by 2030 and 60 percent by 2035. As discussed at the COP29 in Baku, **Carbon Capture and Storage (CCS)** deployment of CCS technologies is seen as essential for achieving net-zero targets. Currently, around **40 million tons of CO_2** are captured globally each year, but the International Energy Agency (IEA) estimates that **7.6 billion tons** will need to be captured annually by 2050 to meet global climate goals.[23]

The Black Sea Economic Council (BSEC) is an example of how a multilateral organisation can facilitate Green energy diplomacy. [24] Azerbaijan is currently the chair for Green energy (July 2023- June 2025) in the Black Sea Economic Council and its main focus is to "develop a competitive regional energy market through supporting investments in energy infrastructure, with the view to increase energy security, interconnectivity and further diversify energy sources and routes." The Working Group also organizes joint programs among the energy authorities in BSEC Member States and engages in the exchange of experience and best practices.

On 27 June 2018, the Council of Ministers of Foreign Affairs of the BSEC Member States held in Yerevan, approved the BSEC Green Energy Strategy.[25] In this document, the Council invites member states to conceptualise and adopt their Green energy policies, thus strengthening regional cooperation in the Black Sea .

Rare earth diplomacy

As President von der Leyen mentioned, decarbonisation is directly linked to having access to rare earth and technologies which will improve competitiveness in Europe.

There is clearly a race to capture supply and supply chains to access rare earth minerals, which are indispensable for the next stage of the European economy, which will be highly dependent on these rare earth minerals - from chips to all modern rapid calculating or quantum computing, which is not only going to become part of the daily life, but will make the economy more competitive and more efficient . These technologies should also help people get to net zero ... but the United States has already stepped away from the Paris Climate accords and the CHIPS Act, not to mention the JCPOA[26]. And the race is on to acquire, restart, install nuclear energy, which will be the key to providing a low

oCoMZTTnCuZTrRSuA

[23] Source: International Energy Agency (IEA), "CCUS in Clean Energy Transitions", 2020. (Link to report: https://www.iea.org/reports/ccus-in-clean-energy-transitions)

[24] https://www.bsec-organization.org/areas-of-cooperation/energy

[25] https://core.bsec-organization.org/UploadedFiles/EventFiles/20180625-26_cso-yerevan_annex-3-to-report_bsec-green-energy-strategy-0c0udf1z.pdf

[26] https://www.britannica.com/topic/Joint-Comprehensive-Plan-of-Action; https://www.cfr.org/backgrounder/what-iran-nuclear-deal

carbon constant baseload energy particularly for heavy industries, that are the foundation of the reindustrial campaign sweeping across Europe.

In fact, all the Black Sea riparian countries have deposits of rare earth minerals [27] . Russia is in the top eight countries, with its rare earth reserves estimated in 2024 to stand at 3.8 million metric tons.[28]

Another major country on the Black Sea, Türkiye, has joined the Minerals Security Partnership, which was launched in 2024 to reduce dependency of supply on China, by a group of 14 countries - these are mineral producing countries, such as Kazakhstan, Namibia, Ukraine, Uzbekistan. Türkiye recently discovered the second largest deposit of rare earth after China in 2022.[29]

The EU recently launched a two-year-long rare earth elements project in Türkiye, worth €12 million ($13.4m) to strengthen the Turkish national rare earth minerals ecosystem – it included enhancing Munzur University's Rare Earth Elements Application and Research Centre, and establishing a recycling facility at the General Directorate Mineral Research Exploration.[30] Here is a link to a detailed account of the four types of deposits and mineralization in Türkiye.[31]

The focus of the Minerals Security Partnership Forum is clearly on minerals, such as lithium, cobalt, nickel, manganese, graphite, rare earth elements, as well as copper, germanium gallium,[32] all necessary to ensure our future energy sovereignty and break the dependencies on outside, non-European monopolies of these minerals.

And the ambitions of the Minerals Security Partnership are clear, says the European Commission president Ursula von der Leyen [33] :

"This Act will bring us closer to our climate ambitions. It will significantly improve the refining, processing and recycling of critical raw materials here in Europe. Raw materials are vital for manufacturing key technologies for our twin transition – like wind power generation, hydrogen storage or batteries. And we're strengthening our cooperation with reliable trading partners globally to reduce the EU's current dependencies on just one or a few countries. It's in our mutual interest to ramp up production in a sustainable manner and at the same time ensure the highest level of diversification of supply chains for our European businesses."

[27] https://www.iea.org/reports/global-critical-minerals-outlook-2024/outlook-for-key-minerals-#abstract

[28] https://investingnews.com/daily/resource-investing/critical-metals-investing/rare-earth-investing/rare-earth-reserves-country/ Russia , according to Interfax , possesses 14 types of rare metals , notably lithium, rubidium, cesium, beryllium, scandium, indium, gallium, germanium, zirconium, hafnium, vanadium, niobium, tantalum, rhenium, totalling over 28,5 million tons.

[29] https://www.aa.com.tr/en/energy/turkey/turkiye-uncovers-worlds-second-largest-rare-earth-element-reserve/35729

[30] https://www.middleeasteye.net/news/turkey-joins-western-critical-minerals-club-amid-eu-china-rivalry

[31] https://dergi.mta.gov.tr/article/show/2104.html

[32] https://ec.europa.eu/commission/presscorner/detail/en/qanda_24_1808

[33] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661

It is evident that these deposits in Black Sea countries offer the opportunities for Rare Earth Diplomacy between Türkiye and Ukraine.[34] As concerns the deposits in Ukraine, there is a very good map provided by the Conflict and Environment Observatory, where the authors claim that

"Russia's calculated focus on resource-rich provinces of Donetsk, Kherson, Luhansk, and Zaporizhzhia, together with Crimea and the Black Sea, underscores the war's economic and strategic dimensions. These marine areas and border territories, abundant in hydrocarbons and critical minerals such as graphite, lithium and uranium, are not only pivotal to Ukraine's sovereignty but also to Europe's energy independence and the competition between the United States and China for technological dominance."

Ukraine is not only the breadbasket of Europe but has large deposits of hydrocarbons, critical minerals, particularly in the occupied Dniepr-Donetsk region, which alone account for 80% of oil, gas and coal reserves of the country. With Russia's invasion of Crimea and the Donbas region, it now controls over $12,5 trillion of minerals and gas, including 55% of its coal reserves, 20% of its gas reserves, and a large part of its reserves of lithium, tantalum, cesium and strontium.

In Romania[3536], looking at mines that have been closed, which may be reopened, such as the Lonea and Lupeni coal mines, there is an inherent cost of the cleanup and who is responsible for protecting the environment. From two different sources, Romania also has rare earth, and tailing ponds and waste heaps where they can recuperate precious metals, which is a circular way of repurposing mineral/metals waste.

Finally, Bulgaria[37] has the second largest Manganese deposit in the world, known as the Varna deposit, after the Kalahari Manganese field in South Africa. It also has Rare Earth elements in the Pirin coal deposits.[38]

In order to make the energy transition complete and reduce carbon output, nuclear has been making a strong comeback, as the IEA clearly states in its 95-page report published in 2022[39] , that "***achieving Net zero globally will be harder without nuclear***".

Nuclear diplomacy: case study – ROMANIA [40] [41]

A report, published in June 2022 by the International Energy Agency (IEA) just after the war broke out in Ukraine (February 2022), and entitled "Nuclear

[34] https://www.cirsd.org/en/horizons/horizons-winter-2025-issue-no-29/the-mineral-wars
[35] https://www.sciencedirect.com/science/article/pii/S2405844023011830
[36] https://energyindustryreview.com/metals-mining/mining-industry-in-romania-to-focus-on-non-energy-mineral-resources/
[37] https://archimer.ifremer.fr/doc/00624/73591/73025.pdf
[38] https://ui.adsabs.harvard.edu/abs/1987IJCG....7..301E/abstract
[39] https://www.iea.org/reports/nuclear-power-and-secure-energy-transitions
[40] https://cnpp.iaea.org/public/countries/RO/profile/highlights
[41] https://www.iea.org/countries/romania/electricity

Power and secure energy transitions"[42]„ particularly brings into focus the double challenges of decoupling from Russia energy and the real risks of climate change, as listed in the World Economic Forum's annual Risk Report[43] above.

In terms of general global trends on page 17 of this report, as of 2021, there are 52 reactors currently being built totaling 54 GW of capacity. For our focus in the Black Sea, Türkiye will soon have 4,4 GW and Russia 3,8 GW.

However, along these general lines, the nuclear issue has specific dimensions in the Black Sea region, calling into question if Russia can remain a trusted producer and exporter of nuclear fuel and supplies.

During the ongoing war between Russia and Ukraine the strategic nuclear plant of Zaporizhzhia, one of the biggest in Europe, and one of five nuclear plants in Ukraine, comes several times into focus. It used to supply 20% of Ukraine's electricity, had 11,000 employees before Russia took control of this massive installation with its six reactors.[44]

A lot of countries are racing to build nuclear power plants, like Turkiye's Akkuyu nuclear power plant, in close cooperation for highest standards with the International Atomic Energy agency (IAEA).

Under the multilateral auspices of the IEA and the IAEA, one can look at how nuclear diplomacy could be very effective in providing neighboring Black Sea countries with either access to the technology or access to baseload grids for industry, or access to energy storage capacity, which will fit in nicely to the green technology /industry section below.

Thus, Romania constructed its first nuclear power plant, Cernavoda, in 1982 - it was handed over to a Canadian - Italian consortium, coming on line in 1996, providing 650 MWe from each of the two reactors, Cernovoda 1 and 2. In this case study, it seems that Romania has two challenges : where to source its uranium (previously sourced from the Soviet Union : 20,000 tons before 1963[45]), now sourced in local mines in Romania with new extraction techniques ; and secondly , the technology needed and the financing needed to build two more standard reactors, Cernavoda 3 and 4 (720 MWe each) and six smaller reactors (SMR) called NuScale, for the latter, in the Transylvania region, supported by an international consortium of partners.

This particular case study is a good example of Scientific Diplomacy between members of the consortium which brought different countries together to develop nuclear power in Romania. In 2013 a consortium with Italy was set up for the construction of the 300 MWt ALFRED (Advanced Lead Fast Reactor European Demonstrator), costing €1 billion. This reactor

[42] https://www.iea.org/reports/nuclear-power-and-secure-energy-transitions
[43] seen on page 2 : https://www.weforum.org/agenda/2024/01/global-risks-report-2024/
[44] https://www.wsj.com/world/europe/trump-wants-control-of-ukraines-nuclear-plants-the-largest-one-is-on-the-front-line-01e1f7a4?reflink=desktopwebshare_permalink
[45] https://world-nuclear.org/information-library/country-profiles/countries-o-s/romania

in Pitesti is an example of cooperation and development under the ESNII (European Sustainable Nuclear Industrial Initiative) bringing together more than 90 stakeholders in the Generation IV reactors involved in nuclear fission.

To wrap it up - the International Energy Agency (IEA)[46] states that in case of **"nuclear fade"** the clean energy transition will become more difficult and more costly, requiring $1.6 trillion of additional investment in advanced economies over the next two decades.

Blue - green diplomacy: blue economy

Probably one of the most important aspects concerning Green legislation and national level policies, is blue-green diplomacy, related to water. In this context, people look forward to the upcoming Oceans Summit in Nice, France, June 3-12, 2025[47]. This third Oceans conference will focus on Sustainable Development Goal 14, on the marine environment, boosting multilateral cooperation for its protection, mobilization of financial resources and their sustainable usage use, and better dissemination of knowledge to improve policy making.

Looking back to 2024, the ninth edition of the two-day Our Ocean Conference[48] welcomed 120 countries and 20 international and regional organizations, which addressed four focus areas: Sustainable Tourism in coastal areas and islands; Green Shipping; Plastic and Microplastic Pollution; and the Green transition in the Mediterranean Sea.

Earlier, the Black Sea Strategic Research and Innovation Agenda (SRIA)[49] was launched in 2019 under the auspices of the European Union and sets the foundational work for protecting unique habitats and the health of the Black Sea, while supporting the development of sea-based sectors, boosting the local blue economy.

There are some good examples of **blue diplomacy** through various initiatives, such as Mission Restore our Waters, the Danube - Black Sea Lighthouse, which are both examples of science diplomacy and regional cooperation. Just looking at the amount of funding available in 2024 through Horizon unallocated monies to the tune of €7,3 billion, here are a few examples of tender calls open and where riparian countries can join hands and cooperate: responsible fish consumption, support for waterfront cities, reconcile offshore renewables with ocean protection etc.

Finally, a specific case study could be also used for illustrative purposes

[46] https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system
[47] https://www.diplomatie.gouv.fr/en/french-foreign-policy/climate-and-environment/protecting-the-environment-and-combating-pollution/third-un-ocean-conference-unoc3-nice-9-13-june-2025-65853/
48 Greece, April 15-17, 2024 : https://www.ourocean2024.gov.gr
[49] https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/european-commission-welcomes-launch-black-sea-strategic-ri-agenda-implementation-plan-2023-05-04_en

– this is the so called Danube region Lighthouse action [50], which is blue diplomacy in in real terms, with 22 partners and 39,000 km of waterways, which now has 10 pilot initiatives and implementation foreseen in Romania, Ukraine, Moldova and Georgia in the Black Sea, driven by the Bulgaria -Romanian chambers of commerce , with a budget of €8 million .

III. THE SPECIFIC CASE OF THE GREEN DEFENSE DIPLOMACY

Greening defense poses unique challenges, but it is necessary and profitable - particularly in reducing the industry's carbon footprint and its dependence on fossil fuels.

NATO: green defense

Ten years ago, in February 2014, the NATO Defence Policy and Planning Committee agreed to the NATO Framework for Green Defense. Back in 1991, in its Strategic Concept, NATO had already addressed the link between security and the environment, but has not taken specific initiatives aimed at environmental or climate challenge since.[51]

Thus, the concept of Green Defense is stated to concern the following: "Green Defense is defined in the framework as 'a multifaceted endeavour cutting across a wide range of activities, including operational effectiveness, environmental protection and energy efficiency".

According to Deloitte's Department of Defense study in 2004, a number of different fuel-reducing means were suggested: "new conservation techniques, renewable resources (particularly solar and wind), renewable carbon-based resources (algae and biomass), nuclear fission, hot/cold fusion, fuel cells, and more advanced electrical systems."[52]

NATO is a good example of Green defense diplomacy, particularly in the Black Sea. Its ambitions are clearly stated in its Climate change and security action plan[53].

The war in Ukraine has put energy efficiency and savings or even extreme climate events and risks on the back burner. This war would in fact be a unique opportunity to test some of these energy savings or efficiency mechanisms on and off the battlefield. Here once again, military training and education are key to shifting acceptance and knowledge of best practices and green solutions. As mentioned above, and even today, there is difficulty making the shift to greener fuels and convincing personnel that they will still be able to maintain performance and interoperability on the battlefield. [54]

[50] https://dalia-danube.eu
[51] https://www.jstor.org/stable/resrep05270.5?seq=2
[52] https://www.calameo.com/read/0000469922e70496e5dcb , page 23
[53] https://www.nato.int/nato_static_fl2014/assets/pdf/2023/7/pdf/230710-climate-change-best-practices.pdf
[54] https://www.nato.int/docu/review/articles/2023/08/10/implementing-natos-climate-security-agenda-challenges-ahead/index.html

The war in Ukraine has also put a highlight on the damage to, or the poor state of, the Black Sea, which is the end point of five major rivers, including the Danube, the Dnipro, and the Dniester. There are fertilizer runoffs and other toxic materials that are dumped into the sea, damaging the marine ecosystem. It must be noted that because the Bosporus Strait limits circulation with the Mediterranean Sea, 90% of the waters in the Black Sea are oxygen poor which directly impacts biodiversity in these waters. [55]

Unfortunately, some costs of war, including the damage to the environment, are not calculated - such as recent oil spills by Russian shadow fleets, the breach of the Kakhova dam on the Dnipro River and loose ammunition floating near the shores of Bulgaria and Romania etc.

IV. GREEN FINANCING AND GREEN INDUSTRIAL DEVELOPMENT

Finally, some of the most important aspects concerning the topics discussed are linked to a brief look at the importance of financing this green transition and the ensuing role of technology end innovation that is at the heart of Green Diplomacy and its policies

Both aspects deserve special attention in the context of the Black Sea Region.

When it comes to the green financing, there have been several examples of effective steps, which deserve being mentioned.

Thus, a Memorandum of Understanding (MoU) was signed between Türkiye, the World Bank, France, Germany, the UN, IFC and the EBRD, which gives a framework for the World Bank and other signatories to provide technical assistance and additional development financing of $3.2 billion. The step would help mobilise private finance for projects which are important for Türkiye to achieve its nationally determined contributions (NDCs) and Long-Term Strategy (LTS). Even though Türkiye's historical contribution to global GHG emissions is less than 1%, the country has committed to reduce its GHG emissions by 41% through 2030, targeting Net Zero in 2053.

If one zooms in on Türkiye 's green finance efforts, some substantial worldwide challenges would be discovered. In fact, the transition to a lower carbon economy will require $1 trillion to $3,8 trillion worldwide annually[56] , all the while reducing fossil fuel investments, and in parallel being mindful of the climate risks discussed above and the costs and damage, not to mention insurance costs of such extreme weather events.

As most experts agree, the world is going over the illusive target of 1,5°C towards a 3°C warming, unprepared to envision or sustain loss and damage of

[55] https://carnegieendowment.org/posts/2025/02/tackling-the-russia-ukraine-wars-environmental-damage-in-the-black-sea?lang=en

[56] https://reports.weforum.org/docs/WEF_Bridging_the_Gap_How_to_Finance_the_Net_Zero_Transition_2025.pdf

such phenomena. Adaptation costs are expected to be in the range of $280 billion to $500 billion a year [57].

In fact in this regard, the COP28, November 30-December 13, 2023[58], was particularly important, as it brought together 150 Heads of State, 85,000 participants, signaling strongly the end of the fossil fuel era, pushing the parties to agree together on new funding for loss and damage - thus strengthening resilience, and clearly linking climate change with nature conservation.

Green technology/industry diplomacy

When it comes to costs, there are two very important figures on how much it will cost to achieve net zero emissions and investments in clean energy and efficiency.

According to **McKinsey & Company[59]**, achieving net-zero emissions globally by 2050 will require around **$9.2 trillion** in annual investment. A significant portion of this cost will go toward decarbonizing high-emission industries such as energy, heavy manufacturing (e.g., steel and cement), and transportation. As for the **International Energy Agency** (IEA)[60], it estimates that the level of $4 trillion annually should be reached to attain clean energy efficiency goals, focusing on electrification and carbon capture.

The President of the European Commission, Ursula von der Leyen, recently spoke at the European Industry Summit in Antwerpen on February 26, 2025[61]. In her statement several key points referring to the Clean industrial Deal were recalled[62], which summarize the key goals along the topic. In this frame, the EU will mobilize over €100 billion, which will support the creation of over 500,000 jobs, growing Europe's manufacturing sector by €100 billion by 2030. The Deal focuses on six main chapters, underlining the importance of closing the innovation gap:

· Affordable Energy, notably completing the internal energy market with physical interconnections;

· Boosting demand for clean products, introducing sustainability, resilience in "Made in Europe";

· Financing the clean transition;

· Circularity and access to materials, notably creating an EU Critical Raw Materials Center;

[57] https://www.unep.org/gan/news/blogpost/unep-report-cost-adapting-climate-change-could-hit-500b-year-2050#:~:text=Rotterdam%2C%2010%20May%202016%20–%20The,Nations%20Environment%20(UNEP)%20report.
[58] https://unfccc.int/cop28/5-key-takeaways#:~:text=COP 28 closed with an,As COP 28 President Dr.
[59] McKinsey & Company, "The Net-Zero Transition: What it would cost, what it could bring", January 2022.
[60] International Energy Agency (IEA), "Net Zero by 2050: A Roadmap for the Global Energy Sector", May 2021
[61] https://www.youtube.com/live/JSu_xX4JsgM?si=qAkEQ2O8j46csQH2
[62] https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en

· Acting on a global scale to create clean Trade and Investment Partnerships;

· Skills and quality jobs.

V. SOME CONCLUSIONS

Green Diplomacy, which has been defined as "accelerating a global just and inclusive green transition" by the EU Consilium on March 18, 2024,[63] will only be successful in the Black Sea region if, at the national policy level in each country, there is a true roadmap, with national political, economic and social objectives, palpable , measurable results , in a European Environmental Social Governance framework .

Extending these efforts to Russia and Georgia, not to mention to Azerbaijan and Armenia, are critical to peace and prosperity in the Black Sea region.

Türkiye should take the lead, as the second most populous country (85,7 million[64]) in the Black Sea and with the longest Black Sea coastline (1.329 km), and as guardian of the Treaty of Montreux since 1936.[65]

As put forth in this paper, there is a need to have legislation which favors green policies with sustainable use of resources, reducing pollution /CO2, boosting economic sustainable growth and employment. Each country and its leaders need a national vision and a cooperative mindset and policies - but while recalling that each country is different, with different characteristics, and that a one-size-fits-all policy will not work. This, however, also underlines the fact that each country cannot alone, in isolation, accomplish the green transition.

Environmental Social Governance is the green key to success: everything people do should be measured in impacts, outputs and the costs on the environment - and how it affects the economy, its resilience as well as how it attracts investments and in what way it is relevant to citizens' prosperity, health and well-being.

While not all the subjects could be treated in such a short space and time, the priority in this paper was given to the most pressing issues: environmental protection, green energy, rare earth, nuclear energy and the blue economy.

Security, Stability, Solidarity[66] was the title of the Stratcom Summit in Istanbul in November 2023, and could be a good resumé, conclusion of this chapter.

Green Defense merits our attention, particularly as Rearm Europe gears up with a hefty budget of €800 billion to get Europe ready for war. This will be an opportunity to develop new technologies, implement and test green

[63] https://data.consilium.europa.eu/doc/document/ST-7865-2024-INIT/en/pdf
[64] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TR
[65] https://www.mfa.gov.tr/implementation-of-the-montreux-convention.en.mfa
[66] https://open.spotify.com/episode/3HHfIZ2FDjWtXN0QgSUt3d?si=9PBesgBTTBi7jxdQSLUsaA

financing mechanisms and create green industrial development projects in the process, knowing that only four of the world's top 50 tech companies are European.

The innovation gap[67] is why Europe is growing slowly or not all. In fact, Europe needs a new alternative business model, a European innovation approach, that needs to balance technological progress and social inclusion. And Education is key to filling the skills gap.

Europe also needs a European Foreign Economic Policy as to increase public innovation to 3% of GDP and Defense to 2%; further, to increase its industrial capacity in defense and space, secure supply chains for critical raw materials, raise R&D spending and secure key technologies.

Investment in Research & Development is key to backing up the leadership policies and should reach at least 4% of GDP.

Attracting, retaining and managing the right talent to implement the policies at all levels of policy making is crucial. Exchange programs between governments, business and universities/research units, i.e. public private partnerships, are beneficial and should be reinforced while ideas and best practices are shared and implemented regionally.

Education[68] should be a key target as to retrain, reformat today's youth to embrace an entrepreneurial mindset, transform knowledge into competencies, and be capable of creating innovative SBUs (Small Business Units) - this is the golden key and underpins the success of all the former, being in parallel the foundation of a solid national green diplomacy policy.

[67] New report just published by the IEA, entitled the State of Energy Innovation" : "The report includes focus chapters on three dynamic fields, namely diversification of battery mineral supplies, application of artificial intelligence to energy innovation, and development of carbon dioxide removal technologies. https://www.iea.org/reports/the-state-of-energy-innovation

[68] https://books.google.fr/books?id=mY-OvgAACAAJ&printsec=frontcover&dq=editio:ISBN0990772144&hl=fr Chapter 19, Wasylina , Ellen , "Transforming Knowledge into Competencies..."

Ellen Wasylina *is the President and founder of the Trocadéro Forum Institute in Toulon, France, whose mission is to train à new generation in Sustainable Leadership and Diplomacy.*

From 2011-2018 she founded and presided over a think tank in Paris, the International Geostrategic Maritime Observatory (IGMO) and was also the founder and Editor in chief of its flagship publication, the Geostrategic Maritime Review (GMR). During this period, she also taught in Parisian business schools and was also hired by a consortium to advise on energy and education issues in North Africa.

Since 2013, she has been a very popular international speaker and lecturer and continues to be invited across the globe and is appreciated for her geopolitical and geoeconomic expertise.

From 2008-2011, she was named Director of Environment and Sustainable Development of a French city in the Oise region, where she was also named as Director of International Relations and was concurrently Vice-President of the Twinning Committee's Ukraine chapter.

From 2008-2018, she was a prominent and sought after commentator in French and international media in both English and French, on Foreign and defense policies, geopolitics, geoeconomics, transatlantic, trade, energy and other important issues, concerning both Europe, the United States, the former Soviet Union and the Middle East /MENA.

From 2004-2006, she completed two master's degrees in French in Paris, France, one in Strategy and Defense policies and the other in Conflict Resolution. Two of her theses gave way to two major books published, notably "Ukraine: prémices de guerre froide en Europe?" (2014); and "La défense européenne face aux menaces: l'Europe est-elle prête pour son 11 septembre ? » (2015)

She has since written numerous books, contributed to numerous collective works and since 2020, during the COVID pandemic, she is now a podcast producer of "Mediterranean Sustainability Partners", and has recorded over 150 episodes, which are heard in 88 countries, on 5 continents, in English and French.

Her most recent contributions are chapters to collective books: "A new Cold War is brewing: vulnerability and inequity in a warming world"; "Green Diplomacy: the soft power axis of Türkiye's public diplomacy"

Podcast episodes as a companion to this paper

February 19, 2021 https://creators.spotify.com/pod/show/mediterranean-sustainable/episodes/Episode-4--Joe-Bidens-Foreign-Policy-Agenda-and-challenges--Interview-with-Dr--Stephen-Blank-eqd8oq

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TÜRKIYE'S STRATEGIC ROLE IN EUROPE'S ENERGY SECURITY AND THE GLOBAL ENERGY TRANSITION

Ambassador Berris Ekinci

In the evolving global energy landscape, Türkiye has emerged as a central actor in the region by addressing its own domestic energy needs and also by contributing to the energy security of its neighbors and partners. Through a comprehensive forward-looking energy policy that has long emphasized supply diversification, large-scale investments in infrastructure and renewable energy, and growing engagement in the supply of critical raw materials, Türkiye plays an increasingly vital role in supplying reliable and secure access to energy in the region and promoting clean energy transition domestically and abroad.

Türkiye's energy strategy is rooted in a longstanding recognition of the risks posed by overreliance on limited sources and routes of supply. Events of recent years have clearly highlighted the importance of this strategy. As a country overwhelmingly dependent on imported energy, Türkiye has pursued a multi-dimensional policy of diversifying energy sources, routes, and suppliers, while simultaneously investing in domestic capacity in order to utilize its own energy resources as efficiently as possible.

At the heart of this strategy is Türkiye's position between the resource-rich regions of the Caspian Basin, Central Asia, the Middle East, and the high-demand markets of Europe. Türkiye's geostrategic location has been harnessed through the development of an extensive and modern large-scale natural gas pipeline infrastructure.

The Trans-Anatolian Natural Gas Pipeline (TANAP), inaugurated in 2018, is a cornerstone of this infrastructure. Spanning over 1800 kilometers across Türkiye and forming the central segment of Europe's Southern Gas Corridor, TANAP delivers natural gas from Azerbaijan's Shah Deniz field to Türkiye and from there on to the European markets. With a capacity of 16 billion cubic meters annually, approximately 6 bcm is allocated to Türkiye's use and the remainder to other European countries. TANAP has significantly bolstered the energy security of both Türkiye and the EU by increasing capacity and diversifying suppliers.

Complementing TANAP is the Baku-Tbilisi-Erzurum gas pipeline which also facilitates the transfer of additional gas from Azerbaijan to Türkiye.

The TurkStream pipeline, launched in 2020 still remains as an important route for not just Türkiye but also various other countries in Europe. This line transports natural gas from under the Black Sea to both Türkiye and to the European markets through Türkiye.

In addition to Türkiye's comprehensive natural gas pipeline network, it is also worth touching upon Türkiye's LNG import capabilities which has grown rapidly in recent years. Türkiye now operates a total of five LNG import terminals and

Floating Storage Regasification Units (FSRUs) with a total daily import capacity of 161 mcm. This gives Türkiye the much needed flexibility to meet energy demand during high-volatility periods in the domestic and international energy markets. This also gives Türkiye the access to a wider range of natural gas suppliers around the globe, enabling imports from countries such as the United States, Egypt Algeria, Qatar, in line with our strategy of source diversification. This expanded infrastructure has allowed Türkiye to adapt quickly to shifts in global markets and offer greater supply optionality to the region.

Türkiye's sound energy policies have proved its effectiveness in the aftermath of the Ukraine war. As energy shortages dominated the headlines globally and especially in Europe, Türkiye has been able to meet its energy needs throughout this process without experiencing energy shortages or serious price fluctuations. Not only has Türkiye been able to meet its own energy demands, but Türkiye has also directly been able to contribute to the gas supply of Europe. It is important to recall that in those times of difficulty, it was thanks to Türkiye's gas infrastructure that difficulties of obtaining gas supplies were overcome in the region.

In addition to diversifying its energy sources, Türkiye has also prioritized the expansion of renewable energy as a key pillar of its long-term energy policy and security. This effort is driven not only by climate goals but also by economic and strategic considerations, including reducing import dependency and enhancing energy independence.

As of March 2025, over 60% of Türkiye's total installed electricity generation capacity, exceeding 117 GW, comes from renewable sources. Hydropower accounts for the largest share, followed by solar and wind. Türkiye also utilizes geothermal and biomass as other renewable energy sources. Türkiye ranks among the top five countries in Europe in terms of installed geothermal and hydroelectric capacity and continues to make rapid progress in wind and solar deployment.

In line with our respective net-zero targets by 2050 alongside energy security becoming an international security consideration, global cooperation in the field of renewable energies has gained strategic importance. Laying out the necessary groundwork to support the continued adoption of clean energy projects requires the transparent sharing of knowledge and experience in the field of renewables.

With respect to increased renewable energy adoption and the electrification process, it is important to note that there is potential to further enhance our energy relations with Bulgaria in this field. Upgrading the existing and constructing new electricity interconnection lines between Türkiye and Bulgaria would allow for the efficient and cost effective flow of energy between our countries and would also make use of electricity generated with renewable sources. We attach particular importance to the Memorandum of Understanding on Cooperation in the field of Green Electricity Transmission and Trade signed in Baku on 4 April 2025 between

the respective Ministers of Türkiye, Bulgaria, Azerbaijan and Georgia which envisages the establishment of a green electricity corridor between these four countries.

Renewable energy development is directly tied to Türkiye's climate and environmental commitments. In 2021, Türkiye ratified the Paris Agreement and announced a net-zero emissions target for 2053. As the Nationally Determined Contributions (NDCs) set out in the Paris Agreement will soon be reviewed and updated, 2025 will also be a year when Türkiye will take transformative, comprehensive and ambitious steps.

Acting with a climate-friendly and sustainable development oriented approach in line with her 2053 Net Zero Emission Target and green transition vision, Türkiye announced its Long Term Climate Strategy (LTS) and Biennial Transparency Report (BTR) just before UNFCCC 29th Conference of the Parties (COP29), submitted the draft Climate Law to the Turkish Grand National Assembly, which includes the Emissions Trading System, also started preparatory work of the National Green Taxonomy Plan, and took the necessary measures to achieve digital transformation and green financing strategy.

Within this framework, in order to achieve Net Zero Emission Target by 2053 and green transition vision, Türkiye has created 2053 Industrial Sectors Low Carbon Roadmap, Green Growth Technology Roadmap, Decarbonization Roadmap for the Building Sector.

Additionally, Türkiye embarked upon an ambitious Zero Waste Initiative, inaugurated under the auspices of First Lady H.E. Emine Erdoğan which gained global prominence and saved 2.6 billion kWh of energy, prevented 5.9 million tonnes of greenhouse gas emissions in Türkiye. Furthermore, in the face of increasing water scarcity, Türkiye has initiated the Water Efficiency Campaign to promote responsible water management.

In the current state of international relations where climate diplomacy is losing ground on the international agenda, the high-level panel on climate diplomacy and energy transition organized within the scope of the Antalya Diplomacy Forum held on 11-13 April 2025, highlighted the importance Türkiye attributes to the climate diplomacy and brought Türkiye's candidacy for hosting COP31 in 2026 to centre stage.

Türkiye's renewable energy success is also relevant for Europe's clean transition. As the EU continues its clean energy transition, Türkiye's growing capacity in wind, solar and other renewable energies provides opportunities for cross-border energy trade, investment and cooperation. Through the development of electricity interconnections Türkiye and Europe could enhance electricity security and accelerate regional integration. Türkiye's sophisticated and developed energy infrastructure alongside its geostrategic location poses itself as a natural partner of the EU to enhance cross-regional energy trade.

The shift toward clean energy technologies has brought the issue of critical raw materials (CRMs) to the forefront of energy security discussions. Minerals such as lithium, cobalt, nickel, rare earth elements, and graphite are essential for batteries, electric vehicles, wind turbines, and solar panels. Ensuring secure, diversified, and sustainable access to these resources has become a strategic priority for governments and industries alike. Türkiye is taking important steps to enhance its dialogue and ties with relevant countries in this field and positions itself as both a producer and a partner in the emerging CRM supply landscape.

To this end, Türkiye joined the Mineral Security Partnership (MSP) Forum in September 2024, an initiative led by the United States, European Union and joined by several other countries in order to strengthen global cooperation on critical minerals. This move reflects Türkiye's interest in contributing to the creation of secure and transparent supply chains, while also enhancing its own economic resilience.

Türkiye's CRM policy is closely linked to its broader energy and industrial strategies. Failure to address increasing demand for CRMs with sufficient mining and processing capabilities risk jeopardizing our future clean energy projects necessary for our collective climate goals. As meeting our climate targets is our collective goal in order to leave a sustainable future for upcoming generations, we must work together that access to CRMs does not become a source of division, but instead a foundation for peaceful and constructive international cooperation.

Currently, however, the whole world economy is facing an all-time high stability risk. With Russia-Ukraine war, armed conflicts in the Middle East, tensions poised over the Pacific, rivalries for critical materials and technologies and drastic changes in trade policies of major powers, no country can easily navigate through the uncertainties of today.

Strong economies undisputedly rely on affordable and reliable supplies of raw materials, energy resources and a solid financial system. As experienced during the war in Ukraine, a disruption in global supply chains of one particular input, created an impact that made itself felt in all sectors of a country's economy, and that is energy. It is the most convertible and most converted ingredient of production: keeps the factories in operation, makes transport possible and powers all services from healthcare to tourism. Regardless of their ideologies or political systems, all governments are responsible for providing their nations with energy they need.

For over thirty years, globalization brought economies of the east and the west ever closer. It also has been a scene where norms of international trade were shaped and rules of the game generally enforced. Today, however, we are faced with a different reality. Rules-based international trade appears to be in a piecemeal decline. North Atlantic is striving to reduce its dependence on Asia, growth is slowing down in Europe and there is dominance of regionalism, friend-shoring, near-shoring and the looming risk of trade wars. Political

tensions have more of an influence than before on corporations' decisions on investments, mergers and partnerships as strategic rivalry between states and regions continue to deepen divisions. Companies are being advised to build their own geopolitical strategies to ensure well-functioning supply chains that are expected to be shockproof against sudden rise of tensions. Risk management strategies are at times higher on a CEO's agenda than increasing productivity.

Financial markets appear to be suffering from this phenomenon as heightened interest rates and stringent monetary policies adopted to curb inflation have put many developing countries in a difficult situation in terms of debt burden. The World Bank Group recently announced that developing countries spent a record $1.4 trillion to service their foreign debt. Their interest costs climbed to a 20-year high in 2023, making these economies more vulnerable to insolvency slumps. Global government borrowing is forecasted to reach 145 trillion USD by 2030 and to 440 trillion USD by 2050. Therefore, many nations will have to adapt themselves to the risks brought by dangerous levels of sovereign debt.

Over and above all these, governments, along with other stakeholders are in a situation to devise and adopt harmonized policies aimed at climate change adaptation and digital transformation. There is a rising dichotomy between economic autonomy and supranational eco-conscious policies while domestic production falls short of green technology capabilities. This was evinced last October by the EU member states approved tariffs on Chinese electric vehicles.

In the absence of oil and gas imports from Russian Federation, how well Europe will fare in green transition without facing an energy crisis depends not only on policy decisions, but also on its success in innovation. Despite its ageing population and high youth unemployment in some of its member states, the EU has significant potential to make great strides towards this objective, since the Commission is earmarking sizable expenditures for R&D activities.

It is yet hard to claim that the world is deglobalizing though. Therefore, Europe's performance in managing green transition without compromising productivity, growth and financial stability will still be depending to a large extent on global economy's course. The EU-wide growth rate is expected to rise to 1.8% in 2025 and 1.6% in 2026. The global economy is expected to grow by 3.2% in 2025, we see that global medium-term growth forecasts have been revised downwards since the 2008-2009 crisis.

According to European Central Bank, the economy is losing momentum, manufacturing is still contracting and growth in services is slowing, firms are holding back on investments, and exports remain weak, with some European industries struggling to remain competitive. With all the parameters and variables mentioned here, including armed conflicts, geopolitical tensions and uncertainties of future Trans-Atlantic relations,

the EU's success in maintaining growth and productivity as well as in providing employment, along with green transition will be a determining factor for EU and its partners.

Türkiye's integrated energy strategy therefore supports not only its national economic interests, but also the long-term stability of Europe's energy and economic growth. In an era marked by volatility, Türkiye offers reliable physical infrastructure, a commitment to market reforms, and a proven track record of delivering on complex energy projects.

Moreover, Türkiye's proximity to multiple energy-producing regions, combined with its growing renewable potential and critical material base, uniquely positions it as a strategic partner in Europe's quest for energy security and decarbonization. Through enhanced regulatory cooperation, cross-border energy trade, and joint investments in infrastructure and technology, the Türkiye–Europe energy relationship has the potential to become a model for resilience, sustainability, and shared prosperity.

As the global energy order continues to evolve, Türkiye's role will grow in strategic relevance. Its contributions, whether in stabilizing gas supply, accelerating the clean transition, or securing critical minerals, will remain essential to meeting the challenges of the next decades.

Ambassador Berris Ekinci *has had a distinguished career in Turkish diplomacy since joining the Ministry of Foreign Affairs in 1994. Her overseas assignments included posts at the Turkish Embassies in London and Baku, the Permanent Mission to the United Nations, and as Consul General in Marseille. From 2016 to 2021, she served as Türkiye's Ambassador to Havana, strengthening bilateral relations and advancing Türkiye's interests in the region.*

At the Ministry's headquarters in Ankara, Ambassador Ekinci specialized in energy, water, and environmental issues, and held several senior positions. She served as Deputy Director General and later as Director General for Energy and Environment, playing a key role in shaping Türkiye's international energy and environmental diplomacy.

In May 2024, she was appointed Deputy Minister of Foreign Affairs. Ambassador Ekinci's career reflects extensive experience in both bilateral and multilateral diplomacy, with a focus on strategic economic and environmental matters. She is proficient in English and French, and has working knowledge of Spanish.

STRATEGIC TRADE IN A MULTIPOLAR WORLD: BALANCING ECONOMIC SECURITY AND ENERGY MARKET LIBERALISM

Tsvetomir Nikolov

The current era of geopolitical and geoeconomic uncertainty is a wake-up call for Europe to strengthen its strategic autonomy. Economic security must become a pillar of national resilience, recognising that vulnerabilities in supply chains, energy, and technology can be exploited as tools of foreign influence. In response, the European Union (EU) has introduced a comprehensive economic security strategy, supported by a broad trade, investment, and research package.

The Russian invasion of Ukraine in 2022 exposed Europe's energy vulnerabilities, prompting a swift reconfiguration of imports, infrastructure, and policies. However, energy security extends beyond crisis response. Structural challenges–such as persistently higher energy costs than in the US and China, slow progress in low-carbon energy transitions, and limited market integration–continue to undermine industrial competitiveness and exacerbate energy poverty.

To strengthen its industrial base, the European Commission has proposed the Competitiveness Fund[1], aimed at supporting critical sectors such as deep tech, energy, and defence. The EU also has extensive financial instruments, including the Recovery and Resilience Facility, the Innovation Fund, and the Cohesion Funds. For the Competitiveness Fund to be effective, it must address structural weaknesses such as fragmented capital markets, regulatory barriers to scaling European firms, and the persistent innovation gap with the US and China.

The past decade has reshaped global economic security. Trade wars, supply chain disruptions, and the weaponisation of critical resources have exposed Europe's economic fragility. While reshoring, nearshoring, and "friendshoring" can enhance security, they also introduce trade-offs. Reducing interdependencies may, in some cases, increase vulnerability by concentrating supply risks in smaller, regionalised markets. Trade fragmentation could lower global GDP, disproportionately affecting smaller European economies. However, in sectors with limited international substitutability, high disruption costs, or monopolistic threats to critical technologies, targeted interventions may be necessary. The key is ensuring policies remain proportionate, evidence-based, and tailored to each sector's needs.

Persistent Energy and Climate Security Risks

Energy and resource dependencies remain at the core of Europe's economic security concerns. The EU has made efforts to reduce its reliance on unstable suppliers, particularly in response to Russia's weaponisation of energy following its

[1] European Commission, Brussels, 29.01.2025, Communication from the Commission to the European parliament, the European council, the Council, the European economic and social committee and the committee of the regions

invasion of Ukraine[2]. However, now in the fourth year of the Kremlin aggression, the EU is yet to strategically decouple from Russian energy imports[3]. Although it is largely Russia's targeted cuts in the supply of natural gas that brought about the surge in natural gas prices, Europe remains dependent on the imports of Russian gas.[4] Yes, the share of Russian gas in the EU's import mix has fallen from around 40% before the war to just around 10% after the halt of the Ukrainian gas transit. However, purchases of Russian LNG and pipeline gas rose by more than 25% in 2024[5] as the two largest Russian gas exporters, Gazprom and Novatek, dumped cheaper gas on the European market undercutting the competition from alternative, mostly LNG supply.

The EU's reliance on natural gas imports has triggered a crisis in energy and industrial competitiveness, intensifying geopolitical risks and economic vulnerabilities. EU consumers in the EU are paying around five times higher prices for its gas consumption than the U.S. and roughly 70% more than China. As natural gas is clearing the electricity market in the merit order of power plants entering the system, electricity prices have also shot up to levels at least two times higher than the 10-year average before the Russian invasion. The outcome has been that between 2021 and 2025 dozens of energy-intensive factories across Europe have closed down, and many more are operating at reduced capacity[6]. Energy affordability risks have surged close to fivefold since 2020 (Figure 1).

In response, the EU members have spent more than EUR 1 trillion[7] in subsidies to the industry and vulnerable consumers to prevent deindustrialisation and a steep rise in energy poverty. This strategy, however, has not stopped European companies from relocating their plants to more cost-competitive locations cutting roughly a million European jobs to oversee competitors[8]. This has cascading effects on public welfare and economic stability.

There has been a limited common EU approach to assessing and countering energy and climate security risks. Each Member State pursues its own strategy, leading to inefficiencies and reduced bargaining power in global energy markets.[9] The European energy market remains deeply fragmented with

[2] Vladimirov, M. and Rangelova, K. The Great Energy and Climate Security Divide: Accelerated Green Transition vs. the Kremlin Playbook in Europe. Sofia: Center for the Study of Democracy, 2022

[3] Center for the Study of Democracy, Phasing Out Russian Gas in Europe, Policy Brief No.146, June 2024

[4] Vladimirov, M. and Levi, I., "Tapping the Loophole: Czechia has spent five times more on Russian oil and gas than aid to Ukraine", Sofia, Center for the Study of Democracy, 2024

[5] CSD based on the assessment of ENTSO-G data on natural gas flows in Europe.

[6] Crellin, F., Buli, N. and Chestney, N. "Gas price shock set to add to Europe's industrial pain". Reuters. December 6, 2024.

[7] Gillian Boccara, Diego Hernandez Diaz, Ole Rolser, Thomas Vahlenkamp, Cindy Xue, "A balancing act: Securing European gas and power markets", Article, McKinsey & Company, April 25, 2023

[8] In 2023, around 60% of European businesses identified energy costs as a major barrier to investment, which is over 20% higher than U.S. businesses.

[9] For example, EU Member States implemented over 400 uncoordinated emergency energy measures, distorting energy markets. European Union Agency for the Cooperation of Energy Regulators. Assessment of emergency measures in electricity markets. 2023 Marketing

significant regulatory barriers and bottlenecks in interconnector capacity, which increases Europe's reliance on costly peak demand power plants operating on expensive and imported natural gas[10].

The EU has responded to the energy supply shocks by initiating in 2022 its flagship REPowerEU initiative, which has aimed to phase out Russian energy imports by 2027 and markedly accelerate the investment in renewable energy. The initiative has streamlined permitting procedures, increased funding for wind and solar projects, and strengthened incentives for green hydrogen production. As a result, the EU installed a record 56 GW of solar PV capacity in 2023–double the pre-crisis level, and another 65.5 GW in 2024[11], while wind power investments have also surged by 31.3 GW since 2022[12].

Moreover, REPowerEU's emphasis on energy efficiency, including the widespread adoption of heat pumps and building renovations, has further reduced demand for imported fossil fuels. These efforts have helped the EU reduce greenhouse gas emissions (GHG) by 8% in 2023 and have increased the share of renewable energy in the power mix to 48% from around 37% in 2021[13].

The expansion of renewable energy investment has strengthened the bloc's economic competitiveness by driving industrial decarbonisation and shielding businesses and consumers from volatile energy prices. The EU remains a global leader in clean technologies, including wind turbines, electrolysers, and low-carbon fuels, accounting for over 20% of global clean tech innovations. However, permitting challenges and high capital costs have delayed renewable projects, particularly offshore wind, increasing the reliance on fossil fuels. Furthermore, substantial investment–around EUR 90 billion per year–is required to upgrade the electricity grid and support the energy transition.[14]

Risk Assessment

The EU must move away from political declarations to concrete actions, such as an ambitious rollout of renewable energy, energy efficiency measures, and decentralization and diversification of energy generation and supply. There is an urgent need for the deployment of a comprehensive policy assessment instrument such as CSD's Energy & Climate Security Risk Index (ECSRI)[15], which provides objective metrics for addressing the most critical vulnerabilities and underscoring the strengths of the different energy and climate security strategies.

The ECSRI provides a structured analysis of these challenges, integrating 21 risk indicators across geopolitical risk, affordability, reliability, and

Monitoring Report.

[10] IMF. Staff Background Note on EU Energy Market Integration. January, 2025

[11] Solar Power Europe. EU Market Outlook for Solar Power: 2024-2028. December, 2024

[12] Based on the annual reports of Wind Europe for 2023 and 2024.

[13] CSD based on Eurostat data.

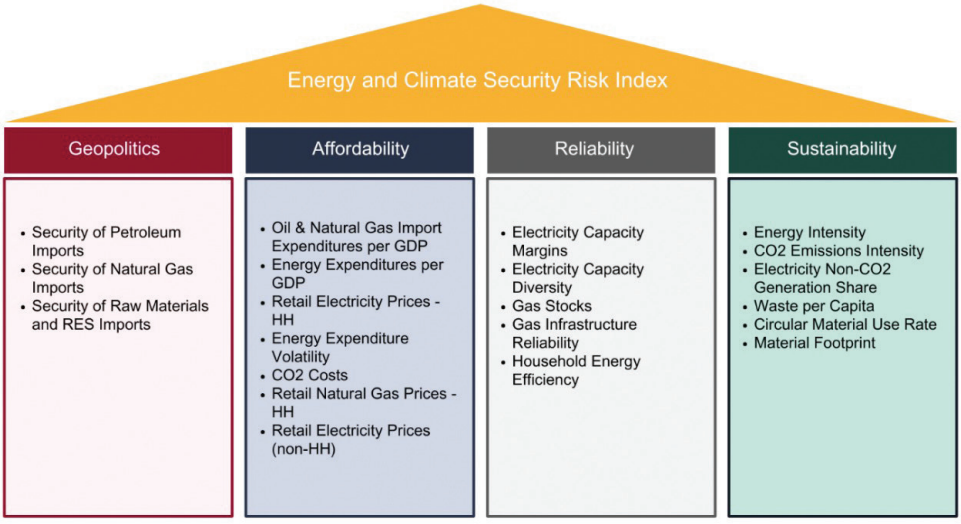
[14] Draghi, M., The future of European competitiveness, September 2024

[15] For a detailed view of the index scores and all the individual riskmetrics, please visit the ECSRI online interactive platform.

sustainability. By tracking vulnerabilities and aligning energy security with decarbonisation and market reforms, it supports policy coordination across the EU. As global energy market fluctuations persist, strengthening resilience and accelerating the transition from fossil fuels remain critical to safeguarding the EU's economic stability.

The index also serves to design country-specific strategies for countering these governance deficits, which undermine the creation of a consistent and effective European energy and climate security strategy. The analysis of the index reveals the main lessons from its application to the EU and the results for Europe as a whole during the energy crisis. It also offers targeted policy action to overcome the most difficult governance challenges to the development of a common European energy and climate security strategy.

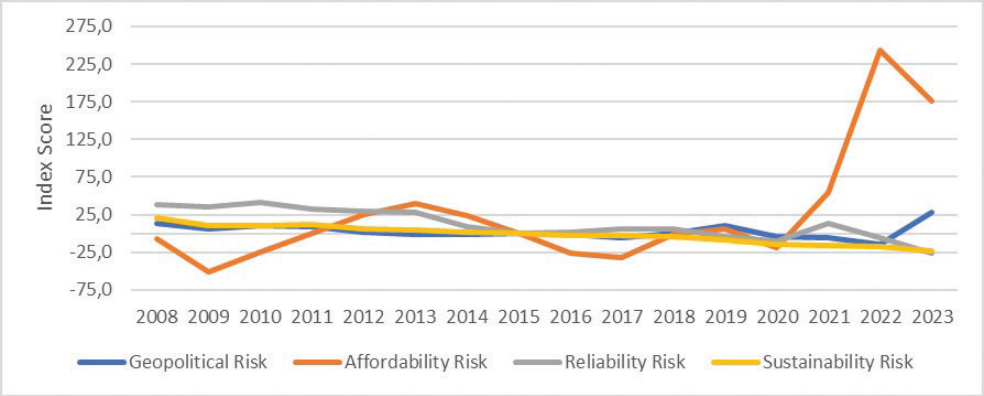
Figure 1. Energy and Climate Security Risk Index[16]



Source: Center for the Study of Democracy

[16] The Energy and Climate Security Risk Index has four pillars, reflecting the four dimensions of energy security risks: geopolitical, affordability, reliability, and sustainability. he Index covers 21 individual risk indicators, based on thousands of data points. The higher the value of the indicator, the higher the risk level. The base year is 2015, reflecting the immediate aftermath of the Russian annexation of Crimea, a key turning point in the geopolitics of European energy which represents a missed opportunity for improving the continent's energy security. The Index allows policy-makers and experts alike to fully reflect on a wide spectrum of risks associated with the rising energy prices, the extent of oil, gas and critical raw materials import dependence, as well as the risk mitigation potential of decarbonisation policies. In addition, the reliability dimension captures the risks associated with the structure of the energy system and its ability to absorb potential shocks.

Figure 2. EU's Energy and Climate Security Risk Index



Source: Center for the Study of Democracy based on the Energy and Climate Security Risk Index

Between 2020 and 2023, the EU's Energy & Climate Security Risk score increased fourfold, driven by soaring energy costs and geopolitical instability following the 2021 energy crisis and Russia's invasion of Ukraine. This surge reflects deep-rooted vulnerabilities within the European energy system, which has long been shaped by conflicting national priorities and a lack of coordinated strategic direction.[17] Despite the creation of the European Energy Union in 2015, the EU has struggled to enforce a unified approach to energy diversification, consumption reduction, and the transition to low-carbon technologies. Instead, energy policy has been dictated by fragmented national interests, allowing certain member states to deepen their reliance on Russian energy supplies even when doing so undermined collective security goals.[18]

Until Russia's full-scale invasion of Ukraine, the EU remained heavily dependent on Russian energy imports, with Russia supplying 33% of its crude oil, 45% of its natural gas, and 50% of its coal.[19] This dependence was particularly pronounced among nine member states–Bulgaria, Estonia, Finland, Slovakia, Latvia, Lithuania, Austria, Czechia, and Hungary–which relied almost entirely on Russian gas. Meanwhile, Germany and Italy, the EU's largest gas consumers, spearheaded Europe's increasing entanglement with Russian energy. [20] Both countries nearly doubled their import reliance over the past decade, securing joint infrastructure projects such as Nord Stream and South/

[17] Center for the Study of Democracy, Energy Transition Governance for Better Energy Security in Europe, Policy Brief No.88, October 2019.
[18] Shentov, O., Stefanov, R., and Vladimirov, M., The Kremlin Playbook in Europe, Sofia: Center for the Study of Democracy, 2020.
19 Reuters, "EU to phase out Russian gas, oil, coal imports - leaders' draft", March 7, 2022
[20] Vladimirov, M. and Rangelova, K., The Great Energy and Climate Security Divide Accelerated Green Transition vs. the Kremlin Playbook in Europe, Sofia: Center for the Study of Democracy, 2022

TurkStream, and entrenching economic dependencies that ultimately left the entire bloc vulnerable to supply disruptions.[21]

This growing dependence on Russian energy was compounded by other structural shifts, including the decline of domestic energy production, the closure of nuclear plants in Germany and the UK, and the accelerated phasing out of coal as part of the EU's decarbonisation efforts. While these measures were intended to facilitate the energy transition, they inadvertently increased Europe's reliance on natural gas, which was largely imported from Russia. As a result, when the Kremlin cut gas flows to Europe in 2022, the continent was plunged into an energy crisis of unprecedented scale. Gas and electricity prices soared tenfold, forcing energy-intensive industries to scale down or shut operations entirely.

Based on ECSRI, between 2015 and 2023, the level of affordability risks has increased by more than 175 points, with the most dramatic surge between 2020 and 2022. The resumption of economic activity after the COVID-19 pandemic led to a sharp increase in energy demand, while disruptions in global supply chains and geopolitical tensions further exacerbated price volatility. Affordability risks rose sharply across Europe, driven by skyrocketing fossil fuel prices and the rising costs of carbon allowances under the EU Emissions Trading System.

Despite progress in renewable energy deployment, the European economy remains highly carbon-intensive, leaving households and businesses exposed to extreme price volatility. Retail electricity, fuel, and gas prices reached record highs, prompting urgent calls for EU-wide energy market reforms and large-scale intervention to shield consumers from financial distress. The consequences of these failures have been severe: inflation has surged, economic growth has slowed, and social unrest has intensified across multiple member states.[22]

The EU's inability to ensure energy supply diversification or accelerate the transition to low-carbon alternatives has created a perfect storm of geopolitical instability, economic strain, and social discontent. While most of the continent has struggled to mitigate these risks, Romania has emerged as an exception, largely due to its domestic oil and gas production, which has shielded it from the worst effects of supply disruptions. In contrast, for the majority of EU nations, the past few years have laid bare the consequences of decades of strategic miscalculations–highlighting the urgent need for a more cohesive and resilient energy policy.

Energy affordability risks increased by more than threefold between 2021 and 2022, putting immense pressure on businesses and households across Europe. In response, governments introduced price caps, subsidies and tax cuts, spending more than €1 trillion to contain the crisis. However, these measures have put additional strain on public finances. High energy costs, resulting from unresolved structural problems, disproportionately affected energy-intensive industries, pushing up operating costs and forcing many companies to reduce production or

[21] Nitzov, B., and Rangelova, K., How to Deal with Kremlin's Desire to Starve Europe of Energy: TheCase of Nord Stream 1 and Beyond, CSD Working paper, August 2022.
[22] Draghi, M., The future of European competitiveness, September 2024

shut down altogether. The crisis also highlighted the economic divide within the EU, with Eastern and Southern European countries most vulnerable to the surge in affordability risks due to weaker energy links, greater import dependence and lower average income levels.[23]

The divergence between affordability and sustainability risks underscores the complexity of managing Europe's energy transition. While energy-related CO2 emissions intensity decreased due to stronger climate policies and the gradual implementation of the European Green Deal, the energy transition process has also led to new supply chain risks.

Many critical materials essential for electrification and renewable energy technologies are sourced from a limited number of suppliers, with China controlling between 35% and 70% of global refining capacity for key minerals such as lithium, nickel, copper and cobalt.[24] As the EU accelerates its decarbonisation and electrification efforts, these dependencies underscore the need for strategic measures to secure supply chains and mitigate potential disruptions. In the context of the trade war, initiated years ago by the first Donald Trump administration and continued under the presidency of Joe Biden, the EU has emerged as the main beneficiary in trade terms, serving as a buffer amid the exchange of tariffs and restrictions between the US and China. This dynamic has in turn made China an even more influential trading partner for the EU.

The EU's estimated demand for rare earth metals is projected to increase sixfold by 2030, and lithium demand is expected to rise twelvefold.[25] The growing dependence on raw materials imports has shifted the geopolitical risk landscape from fossil fuel suppliers to mineral-exporting countries like China, raising concerns over monopolistic control and potential trade restrictions. The EU has sought to mitigate these risks through trade restrictions, export controls, and diversification strategies, but these efforts have introduced new uncertainties.

Reliability risks have also decreased as a result of the expansion of the natural gas storage facilities, gas and power interconnectors, LNG regasification facilities, and the much greater power generation capacity boosting higher margins. These, largely, public investments have increased the energy market stability and have diminished the likelihood for supply disruptions. However, reliability risks remain uneven across different regions. Northern and Western European countries have lower reliability risks due to their more diversified energy mixes and stronger energy infrastructure, while

Southern and Eastern European countries remain more vulnerable to supply shocks. Countries heavily dependent on natural gas, such as Italy and Spain, have developed robust infrastructure to mitigate short-term risks, but long-term dependence on external suppliers remains. In addition, the shift towards renewable energy will require new investments in grid infrastructure

[23] European Commission, Electricity price statistics, April 2025
[24] IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris
[25] European Commission, "Overview of the Critical Raw Materials Act", The Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

and battery storage capacity to ensure continued reliability. Between 2015 and 2022, electricity capacity margins declined, highlighting the growing challenge of balancing intermittent renewable generation with demand.[26]

Emerging Critical Resource Dependencies

The broader economic security implications of Europe's energy crisis extend beyond the dependence on Russia. The EU has also become increasingly reliant on China, particularly for critical raw materials and clean technology manufacturing. This reliance is most pronounced in key clean energy sectors such as electric vehicles (EVs), batteries, and solar PV products. For instance, China dominates the processing of essential minerals such as lithium, nickel, copper, and cobalt, accounting for 35–70% of global refining activity. This dominance has already been used as a geopolitical tool, posing potential risks to the stability of Europe's energy transition.

The EU's Critical Raw Materials Act, alongside initiatives such as the Critical Raw Materials Club and the Minerals Security Partnership Forum, represents an attempt to mitigate these risks by diversifying supply chains[27]. A two-pronged approach is necessary: strengthening domestic production capacity where feasible and deepening strategic partnerships with resource-rich nations. However, these agreements must extend beyond transactional arrangements. European economic security cannot be built solely on resource extraction; instead, the EU must foster value creation, ensuring that partner countries benefit from industrial development rather than serving merely as suppliers of raw materials. Aligning these efforts with the Clean Industrial Deal[28] is essential to maintaining a sustainable economic model while securing the materials needed for the green transition.

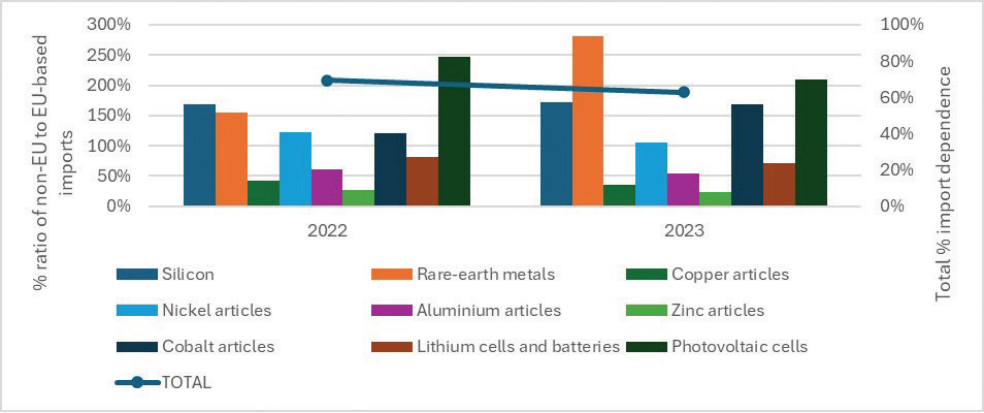
Developing domestic capacity for raw material extraction and processing is also crucial. Accelerating the opening of mines in EU member states could enable the bloc to meet its own demand for certain minerals and reduce dependence on external suppliers (Figure 2). Additionally, enhancing coordination on supply chain security and industrial policy is vital. This can be achieved by replacing overlapping coordination mechanisms with a more streamlined framework to ensure policy interventions are both efficient and effective.

[26] European Commission Brussels, 28.05.2024, "Natural gas demand drops by 7.4% to 12.72 TJ in 2023", News Article

[27] Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1724 and (EU) 2019/1020

[28] EUROPEAN COMMISSION Brussels, 26.2.2025 COM(2025) 85 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS "The Clean Industrial Deal: A joint roadmap for competitiveness and decarbonisation"

Figure 2 Non-EU to EU ratio for the origin of metals and minerals imports in the EU (left axis) (Total import dependence for selected goods - right axis)



Source: CSD based on COMEXT Data

It is also necessary to develop domestic capacity for raw material extraction and processing. Accelerating the opening of mines in EU member states could enable the bloc to meet its own demand for certain minerals and reduce the dependence on external suppliers (Figure 2). Additionally, enhancing coordination on supply chain security and industrial policy is crucial. This can be achieved by replacing overlapping coordination mechanisms with a more streamlined framework to ensure that policy interventions are efficient and effective.

Towards a New Energy and Climate Security Strategy

The 2021 energy crisis has underlined the urgency for the design and deployment of a new EU energy and climate security strategy. It should be based on accelerating the transition away from fossil fuel dependence and of strengthening the security of supply through diversification. The root causes of the crisis – the high gas prices and the dependence on natural gas for power generation - need to be addressed through improved energy efficiency, the deployment of alternative fuels such as green hydrogen and a steep increase in renewable energy capacity. The EU's strategic shift towards renewables has demonstrated progress, but new risks related to feedstock supply chains, affordability and infrastructure adequacy require comprehensive policy responses. The need for a more integrated and resilient energy framework has never been clearer as Europe faces the dual challenge of reducing geopolitical vulnerability while maintaining industrial competitiveness. Without decisive action to mitigate these risks, the EU remains exposed to further energy crises that could undermine economic stability and strategic autonomy.

The EU's reliance on Russian energy imports has long undermined its economic competitiveness, industrial resilience, and strategic autonomy.

Full decoupling from Russian fossil fuels will stabilise energy costs, foster industrial innovation, and strengthen Europe's long-term economic resilience. The EU must enforce a uniform approach by removing exemptions that allow certain member states to continue importing Russian crude oil, undermining collective security and economic stability. It needs to also move swiftly to ban Russian natural gas imports and ensure that the collective EU response mitigates security of supply risks and excessive price surges.

A crucial policy to accelerate decoupling is the reinforcement of the EU's joint energy purchasing mechanism. Negotiating gas and oil contracts as a single bloc will secure stable, lower-cost supplies from alternative partners such as Norway, the US, and Middle Eastern producers. A decline in natural gas imports from Russia has already been observed in 2023. However, coordinated action is necessary to eliminate the remaining Russian supply routes.Expanding LNG terminals in Spain, Germany, and the Baltics has increased regasification capacity, ensuring the EU can fully replace Russian pipeline gas. Investments in cross-border energy interconnectors will further reduce regional disparities in energy security and prevent individual member states from maintaining Russian supply dominance.

Electrification and renewable energy must form the backbone of the EU's industrial transformation. The European Commission's REPowerEU plan aims at increasing renewable energy's share to 45% of total consumption by 2030 - , however, this requires accelerating permitting processes, scaling up grid infrastructure, and expanding energy storage. Industrial electrification, particularly in heavy manufacturing, is key to reducing fossil gas consumption. Large-scale battery storage and hydrogen electrolysers must be rapidly deployed to stabilise renewable power generation and provide reliable energy for industrial processes. Denmark's success in decarbonising district heating through renewable sources provides a model for broader EU adoption, particularly in countries with high gas dependency.[29]

Industrial competitiveness will be strengthened by phasing out fossil fuels in high-emission sectors. Heavy industries such as steel, cement and chemicals must transition to green hydrogen and electrified processes, supported by the EU Hydrogen Strategy.[30] Electrolysis capacity must be expanded, and the EU Emissions Trading System (ETS) should further disincentivise fossil fuel reliance by increasing carbon pricing. The Carbon Border Adjustment Mechanism (CBAM) will help prevent carbon leakage and ensure European manufacturers remain competitive by imposing tariffs on high-emission imports. Additionally, targeted subsidies for industries investing in decarbonisation technologies will support businesses in maintaining global competitiveness while reducing reliance on volatile fossil fuel markets.

[29] Center for the Study of Democracy, Phasing Out Russian Gas in Europe, Policy Brief No.146, June 2024

[30] European Commission, Communication from the Commission to the European parliament, the Council, the European economic and social committee and the committee of the regions, Hydrogen Strategy for a climate-neutral Europe, Brussels, 8 July 2020

The transport sector must also undergo rapid electrification to enhance energy security and industrial efficiency. The EU's 2035 ban on internal combustion engine vehicle sales will accelerate the shift towards electric mobility, but further investment in charging infrastructure and battery production is needed to maintain a competitive European automotive industry. Hydrogen-powered freight transport, already advancing in Germany and the Netherlands, must be expanded across Europe. Investment in railway electrification and urban public transport modernisation will further decrease fossil fuel consumption and reduce logistics costs for businesses.[31]

Financial instruments that are part of the European Green Deal and the Fit-for-55 long-term strategies must be leveraged to accelerate clean energy investment. Green bonds and targeted subsidies should prioritise the industries and the regions that are most affected by the natural gas phaseout, preserving industrial competitiveness. Enhancing cross-border energy cooperation and modernising power grids will facilitate the integration of renewables and reduce regional disparities in capacity margins. By aligning industrial policy with the energy transition, the EU can solidify its position as a global leader in clean technology innovation.

Europe must move beyond a reactive approach to secure its economic future through strategic engagement, innovation, and resilience. Economic security depends on fostering a competitive business environment, reducing dependencies, and reinforcing the EU's global leverage. A robust strategy must integrate risk assessment, diversification, and industrial transformation while ensuring that resilience does not come at the expense of economic dynamism.

Trade diversification must underpin Europe's resilience. Strengthening and modernising trade agreements to prioritise supply chain security will reduce exposure to economic coercion. Industrial partnerships must move beyond resource extraction, fostering sustainable economic ties that ensure mutual benefits. Supporting SMEs in global expansion through improved trade and investment promotion will further bolster the EU's economic reach and flexibility.

Institutional coherence is necessary to align economic security policies with broader industrial and trade strategies. The EU must strengthen its capacity to monitor supply chain vulnerabilities and integrate this intelligence into policymaking. The Anti-Coercion Instrument should be reinforced to deter external pressure, while ensuring internal market stability through strict enforcement of trade policies. Eliminating inconsistencies in the EU's approach to energy security and economic resilience will create a more predictable and competitive business environment.

A proactive economic model must balance resilience with global leadership. The EU must shape economic trends rather than react to them, positioning

[31] Dr. Boyko Nitzov and Konstantsa Rangelova, Decoupling from Russian Oil Overcoming Path Dependencies in the Bulgarian Energy Sector, Sofia, Center for the Study of Democracy, Working Paper, February 2023

itself as a centre of innovation, industrial strength, and strategic engagement. By integrating competitiveness with security, Europe will reinforce its role as key actor in the evolving global economy, ensuring long-term prosperity and economic sovereignty.

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Prior to joining CSD, Tsvetomir gained experience at the Bulgarian Ministry of Energy, where he worked as an intern. During his tenure, he contributed to legislative efforts aimed at market liberalisation and the implementation of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

THE ROAD TO A SUCCESSFUL ENERGY TRANSFORMATION IN SOUTH-EAST EUROPE: ELECTRICITY MARKET COUPLING AND GAS SUPPLY DIVERSIFICATION

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Introduction

Recent developments in the field of the energy security have led to a renewed interest in finding the adequate measures to create a robust, and efficient economic system, fit to absorb volatilities and shocks, triggered by both the energy transition and geopolitics.

Therefore, critical pre-requisites such as market coupling and building resilience by increasing domestic energy production, supply flexibility and diversification are overlapping with the decarbonization agenda. Considerable literature was written around the theme and the existing body of research is highlighting the importance of capitalizing on reliable low-carbon and clean natural endowments, intensifying supply source diversification and increased interconnectivity.

For the South-Eastern European (SEE)[1] Region it has become a pressing priority to find the adequate response to this dual challenge: improving energy security, while spurring economic growth in a sustainable paradigm. And the pathway for a sustainable and affordable energy transition is the same for South-Eastern European Union (SEEU) and Western Balkans (WB6): electricity market coupling, coal to gas switch and diversification of gas supply sources.

Despite political and institutional diversity, energy transition efforts in SEE share common drivers:

1. Fulfilling the decarbonization commitments under EU policies and the Energy Treaty;

2. Mitigating existing energy security concerns;

3. Retrofitting the entire value chain of the energy sector and of the industrial base;

[1] South-East European Region: EU Member States, or SEEU: Bulgaria, Croatia, Greece, Romania, Slovenia; Balkan Region or WB6: Albania, Bosnia and Herzegovina, Montenegro, North-Macedonia, Serbia, Kosovo

4. Overcoming social equity challenges;

OMV Petrom, as the largest integrated energy producer in the region, plays a pivotal role in securing reliable energy supply, by using domestic production, investing in infrastructure, and integrating low-carbon technologies, thus contributing to the region's energy security and transition.

Objectives

Being a question of great interest, the pathway to a successful energy transition depends on overcoming geographical constraints, policy changes, and infrastructure limitations, while aspiring to become self-sufficient and more economic integrated at the same time.

Therefore, the present paper explores why deeper integration and collective action are the key enablers for improving the energy security of the Region. From the perspective of an energy company, the solution is to capitalize on domestic energy resources with a reduced CO2 footprint and consolidate the partnership between electrification and natural gas "Made in EU". It is considered to be the key to unlocking the economic benefits of the energy transition.

From the consumer's perspective it has been observed that tailored policies are needed to support the energy markets development. Price transparency encourages investments, the efficient utilization of energy and a fair treatment between different categories of customers.

The right direction is to increase the competition, stimulate investments in domestic energy production and improve cross-border connectivity, reducing market fragmentation and over-regulation, cutting red-tape, simplifying procedures and permitting, and creating the right balance between incentives and taxation in a liberalized market where vulnerable consumers are protected.

Energy transition from the perspective of the largest energy producer in South-Eastern Europe

OMV Petrom is one of Romania's largest companies and the largest integrated energy producer in South-Eastern Europe, fulfilling a key role in the country's energy security architecture due to the company's coverage on the energy market and also due to its impact in the economy.

The Group's annual hydrocarbon production was around 40 mn boe in 2024. The Group has a refining capacity of 4.5 mn tons annually and operates an 860 MW high-efficiency gas-fired power plant. The Group is present on the oil products retail market in Romania and neighbouring countries through approximately 780 filling stations under two brands – OMV and Petrom. The company is committed to support Romania's energy transition with investments amounting to EUR 11 bn by 2030.[2] Launched in December

[2] OMV Petrom 2030 Strategy: Transforming for a lower carbon future. December 2021

2021, this is the largest investment plan in the Romanian energy sector which is based on three pillars: transition to low carbon business, grow regional gas and optimize traditional business.

OMV Petrom plans to invest around EUR 3.7 bn by 2030 in low carbon businesses, to achieve an installed capacity of 2.5 GW of solar and wind, including partnerships, to consolidate the no 1 choice mobility provider in Romania with more than 5,000 charging points to be deployed in Romania and in the region and to capture unique opportunities related to Carbon Capture and Storage, hydrogen, energy storage, geothermal energy and biogas.

Another goal of OMV Petrom investment plan is to reach a level of 70% natural gas in its portfolio, by exploring and developing opportunities in the Black Sea region. The company has been present in the shallow Romanian Black Sea for more than 40 years, strongly considering that this basin holds significant potential. Neptun Deep is the most advanced project of the area.

As energy consumption is strongly linked with economic development, natural gas will remain crucial for the foreseeable future. Because the energy transition must take into account regional economic realities, it must provide the right balance between economic prosperity and energy security.

Diversifying towards a cleaner portfolio means that the company believes in a right mix between natural gas and electricity, which will contribute also to support customers to reduce their own carbon footprint. It has been proven by different studies, that it is preferable to have a mixed portfolio of zero and low carbon solutions paired with Carbon Capture for Utilization or Storage (CCUS) which generate lower costs compared to a 100% electrification of the system.

As the company will not leave aside the current assets, which will continue to be modernized and transformed for future activities, it aims to reach net zero operations by 2050.

Being part of an energy system that embarked towards the energy transition, the company is looking at the regional developments in South-Eastern Europe, concerning the sustainable and security of supply dimensions of this complex process.

The importance of electricity market coupling in South-Eastern Europe

South-Eastern Europe is very heterogenous, comprising both EU and non-EU counties, EU countries which are members of the Eurozone and others that are not, non-EU countries aspiring to join the EU and others still contemplating it, as well as NATO and non-NATO members.

Despite this institutional diversity and the variety of economic stakeholders in the SEE, the overall trend of the Region is oriented towards achieving a greater market integration with the EU27, in general, and with its core economies, in particular, especially in the energy, communication and

transportation sectors. This is the case for both the EU Members, and also for the non-EU countries that are aspiring at EU integration.

The ability of the energy system was always to act as a unifying bridge and the SEE Region made the first steps towards integration under the Energy Community Treaty, which reunites the EU Members of SEE and the Western Balkans. The signatory countries which adopted the Treaty "made binding commitments to adopt, implement and enforce all current EU rules on energy, environment, competition and renewables."[3]

Therefore, the European Union and WB6 have a common strategic target: to achieve a full convergence of their energy markets. It includes both the policy framework and the cross-border interconnections architecture.

A series of measures have already been taken in this direction. WB6 is already part of the ENTSO-E synchronized area and a member of the Central and South-Eastern Europe Energy Connectivity (CESEC). Also, the Region makes efforts, despite administrative difficulties, to capitalize on the future advantages provided by the Trans-Balkan Electricity Corridor.

And it is worth mentioning that one of the biggest achievements of the WB6 is the creation of the day ahead markets in five of the six countries of the group of states, which is the first step towards the integration with the SEEU markets in the region, based on market coupling.

According to a report, "market coupling is seen as the best way to integrate electricity markets across regions, using an implicit, market-based, and non-discriminatory method for coordinated price formation and allocation of Available Interconnection Capacity."[4]

Achieving a single pan-European electricity market aims to generate various economic benefits. It will reduce the reliance on a single supply source, will ensure stable supply, strengthen the resilience to supply shocks, stimulate investments in upgrading the grids to be more resilient and retrofitting the power generation fleet. It will also encourage competition, ultimately leading to a more predictable and transparent market price formation.[5]

For an energy system where Variable Energy Resources (VRE) are foreseen to increase their penetration in the mix, it is essential to be cross-border interconnected in order to enable an optimum use of the resources. As one study refers, fragmented markets will have the possibility to function as a single unified system. Its conclusion is that "prices obtained will reflect the

[3] European Commission. The Energy Community Treaty (link) is made up from the EU, represented by the European Commission and 9 other neighboring countries from Western Balkans, plus Georgia, Republic of Moldova and Ukraine

[4] Nord Pool Consulting et al. Regional day-ahead market coupling Template for General Framework Agreement. Energy Community. December 2018. Page 9

[5] Pablo Hevia-Koch, Rena Kuwahata, Camille Paillard, Jae Sun Lee. Cooperation across borders is key to building interconnected power systems of the future. International Energy Agency. 16 August 2023

cost of energy and the cost of transportation", leading to lower future prices "due to the convexity of the curve".[6]

Supply shortfalls and demand spikes can be attenuated due to the availability of a larger generation base, while energy will flow from low-cost to high-cost markets, allowing in the longer term higher transparency and the levelling of prices between markets. The condition to achieve the price convergence between markets will depend on increasing the interconnection capacity, otherwise, a limited and small transfer capacity will increase the volatility in the market with the lowest level of volatility.[7]

The European Commission estimated that the savings obtained after the market coupling will reach between EUR 2.4 bn – EUR 4 bn per year, due to more efficient cross-border trading.[8]

To continue the process of market integration in SEE, the European Commission proposed a full set of priorities to be addressed by the WB6, such as the implementation of market coupling mechanisms, introducing carbon pricing tools, aligning national policies with the EU's climate objectives, adherence to EU's environmental standards and prohibiting the public financing support for new power plants that could emit more than 550 gr. CO2/kWh.[9]

First, the Western Balkans will need to synchronize their trading platforms and functioning rules with EU's, aligning gate closure times, and auction formats. The minimum requirements for starting the integration in the single day-ahead coupling (SDAC) and the single intraday coupling (SIDC) is based on "the full transposition of the Electricity Integration Package, as well as its implementation, starting with the designation of at least one Nominated Electricity Market Operators in each country, the adoption of a market coupling operator (MCO) Integration Plan and the operationalization of capacity calculation regions (CCRs)."[10]

Implementing these measures is necessary in order for the WB6 to obtain an exemption from the effects of the Carbon Border Adjustment Mechanism (CBAM)[11] in regarding with the electricity exports in the SEEU markets. However, according to the CBAM Readiness Tracker, more progress is needed to be achieved in order to initiate the market coupling integration, a process which will last at least 18 months.

Currently, the average emission factor of the WB6 countries is at 890 gr. CO2/

[6] Rudiger Kiesel, Michael Kusterman. Structural models for copled electricity markets. Journal of Commodity Markets, No. 3, 2016. Pag 16-17
[7] Rudiger Kiesel, Michael Kusterman. Op. Cit. Pag. 36
[8] Gerard Wynn. A Test Now for the Western Balkans: Adhere to the Past or Embrace a New Energy Economy? Institute for Energy Economics and Financial Analysis. (link) May 11, 2016.
[9] Pippa Gallop. The EU carbon border adjustment mechanism: How to make it work for decarbonisation in the Western Balkans. Bankwatch. February 2022
[10] Energy Community CBAM-Readiness Tracker. Energy Community. 2024. Page 10
[11] Igor Todorović. Western Balkans can't secure CBAM exemption for electricity in time. October 2024

kWh, giving that Albania's electricity mix is largely based on hydropower, while the other WB6 states remain reliant on coal power generation. While Albania's electricity generation has no CO2 intensity, Bosnia and Herzegovina is at the opposite side, with 1139 gr. CO2/kWh, due to its coal-intensive electricity generation.

If the WB6 would not be able to integrate into SDAC and SIDC, then, the total annual CBAM cost to be supported by the EU importers for the electricity quantities imported from WB6 was estimated by the CBAM Readiness Tracker at EUR 1.9 bn. And this is posing challenges not only for the trading activities, but also for setting the electricity tariffs and the social acceptance of such a cost.

Security of supply and transition readiness of the SEE Region

Being already aligned with the EU's Third Energy Package, the entire SEE Region set out a pragmatic approach concerning the energy transition, reflected by a complementary partnership between increased electrification and natural gas source diversification.

Energy transition is about energy security and there are two main triggers that will determine SEE to decarbonize. The first one is climate change, and the second one is self-sufficiency. Both are influencing the security of supply, which is the core of any energy security policy aiming to provide a flexible, reliable, and affordable energy supply.

Security of supply needs to address the challenges of a changing climate in SEE: increased temperatures, lower precipitations and longer draught periods.

According to Copernicus data[12], in the summer of 2024, the population of the SEE experienced 66 days with temperatures exceeding 32°C. The region also faced below-normal number of wet days and "35% of European rivers were notably exceptional low", according to the mentioned source. The overheated landscape was accentuated by the severe draught which covered the entire SEE Region.

Future projections indicate a trend marked by severe weather changes. One study indicates that temperatures are forecasted to increases in the Region, ranging between +1.7°C – +4°C and even surpassing +5°C increase by the end of the century[13]. Another study indicates that Central Europe and the Balkan Peninsula are facing a decrease in the number of spring rains[14], while the Danube River or the Vistula River recorded in the last years record low levels due to the severe draught.

If confirmed, this new paradigm will affect not only the demand curve for cooling needs, but also the production curve, giving that hydropower generation represents 22% in SEE electricity generation mix, while electricity also represents 22% in the final energy consumption mix.

[12] Record-breaking heat stress in southeastern Europe during summer 2024. Copernicus. 26th September 2024.
[13] Dr. Ana Vuković, Dr Mirjam Vujadinović Mandić. Study on climate change in the Western Balkans region. Regional Cooperation Council. 2018. Page 6
[14] Klimadapt. The Danube's record low levels in the summer of 2022

The consequences of the severe heatwaves which swept SEE in the Summer of 2022 and Summer of 2024, were reflected in price spikes and supply scarcity in some countries especially during evening hours and have provided valuable lessons. Also, periods with low wind and almost no sun, called Dark Lulls, are becoming more and more common.

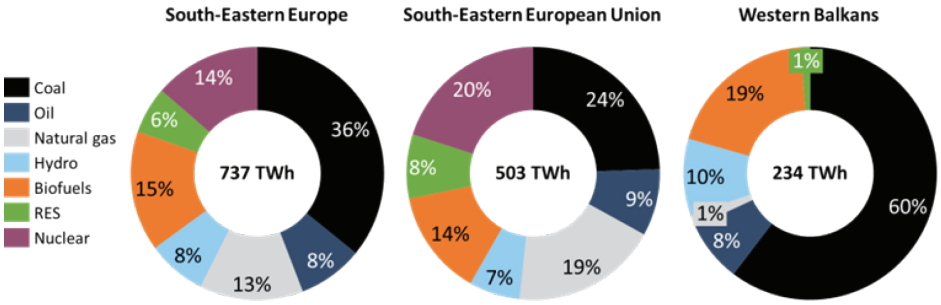
Therefore, the Region needs to integrate and invest in the flexibility of the system – cross-border interconnections, battery and pump storage solutions and also gas fired-power plants to replace the old fleet of the coal-fired generation.

Phasing-out coal remains a lengthy process. The alternative is natural gas to provide reliable energy supply.

During 2022 – 2023, SEE's total Primary Energy Production (PEP) amounted almost to 750 TWh, while its Final Energy Consumption (FEC) reached almost 950 TWh. SEE's energy production remained dominated by CO2 emitting resources, with an average share of 72% in the mix, followed by RES and Nuclear, with a 28% combined share in the mix.

Coal production – mostly lignite but also hard coal – dominates the PEP mix in both regions of the SEE. It is the main energy resource produced in five out of six Western Balkans states, while in SEEU, coal is the main produced energy resource in Bulgaria, having also a considerable footprint in Romania and Slovenia.

FIG 1. Primary energy production mix composition in South-Eastern Europe

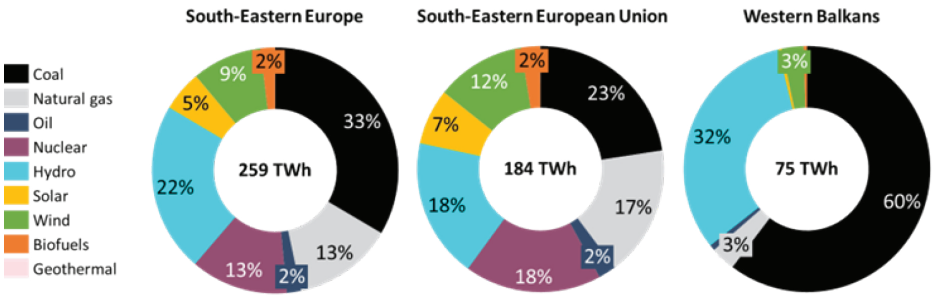


Source: Energy mix. Countries Factsheet. International Energy Agency, 2022 – 2023. Data compiled by author.

The heavy reliance on coal production is also highlighted in the electricity generation mix. While SEEU has a more diverse generation mix and more options to phase-out coal through a partnership between natural gas and variable energy resources (VRE), in the Western Balkans, coal remains the dominant resource.

One special case is Albania. It relies solely on hydropower generation, which covers 98% of the mix, but is being exposed to climate change effects. At the same time, Kosovo depends 91% on coal generated electricity. Significant shares of lignite in the generation mix could be identified in Bosnia and Herzegovina – 68%, Serbia – 66%, North Macedonia and Montenegro – both 47%.

FIG 2. Electricity generation mix across South-East Europe



Source: Energy mix. Countries Factsheet. International Energy Agency, 2022 – 2023. Data compiled by author.

Across the Region, there is a common understanding that coal production and consumption make SEE economies highly exposed to decarbonization pressures.

SEEU Members have committed to a gradual coal phase-out during 2028 – 2038. Greece seems willing to be the first to exit, while Bulgaria has scheduled to end is coal production by 2038. A similar pledge exists also in the Western Balkans, although stretching over a longer timeframe, 2030 – 2050, with the region's first mover to be North Macedonia[15].

The pragmatic and realistic approach should consider the replacing of coal with a partnership between renewables and natural gas. This approach also has the support of the European Commission, which considers natural gas a solution for a gradual decarbonization where there is a significant reliance on coal.[16]

The transition process faces significant challenges that must be addressed with solutions carefully planned. It requires a considerable financial effort to overcome the hurdles in professional reskilling of workers, attracting new investments in the coal extraction basins and the technical challenges of replacing a baseload conventional power generation source with intermittent ones.

To avoid rising unemployment in coal regions, a large re-skilling process needs to be performed. It was calculated that almost 140 thousand jobs[17]

[15] Energy Community CBAM-Readiness Tracker. Energy Community. 2024. Page 19
[16] European Commission. Guidelines for the Implementation of the Green Agenda for the Western Balkans. 2020. Page 4
[17] Western Balkans Competitiveness Outlook. OECD. 2024. Page 86

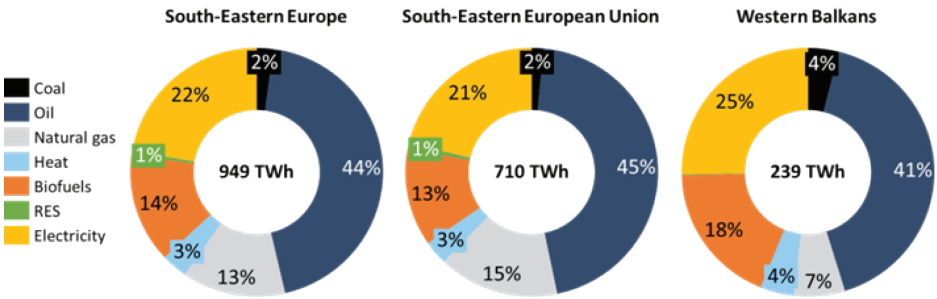
in the coal regions of the WB6 will need to undergo a reskilling process. In the mining sector of the SEE Region, in 2023, there were 160,000 workers employed, most of them concentrated in Romania, Serbia, and Bosnia and Herzegovina. But the opportunity is that across the region there is also a significant shortage for skilled manpower needed for a low-carbon economy.

In this context, OMV Petrom is taking concrete steps to support the reskilling of workers in the Romanian coal mining sector. In a partnership with Monsson, benefiting from EU financing via the Just Transition Fund, a battery manufacturing facility will be built on the site of a previous hard coal exploitation mine in Valea Jiului. In the end, this initiative will generate a new reskilled workforce and will support the energy transition and the local economy.

Due to aging grid infrastructure and outdated distribution networks, a leap from coal to variable renewable resources is not realistic. Replacing coal fired power plants with CCGTs could provide a technical viable alternative for ensuring the required flexibility that will enable a higher penetration of the variable renewable energy sources.

Strategically located between major gas producing and consuming regions, the SEE is a net natural gas importer and also a critical gas transit route. The SEE Region is well connected via large transmission pipelines with the Caspian Region, Türkiye and Ukraine. Starting with 2022, the Region is also able to import natural gas via the Trans-Adriatic Pipeline (TAP) and, using the Interconnector Greece – Bulgaria, and Bulgaria-Romania-Hungary-Austria (BRUA) Phase I, Azeri and LNG gas flows can reach Romania and other European Central markets.

FIG 3. Final energy consumption mix in South-Eastern Europe



Source: Energy mix. Countries Factsheet. International Energy Agency, 2022 – 2023.

Data compiled by author. RES includes wind and solar generation. Biomass includes also energy generated from waste

Due to the existing interconnections, Bulgaria and Serbia are positioning themselves as critical nodal points along the natural gas East to Central Europe routes. The new Interconnector Bulgaria – Serbia, operational from 2024 and the Trans-Adriatic Pipeline are already supporting the supply diversification of the Region, waiting for the next pieces of the puzzle to be placed: the Vertical Gas Corridor, the expansion of the South Gas Corridor in Western Balkans and other potential LNG infrastructure projects that could position Albania and Montenegro as energy security providers in the Balkan region.

The energy crisis determined the SEE countries to reevaluate their gas supply sources by increasing the diversification level and aiming to become self-sufficient with the support of new RES deployment.

Natural gas production in the Region amounted to almost 100 TWh in 2023, while gas consumption amounted almost 200 TWh, having a 13% share of the Region's PEP and PEC.

Gas production is concentrated mostly in Romania, which is also the largest gas consumer of the SEE. Romania is producing natural gas mostly from onshore fields and from the shallow waters of the Black Sea, but also has new resources under development located in the deep offshore area of the Black Sea, in the Neptun Deep perimeter.

OMV Petrom, the operator, and Romgaz are equal partners. OMV Petrom has been present in the shallow Romanian Black Sea for more than 40 years and the company's experts believe this basin holds significant potential. The company is also present in the Bulgarian waters of the Black Sea. Located near Neptun Deep is the Han Asparuh exploration block, covering an area of 13,712 km2, with water depths of just under 2,000 m. OMV Petrom and NewMed are equal partners, with OMV Petrom being the operator. Exploration activities began in 2012 and included geological and geophysical surveys and the drilling of three exploration wells. An extensive 3D seismic campaign was completed in May 2020 to identify potential drilling targets.

Currently, daily gas production in Romania reaches around 250 GWh, while consumption is at approximately 270 GWh on average, not considering the effect of seasonality. The gas production from the Neptun Deep perimeter, located in the Black Sea, will contribute, starting with the first full year of production, with additional 192 GWh/d to the system. Therefore, Romania's annual gas production could surpass 200 TWh, representing a daily average production of more than 400 GWh/d, above the current internal consumption needs.[18]

At the same time with the exploration and production activities carried in the Black Sea, Romania managed to improve its gas transmission connectivity with the region: the Iasi – Ungheni pipeline with a technical capacity of 2.25 bcm/y which supplies with gas the Republic of Moldova, the reverse flow between Romania and Bulgaria for the first branch of the TransBalkan pipeline

[18] Transgaz. The National Gas Transmission Development Plan 2024 – 2033. Page 31.

and BRUA Phase I, which allows the "permanent bidirectional flow between the interconnections with Bulgaria and Hungary"[19], with a transport capacity to Hungary of 1.75 billion cubic meters of natural gas per year, respectively 1.5 billion cubic meters/year to Bulgaria.

While gas production in the region is insufficient to cover demand, SEE has pursued ways to diversify its gas supply sources, being historically tied with only one supplier.

Slovenia was able to import natural gas from Algeria via Italy. Greece and Croatia developed critical LNG infrastructure to support gas supply diversification, with a combined capacity of importing almost 420 GWh/d, and potential to increase it and surpass 500 GWh/d.

Being interconnected with Bulgaria via gas pipelines, Serbia and North Macedonia have the option to replace coal with natural gas in the electricity generation mix. But this is not the case for the other Western Balkans states, where natural gas doesn't have a relevant footprint in Final Energy Consumption (FEC), for the moment.

But the option for a pragmatic approach in the energy transition is evaluated and a gradual coal to gas shift could contribute to the decarbonization of the entire WB6 energy system.

Natural gas, being 2.5 times less CO2 intensive than coal, could support a lower carbon electricity generation. Thus, the Region, which is reliant on coal, could retrofit its old thermal power fleet with flexible gas-fired power plants which could also support a higher integration of variable renewable energy sources.

Romania could step up and contribute to the WB6 efforts to diversify the natural gas supply sources. A Memorandum of Understanding (MoU) was signed between Serbia and Romania for the construction of a 97 km gas pipeline with a capacity of 1.5 bcm/y, or the equivalent of an average daily 45 GWh of gas, enough to ensure 50% of Serbia domestic gas consumption.

A MoU was also signed between Serbia and North Macedonia for the construction of a gas pipeline able to transport 14 bcm/y and to be connected with the LNG terminal in Alexandropoulos, Greece.[20] As part of the Three Seas Initiative, an Interconnector between North Macedonia to Albania able to supply 1.75 bcm/y was also proposed. The region could enhance further on its geographical position by implementing the Ionic-Adriatic Pipeline (IAP) project, aimed to connect Croatia, Montenegro and Bosnia and Herzegovina with TAP in Albania.

One critical aspect that needs attention is the problematic entry/exit tariffs, which need to encourage flows to move in multiple directions. ACER[21]

[19] Three Seas Initiative. BRUA. 2018 (Link)
[20] IntelliNews. Serbia signs MoU with North Macedonia for gas interconnector. (Link) October 8, 2024
[21] ACER. Key developments in European gas wholesale markets (Link). 22 October, 2024

highlighted in its latest report that gas transportation tariffs continued to increase, as the gas consumption in the EU is on a decreasing trend, which has led to a decline in capacity bookings. But for the SEE, gas supply diversification and network expansion represents a cost-affordable option for a pragmatic approach of the energy transition. Therefore, tariffs should not become a barrier for gas flows.

The asymmetry of the energy transition in South-Eastern Europe

The pace of the energy transition's implementation is asymmetric, due to both shared challenges and country-specific ones. The Energy Transition Index, elaborated by the World Economic Forum shows that SEE needs to make additional efforts in order to unlock its untapped potential in decarbonization.

While Romania received the lowest score among the SEEU countries, Serbia recorded the lowest score of the SEE region regarding its Transition Readiness. When it comes to System Performance, Bulgaria received the lowest score among SEEU, while Bosnia and Herzegovina received the lowest score among the entire Region.

Table 1. Energy Transition Readiness of the South-East European countries

Ranking	SOUTHEASTERN EUROPE	2024 ETI score	System Performance (24)	Transition Readiness (24)
29	Slovenia	• 61.9	• 68.2	• 52.5
36	Bulgaria	• 60.6	• 66.9	• 51.2
37	Greece	• 60.5	• 58.9	• 63.1
39	Croatia	• 60.1	• 66.4	• 50.7
43	Albania	• 59.4	• 65	• 51
48	Romania	• 58.3	• 69	• 42.2
67	Montenegro	• 54.6	• 59.9	• 46.6
78	Serbia	• 52.9	• 61.1	• 40.5
81	Macedonia, FYR	• 52.6	• 59.5	• 42.3
88	Bosnia and Herzegovina	• 51.5	• 55.3	• 45.8

Source: World Economic Forum. Fostering Energy Transition. June 2024.

An aspect that requires increased analysis is the issue of the large energy-intensive industrial basin, which needs support to decouple from its CO2

legacy. According to Eurostat data, the Manufacturing activity of the South-Eastern European Region has the highest CO2 intensity in Europe, calculated as a ratio between CO2 and the Gross Value Added.

Table 2. The CO2 emission intensity of the Manufacturing sector – Top 10 European Countries

Rank	Country	CO2/GVA (Grams per euro)
1.	Cyprus	1175
2.	Serbia	1004
3.	Greece	866
4.	Bulgaria	806
5.	Türkiye	739
6.	Iceland	736
7.	Slovakia	642
8.	Romania	513
9.	Poland	509
10.	Croatia	497

Source: Eurostat, 2022 (Link).

Manufacturing activity in the SEE remained mostly in a linear economic paradigm and is at the beginning of the energy transition journey, which is based on the transition to a circular economy. Creating financial incentives by enabling the potential of the Power Purchased Agreement (PPA) becomes a necessary pre-requisite in order to switch from CO2 emitting resources to cleaner alternatives for heating and cooling processes.

Affected by the energy crisis and strong competition from outside Europe, energy-intensive industries of the SEE are at a crossroad. The only option is decarbonization, but incentives to support this direction are missing, while the existing financing sources are oriented more towards clean energy production and less towards the decarbonization of large consumers.

Renewable energy deployment in SEE varies significantly. Greece is the regional leader in solar and wind expansion and is aiming for 27.3 GW by 2030.[22] For that, it will require between 3,000 and 5,000 skilled workers will be needed for the deployment of wind and solar energy, which may require an investment in skills of EUR 19.3-24.2 million".[23]

Romania also has ambitious plans, aiming to install 30.4 GW of solar and wind capacity by 2030 and have 76% of its power generated from RES.

[22] Commission Staff Working Document. Country Report – Greece. European Commission. 19 June, 2024. Pag. 16
[23] Op. Cit. European Commission. 19 June, 2024. Pag. 53

Bulgaria, which has seen an exponential increase of solar power generation reaching almost 3 GW, has also a slow expansion of new wind capacities, due to permitting delays,[24] which hampers also its offshore wind potential, estimated at 26 GW.

Western Balkans are still in early stages concerning the RES deployment.

By 2030, Bosnia and Herzegovina aims to increase wind power capacity from 0.14 GW to 0.6 GW and solar power capacity from 0.1 GW to 1.5 GW,[25] Montenegro established a target of 0.3 GW of solar and 0.15 GW of wind[26], Serbia intends to have a 0.39 GW installed capacity of solar and 0.75 GW of wind and North Macedonia wants 0.75 GW of solar and 0.6 GW by 2040[27].

Considering that renewable potential is distributed differently in the Region, a coordinated development between the countries, coupled with interconnection capacity, can generate an optimal solution for the transition to renewables for the entire region.

These pledges fall short compared to IRENA's estimations, which include also Central Europe in a comprehensive analysis regarding the entire region's VRE deployment: 845 GW for wind, 402 GW for solar, 46 GW for bioenergy and 75 GW for hydropower.[28]

The need for grid investments to further scale the renewable potential through interconnections, an enhanced flexibility of the system, permitting simplification, cutting red tape and stimulate investments in storage solutions are common measures that need to be adopted all across the Region.

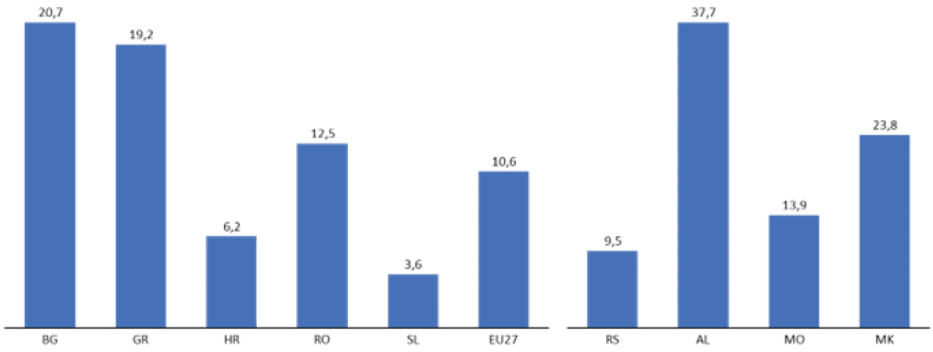
Energy poverty and price affordability are also triggering serious concerns across all the SEE Region, accentuated by the recent energy crisis, limiting the speed of the energy transition.

Many consumers struggle with poor insulation of buildings, some households are relying on primitive heating devices based on firewood and stoves, while the district heating systems are recording energy losses.

In WB6, the share of households unable to keep an adequately warm temperature varied between 9.5% in Serbia and 37% in North Macedonia, while in SEEU varied between 2.6% in Slovenia and 22.5% in Bulgaria.

[24] Commission Staff Working Document. Country Report – Bulgaria. European Commission. Pag. 11
[25] Recommendations on the draft integrated National Energy and Climate Plan of Bosnia and Herzegovina covering the period 2025-2030. Energy Community Secretariat. February 2023
[26] Draft of the National Energy and Climate Plan of Montenegro. 5 December 2024. Page 267
[27] National Energy and Climate Plan of the Republic of North Macedonia. Ministry of Economy. January 2022
[28] IRENA. Renewable Energy Prospects for Central and South-Eastern Europe Energy Connectivity. 2020. Page 2 26.

FIG 1. Share of the total population living in a household unable to keep its home adequately warm.



Source: Eurostat, 2023 for EU countries and 2021 – 2023 for non-EU countries. Missing data for Bosnia and Herzegovina and Kosovo

The response across the Region during the energy crisis was the same, a mix between broad and untargeted consumer subsidies, regulated tariffs, and increased taxation on companies. While on short-term this strategy could seem suitable to alleviate the social pressure, on the medium-term, prices remain distorted. And the pressure shifts from consumers to the countries' budgets and, at the same time, diminishes the prospects for investment.

Conclusions

Energy transition is not a linear process when it comes to decarbonization, but its core should be based on strengthening the security of supply, oriented towards the less CO2 intensive and affordable options.

While decarbonization is making the leap from concept to implementation, the classic theory of the energy trilemma (the dynamic between security, affordability and sustainability) is being reshuffled and is beginning to explore self-sufficiency's potential in terms of energy production using cleaner resources but remaining at the same time interconnected with surrounding markets. In this way, a country can safeguard its security of supply and avoid unexpected supply volatilities that are not triggered by market imbalances.

Energy consumers are already adapting their energy needs, based on reliability, affordability, looking also at their carbon footprint and being more efficient at the same time. Therefore, the grid itself needs to integrate new types of consumers that are interacting actively with it: prosumers, EVs, battery storage systems, and, in the near future, AI systems.

However, price disparities and energy poverty remain serious concerns

for the South-Eastern Region. But affordability goes beyond being an essential social issue. It is becoming an imperative for preserving a country's competitiveness. The pressing need is to ensure that industries remain economic viable in the energy transition. This will enable job creation and integration of new technologies.

State's footprint is increasingly visible, and the economic landscape needs support with tailored measures in order to enhance its development that are not disrupting the market evolution or discourages critical investments.

In this new energy landscape that is unfolding, the South-East European (SEE) Region needs to keep the pace and constantly adapt. In the energy sector, the partnership between natural gas and electrification will represent the cornerstone of the region's economic prosperity. Something that is achievable.

OMV Petrom is making significant progress in implementing its ambitious 2030 Strategy, to reach net zero operations by 2050. Through the development of the Black Sea natural gas resources, by investing in one of the largest renewable portfolios in the SEE Region, totalling 2.5 GW generation capacity, by building a strong infrastructure to supply Sustainable Aviation Fuels (SAF) and electric recharging stations for e-mobility, OMV Petrom is well positioned to lead the energy transition in SEE and support economic growth.

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THE GROWING IMPORTANCE OF ENERGY DATA FOR THE INTEGRITY AND TRANSPARENCY OF THE EU WHOLESALE ENERGY MARKET DURING ENERGY CRISES

Desislava Stefanova

In the wholesale energy market, as in any industry, crises serve as powerful catalysts for change. The energy crisis brought about an officialised sign that policymakers are looking into the potential of data collected under the Regulation on wholesale energy market integrity and transparency (REMIT)[1] for ensuring market transparency not only as a preventive measure against market abuse and manipulation, but also as a tool to inform both policy-making and the general public discourse on the evolution of the European energy market.

Compared to other critical moments in history, the 2022 energy crisis[2] came at a time when the EU regulatory framework was already saturated with data collection frameworks with distinct policy goals and legal basis. In the context of data collection, Europe's goal of streamlining this framework and reducing administrative burden thus proves challenging: unifying all data sources by avoiding lengthy and costly implementation by the industry, as well as ensuring that data quality is uncompromised by the intermediate steps and data owners in-between.

This article covers the evolution of energy market data collection specifically for the purposes of REMIT.

Origins of REMIT and data in scope

REMIT originated as a regulatory framework against market abuse that was tailor-made for the EU electricity and gas products not covered by the existing EU securities legislation, i.e. Directive 2003/6/EC (the Market Abuse Directive)[3].

In 2005, with the goal of addressing barriers impeding the development of a fully functioning open and competitive EU-wide energy market, the European Commission launched an inquiry on energy sector competition. In 2007, the Commission's final report outlined key shortcomings in the electricity and gas markets[4]. Among else, the report highlighted competition problems caused by market concentration and the insufficient progress of

[1] REGULATION (EC) No 1227/2011 of the European Parliament and of the Council on wholesale energy market integrity and transparency, OJ L 326, 8.12.2011, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:326:0001:0016:en:PDF

[2] See more on the crisis and its effect within the EU at https://www.consilium.europa.eu/en/policies/energy-prices-and-security-of-supply/

[3] Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation (market abuse), OJ L 96, 12.4.2003, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0006

[4] Energy sector competition inquiry – final report – frequently asked questions and graphics, 10th January 2007, available at: https://ec.europa.eu/commission/presscorner/detail/fr/memo_07_15

unbundling of network and supply businesses. The report further linked the absence of transparently available market information to distrust in the pricing mechanisms.

In 2008, by request of the European Commission, a joint expert group between the precursors of the European Securities and Markets Authority (ESMA) and the European Union Agency for the Cooperation of Energy Regulators (ACER), the then-existing Committee of European Securities Regulators (CESR) and European Regulators' Group for Electricity and Gas (ERGEG), published their advice[5] in the context of the preparation of the Third Energy Package. Their conclusions were based on a consultation with market participants, as well as the abovementioned final report that highlighted concerns on information asymmetry and other factors that may enable market abusive practices. The advice raised concerns about the lack of data impeding regulators from preventing and detecting market abuse, claiming that the existing Market Abuse Directive, having been designed for the financial markets, only partly covers electricity and gas markets and thus may not properly address integrity issues there. The advice further warned against merely extending the scope of the market abuse provisions of the directive to physical products which would not reflect the needs of energy markets.

Adopted as part of the Third Energy Package, REMIT entered into force in 2011[6] , with some of its provisions dependent on an implementing regulation adopted at the end of 2014. Since the data reporting obligation of market participants was among them, and ACER had to establish relevant reporting guidance and formats, reporting of data under REMIT did not start until October 2015.

REMIT tasked ACER with carrying out market monitoring at EU level for detecting and deterring market abuse on the EU wholesale energy market. It is important to clarify that the definition of the wholesale energy market under the regulation only encompasses electricity and natural gas and leaves out of its scope other commodities like oil, coal, and emission allowances. Data originally collected and monitored under REMIT did not include small retail contracts, storage contracts, or financial positions, or contracts for the supply of electricity or natural gas produced in the EU but delivered beyond its borders. Other data was included in scope but was made reportable only at the Agency's request unless concluded on an organised market place, e.g. intragroup contracts, contracts for balancing services or for the sale of the output of small energy production facilities.

ACER's REMIT database stores all data collected under this regulatory framework. These data include not only transaction data but also data on the state and use of energy facilities, inside information disclosed on approved

[5] CESR and ERGEG advice to the European Commission in the context of the Third Energy Package. Response to Question F.20 – Market Abuse, October 2008, available at: https://www.esma.europa.eu/sites/default/files/library/2015/11/08_739.pdf

[6] REGULATION (EC) No 1227/2011 of the European Parliament and of the Council on wholesale energy market integrity and transparency, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:326:0001:0016:en:PDF

platforms, and details on market participants registered by each national authority. The data stored within it serves two main purposes:

a. Wholesale energy market monitoring. Those data are used by the Agency and national regulatory authorities to prevent and detect market abuse. These data are subject to a strict regulatory obligation of the Agency to ensure their operational security and protection. Due to their sensitivity, part of those data is not accessible to the public but only shared with national regulators.

b. Enhancing the transparency of the energy market to build trust and foster wider knowledge on its functioning. REMIT and its implementing regulation set rules for publishing some of the collected information that was not commercially sensitive. Such are the European register of market participants, the list of standard contracts and the list of organised market places. The Agency is also obliged to make its commercially non-sensitive trade database available for scientific purposes, subject to confidentiality requirements and based on transparent rules.

Most market participants do not report directly to ACER. The implementing regulation sets channels for reporting of each type of data, e.g. organised market places, system operators. At the time of the adoption of REMIT, some relevant data for market monitoring were in scope of existing data collection methods that the regulation considered to avoid double reporting. Those were the data that the European Network of Transmission System Operators for Electricity (ENTSO-E) and the European Network of Transmission System Operators for Gas (ENTSOG) collected and published on their transparency platforms. Such centralisation of the generation of the incoming data contributed not only to reducing the burden of reporting to market participants but also to standardising the data more efficiently. On the downside, the introduction of a sequence of intermediate steps and responsible actors for the transfer of data before its ultimate destination in the ACER database also posed challenges to the reliability of its reporting.

To ensure that any entity reporting data directly to its system has set up the necessary security, confidentiality and data quality measures, the Agency established technical and organisational requirements and started registering reporting mechanisms that comply with them. The amount of data collected grew rapidly over time, facilitated also by the emergence of algorithmic trading. From 2023 onwards, the Agency is collecting billions of data records every month[7]. ACER is continuously working on assessing the quality of these data, on enhancing the automated data validation of incoming data records, and collaborating with more than 100 reporting entities in resolving issues. The volume of data and the rapid evolution of markets and changes in products traded pose significant challenges to ensuring the data's consistency

[7] Figure 6: Number of records collected per month under additional SIDC data collection, ACER's quarterly report on its activities under Regulation (EU) No 1227/2011 (REMIT), Issue No. 35/Q4 2023, available at: https://www.acer.europa.eu/sites/default/files/REMIT/REMIT%20Reports%20and%20Recommendations/REMIT%20Quarterly/REMITQuarterly_Q4_2023_1.0.pdf

and reliability, and the legal basis setting the obligations for data providers was, at that time, open to interpretation.

Evolution of REMIT data and transparency after the 2022 energy crisis

Article 122(1) of the Treaty on the Functioning of the European Union (TFEU) enables the Council to decide upon appropriate measures if severe difficulties arise in the supply of energy products[8]. On this basis, at the end of 2022, the Council adopted an emergency regulation[9] aimed at the better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders. The severe difficulties that it addressed were the reduced supply of natural gas from Russia in the context of its war of aggression against Ukraine, as well as the rising energy prices caused by the weaponisation of the supply of gas and Russia's manipulation of the markets through intentional disruptions of gas flows. The regulation stated that the dataset collected under the REMIT legal framework is not sufficient to reflect the delivery of liquified natural gas (LNG) to the EU. To this end, it urgently created a new reporting regime for the collection of transactions, bids and offers on LNG deliveries to the EU that were to be used by the Agency to establish a daily LNG price assessment and an LNG price benchmark, noting that at a later stage this should be included in a comprehensive revision of REMIT.

In parallel, the Council adopted another emergency regulation[10] introducing a market correction mechanism via a dynamic safety ceiling for the price of front-month to front-year title transfer facility (TTF) derivatives on gas. It entered into force in February 2023, initially for a year, and was later extended until 31 January 2025. This regulation tasked ACER with calculating a daily LNG reference price[11] and the power to activate a dynamic ceiling if, for three consecutive working days, the gas prices at EU virtual trading points exceeded €180/MWh, and if they were €35/MWh above the calculated daily LNG reference price. If the ceiling had been activated, market operators and participants would have had to respect the bidding limit to protect the market from further escalation. Ultimately, the ceiling was never activated as prices never reached the pre-defined levels.

These two emergency measures were a strong signal of the political will

[8] Consolidated version of the Treaty on the Functioning of the European Union, OJ C 326, 26.10.2012, available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12012E/TXT:en:PDF

[9] See Recitals (1) and (3) of Council Regulation (EU) 2022/2576, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R2576

[10] Council Regulation (EU) 2022/2578 of 22 December 2022 establishing a market correction mechanism to protect Union citizens and the economy against excessively high prices, OJ L 335, 29.12.2022, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ%3AL%3A2022%3A335%3ATOC&uri=uriserv%3AOJ.L_.2022.335.01.0045.01.ENG and Commission Implementing Regulation (EU) 2023/736 of 31 March 2023 on the definition of the technical details of the application of the market correction mechanism to derivatives linked to virtual trading points in the Union other than the TTF, OJ L 96, 05.04.2023, available at: https://eur-lex.europa.eu/eli/reg_impl/2023/736.

[11] Based on monitoring world LNG market prices, import prices to the EU, and the front-month TTF derivative settlement price.

to use REMIT-related energy data and ACER's market expertise for protecting consumers from unjustified price spikes, and for immediate visibility to the public on key transactions, in this case imports, that can greatly influence price fluctuations on the European market.

In March 2023, with the crisis ongoing, the market growing volatile and prices increasing, the European Commission launched a legislative proposal to revise REMIT. A year later, the EU co-legislators adopted the revised text. Regulation (EU) 2024/1106 of the European Parliament and of the Council of 11 April 2024 (REMIT II)[12] entered into force on 7th May 2024.

Some of the revised provisions ensured alignment with the legal framework for EU financial markets, others harmonised the fines imposed under REMIT at national level. ACER was granted new investigatory powers over certain cross-border cases of market abuse. In terms of the data collected under REMIT, the revised text expanded the products and markets in scope. The revised definition of wholesale energy product in Article 2(4) now also explicitly covers contracts and derivatives relating to storage. To address the gap recognised in 2022 and ensure the addition of the activities on a daily LNG price assessment and an LNG benchmark into the text of the Regulation as permanent tasks of the Agency, LNG was added as a commodity in scope.

The circumstances of the crisis in which the regulation was updated is likely to have impacted the fact that data was not removed but only added to the scope of REMIT. The new text of the regulation had to ensure that market monitoring would be enabled by any data significant for price formation, and that all developments on the market since 2011 were taken into account.

The inclusion of coupled markets in the definition brought practically no changes to data reporting but only formalised the fact that coupling markets were not considered in REMIT initially but were a key development in the electricity market since. ACER had already started collecting additional single intra-day coupling data based on an individual decision issued in January 2022. A novelty in the revised text was the explicit inclusion of contracts and derivatives with potential delivery in the EU as a result of single day-ahead and intraday coupling, which imposed REMIT registration obligations on Norwegian market participants who are placing orders on a nominated electricity market operator outside of the EU.

Further expansion of REMIT data collection was brought about by the inclusion of new balancing markets and contracts for balancing markets which were previously only reportable upon request of the Agency unless concluded on an organised market place. The revised Article 8(1) foresees that market participants also report information about their exposures, detailed by product. Since financial exposures are already reported under EU financial regulation,

[12] Regulation (EU) 2024/1106 of the European Parliament and of the Council of 11 April 2024 amending Regulations (EU) No 1227/2011 and (EU) 2019/942 as regards improving the Union's protection against market manipulation on the wholesale energy market, OJ L, 2024/1106, 17.4.2024, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401106

the tailor-made approach fit for the energy market is expected to be clarified in the revised text of the REMIT implementing regulation. In July 2024, even if not as part of the REMIT text itself, Article 83 of the recast Gas Regulation[13] amends the definition of wholesale energy product in REMIT directly to include hydrogen wherever the text 'electricity or natural gas' is used.

The revised text of REMIT also sent a clear signal on the recognised importance of the quality of REMIT data. Notably, the Regulation now officialised the status of entities directly reporting to ACER and set the legal basis for the Agency's authorisation and supervisory powers over them. The text acknowledges the importance of the responsibilities conferred on these entities in terms of the quality of the data that they submit to ACER's database, explicitly requiring them to have mechanisms in place to check the completeness of the data and identify omissions and obvious errors in the dataset.

The revised text also recognised the growing potential of the ACER database not only for enhancing the level of transparency of the market but also for achieving a common European energy data strategy. ACER was tasked with developing and operating by May 2025 two publicly available data portals:

a. A sector-specific electronic access point for inside information disclosed on inside information platforms. This measure would improve the accessibility of previously disclosed inside information in a standardised and user-friendly manner – which is often impeded by the various formats used by platforms in the data exports and application programming interfaces they may or may not offer to the public free of charge.

b. A digital reference centre containing information on EU wholesale energy market data. The recital of the regulation proposes the Agency publishes in a user-friendly manner information regarding the trading of over-the-counter contracts and power purchase agreements (PPAs).

The growing relevance of energy data after the crisis

Evaluating the high electricity prices in South-Eastern Europe in the summer of 2024 brought out suggestions on better informed planning and coordinated decision-making that can benefit from a streamlined data source. In his letter to the President of the European Commission Ursula von der Leyen of September 2024, the Greek Prime Minister Kyriakos Mitsotakis[14] called for a system that allows more EU input into country decisions. Referring to the outages of generation and cross-border capacity, as well as the burden of fulfilling supply shortages in Ukraine due to Russia's attacks against their grid, he highlighted the importance of taking country-level decisions on planned outages "with a view towards broader regional dynamics to avoid instances where such an

[13] Regulation (EU) 2024/1789 of the European Parliament and of the Council of 13 June 2024 on the internal markets for renewable gas, natural gas and hydrogen, OJ L, 2024/1789, 15.7.2024, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401789

[14] Prime Minister Kyriakos Mitsotakis' letter to the President of the European Commission Ursula von der Leyen regarding the EU energy market, 13 September 2024, available at: https://www.primeminister.gr/en/2024/09/13/34887

event causes ripple effects across a much wider space than anticipated". To empower data-driven decision-making in this sense, policymakers could utilise the available outage data but might find some challenges in consolidating them. For instance, past and future planned electricity outage information is currently spread across different sources – the ENTSO-E transparency platform or inside information platforms. Harmonisation of energy data is a key part of Enrico Letta's report published in April 2024 and his idea of establishing a central entity to manage EU funding and incentive schemes on clean energy[15].

One of the most influential drivers for policy changes undertaken by the new team of the European Commission in 2025 is undoubtedly Mario Draghi's report on 'The Future of European Competitiveness'[16]. There are several proposals that could influence how REMIT data is sourced and used in the future:

a. Centralising all public and open energy data sources (e.g. ENTSO-G, ENTSO-E, ACER and Eurostat) in a common hub or platform for energy data to allow the EU to support a better understanding of energy markets by industries. Draghi suggests the US Energy Information Administration as a blueprint for these efforts.

b. Further integrating and standardising the regulatory and supervision framework for financial markets for energy through coordination between energy and derivative market regulators at the European level (ACER and ESMA).

c. Additional policy and supervisory coordination powers at the EU level, including the power to revise current rules on limiting financial positions or on price limits, to collect position data from market participants related to over-the-counter energy derivatives, and to initiate dynamic price caps by example of the Market Correction Mechanism.

d. The proposed new benchmarks on EU pipeline import prices and on EU industry purchasing prices by example of the LNG benchmark.

Furthermore, REMIT data could help evaluate the potential or progress in some of the other areas for improvement such as the promotion of power purchase agreements, improved coordination of storage management and hydrogen production and imports (as part of the foreseen future reporting).

Given the number of proposals made in the report, it remains to be seen how many of those will be adopted while keeping in line with Draghi's horizontal proposal to simplify rules and avoid excessive regulatory and administrative burden that can hinder the competitiveness of EU companies.

[15] Letta, E., Much more than a market, April 2024, available at: https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

[16] Draghi, M., The future of European competitiveness, Part B | In-depth analysis and recommendations, September 2024, available at: https://commission.europa.eu/document/download/ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en?filename=The%20future%20of%20European%20competitiveness_%20In-depth%20analysis%20and%20recommendations_0.pdf

In February 2025, the European Commission published its Action Plan for Affordable Energy. The Action Plan combines measures to lower energy bills in the short term and to introduce structural reforms and strengthen the energy system to mitigate future price shocks[17]. Its initiatives mirror closely the proposals from the report of Mario Draghi. The plan outlined the approach for integrating and standardising the regulatory and supervision framework for financial markets for energy. As part of the action to ensure the functioning of gas markets, a Gas Market Task Force was set up to scrutinise gas markets, and the Commission launched a stakeholder consultation to collect feedback on any necessary legislative changes to align energy and financial market rules between MiFID and REMIT. The consultation notably includes a proposal of reducing the administrative burden by single reporting and a joint harmonised database between the two frameworks.

In his report, Draghi also pointed out the underdeveloped potential of PPAs to reduce exposure and hedge industry against high and volatile prices. Among the measures the plan is targeting is the promotion of PPAs. PPAs are a good example of the speed of implementation of reporting changes that are not dependent on legislative changes. When data on emerging products or contract types in the market is within the reportable dataset but the latter is not granular enough to enable policy conclusions, ACER's REMIT reporting guidance can help introduce the necessary precision without a lengthy revision of the legislation. While PPAs were originally in scope of the definition of wholesale energy market products of REMIT and reportable as non-standard contracts, there was not enough visibility over what part of the bilateral transactions reported via REMIT constituted PPAs. This changed in 2024 when ACER's guidance and data formats introduced dedicated codes meant to be used by market participants who reported such contracts to the Agency, enabling the dataset to show the trends in adoption and conclusion of such agreements.

The insufficient reliable data on energy-related topics is an issue pointed out by a Bruegel policy brief on Europe's energy information problem[18]. Some of the data highlighted as missing are data on the take-up of heat pumps, industrial natural gas consumption and prices, final energy prices, and battery connections to the electricity grid. Similarly to Mario Draghi's report, the policy brief draws another parallel between the energy data needs met successfully by the United States Energy Information Administration (EIA) established in response to the 1970's oil crisis. While the EIA was developing its data collection on a clean slate though, the collection and dissemination of data on the European energy market is scattered across multiple providers operating on the basis of different legal provisions. A key difference between the EU and US approaches pointed out by the Bruegel policy brief is that the initiative for developing new data sources in

[17] European Commission, COM(2025) 79 final, Action Plan for Affordable Energy, Brussels, 26.2.2025, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025DC0079&qid=1741780110418

[18] McWilliams, B., Tagliapietra, S., Zachmann, G., Europe's energy information problem, 19 February 2025, available at: https://www.bruegel.org/policy-brief/europes-energy-information-problem#footnote15_35dkcd9

the US was given to the EIA, while major changes in the data collection in Europe have to go through a long process of political approvals.

Potential of the REMIT database for further enhancing transparency and informing policy decisions

In ACER's 2024 electricity market monitoring report[19] REMIT data was used for evaluating the progress of EU electricity wholesale market integration – a purpose not spelled out in the Regulation directly. The report draws conclusions from the data over the liquidity of forward markets, the volatility of day-ahead prices, the occurrence of negative prices, and the proportion of cross-zonal traded volumes on the intraday market. This is a testament to the potential of REMIT data to serve for drawing conclusions relevant for energy policy decision-making – apart from preventing and detecting market abuse. There is also increasing interest by academia to be granted access to REMIT data for scientific purposes.

The potential challenge of re-using data which was originally meant for tackling market abuse is that some datasets linked to REMIT data are exempted as unnecessary for this purpose but might prove useful elsewhere. As an example, the use and capacity of consumption units is reportable for electricity but not reportable for gas units, as stated in Articles 8 and 9 of the implementing regulation of REMIT. The Bruegel policy brief also finds that some European countries collect and publish daily natural gas demand data but those are not easily comparable across Europe.

Relevant to the policy drive of streamlining energy data sources is also the European data strategy[20]. As part of it, Common European Data Spaces have been created in several strategic fields, including energy. The intention is for data spaces to gradually be interconnected to form a single market for data.

Designing expansions and improvements to REMIT data collection is beneficial as long as they take into account that there are currently more than 19 thousand market participants registered under REMIT. When ACER proposes and consults any changes to its reporting guidance, those need to be strictly necessary for the purposes of effective market monitoring and/or for ensuring data quality in order to justify any regulatory burden placed on participants. There are obvious long-term benefits of any EU policy directed to streamlining data sources, however, in the short term, be it through adding datasets in scope of the regulation, or by further aligning the data formats with other data providers, such initiatives would also come at a lengthy and heavy implementation price for all parties involved.

[19] Progress of EU electricity wholesale market integration, 2024 Market Monitoring Report, 14 November 2024, European Union Agency for the Cooperation of Energy Regulators, available at: https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Market_Integration.pdf

[20] Common European Data Spaces, European Commission, 27 March 2025, available at: https://digital-strategy.ec.europa.eu/en/policies/data-spaces

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The information and views set out in this article are those of the author and do not necessarily reflect the official opinion of the EU Agency for the Cooperation of Energy Regulators (ACER).

ELECTRICITY PRICES AND COMPETITIVENESS IN THE EU: ARE COMPENSATIONS THE ONLY ANSWER?

Vera Karabashlieva, Shteryu Radev, Monika Kirova

Introduction

At a time of energy price crisis, states resort to measures of financial support to customers to immediately tackle negative effects and public unrest. Compensations, which are a form of subsidy, however, have negative budgetary implications and strong market distorting effects, therefore it is crucial that their implementation is limited, targeted and temporary. The Bulgarian energy price compensation scheme, originally introduced as an emergency response to the energy crisis, has evolved into an untargeted financial transfer practically guaranteeing a fixed end price for non-household customers to the detriment of the market price signal.

While financial relief for businesses may be a legitimate tool in times of crisis, the continuation of universal, non-targeted subsidies raises serious economic, fiscal, and legal concerns. In order to preserve the stability of the electricity sector and avoid market distortions in the future, the scheme should be either removed or altered to provide targeted support to specific sectors that can justify the need for such support. With concerns about competitiveness taking a leading role in European policy discussions, legislative initiatives aimed at enhancing industrial competitiveness are being advanced by decision-makers. New common European Union (EU) rules on State aid are likely to emerge, balancing the need to support domestic industry and the risk to distort or even disintegrate the common market.

The following analysis outlines the accepted practice with respect to EU energy price support measures as well as other policy alternatives governments have. It is guided by the key questions: when electricity prices justify state intervention; how can states intervene; what are the allowed and recommended policy measures by the EU legal framework; to whom support should be granted or how to best target customers and to what extent the cost should be compensated while leaving room for the market price signals to continue doing their job. Following this, the authors evaluate the Bulgarian experience against these questions and look into the factors impacting a country's attractiveness to investors. Finally, the paper discusses policy alternatives which deliver a similar effect at a lower cost – fewer market distortions or budgetary implications. The argument is that state support should be a measure of last resort and recommend a shift from universal subsidies to targeted, limited and conditional energy support policies to ensure compliance with EU's regulatory framework and guarantee economic resilience and long-term industrial competitiveness, without exposure to fiscal and legal risks.

Basic principles

Before jumping into the analysis, it is worth reminding some basic principles that define the energy market. To begin with, energy is a scarce resource. It cannot be provided for free and the price for its supply reflects the production cost (not marginal cost) for the demanded quantity and a margin that compensates the investors in the energy supply chain so that they stay in business, guarantee the security of supply at all times and expand and modernize the offered services.

Energy is also a service. Like all services, it is consumed at the time of its production. Its price varies for each hour of the day, for each season and across regions. The varying market price is an important source of information which is used to allocate investments and shift consumption. Different prices reflect different market structures, energy mix, level of liquidity and development of the market. Where lower prices are observed, they are not achieved by state intervention or control. In light of this, it is not surprising that according to ACER's last report on the functioning of the retail electricity market[1], Member States' interventions in retail and wholesale markets had a negative impact on market integration and artificially increased price divergence. Considering these basic principles, continued financial transfers from the energy industry to its customers in the absence of surplus revenue may eventually deplete resources in the sector, postpone investments and, as seen in the 1990's, result in blackouts due to financially unsound policies despite adequate generation capacity

Key questions

Our approach is guided by four key questions explaining the basis and scope of price support measures in the EU and their applicability to Bulgaria.

When?

Starting in August 2021 and during 2022, the EU experienced an energy price crisis – a sharp twofold increase of wholesale electricity prices on a yearly basis. It was a union-wide external shock caused by disproportionate dependance on natural gas supply, which necessitated the adoption of emergency measures to cope with the price increase.

Following this, the Electricity Market Design Directive (EU) 2024/1711[2] gave power to the European Commission to propose (and the Council to declare) a state of energy price crisis, thereby allowing the Member States to adopt a set of standard measures during such a crisis.

The conditions constituting a price crisis are defined in Directive (EU)

[1] ACER, CEER, 2024. Energy retail - Active consumer participation is key to driving the energy transition – how can it happen? 2024 Market monitoring report. https://www.ceer.eu/wp-content/uploads/2024/09/ACER-CEER_2024_MMR_Retail-1.pdf.

[2] Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024 amending Directives (EU) 2018/2001 and (EU) 2019/944 as regards improving the Union's electricity market design.

2019/944 as amended by Directive (EU) 2024/1711[3] and require the existence of very high average prices in wholesale electricity markets that are at least 180 EUR/MWh and are at least two and a half times the average price during the previous five years[4], where such prices are expected to continue for at least six months, as well as sharp increases in electricity retail prices in the range of 70% expected to continue for at least three months[5]. All conditions need to be met for a regional or EU-wide price crisis to be declared.

How?

The European Commission reacted by issuing the Communication "Tackling rising energy price: a toolbox for action and support"[6] in October 2021 which allowed Member States to impose different price support measures. The following year, Regulation (EU) 2022/1854[7] was adopted as an emergency intervention designed to mitigate the effects of high energy prices through exceptional, targeted and time-limited measures. The Regulation applied until December 31, 2023 and enabled Member States, among else, to limit certain electricity producers' surplus market revenues to 180 EUR/MWh and use the extra revenues to finance support measures for final electricity customers. Other allowed measures included financial compensation to final electricity customers for reducing their electricity consumption, including through demand reduction auctions or tender schemes; compensation to suppliers who had to deliver electricity below costs; lowering the electricity purchase costs of final customers, including for a limited volume of the consumed electricity; promoting final electricity customers' investment in decarbonisation technologies, renewables and energy efficiency. From all available options, Member States mostly applied reductions of RES charges and compensation of indirect ETS costs.[8]

With the 2024 electricity market design overhaul, Directive 2019/944 was amended to allow temporary, targeted public interventions in electricity price setting for small and medium-sized enterprises during an energy crisis. These interventions must adhere to the following conditions:

- Limited scope – support must cover no more than 70% of the

[3] Article 66a, paragraph 1, Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast).

[4] As per Article 66a, the calculation of the average price during the previous five years shall not take into account those periods where a regional or Union-wide electricity price crisis was declared.

[5] Neither the Directive, nor the Regulation clarifies what is the basis for calculating the 70% increase in retail prices.

[6] Communication from the Commission to the European Parliament, the European Council, the Council, the European and Social Committee and the Committee of the Regions: Tackling rising energy prices: a toolbox for action and support, COM/2021/660 final.

[7] Council Regulation (EU) 2022/1854 of 6 October 2022 on an emergency intervention to address high energy prices.

[8] Mario Draghi, 2024. The future of European competitiveness, p.39, footnote 31. https://commission.europa.eu/document/download/ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en?filename=The%20future%20of%20European%20competitiveness_%20In-depth%20analysis%20and%20recommendations_0.pdf.

beneficiary's consumption for the same period of the previous year, ensuring incentives for demand reduction.

- Proportionality & necessity – interventions must serve a general economic interest and be strictly limited to what is necessary to achieve that goal.

- Transparency & fairness – measures must be clearly defined, transparent, non-discriminatory, and verifiable.

- Time-limited & targeted – interventions must be temporary and proportionate to their beneficiaries.

- Non-discriminatory supplier treatment – pricing methodology must ensure equal treatment of suppliers.

- Minimizing market distortions – measures should limit negative impacts on the wholesale electricity market and prevent fragmentation of the internal market.

- No cross-subsidization – the intervention must not lead to direct cross-subsidization between regulated-price and free-market customers.

To whom?

Mario Draghi's report on the future of European competitiveness[9] (Draghi report) considers electricity price reliefs as a last resort measure and recommends that they are restricted to the economic sectors that are most exposed to international competition as well as to industries that are energy-intensive, i.e. energy represents the greatest share of their value added. For that reason, a sector list should be established at EU level. In addition, such measures should be limited and temporary, meaning that Member States should not guarantee an end price to the industry and instead offer a percentage discount on the normal market price. Moreover, the measures should be designed in a manner that preserves incentives for energy efficiency investments and industrial demand flexibility. Finally, the report calls that price reliefs are harmonised and avoid distortions to the Single Market, therefore it recommends that the European Commission develops State aid guidelines to that purpose.

With respect to limiting the support to energy intensive industries, there is no set legal definition of such industries[10]. In Germany, for example, they are classified as consuming more than 10 GW hours of electricity and operating for at least 7000 hours per year.

As seen from the above, targeted price support is both in line with the applicable

[9] bid.

[10] Annex I of Communication from the Commission – Guidelines on State aid for climate, environmental protection and energy, 2022/C 80/01, could be used to identify the sectors eligible for price reliefs. While the Communication concerns exemptions from environmental levies, it considers the risk of businesses losing their competitive edge against international competitors and relocating their operations, where Annex I lists sectors "which are particularly exposed to international trade and rely heavily on electricity for their value creation".

legislation and recommended by policy experts. It is also an economically rational way to distribute the limited resources collected from society.

The Action Plan for Affordable Energy[11] gives a further indication of preferred policies to deliver affordable energy prices. It focuses on accelerated deployment of renewable energy through a range of measures to ensure that households and industrial customers have wider direct access to low-cost electricity. The plan aims to help leverage the price reduction benefits coming from further market integration by expanding the use of guarantees and risk reduction instruments to facilitate conclusion of long-term power purchase agreements, incentivising industrial customers to provide demand flexibility services, and encouraging a fair allocation of energy system costs through better designed tariff methodologies.

How much?

As recommended in the Draghi report, there shouldn't be a guaranteed end price of electricity and measures should be such that they encourage energy efficiency and demand flexibility.

Alternatives

While direct financial compensation is often used to address rising energy costs, it is not a universal solution and can lead to market distortions and fiscal strain. Instead, governments have a broad range of alternative policy instruments that can provide targeted relief to businesses while promoting long-term resilience, energy efficiency, and industrial competitiveness. These measures focus on reducing tax liabilities, incentivizing energy efficiency investments, modernizing infrastructure, and supporting industrial competitiveness through regulatory and financial mechanisms. By leveraging targeted incentives, preferential financing, and regulatory adjustments, policymakers can create a more sustainable and market-compatible framework that enhances energy affordability while encouraging long-term resilience and innovation.

Financial compensations in Bulgaria

When?

Price support reliefs in Bulgaria were granted due to the energy price crisis and they continue to be in place. Despite declining prices in Bulgaria since the price peaks of the energy crisis (see Figure 1), business customers still argue that their electricity costs need to be subsidized. In that context, it is important to highlight the reasons for prices higher than pre-crisis levels (higher than EUR 90/MWh), which are as follows:

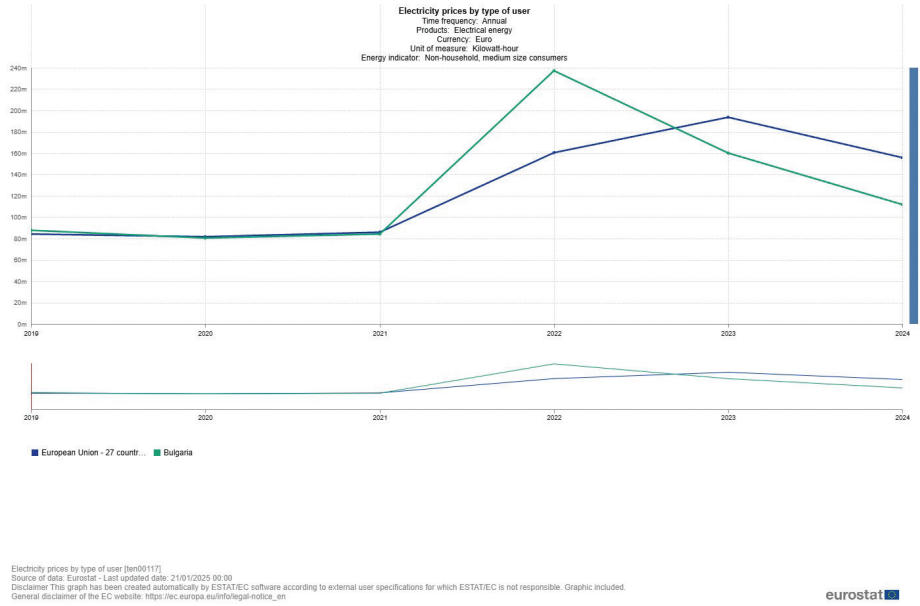
- high demand, for example, due to cold weather (short term/long term);

[11] Communication from the Commission to the European Parliament, the European Council, the Council, the European and Social Committee and the Committee of the Regions: Action Plan for Affordable Energy -Unlocking the true value of our Energy Union to secure affordable, efficient and clean energy for all Europeans, COM(2025) 79 final.

- lower supply due to planned or unplanned production facility maintenance (coal & nuclear);
- weak generation from RES – sun, wind, water (lower share of low-marginal-cost generation in the mix);
- levels of gas storage (when lower compared to a year ago - a price increasing effect);
- decline in gas production from Shah Deniz;
- prices of oil, gas, coal, CO2 emission allowances;
- political, geopolitical and security issues.

By way of comparison, lower prices in Germany in January 2025 are not because of price intervention but are due to availability of a variety of lower price generation sources, interconnectivity, high energy efficiency, and more advanced technologies for managing demand response and flexibility. This leads to the conclusion that price interventions are not the only tool to manage high electricity prices.

Figure 1. Electricity prices in Bulgaria compared to the EU average prices 2019 – 2024.



Source: Eurostat[12]

[12] Data for 2024 shows that with EUR 0.1119 kWh (EUR 111.19 MWh) Bulgaria is placed well below the EU average of EUR 0.1558 kWh (EUR 155.8 MWh). Eurostat, 2025. Electricity prices by type of user. https://ec.europa.eu/eurostat/databrowser/view/ten00117__custom_15868113/default/line?lang=en.

Clearly, the Regulation on emergency measures expired more than a year ago and with it the justification for the compensations to non-household customers. While the European Commission has not officially declared an end to the energy crisis, it has emphasized the importance of phasing out national support measures as the new market design framework is established. This approach aims to ensure a smooth transition and maintain market stability. It is therefore crucial for the Bulgarian government to carefully consider the potential risks associated with continuing compensations to non-household customers without explicit justification under the current regulatory framework.

How?

So far (beginning of 2025), Bulgaria has not followed the best practices set out in Directive 2019/944 and market distorting effects can be expected. Due compensations have often exceeded the surplus revenue collected in the Fund Security of the Energy System and financial transfers to customers have been covered by the state budget, causing fiscal and inflationary pressure. Four different versions of compensations were applied:

- For October and November 2021 – lump sum price relief BGN 110/MWh (BGN 128.98/MWh) in December 2021;
- January 2022 to June 2022 - 75% of the difference between IBEX DAM price and BGN 250/MWh;
- July 2022 to July 2024 100% of the difference between IBEX DAM price and BGN 200/MWh;
- July 2024 to March 2025 – 100% of the difference between IBEX DAM price and BGN 180/MWh.

To whom?

The argument that compensation should be applied to all because otherwise the measure would be discriminatory is a gross misunderstanding. Non-discrimination means that the measure should not favour some suppliers against other suppliers, some bakers against other bakers, some aluminum plant against another aluminum plant, one oil refinery against another oil refinery, etc. Discrimination is to create a competitive advantage for one of several competitors. However, a baker is not in competition with an oil refinery. Non-discriminatory does not mean equally to all. It means without affecting the competitive advantage of different actors who are competing in one category. Giving a state subsidy to the entire economy is like giving doping to all athletes. No one will be discriminated against, but all medals will have to be returned. In the case of state aid, returning the medal means that someone will have to pay the bill because someone's price relief is someone else's lost revenue or taxes. What is gained in this compensation must be clear and justified to the public, not to the group with specific interests.

Are gains in an export sector transformed into higher wages for its workers? Do oil refineries who benefit greatly, pay all taxes, so the state has resources to build roads and schools? Why should a rural region care if the main factory there is an export champion, if the people don't have basic social services – clean streets, intercity roads, access to good healthcare or education? All these questions should be considered when designing the right policy framework.

Targeted support is a responsible use of public resources. Most countries subsidized households because such customers cannot pass on the higher cost. Unlike households, a business can include the higher cost of electricity in its product price and thus pass it on to their customers.

Is the financial sector using energy as a main resource to its added value? Clearly not. Operating several servers or even a data center and air conditioning a few customer centers does not make electricity the highest source of value added. Then why should banks benefit from reduced electricity prices, while at the same time keep increasing their tariffs for end customers?

If the glass industry's use of energy is more than 50% of its value added then it should be entitled to some price support, but only after they have done something on their own to decrease energy costs, for example, invested in own RES installations, improved energy efficiency.

Big industrial customers with more than 3 GW hours annual consumption already pay a much lower price than the IBEX average. First, they have a volume-based discount, and second, they operate at hours that benefit from low prices. They have a flat load curve, not a peak profile like households, for example. It would be useful to review the specific conditions they are able to secure on the market before deciding on the size of the compensation.

Passing on the increased cost has been seen in the case of restaurants which not only receive electricity price support, but have also benefited from a 9% VAT rate – a measure initially introduced as a COVID-19 relief policy, but which remained in place until the end of 2024. Despite these cost-relief government policies, the sector did not keep original prices, but let them rise with the inflation index, which was double digit, and retained the surplus profit.

The opposite example can be given with sunflower oil in 2022. Due to the war in Ukraine and interrupted supply of sunflower seeds, its retail price more than doubled and customers cried out. Politicians hurried to propose market interventions. When the situation normalized, price returned to its normal level (no one announced the price decline).

The last two examples suggest that price relief has a continued inflationary effect. While restaurants could pass on the extra cost to their customers, the producers of essential food products could not permanently pass on the higher cost to the customers. Price support in the first case generated surplus

profit for restaurants. In the absence of specific price support, sunflower oil returned to normal levels and consumers only temporarily experienced a higher price, not contributing to surplus profit.

How much?

Measures in Bulgaria, in contrast to the EU-wide practice include direct financial transfers to the customers who for the most part have enjoyed a guaranteed end price for energy. So far (beginning of 2025), Bulgaria has redistributed in compensations through the suppliers almost EUR 4.8 billion in untargeted/universal compensations for 100% of the electricity consumed, without any requirements for demand reduction.[13] The "Obligation to Society" charge has been set at BGN 0 by the Energy and Water Regulatory Commission for the past several years, so a reduction in this charge is not an option. No funds were transferred to encourage investments[14] or demand reduction.

Covering 100% energy consumption under a price support scheme removes any incentive for energy efficiency, leading to inefficient consumption patterns, higher energy losses, and increased waste. When energy costs are subsidized, businesses and consumers have little motivation to optimize their energy use, invest in energy-saving technologies, or adopt more sustainable consumption behaviors.

This issue is particularly relevant for Bulgaria, which remains the least energy-efficient country in the EU. A key indicator of this inefficiency is energy productivity - the measure of economic output per unit of energy consumed[15]. Bulgaria ranks the lowest among Member States, meaning that for every unit of energy used, the country generates less economic value, namely EUR 2.94 for 2023, compared to its European counterparts[16]. This highlights a structural weakness in the economy, where energy-intensive industries and outdated infrastructure contribute to excessive energy use without proportional economic benefits. Bulgarian needs to increase its output per unit of energy to utilize the scarce resource in a more efficient way.

A well-designed price support scheme should aim to balance affordability with efficiency, ensuring that aid is targeted and does not incentivize wasteful energy consumption. Instead of blanket subsidies, measures such as tiered compensation structures, incentives linked to energy-saving investments, and requirements for energy audits could encourage businesses to reduce consumption and improve efficiency, ultimately enhancing Bulgaria's long-term energy security and economic competitiveness.

[13] Although total final energy consumption is declining since 2022 for all sectors monitored by NSI, these are not due to energy efficiency measures.
[14] Other instruments, such as the Recovery and Resilience Plan, have been used to support own RES installations + batteries for non-household customers, but not surplus revenue.
[15] Measured in EUR per kilogram oil equivalent.
[16] Eurostat, 2024. Energy productivity. https://ec.europa.eu/eurostat/databrowser/view/sdg_07_30/default/map?lang=en&category=t_nrg.t_nrg_indic.

How do electricity prices affect a country's competitiveness, particularly in terms of its ability to compete in international markets?

In Bulgaria, paradoxically, the year with the highest prices (2022) was also the year with the greatest export growth. Based on the previous year (2021) exports to Germany increased by 29%, exports to the EU - by 34% and exports to third countries - by 40%. This all-time export record coincides with exporters having a great share of their electricity costs covered by compensation.

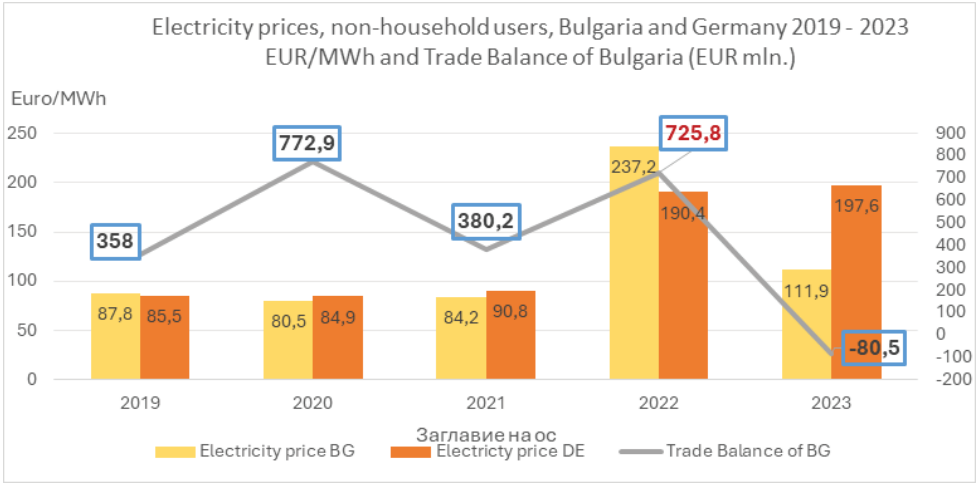
In international trade theory the rule of thumb is that lower cost of production (energy prices having only a partial effect on costs) makes an economy more competitive against other exporting economies. This simple argument has been used as the only ground for securing fixed end price of electricity for the entire consumption of non-household customers in Bulgaria. Looking at the data, though, this argument does not always hold true.

Looking at a single country - Germany – Bulgaria's main trading partner and the one most often looked up to for price comparisons, the evidence is quite surprising. In the year when Bulgarian electricity prices were highest and indeed much higher than in Germany, exports to Germany were also at a record high level and the positive trade balance almost doubled from the previous year's level. This evidence runs counter to the claim that high energy prices are detrimental to national competitiveness.

Again, looking at 2023, the picture continues to be puzzling (see Figure 2). Prices in Germany are 76.6% higher than prices in Bulgaria, but still German imports to Bulgaria surpassed Bulgaria's exports to Germany and the year ended with a negative trade balance for Bulgaria vis-à-vis its main trading partner. The simple rule of thumb only holds true for the year 2020 when Bulgarian electricity prices were just slightly lower than those in Germany, but exports exceeded imports with EUR 772.9 million.

All this suggests that electricity price alone does not explain national competitiveness. Trade results are a function of external demand and other factors of local competitiveness and productivity. It is a complex issue and deserves an in-depth analysis.

Figure 2. Electricity prices for non-household customers in Bulgaria and Germany and Bulgaria's trade balance with Germany.



Source: National Statistical Institute of Bulgaria[17] and Eurostat[18]

These are just quick observations suggesting that the relationship between energy prices and competitiveness is not so simple and that there is more to having an advantage in international trade than cheap energy.

The Bulgarian subsidy scheme may have not only mitigated a potential downturn, but also artificially boosted Bulgarian exports, distorting competition within the EU market. Instead of merely offsetting losses, it may have granted Bulgarian exporters an unfair advantage over competitors in other Member States, potentially violating the Single Market and State aid rules.

Given that the European Commission has not approved this measure, the Bulgarian government faces greater legal and financial risks. Companies from other Member States could file formal complaints with the European Commission, prompting an investigation that may lead to an infringement procedure against Bulgaria. Additionally, affected competitors or Member States could challenge the scheme directly before the Court of Justice of the European Union, seeking its annulment and the repayment of unlawful subsidies.

As Bulgaria considers whether to continue or modify the scheme, it must carefully assess its compliance with EU law, the potential for legal challenges, and the broader reputational and financial consequences of maintaining a measure that lacks the European Commission's approval.

[17] National Statistical Institute of Bulgaria, 2024. Export, import and trade balance by main trading partners. https://nsi.bg/en/content/7510/main-trade-partners.
[18] Eurostat, 2025. Electricity prices by type of user. https://ec.europa.eu/eurostat/databrowser/view/ten00117/default/table?lang=en

Competitiveness is not just energy price, but what else?

In their efforts to secure a fixed and affordable electricity price, non-household customers also claim that unless the government intervened in the end price of electricity, capital would move out of the country together with its output and employment and relocate the business operations to other countries where electricity is cheaper. However, such events have not materialized since the energy crisis and as observed, there is more to competitiveness than energy prices.

This section analyses *inter alia* the advantages of Bulgaria as business and investment location compared to other countries (mostly EU) and finds that the local business climate, although not perfect, provides enough stability and predictability for investors to stay and reinvest in the country.

The threats of leaving are greatly unfounded due to a number of advantages Bulgaria has. Firstly, there is macroeconomic and financial stability brought about by the currency board arrangement, which has proven to be a stable guarantor against monetary policy risks. It provides for zero exchange rate risk and contributes to fiscal discipline. The only accepted way out of it is by joining the Eurozone, which is expected to happen in 2026 and to further enhance financial stability. There is also a liquid banking system with high level of deposits and credit activity. In addition, Bulgaria has an open economy with steadily growing domestic demand that is well integrated with the core EU economies.

Secondly, Bulgaria has created a favorable tax environment by imposing flat 10% corporate tax rate, which is one of the lowest in the EU. By way of comparison, Germany's corporate tax is around 30% with local taxes and France's is 25%. Personal income tax is also 10%, establishing an attractive environment for talent acquisition. The country has agreements with nearly 70 countries, minimizing double taxation for international businesses.

Thirdly, labor costs in Bulgaria are among the lowest in the EU (approx. EUR 8/hour, while in Germany - approx. EUR 39/hour and France - approx. EUR 37/hour), and despite such low costs, the workforce is well-educated, multilingual, and adept in fields like technology, engineering, and customer services.

Fourthly, Bulgaria's strategic geographic location connects major trade routes between Europe, Asia, and the Middle East and its membership in the EU ensures seamless trade across the Single Market. Bulgaria's logistics infrastructure of ports, highways, and railways enhances transportation efficiency. Moreover, accession to the Schengen Area further reduces logistics costs and streamlines supply chains, giving businesses in the country an extra advantage.

Fifthly, there is a supportive business environment as shown by Bulgaria's ranking regarding ease of starting and operating businesses (see Figure 3). In particular, investment incentives, such as tax breaks for investments in high-unemployment areas and support for R&D projects through national and EU funding programs, are in place. The well-established industrial base

and growing infrastructure ensure consistent and reliable supplier networks, while the diverse supplier landscape across key industries facilitates business operations and reduces dependency risks.

Figure 3. Bulgarian business environment compared to other countries.

Source: Business Ready (B-Ready) 2024[19]

The analysis continues with assessment of how Bulgaria compares specifically to Romania, Greece and Serbia according to some of the described key indicators (see Figure 4). With respect to corporate tax rate, Bulgaria stands out with its flat 10% tax rates, making it one of the most attractive EU destinations for investment. Romania also has a low 16% rate, but Bulgaria's simplified tax structure gives it a further edge. Greece's progressive tax system is less favorable, while Serbia's 15% corporate tax is competitive, but lacks the EU framework benefits. On labor costs, Bulgaria and Romania offer some of the lowest labor costs in the EU, making them particularly attractive for labor-intensive industries. Looking at regulatory frameworks, Bulgaria scores relatively high on regulatory clarity and simplicity, offering an efficient environment for starting and operating a business. Romania has similar strengths to Bulgaria, but faces challenges in ensuring consistency in the enforcement of regulations, while Greece and Serbia are placed further down the scale due to bureaucratic hurdles and less transparent and more complex regulatory processes, respectively.

Moving on to public services, Bulgaria and Romania exhibit improved access to digital public services, with ongoing infrastructure development. Greece has more advanced infrastructure, but lags in public service efficiency due to administrative bottlenecks. Serbia faces significant challenges in public service delivery, with notable delays in utilities and approvals. Assessing operational efficiency, in Bulgaria, competitive labor costs and simplified tax structures contribute to high efficiency. These can also be observed in Romania, but there are challenges in judicial efficiency and tax administration. In Greece, high costs of labor and energy reduce operational efficiency, while in Serbia operational inefficiencies are marked by slower administrative processes and less developed infrastructure.

[19] World Bank, 2024. Business Ready (B-READY) 2024. https://www.worldbank.org/en/businessready/publications.

Figure 4. Comparing key factors of business environment in Bulgaria, Germany, France, Poland, Romania, Greece and Serbia.

Factor	Bulgaria	Germany	France	Poland	Romania	Greece	Serbia
Corporate Tax Rate, %	10	30 (incl. local taxes)	25	19	16	22	15
Labour Costs in €/hour	8	39	37	14	9	12	6
Personal Income Tax %	Flat 10	Progressive max 45	Progressive max 45	Progressive max 32	Flat 10	Progressive max 44	Flat 10
Schengen Area	Yes, since 01.01.2025	Yes	Yes	Yes	Yes, since 01.01.2025	Yes	No
Euro Zone	Expected 2026	Yes	Yes	No	No	Yes	No

Source: Business Ready (B-Ready) 2024[20]

All this evidence suggests that the threats about capital flight are unfounded and greatly exaggerated in the rhetoric of the interested parties. The economy of Bulgaria is growing steadily as seen from the steadily growing GDP (both in terms of purchasing power and production) and the growth in investments. The burden of proof to justify a support scheme should fall on the specific sectors asking for it or there is a risk of inflation and wasting public funds.

Proposed measures to tackle high electricity prices and best practices from Member States

In the wider EU context, there is a lot of movement in the direction of guaranteeing affordable electricity prices. It is important that Bulgaria follows the common rules to avoid sanctions. This section considers different measures that could be applied in the Bulgarian context, also providing examples from across the EU.

Targeted support for strategic and energy-intensive industries

Compensation should be focused on sectors crucial to Bulgaria's economy and those most impacted by energy costs, such as manufacturing, agriculture, and critical infrastructure (e.g. public utilities). Eligibility could be determined by the economic impact of the sector, where sectors with significant contributions to GDP or employment are prioritized. In regard to energy-intensive industries, as already noted, there is no uniform legal definition of such industries and Bulgaria is no exception to this. The entities obliged under the Bulgarian Energy Efficiency Act could be taken as a reference. These include industrial systems with an annual energy consumption exceeding 3 GWh. Other criteria could be the share of energy costs in the total cost or value-added, for example, where that is more than 20-30% of the value created during the production process.

[20] Ibid.

An example of such support is the State aid scheme notified to the European Commission by Poland, with a total estimated budget of EUR 10 billion, which aims to cover part of the higher electricity prices arising from the impact of carbon prices on electricity generation costs (the so-called "indirect emission costs") incurred between 2021 and 2030. The compensation is granted to eligible companies through a partial refund of the indirect emission costs incurred in the previous year, with the final payment to be made in 2031. The maximum aid amount per beneficiary is equal to 75% of the indirect emission costs incurred. However, in some instances, the maximum aid amount can be higher to limit the remaining indirect emission costs to 1.5% of the company's gross value added. This additional aid shall not exceed one third of the regular compensation based on the 75% aid intensity. The aid amount is calculated based on electricity consumption efficiency benchmarks, which ensure that the beneficiaries are encouraged to save energy.

The following industries are included in the measure: manufacture of leather clothes; aluminum production; manufacture of other inorganic basic chemicals; lead, zinc, and tin production; manufacture of pulp; manufacture of paper and paperboard; manufacture of basic iron and steel and ferro-alloys; manufacture of refined petroleum products; copper production; other non-ferrous metal production; polyethylene in primary forms (plastics sector); casting of iron (all product categories); glass fibre mats and glass fibre voiles (glass fibre sector); hydrogen and inorganic oxygen compounds of non-metals (industrial gases sector). [21]

In Romania, a State aid scheme that is the same in principle as the one in Poland, but with lower budget (EUR 1,5 billion) is granted to companies in sectors considered to be exposed to a real risk of carbon leakage due to the significant indirect costs they actually incur as a result of the transfer of the costs of greenhouse gas emissions in the price of electricity. The scheme covers the years 2021-2030, therefore payments will be made in the period 2022-2031.[22]

Romania's energy strategy 2025-2035[23] adopted by the Romanian government on November 21, 2024 discusses high energy prices and carbon emissions as additionally increasing prices for electricity and reports that "an average of 70 companies benefit annually from the State aid scheme aimed at supporting large enterprises, including heavy industry, which are affected by increased energy costs, with an annual budget of EUR 75 million."

[21] European Commission, 2022. State aid: Commission approves €10 billion Polish scheme to compensate energy-intensive companies for indirect emission costs. https://ec.europa.eu/commission/presscorner/detail/%20en/ip_22_6079.

[22] European Commission, 2022. State aid: Commission approves €1.5 billion Romanian scheme to compensate energy-intensive companies for indirect emission costs. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4927.

[23] Energy Ministry, 2024. Romania's energy strategy 2025-2035, with a 2050 perspective, p.72 https://energie.gov.ro/wp-content/uploads/2024/11/Strategia-Energetica-a-Romaniei-2025-2035-cu-perspectiva-anului-2050_23_10_2024_vf.pdf.

Consumption-based caps

With this type of support, the amount of energy eligible for compensation should be limited. More specifically, there could be a cap based on historical consumption averages (e.g., 80-90% of the last three years' consumption) and consumption above this cap is not compensated for, thereby encouraging optimization of energy use. To illustrate this, a factory with annual historical consumption of 10,000 MWh is compensated only for up to 8,000 MWh, regardless of its actual consumption.

Partial compensation for energy costs

Another form of compensation is where a share of total energy costs in a given period are compensated for. A good illustration of this is the Temporary Business Energy Support Scheme[24] in Ireland[25]. The scheme is administered by the tax authority and applies when a business can demonstrate that there was at least 30% increase in the average unit price between two invoices for the same reference period a year apart. In addition, to be eligible businesses must have complied with their tax obligations, i.e. their obligations regarding tax registration, tax payments and filing of tax returns, and to be eligible for a Tax Clearance Certificate[26] throughout the claim period. The amount of the compensation is 40% of business' eligible energy costs for September 2023 to February 2023, and 50% - from March 2023 to July 2023. The eligible costs must have been incurred directly for the purpose of the trade or profession. Costs for home and personal use are excluded. In case of a new business, a reference price is provided by the Sustainable Energy Authority of Ireland. An online calculator[27] is also available.

Points-based eligibility system

Here, a transparent points system could be created, where businesses are evaluated according to multiple criteria and allocated the respective points. Only businesses meeting a minimum score (e.g., 6 out of 10 points) qualify for compensation. The criteria may include the energy intensity of the business (e.g., >30% = 3 points); its economic importance (e.g., contribution to GDP = 2 points); regional impact (e.g., high unemployment regions = 2 points); and participation in energy efficiency programs (e.g., committed targets = 3 points).

Tiered timelines for compensation

[24] Revenue, 2023. Guidelines on the operation of the Temporary Business Energy Support Scheme (TBESS). https://www.revenue.ie/en/starting-a-business/documents/tbess-guidelines.pdf.

[25] The outlier with highest electricity prices for 2024.

[26] Revenue, 2024. When is a Tax Clearance Certificate required? https://www.revenue.ie/en/starting-a-business/tax-clearance/when-is-a-tax-clearance-certificate-required/index.aspx.

[27] Revenue, 2024. Temporary Business Energy Support Scheme (TBESS). https://www.revenue.ie/en/starting-a-business/tbess/eligible-businesses.aspx.

With this way of compensating businesses, the timing of distributing compensations is based on the industry's importance and vulnerability, so that funds are available for the most critical industries first. In particular, strategic sectors (e.g., food production, public utilities) receive compensation immediately, while non-essential sectors (e.g., non-energy-intensive manufacturing, finance) receive compensation at a later stage.

Exclusion of non-essential and low-impact businesses

In order to avoid inefficient use of funds, some businesses may be excluded from compensation. If that is to apply, it needs to be clearly defined which are the excluded businesses. These could be low energy consumption sectors (unless they meet energy intensity thresholds), such as retail, administrative services, and hospitality, and non-essential luxury industries, such as entertainment, tourism, or high-margin services.

Dynamic and tiered compensation

Instead of a flat-rate mechanism, a varied rate of compensation based on the degree of cost impact and business vulnerability could be introduced, as follows:

- costs exceeding a 10% share of electricity → 50% compensation;
- costs exceeding a 20% increase → 75% compensation;
- costs exceeding a 30% increase → 90% compensation.

A profitability-based adjustment could also be added where profitable businesses (e.g., with profit margins > 10%) receive reduced compensation, while struggling businesses receive full compensation.

Monetary cap on energy compensation

Here, compensation is given for energy costs exceeding 180 BGN/MWh on the IBEX, with a maximum compensation of 50 BGN/MWh. To illustrate this, if the IBEX price is 200 BGN/MWh, the eligible amount for compensation is the difference above 180 BGN/MWh, which is 20 BGN/MWh and this is within the 50 BGN/MWh limit, so the compensation amounts to the full amount, i.e. 20 BGN/MWh. However, if the IBEX price rises to 250 BGN/MWh, the eligible amount is 70 BGN/MWh (the difference above 180 BGN/MWh), but since the compensation is capped at 50 BGN/MWh, the beneficiary receives the maximum of 50 BGN/MWh.

This measure ensures budget control by capping compensation, making subsidy costs predictable. It promotes efficiency by encouraging optimized energy management and reduces reliance on excessive compensation. Moreover, the approach ensures fairness, providing consistent support based on market dynamics.

Sector-based compensation caps

It is also possible to allocate funds proportionally across sectors to ensure fair distribution. For example, critical infrastructure (e.g., public utilities) receives 40% of funds, heavy industry (e.g., steel, cement) - 30%, food production and agriculture - 20%, other eligible sectors - 10%.

Incentives for sustainable behaviour

Here, the level of compensation could be varied on the basis of the source of electricity, so that the transition to cleaner energy is incentivized. For instance, businesses using their own renewable energy sources receive higher compensation, while businesses relying on fossil fuels, get lower compensation[28].

Tying compensation to workforce retention

Compensation could be made conditional on maintaining employment levels, where businesses must commit to preserving jobs to qualify for support. Additional incentives may be provided to companies creating new jobs or expanding operations in disadvantaged regions.

Alternatives

Other proposed measures besides direct financial compensation should be prioritized, as the government has a variety of policy instruments at its disposal, and, as the Draghi report emphasized, subsidies should be a measure of last resort[29]. This section outlines such measures.

Tax relief and incentives

Corporate income tax rates could be reduced temporarily for energy-intensive or strategic industries. In addition, VAT rates on electricity bills could be reduced for businesses meeting specific criteria, such as energy intensity or economic contribution. Such practice is observed in Germany, which until March 31, 2024 implemented lower VAT rates on gas and electricity to reduce overall energy expenses for consumers and businesses. [30]

Accelerated depreciation for energy-efficiency investments

[28] There are good examples among Bulgarian companies who implement systems for own electricity generation from RES, utilize the heat emitted in the industrial process, implement batteries to shift energy from cheaper to more expensive hours of consumption, thereby recycling and investing in highly efficient production equipment. The most advanced decarbonization investment program is probably that of Aurubis. Its photovoltaic plants alone are said to cover about 15% of the plant's energy consumption, making the business less susceptible to price fluctuations and decreasing its carbon emissions. Many companies install photovoltaic panels to reduce exposure to volatile prices. Such projects need to be not only recognized by the government as the right way forward, but also encouraged with policies such as the ones described in the section.

[29] See Draghi report.

[30] Bundesregierung, 2022. Reduction of value added tax on gas. https://www.bundesregierung.de/breg-en/news/tax-reduction-gas-2126308.

Businesses may be allowed to rapidly depreciate the cost of investments in energy-saving technologies or renewable energy systems. Such measure reduces taxable income and incentivizes energy efficiency. For example, Austria introduced the option for degressive (declining balance) depreciation for certain assets acquired or created after June 30, 2020.[31] The measure aims to promote investments, including those in the energy sector, by allowing accelerated depreciation. The degressive depreciation method permits up to 30% depreciation in the first year, based on acquisition or production costs. This provision is set to continue until January 1, 2026. The law promotes renewable energy by excluding certain assets related to fossil fuels from the benefits of declining depreciation for wear and tear. Specifically, it states that facilities that serve the promotion, transport, or storage of fossil fuels, as well as those that directly use fossil fuels, are not eligible for declining depreciation. This includes energy generation facilities operated with fossil energy, tank and dispensing facilities for fossil fuels, and aircraft. By excluding these assets, the law indirectly encourages investment in renewable energy sources, as they are not subject to these restrictions. In Netherlands, the Energy Investment Allowance provides a tax deduction for up to 45.5% of the investment in energy-efficient systems.[32]

Modernization investments

Grants or low-interest loans can be provided to businesses for upgrading production facilities to more energy-efficient technologies. Here, industries with older, energy-intensive infrastructure could be targeted in order to reduce their long-term energy dependence. For instance, the Czech Republic offers subsidies through its Modernization Fund to support the decarbonization of industrial processes.[33]

Fuel subsidies

It is possible to provide subsidies for non-electric energy sources used in industrial production, such as different types of fuel. An example here is France, which offered rebates for fuel costs for agriculture and logistics sectors heavily affected by energy price surges.[34]

State aid for energy-intensive industries linked to a power purchase agreement (PPA)

This is another way to target support to energy-intensive industries. Eligibility criteria can be such that industrial customers using over 1 GWh/year, with 50% off-peak consumption, qualify. New companies can use projected consumption. In addition, businesses need to have concluded a PPA, for

[31] Austrian Economic Strengthening Act 2020 (Konjunkturstärkungsgesetz 2020).
[32] Business.gov, 2025. Energy Investment Allowance (EIA). https://business.gov.nl/subsidy/energy-investment-allowance/.
[33] State Environmental Fund of the Czech Republic, 2025. Modernisation Fund. https://www.sfzp.cz/en/about-the-modernisation-fund/.
[34] Reuters, 2022. France to offer fuel rebate to cushion soaring prices. https://www.reuters.com/business/energy/france-offer-fuel-rebate-cushion-soaring-prices-pm-2022-03-12/.

example, for a term of at least five years and covering at least 10% of their annual consumption to be granted support. The State aid itself could be in the form of up to 85% compensation for levies on renewables, cogeneration, etc. The Spanish government introduced such measure to reduce electricity costs for energy-intensive industries while promoting renewable energy development. [35]

Support for regional economic clusters

The government may offer incentives for businesses located in energy-intensive industrial clusters to invest in shared renewable energy or infrastructure projects, reducing their overall costs. Norway adopted such approach. The country provides grants for green industrial zones where multiple companies share renewable energy resources, lowering collective costs. On October 10, 2023, a scheme came into force that allows customers to use up to 1 MW of surplus electricity produced from renewable energy generators in the same property (e.g. a farm that has solar panels and a house). Participants are granted exemptions on the electricity tax and grid tariffs for the electricity that is shared. The sharing takes place via financial settlement, i.e. virtual sharing.

Another scheme was subject to public consultation. It would allow surplus renewable electricity from plants up to 5 MW to be shared within the same industrial area, i.e. there wouldn't be a requirement to be within the same property, but equally the power plants would need to be in proximity to the generators. Businesses would receive tax exemption on the surplus electricity they use. The consultation closed on February 3, 2025 and if approved, the scheme will come into effect on July 1, 2025.[36]

Public procurement criteria

Public procurement may be used to target businesses and at the same time incentivize sustainability. For example, the public procurement process may give priority to businesses that adopt energy-efficient technologies or meet specific sustainability criteria. Such practice is demonstrated in Austria, where public projects are required to prioritize companies with demonstrable energy-saving practices, thereby indirectly supporting energy-intensive businesses that adapt to higher costs. [37]

[35] Renewables now, 2020. Spanish govt plans to back PPAs for energy-intensive industry. https://renewablesnow.com/news/spanish-govt-plans-to-back-ppas-for-energy-intensive-industry-687950/.

[36] Regjeringen, 2025. Consultation. https://www.regjeringen.no/no/dokumenter/hoyring-av-forslag-om-delingsordning-for-fornybar-kraft-tilpassa-naringsomrade/id3076839/?expand=horingssvar.

[37] nabe, 2025. The public sector shows the way! https://www.nabe.gv.at/en/.

Conclusion

The analysis concludes that targeted price support measures are both legally permissible and at times necessary. In contrast, universal subsidies risk distorting the energy market, eroding competitiveness, and creating long-term economic inefficiencies. The Bulgarian subsidy scheme, initially introduced as an emergency measure, has evolved into a broad, untargeted financial transfer that lacks a clear economic or legal justification under EU rules.

The key takeaway from the EU's evolving energy policy is that any continued support must be limited, temporary, and targeted to sectors where energy costs directly impact competitiveness. The Draghi report and the new EU market design rules emphasize that state support should be reserved for industries with high energy intensity, i.e. their energy consumption accounts for a significant portion of the value added; sectors exposed to international competition where higher energy costs could lead to relocation or a loss of market position; and businesses committed to energy efficiency and sustainability, ensuring that subsidies do not disincentivize investment in cost reduction measures.

The legal and financial risks of continuing untargeted compensation should not be ignored. Given that the European Commission has not formally approved Bulgaria's current price support scheme, the government faces increased risk of legal challenges, including State aid complaints from businesses in other EU countries, which could lead to an investigation by the European Commission; potential infringement procedure against Bulgaria for violating EU competition and energy market rules; judicial review before the Court of Justice of the European Union, where companies or Member States could seek an annulment of the scheme. If the scheme is found to be unlawful, Bulgaria could be required to repay previously granted subsidies, leading to significant financial and reputational consequences.

The argument that Bulgaria needs to maintain universal energy subsidies to retain businesses is not supported by evidence. Bulgaria can remain a highly attractive business destination even without universal energy support due to its low corporate tax rate, low labor costs, strategic location, full Schengen Area membership, and stable macroeconomic framework. These factors offer a far stronger incentive for investment and economic stability than short-term energy subsidies, which could otherwise create distortions and fiscal burdens.

In the long run, subsidies cannot be the foundation of a competitive industry. On the contrary, as evident from the case of Volkswagen in 2024, they lead to loss of profit and labour force cuts. Instead, Bulgaria should adopt a smarter approach aligned with best practices in the EU. This can involve sector-specific support that is targeted to industries where energy costs are actual competitiveness factor; time-limited and gradually phased-

out measures, so that businesses adapt rather than become reliant on state support; incentives for energy efficiency, encouraging companies to invest in renewables, flexible demand, and cost-reducing technologies rather than depend on subsidies; market-based mechanisms, such as contracts for difference, power purchase agreements, and energy storage incentives, which offer long-term price stability without distorting competition.

By moving away from distortionary compensation schemes and towards targeted, forward-looking policies, Bulgaria can strengthen its economic position without exposing itself to financial, legal, and structural risks. The transition should focus on enhancing market resilience, maintaining fiscal discipline, and ensuring compliance with EU law–ultimately securing a more competitive and sustainable energy future.

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THE ROLE OF SOLAR ENERGY IN THE UPDATED EU APPROACH TOWARDS COMPETITIVENESS

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SUMMARY AND SCOPE

Following the recent geopolitical and economic changes throughout the world, the European Commission has developed and announced new strategies and policies aimed at increasing competitiveness. Thus, based on Mario Draghi's report on EU competitiveness[1] and Enrico Letta's report on the future of the Single Market[2], key recent EU initiatives were presented – these include The Competitiveness Compass (January 2025)[3] and the Clean Industrial Deal (February 2025)[4]. These strategic documents contain all the fundamental concepts and general directions of how to proceed in today's complicated geopolitics and challenging market conditions. In fact, in general terms, these documents represent appropriate opportunity to create the basis for a new political, regulatory, technological and market environment. The outlined steps will certainly relieve European businesses of excessive administrative burden and bureaucracy and will promote their competitive advantages, with a focus on sustainable development. In concrete, they also refer to the changing energy related environment, within which the solar energy plays more and more important role.

As already mentioned, the EU new concepts for economic development reflect to huge extent the overall economic and geopolitical trends. This, inter alia, includes also today's understanding of sustainable development, from the perspective of business and society along the accepted UN Sustainable Development Goals[5] in Bulgaria[6] (affordable and clean energy, industry, innovation and infrastructure, sustainable cities and communities, etc.). Further, it also includes and is complemented by various provisions of the European Green Deal in these aspects, which have been established as strategic.[7]

On the other hand, sustainability, green innovations, and business competitiveness are not opposing concepts but complementary and synergistic forces that contribute to the overall enrichment of companies. Since high energy costs can undermine profitability, models of energy self-sufficiency are becoming increasingly desirable.

[1] https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en
[2] https://single-market-economy.ec.europa.eu/news/enrico-lettas-report-future-single-market-2024-04-10_en
[3] https://ec.europa.eu/commission/presscorner/detail/en/ip_25_339
[4] https://ec.europa.eu/commission/presscorner/detail/en/ip_25_339
[5] On these goals see in concrete https://dashboards.sdgindex.org/profiles/bulgaria
[6] On these goals see in concrete https://www.mfa.bg/upload/56951/26290VNR_2020_Bulgaria_Report.pdf page 2
[7] See https://documents.un.org/doc/undoc/gen/n15/291/89/pdf/n1529189.pdf?OpenElement

The expansion of renewable energies offers numerous economic benefits. It creates jobs and adds value, contributes to economic growth, generates tax revenue, and reduces the costs associated with importing fossil fuels. For example, in Germany by 2030, at least 80% of gross electricity consumption is expected to be covered by renewable energies. To this end, the Renewable Energy Sources Act (EEG) establishes targets for installed capacity by 2030. If these targets are met, they will lead Germany to private investments of more than €260 billion in wind, solar, and biomass by 2030. At the same time, operation and maintenance will generate over €70 billion in economic stimulus. The number of jobs is projected to increase to nearly 500,000, almost doubling since 2023. Limiting the envisaged expansion path would not only jeopardize climate targets but also result in economic losses. On the other hand, if the expansion path is reduced by 25%, private investment will be between €7 billion and €13 billion lower per year, leading to a total shortfall of approximately €65 billion by 2030. In 2030, the economic stimulus from plant operation and maintenance would be €2 billion lower, and there would be 65,000 fewer jobs. [8]

On this ground, the article presents the argument that the implementation and investment in solar energy sources, combined with digitalization and full electrification of as many processes as possible in all sectors of the economy and everyday life, are profitable, while providing positive financial results for companies and green reputation in line with sustainable development. This, in turn, makes them more competitive and innovative.

SUMMARY ON COUPLE OF ASPECTS – PRICES AND RAW MATERIALS

In fact, when analyzing the role of solar energy at EU level, the first two points, which seem to be most debated, are linked to prices and raw materials. Therefore, prior to focusing on the general role of solar incl. inter alia on more details in these two aspects, short summary look would be certainly useful.

Solar in the energy mix and the price dimension

A change in the mindset of Europe and Europeans goes through decarbonization, through self-generation of electricity, which is also part of the main pillars of the Competitiveness Compass and Clean Industrial Deal. Based on the recommendations made by Mario Draghi in his report on the future of European competitiveness, the aim of the compass is to make business easier and faster and ensure Europe's prosperity. The compass guides the EU Commission's work for the 2024-2029 period on the basis of three pillars: closing the innovation gap with the EU's main competitors, linking decarbonization and competitiveness and reducing dependencies and increasing security. EU countries are committed to making the EU climate-neutral by 2050. Decarbonization policies are a strong driver of growth if well integrated with industrial, competition, economic and trade policies. At the same time, to be more competitive, the EU needs to address structural problems behind the high energy prices in Europe and its dependence

[8] See https://green-planet-energy.de/fileadmin/docs/publikationen/Studien/studie-wirtschaftliche-vorteile-erneuerbarer-energien-und-folgen-eines-langsameren-ausbaus.pdf page 1

on fossil fuel imports. Faced with high energy costs and fierce global competition, European industries need urgent support. The Clean Industrial Deal outlines concrete actions to turn decarbonization into a driver of growth for European industries. This includes lowering energy prices, creating quality jobs and the right conditions for companies to thrive. The Deal presents measures to boost every stage of production, with a focus on energy-intensive industries such as steel, metals, and chemicals, that urgently need support to decarbonize, switch to clean energy, and tackle high costs, unfair global competition, and complex regulations and the clean-tech sector which is at the heart of future competitiveness and necessary for industrial transformation, circularity, and decarbonization.

The development and competitiveness of the European business (particularly in Southeastern Europe) depends on the use of freely available clean solar energy to generate its own electricity and reduce consumption from the energy mix. By generating their own electricity through solar panels, businesses can significantly reduce their reliance on grid electricity, leading to lower energy bills. The savings can be particularly pronounced during peak energy usage times when electricity rates are typically higher. Generating power on-site through solar reduces dependence on external grid energy suppliers and improves energy security. This independence buffers businesses against price volatility and supply interruptions common in traditional energy markets. Further, by generating their own electricity, the business consumers decrease their reliance on grid power. This means they would purchase less electricity from the utility, resulting in lower overall energy costs. And solar energy produced on-site is typically cheaper than the cost of purchasing electricity from fossil fuel sources, especially during peak hours.

Another aspect of solar energy is that it becomes a more significant component of the energy mix in another context - it helps decrease the overall percentage of fossil fuels used, contributing to a more sustainable and cleaner energy system.

In fact, solar is the fastest growing energy source in the EU and is cheap, clean and flexible. The cost of solar power decreased by 82% between 2010-2020, making it the most competitive source of electricity in many parts of the EU. In 2024, 46.9% of the electricity generated in the EU came from renewables and 22% of it came from solar energy. [9] The integration of solar energy into various economies over the past decade has demonstrated its positive correlation with economic growth. From 2013 to 2023, the global installed solar PV capacity increased from approximately 100 GW to over 1,200 GW. By 2023, the total installed solar capacity in the EU had surpassed 200 GW, and this figure has been anticipated to increase further in 2024.[10] This rapid growth reflects increasing investments in solar technology and infrastructure.

On the other hand, decentralized electricity generation provides the flexibility needed by industry and citizens to overcome peak and shock price

[9] See https://ec.europa.eu/eurostat/en/web/products-eurostat-news/w/ddn-20250319-1

[10] See https://www.solarpowereurope.org/insights/outlooks/eu-market-outlook-for-solar-power-2024-2028/detail

increases in energy during crises. Businesses that adopt solar energy systems save on electricity costs, with average savings estimated between 20% to 50%, depending on system size, location, and local energy rates.[11]

On this ground, it is evident that the Competitiveness Compass and the Clean Industrial Deal indicate clear trend towards introduction of a new strategic dimension, which needs to be accepted.

On the technologies and the raw materials

Both strategic documents underline that – as to stay competitive - Europe needs to focus inter alia on the ownership of key new technologies. These are linked to quantum computing, artificial intelligence (AI), blockchain, critical chips etc. A separate but basic point of concern is related to the security of supply of critical minerals in the context of ensuring the relevant supply chains involved. Identifying the critical raw materials that are essential for these technological advances, energy transition and digitalization, is a key point for developing competitiveness.

In fact, securing raw materials is one of the main points which needs to be developed. The EU faces significant dependency on raw materials necessary for solar energy technologies, particularly in the context of the growing demand for clean energy. Solar panels require several critical raw materials, including silicon, silver, rare earth elements (like indium and gallium), and various rare metals. These materials are essential for the manufacturing of photovoltaic (PV) cells and other solar technologies. The EU is heavily reliant on imports for these raw materials, as many are sourced from outside Europe. Thus, e.g., countries like China dominate the supply chain for key solar materials, raising concerns about vulnerability to supply disruptions. In 2023, 94% of EU imports of rare earth elements came from China, Malaysia and Russia combined.[12]

The outlined trends could promote a circular economy as a way to minimize waste and increase the efficiency of resource use. In this context, it should be recalled that the circular economy emphasizes the systematic recycling and reuse of materials, significantly reducing the demand for virgin raw materials. By designing products for longevity and recyclability, the need for new resource extraction is minimized. Implementing closed-loop systems in manufacturing means that materials from end-of-life products are returned to the production cycle. This can decrease dependency on raw material imports and enhance overall supply chain resilience. One of the effects is improving the recycling processes of materials used in solar panels, such as silicon and metals - as to reduce reliance on imported raw materials and enhance resource security. Materials such as lithium, cobalt, rare earth elements, and silicon are considered vital for many industries and specially for industries like renewable energy, battery production, and electronics. This makes solar industry to be focused on

[11] Real time statistics from completed PV plants taken from monitoring systems of ZCS Azzurro portal https://www.zcsazzurroportal.com/

[12] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_critical_raw_materials

improving material efficiency in the production of solar panels. Additionally, it leads to iinnovations in manufacturing processes which can reduce the amount of silicon used in solar cells while maintaining high efficiency.

The combination of ownership in advanced technologies such as quantum computing and artificial intelligence (AI) with a robust solar energy sector and principles of a circular economy can position Europe as a leader in sustainable development, innovation, and economic growth. Leveraging AI to optimize solar energy production can also cause more efficient energy management. Besides, AI can enhance predictive analytics for energy demand, improving the integration of solar energy into the grid, managing fluctuations in energy supply, and optimizing storage solutions. Integrating AI with smart grid technology enables real-time monitoring and control of energy systems, enhancing reliability and allowing for the seamless incorporation of renewable energy source. The application of quantum computing in energy systems can lead to breakthroughs in materials science, benefiting solar technology development. Quantum algorithms would also optimize designs for solar cells, leading to more efficient and cost-effective technologies. Therefore, ownership of advanced technologies helps European industries to create sustainable supply chains that prioritize local sourcing and recycling, reducing the carbon footprint associated with production and transportation. E.g., combining solar energy with circular economy principles allows for the efficient recycling and repurposing of materials used in solar panels, batteries, and electronics. And innovations in AI can streamline recycling processes, minimizing waste and recovering valuable materials.

Collectively, these elements contribute to a more resilient economic framework. It is clear that a secure and sustainable raw material chain, supported by innovative technologies and renewable energy, enhances economic security while minimizing environmental impact.

Interconnection

Interconnection is vital to the successful functioning and resilience of a solar energy system. The intermittency of renewable energy sources presents the challenge of always ensuring security of supply. This problem can be addressed by reducing the isolation of energy generation sources. Analysis from 2023 shows that renewable electricity generation from multiple sources across the Union exhibits very limited variability, meaning there is always electricity available if Europe is fully interconnected [13]. Furthermore, extreme weather has practically never hit all of the European continent at once, meaning interconnection is a strong safeguard against weather-related disruptions.

European member states are actively working towards greater interconnection and cooperation in the energy sector, particularly concerning solar energy. The goal is to create a more integrated and resilient energy system across Europe that harnesses renewable energy sources effectively. Theses initiatives focus on enhancing cross-border energy infrastructure,

[13] See https://ember-energy.org/app/uploads/2024/10/European-Electricity-Review-2024.pdf p.37

including electricity transmission lines. Improved grid interconnections facilitate the transport of solar electricity generated in sunny regions to areas with higher demand or less solar capacity. Specific projects aim at connecting solar-rich regions, such as Southern Europe, to Northern and Central Europe. The relevant projects enhance the capability to deliver solar power where it's needed most, reducing reliance on fossil fuels.

However, Interconnection of energy grids between Member States is a shared competence with the European Union and has previously been mainly concerned with the coherent operation of the Energy Union. Interconnection agreements between EU Member States and beyond are often boutique projects negotiated over many years between governments and Transmission System Operators (TSOs) under the supervision of several EU bodies. The EU also provides some limited funding for projects through the Connecting Europe Facility (CEF). Subsequently, the current process places too much emphasis on the narrow self-interests of domestic energy systems, system operators and cost-benefit analyses, rather than on the vital strategic importance of integration. As a result, projects take years and even decades to complete, end up being considerably more expensive than they should be, and rarely turning into a factor in security considerations. The outcome is very few projects, which are more vulnerable to attack or sabotage. Besides, some projects are often irrational and bypass nearby Member States. Most importantly, the process is exceptionally slow, which wastes precious time that Europe cannot afford to lose, both for its geostrategic security and industrial competitiveness.

Therefore, the process of interconnection must involve security considerations related to European and Member States' collective energy security. Ideally the EU should aim for a meshed grid, which will increase its resilience and resistance to external disruptions, especially those originating offshore.

The EU aims at creating a fully integrated internal energy market where electricity can flow freely across borders. This framework allows solar energy produced in one member state to be transmitted to others, enhancing energy security and efficiency. These steps are combined with initiatives like e.g. market coupling and enable countries to synchronize their electricity markets, pushing also for better integration of renewable energy. The effect is optimization of the resource use – in concrete, via balancing excess solar generation in one region with demand in another.

In a nutshell, it is evident that the interconnection of European member states in relation to solar energy is essential for achieving a sustainable and resilient energy future. By enhancing grid connectivity, harmonizing policies, and fostering collaboration on solar projects, the EU will continue positioning itself as a leader in renewable energy integration. These efforts not only improve energy security and efficiency but also contribute to the EU's climate goals, helping to create a cleaner, greener, and more interconnected energy landscape across the continent.

ON THE IMPORTANCE OF SOLAR IN THE EU CONTEXT

The role of solar energy in the updated EU approach towards competitiveness is multifaceted and significant. Here are some key points highlighting its importance:

- **Energy Transition and Sustainability** - Solar energy is pivotal in the EU's transition to a low-carbon economy. The European Green Deal aims at turning Europe into the first climate-neutral continent by 2050[14]; in this context, solar energy plays a crucial role in reducing greenhouse gas emissions and dependence on fossil fuels.

- **Economic Growth and Job Creation -** The solar energy sector is a rapidly growing industry that creates jobs in manufacturing, installation, and maintenance. As of 2021, the solar sector employed over 4 million people worldwide, according to the International Renewable Energy Agency (IRENA) [15]. This number has likely continued to grow into 2024, indicating strong job creation in this sector. At the end of 2023, the EU solar sector hosted 826,000 jobs - marking a 27% growth since 2022[16]. By investing in solar energy, the EU can stimulate economic growth and foster innovation in renewable technologies.

- **Energy Independence** - Russia's invasion of Ukraine led to significant changes in the share of the main partners because of several sanctions directly and indirectly affecting the imports of energy products. The share of energy products like gas, coals and petroleum products on total EU imports observed significant fluctuations due to strong volatility in their prices, peaking in 2022 at 22.8% on total EU imports. This was followed by a notable decline in 2023 to 17.8% and again in 2024 to 15.4%[17]. By increasing the share of solar energy in the EU's energy mix, the member states and EU as a whole can enhance energy security and reduce reliance on energy imports. This is particularly important in the context of geopolitical tensions and fluctuations in fossil fuel prices.

- **Technological Innovation -** Focus on fostering research and development in renewable energy technologies, including solar, leads to advancements that enhance efficiency, storage solutions, and integration with other energy systems, further bolstering competitiveness. Thus, e.g., Perovskite solar cells are a breakthrough innovation[18]. These cells offer a cheaper and more efficient alternative to traditional silicon cells, dramatically increasing the accessibility and efficiency of solar power.

- **Cost Competitiveness:** The cost of solar photovoltaic (PV) technology has declined significantly over the past decade, making it one of the most

[14] See https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[15] See https://www.irena.org/News/pressreleases/2022/Sep/Renewable-Energy-Jobs-Hit-12-7-Million-Globally

[16] See https://www.solarpowereurope.org/insights/outlooks/eu-solar-jobs-report-2024

[17] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_imports_of_energy_products_-_latest_developments#Source_data_for_tables_and_graphs

[18] https://www.sciencedirect.com/topics/materials-science/perovskite-solar-cell

affordable sources of energy. Between 2010 and 2020, the average price of solar panels (solar photovoltaic, or PV modules) decreased by approximately 82%, according to the International Renewable Energy Agency (IRENA) [19]. Also, the global average cost of solar PV systems has decreased dramatically. According to the International Renewable Energy Agency (IRENA), the global weighted-average levelized cost of electricity (LCOE) from solar PV fell by about 89% from 2010 to 2020. In 2010, the average price of solar PV modules was around 1.50 Euro to 2.00 Euro per watt. By 2020, this price had fallen to approximately 0.20 Euro to 0.30 Euro per watt, depending on the type and quality of the panels. This competitiveness supports the EU's goals of achieving affordable energy for all citizens and businesses etc.

In addition to the general reference on the importance of solar as above, there are few additional points, which deserve special attention in more details.

One of these aspects concerns the economic sustainability. The combination of **Energy Transition** and **Sustainability** with solar energy can significantly enhance the competitiveness of European businesses in multiple ways. Solar energy provides a cheaper and more stable alternative to fossil fuels, reducing operational expenses for businesses. By the latest reports from organizations like the International Renewable Energy Agency (IRENA), the International Energy Agency (IEA) [20], between 2022 and 2023, utility-scale solar PV projects showed the most significant decrease (by 12%). For newly commissioned onshore wind projects, the global weighted average LCOE fell by 3% year-on-year; whilst for offshore wind, the cost of electricity of new projects decreased by 7% compared to 2022. Battery storage project costs dropped by 89% between 2010 and 2023.

Power generation from renewable energy technologies is increasingly competitive, despite fossil fuel prices returning closer to the historical cost range. The most dramatic decline has been seen for solar PV generation; the LCOE of solar PV was 56% less than the weighted average fossil fuel-fired alternatives in 2023, having been 414% more expensive in 2010. Also in 2023, the global weighted average LCOE of new onshore wind projects was 67% lower than the weighted average fossil fuel-fired alternative, having been 23% higher than the weighted average fossil fuel-fired equivalent in 2010. The new renewable capacity added since 2000 is estimated to have reduced electricity sector fuel costs in 2023 by at least USD 409 billion, showcasing the benefits renewable power can provide in terms of energy security.

LCOE for solar PV was projected to decrease further, with estimates ranging from 0.15 Euro to 0.25 Euro per kilowatt-hour (kWh) depending on regional conditions and technological advancements. At the same time the cost of natural gas-generated electricity was expected to remain around 0.40 Euro to 0.60 Euro per kWh; in parallel, coal generation could be higher, but only for a while

[19] See https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_Power_Generation_Costs_2020.pdf

[20] See https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Sep/IRENA_Renewable_power_generation_costs_in_2023.pdf

being dependent on market dynamics and regulatory impacts. In comparison, once installed, solar panels have low maintenance costs and provide free energy for decades, offering a hedge against rising energy prices. The operation and maintenance (O&M) costs for solar PV plants typically range from 10 euro to 20 euro per megawatt-hour (MWh) of electricity generated. Annual maintenance costs can average between 1% to 2% of the initial capital costs of the solar installation. The O&M costs for fossil fuel power plants can be significantly higher, generally ranging from 30 euro to 70 euro per MWh, depending on the type of fossil fuel used (coal, natural gas, oil) and the specific technology. Businesses that adopt solar energy can position themselves as sustainability leaders, appealing to environmentally conscious consumers and investors. Therefore, solar energy helps businesses meet Environmental, Social and Governance criteria (ESG), which are increasingly important for attracting investment and securing partnerships.

The adoption and expansion of solar energy can significantly contribute to **Economic growth and job creation** at both regional and national levels. The solar energy sector is creating jobs in various stages of the value chain – the latter includes Manufacturing, Installation, Maintenance and operation, Research and Development, Sales and Distribution and Project development. Producing solar panels, inverters, batteries and other components require significant upfront investment, which stimulates local economies. This includes spending on equipment, labor and infrastructure. Countries and regions with strong solar energy policies attract international investors looking to capitalize on the growing renewable energy market. The solar industry fosters the growth of ancillary industries, such as glass manufacturing, metal framing, and electronics, further boosting economic activity.

Installation, maintenance and operation and R&D could stimulate educational institutions like universities, high schools and colleges for training high expertise student in new technologies. The solar industry creates opportunities for engineers, technicians, and project managers, offering well-paying and stable employment. According to the International Renewable Energy Agency (IRENA), the renewable energy sector, including solar, employed over **12 million people globally in 2022** [21], with solar PV being the largest employer.

In the EU, the solar industry has created hundreds of thousands of jobs, and this number is expected to grow as solar adoption increases [22]. As of 2023, the solar sector in Europe has been a significant source of employment, with estimates indicating that it supports around 300,000 jobs across the continent. The number of jobs in the solar sector is expected to continue growing, driven by increasing investments in renewable energy, supportive government policies, and the overall shift toward sustainable energy sources in response to climate change.

Achieving **energy security – and in particular the security of supply –** solar

[21] See https://www.irena.org/Digital-Report/Renewable-energy-and-jobs-Annual-review-2023
[22] See https://elettricomagazine.it/wp-content/uploads/2023/10/Report-Solar-Job-.pdf

energy involves a combination of technological, economic and policy measures to reduce reliance on external energy sources and create a self-sufficient energy system. It is highly important to make a good assessment of energy needs and potential in order to become more closer to energy independence and to decrease signify usage of coal plans in energy mix. In this context, creating an energy audit is key point for successful implementation of any solar project.

Europe currently imports a significant portion of its energy, particularly natural gas. Reducing dependence on imported fossil fuels can improve energy security. Localized power generation can protect businesses from geopolitical tensions and energy supply disruptions. Solar energy provides a more predictable and stable energy supply, reducing the risk of energy shortages and price spikes. By generating their own energy, businesses can hedge against volatile fossil fuel prices. This stability allows for better financial planning and management.

In 2022, in the midst of post-COVID-19 recovery and increased energy use, the EU was hit by an energy crisis. The Russian invasion of Ukraine further increased the already high natural gas prices and gave rise to uncertainty over gas and oil supply. An exceptionally hot and dry summer in many EU countries did not help alleviate the situation, affecting nuclear and, in particular, hydro power generation. Faced with concerns on the security of energy supply, the EU moved forward with the clear objective of saving energy, diversifying the energy supply, and boosting the clean energy transition.

According to preliminary energy data for 2023, it seems that decisions taken in 2022 contributed to creating a significant positive impact on the EU's energy supply, which saw a remarkable increase in renewable energy and a sharp drop in fossil fuels, in particular natural gas and coal. The fossil fuel drop is largely driven by the decrease in electricity produced from natural gas (-72.9 TWh or -13.5 %), as well as from other bituminous coal (-64.0 TWh or -31.2 %) and lignite (-62.9 TWh or -26.1 %). To replace these fuels, the EU turned to renewables, with wind electricity increasing by 56.5 TWh or 13.4 %, and electricity from solar photovoltaic energy by 38.8 TWh or 18.9 % (for a period 2022-2023). Electricity from solar photovoltaic energy, on the other hand, increased by as much as 126.3 % in the period from 2018 to 2023, and wind electricity by 49.0 %. In the same five-year period, electricity generated from natural gas dropped by 4.6 %, from other bituminous coal by 50.8 % and from lignite by 38.9 %.[23]

Solar energy has become a significant driver of **technological innovation**, fostering competitiveness across various industries. It has spurred advancements in PV materials, such as perovskite solar cells, bifacial panels, and multi-junction cells, which improve efficiency and reduce costs. As solar adoption grows, manufacturing processes have become more efficient, driving down costs and making solar energy more competitive with fossil fuels. The intermittent nature of solar power has led to innovations in battery storage

[23] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_production_and_imports

technologies (e.g., lithium-ion, solid-state batteries), enabling better energy management and grid stability. One of key innovations driven by solar energy is the development of smart grids, which use advanced sensors, IoT, and AI to optimize energy distribution and integrate renewable energy sources seamlessly. Solar power has enabled the rise of microgrids and decentralized energy systems, empowering consumers to generate, store, and manage their own energy, fostering competition in the energy market.

Innovations in materials have led to the development of lightweight, flexible solar panels that can be integrated into buildings, vehicles, and even clothing, opening new markets and applications. The solar industry is driving innovations in recycling technologies to recover valuable materials from decommissioned panels, reducing waste and improving sustainability. AI and machine learning are being used to optimize the performance of solar farms, predict maintenance needs, and reduce downtime. Advanced algorithms help predict solar energy generation based on weather patterns, improving grid reliability and energy trading.

Further, new business models are created. Companies are offering solar energy through leasing or power purchase agreements (PPAs), reducing upfront costs for consumers and increasing accessibility. Blockchain technology enables consumers to trade excess solar energy directly with others, creating a more competitive and decentralized energy market. In additional of that I would like to add integration into electric vehicles (EVs) and charging infrastructure, reducing reliance on fossil fuels and driving innovation in the automotive sector.

The most important factor for competitiveness when adopting solar energy is cost efficiency. The good point in this relation is that there are already numerous examples of how businesses in the solar energy sector have become more competitive through innovation, cost reduction and strategic positioning. These examples demonstrate how businesses in the solar energy sector are leveraging innovation, cost reduction, strategic partnerships, and new business models to gain a competitive edge. By addressing customer needs, improving efficiency, and expanding into new markets, these companies are driving the growth of solar energy while staying ahead of the competition.

The companies have been proactive in adopting sustainable practices, including utilizing solar energy in its manufacturing processes. Most of factories in EU embraced solar power to supplement its energy needs, reducing reliance on fossil fuels. Businesses that install solar panels can significantly lower their electricity expenses. By generating their own power, they reduce their reliance on the grid and, consequently, their electricity bills. Solar energy provides a stable cost structure since sunlight is free, reducing exposure to fluctuating energy prices. By locking in their energy costs through solar power, businesses can forecast expenses more accurately and mitigate the impact of rising utility rates. The impact on competitiveness is that by

generating a portion of its energy needs from solar power, they lower its overall energy costs. This reduction allows for more competitive pricing on its products, helping to maintain or increase market share in the competitive automotive parts market.

Using renewable energy also enhances the brand reputation of the relevant company as an environmentally responsible one by integrating renewable energy.

Thus, in general, these companies reduce costs, strengthen its brand, and position themselves as a industry leaders with environmentally friendly practices. This strategic use of solar energy not only helps meet current market demands but also prepares the companies for future challenges in the evolving automotive landscape. By leveraging solar energy, businesses can experience reduced operational costs, financial incentives, increased property values, and improved sustainability profiles. These cost effects not only lead to immediate financial benefits but also position companies favorably for long-term growth and resilience in an evolving energy landscape.

CONCLUSION

Without any doubt, solar energy plays a pivotal role in the European Union's updated approach to enhancing competitiveness amid contemporary geopolitical and economic challenges. The strategic initiatives outlined in documents such as the Competitiveness Compass and the Clean Industrial Deal underscore the necessity of integrating solar energy into the broader energy landscape. As Europe aims for climate neutrality and sustainable growth, the adoption of solar energy is not only critical for reducing greenhouse gas emissions and reliance on fossil fuels, but it also presents substantial economic opportunities.

The substantial cost reductions in solar technology, along with innovative financing options, make solar energy an increasingly attractive choice for businesses. By investing in solar solutions, companies can achieve lower operational costs, enhance energy independence, and foster economic resilience, ultimately improving their competitive advantage in the marketplace. This transition encourages job creation within the sector and supports ancillary industries, thereby contributing to overall economic growth.

Moreover, the synergy between solar energy, advanced technologies like AI and quantum computing, and circular economy principles creates a robust framework for sustainable development and innovation. This combination not only secures the supply chains for critical raw materials, essential for solar technology, but also promotes a more resilient and interconnected European energy market.

Importantly, as businesses adopt solar energy, they can leverage these investments to improve their market positioning. Companies utilizing solar power not only benefit from reduced energy costs, but they also enhance their brand reputation as environmentally responsible entities committed to sustainability.

This can lead to increased customer loyalty and market share, particularly among consumers who prioritize sustainability in their purchasing decisions.

In light of the ongoing energy turbulences and the imperative to transition to renewable sources, leveraging solar energy emerges as a cornerstone for achieving energy security, fostering technological advancements, and enhancing the competitiveness of European businesses on a global scale.

As EU member states continue to work towards integrating solar energy into their respective energy strategies, the collective efforts will bolster Europe's position as a leader in the sustainable energy transition and ensure a more prosperous, eco-friendly future.

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THE COAL ISSUE IN BULGARIA ALONG THE EU ENERGY AND CLIMATE POLICY

Eng. Ilza Chinkova
former Executive Director of Mini Maritsa Iztok EAD

Introduction and scope

Over the past decades, the EU has adopted a range of legislative and policy measures aimed at achieving ambitious decarbonization and sustainable development goals. In parallel, through a combination of regulatory measures, financial incentives, and social support, the EU strives to ensure a fair and sustainable transition to a green economy that minimizes negative impacts on affected regions and communities. These efforts not only help achieving climate goals but also create new opportunities for innovation, sustainable development, and improving citizens' quality of life.

The European Union aims at reducing its net greenhouse gas emissions by 55% by 2030 compared to 1990 levels and achieving climate neutrality by 2050.

In this context, the role of coal has been not only actively debated, but the views in this aspect – particularly in the EU member states, which are strongly dependent on this source of energy – seem to be quite controversial. This e.g. is very relevant for countries like Bulgaria, Poland etc. However, the problem has not only European, but also global dimensions - the energy policy transforming coal mining activities contribute to fulfilling the goals of the Paris Agreement. Thus, a special set of conceptual documents and legislation have been adopted to ensure the achievement of the pronounced 2030 targets along with the long-term general and specific goals of the EU, in line with the Paris Agreement. These reflect the EU various policies and initiatives along the European Green Deal[1] and include inter alia Action Plan for the Circular Economy, Biodiversity Strategy etc**.** representing a comprehensive set of activities for transforming the EU economy. Coal mining is one of the sectors most affected by these changes and requires significant efforts for adaptation and transition to new economic models. In this relation, the EU frame includes also a specific Just Transition Mechanism[2].

The European policy regarding coal mining is linked to gradually phasing it out and transitioning to cleaner and more sustainable energy sources – however, this turns to be a challenging process. In fact, these challenges are in the focus of the current analysis – on the one side in general terms and on the other – concretely in the case of Bulgaria.

[1] See for details https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[2] Details on the Just Transition Mechanism are available at https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

ON THE EUROPEAN AND BULGARIAN CLIMATE POLICY FRAMEWORK

The transition to green energy requires coordinated efforts at both national and European levels to ensure a smooth and fair process, defined as energy transformation. National climate policy needs consistency and coherence to harmonize goals and interests with those of the EU and contribute to the overall efforts to mitigate the effects of climate change. Thus, the implementation of a decisive and comprehensive framework policy on climate change is not only a formal national obligation, but will also enable Bulgaria to contribute for achieving the goals of European climate policy.

Bulgaria has its contribution to achieving common goals, although the European Commission's assessment of country's Integrated National Plan on Energy and Climate 2021-2030 (INPEC) indicates that individual goals are not ambitious enough[3]. The current national legislative framework regarding climate change has been assessed as incomplete. The EU law, envisaging the development of these plans and their regular review by the European Commission (EC), states that every national plan should include policies for reducing emissions and gradually achieving climate neutrality across the entire economy, as well as policies for adaptation and managing risks from ongoing climate change[4].

Thus, it is clear that the success of national climate policy depends on implementing national legislation, which should be synchronized with the European climate framework and the relevant acquis – and at the moment in Bulgaria this evidently looks problematic, which in Bulgaria is incomplete, lacks specific information, and has no stages for achieving climate neutrality.

In fact, the EC states that Bulgaria needs an improved regulatory and institutional framework in the field of climate change. Currently, separate documents have been created, but there is no complete legislative package, such as a new framework climate law or even an amendment to the existing Law on Limiting Climate Change (ZLIK)[5].

National Energy and Climate Plans (NECPs) and Long-Term Strategies (LTSs) for decarbonization are strategic documents that European Union member states prepare with the aim of achieving ambitious goals for reducing greenhouse gas emissions and transitioning to a low-carbon economy. These plans typically include specific targets for emission reductions by certain dates, such as 2030, 2040 and achieving climate neutrality by 2050.

Bulgaria has not specified concrete targets for reducing greenhouse gas emissions by a certain date in its current ZOI Act. There is no specific information, levels, threshold values for emissions, or carbon budgets by sectors. For example, the goals that should be included in the regulatory and institutional framework in the area of climate change are:

[3] https://www.climateka.bg/definirane-tseli-energuya-klimat-2030-vklyuchvame-mestni-vlasti/
[4] For the INPEC see Article 3 etc. Regulation 2018/1999 as well as more requirements at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022R2299 etc.
[5] https://lex.bg/laws/ldoc/2136124027 (in Bulgarian)

By 2030:

1. Reduce greenhouse gas emissions by at least 55% compared to 1990 levels, in line with the goals of the European Green Deal;

2. Increase the share of renewable energy sources to at least 32% of total energy consumption;

3. Increase the share of renewable energy sources to at least 32% of total energy consumption.

By 2040

1. Continue reducing emissions: Further reduce greenhouse gas emissions to reach intermediate stages towards climate neutrality;

2. Develop new technologies: Invest in innovations and new technologies for energy production and storage;

3. Decarbonize industry: Transition to cleaner production processes and use hydrogen and other low-carbon fuels.

Climate neutrality by 2050

1. Net zero emissions: Achieve a balance between greenhouse gas emissions and their absorption through natural and technological means:

2. Full decarbonization of the energy sector: Replace coal and other fossil fuels with renewable and low-carbon energy sources;

3. Integrated policies: Coordinated efforts across various sectors such as transport, agriculture, construction, and industry to achieve long-term goals

These goals may vary depending on updates to national plans and international commitments, but the main direction for transitioning to a sustainable and low-carbon future will always remain.

ZLIK must harmonize and incorporate the new processes and obligations arising for Bulgaria from the adoption of the Fit for 55 Package, such as more ambitious emission reduction targets for countries in the update of the Effort Sharing Regulation (EU 2018/842), or new mechanisms of the European Emissions Trading System. In fact, this law is more focused on limiting the causes of climate change rather than reducing risks and damages resulting from it. A framework national climate law should encompass and harmonize horizontal climate policy regarding necessary short-term and medium-term adaptation actions.

In summary, when it comes to laws, Bulgaria needs a modern and ambitious framework climate law – either entirely new or significantly revised ZLIK. It should set the framework for horizontal climate policy in terms of reducing greenhouse gas emissions and achieving climate neutrality by 2050, as well as for national policy. Significant improvement is needed in the institutional

framework in terms of accountability, monitoring, and control mechanisms.

At strategic level, there is no updated energy strategy yet – besides, a procedure for adopting a Long-Term Strategy in line with the EU's goal of carbon neutrality is also missing. In parallel, however, the Bulgarian Parliament has adopted several decisions, concerning the continuous usage of coal, which are still in force.

A significant problem hindering the successful achievement of national decarbonization goals is the delay in the implementation of the National Recovery and Sustainability Plan (NRSP), which seriously jeopardizes the provision and absorption of the second and remaining tranches. The NRSP represents an important step towards the modernization and sustainable development of Bulgaria and is the strategic document aimed at supporting economic recovery and sustainable development in the country following the COVID-19 pandemic.

With the first payment under Bulgaria's NRSP, the European Commission provided €1.37 billion. This amount was approved and transferred in July 2022. These funds are intended to finance various projects and reforms aimed at improving infrastructure, healthcare, education, energy efficiency, and other key sectors that will support the sustainable development of the country.

The size of the second payment under Bulgaria's NRSP is also €1.37 billion. This payment is part of the total sum of €6.3 billion that Bulgaria expects to receive from the European Union's Recovery and Resilience Mechanism. The second payment under the NRSP is seriously threatened because Bulgaria has not fulfilled its commitments for a package of laws that need to be adopted and insufficient time for the implementation of the planned projects (by the end of 2026).

An important part of the package of documents that has not yet been approved by the EC due to non-compliance with the requirements for specific dates for achieving the country's climate neutrality goals, including intermediate ones, is the Climate Neutrality Roadmap.

The Climate Neutrality Roadmap has not yet been updated and aligned with the EC's requirements, with one of the main reasons being the lack of understanding and resistance among the population, particularly in the Maritsa East region, as well as the lack of consensus among political parties and the government, leading to delays and even blocking the adoption of necessary legal and regulatory measures.

The resistance of people from the Stara Zagora region, who have traditionally been directly or indirectly involved in working at the Maritsa East complex, is due to low awareness and skepticism among the population regarding the necessity and benefits of climate neutrality. The lack of active communication and dialogue with society has led to serious distrust and resistance. This escalated into heightened tensions, culminating in effective protest actions by miners and energy workers in 2023. Under pressure from prolonged protests, no specific dates or commitments were included in

the Climate Neutrality Roadmap submitted to the EC for achieving climate neutrality for Bulgaria. This blocked the provision of the second tranche under the NRSP.

Despite the difficulties and serious challenges, the NRSP represents an important step towards the modernization and sustainable development of Bulgaria, and expectations are that political forces and the government will make maximum efforts to secure the remaining tranches under the NRSP.

BULGARIA - BETWEEN CLIMATE POLICY GOALS AND COAL MINING

Coal mining is one of the sectors most affected by the European climate policy. Coal is a major source of carbon emissions, and thus its use for energy production is in direct conflict with decarbonization goals. As a result, the EU is taking measures to gradually phase out coal mining and transition to cleaner energy sources. This generally established frame at EU level inevitably affects the national energy policies of the relevant member states, for which coal contributes substantially to their energy mix – and this is the case in Bulgaria with the role of coal for electricity production, where coal still plays very important role for the security of electricity supply with close to 40% in 2022[6]. Further to the economic aspects, the coal usage in the country is intensively linked with substantial social dimension via the employment it provides etc. In fact, the coal mined in the country, mainly lignite found in the largest Bulgarian deposit in the "Eastern Maritsa Basin," is the only local source guaranteeing the independence of the national energy system. Thus, it would be fair to state that coal mining in Bulgaria is an important sector - but it is also a significant source of carbon emissions.

Nonetheless, one of the primary goals of Bulgaria's energy policy – at least at declarative level - is the energy transformation by 2050. In theory, a crucial element in this context is the transformation of coal mining activities, which will be implemented over time to ensure a successful transition from domestic energy resources – lignite coal – to building a low-emission energy system in a fair, smooth, and solidarity-based manner.

Aside the political statements and decisions, the mere fact is that transitioning to a green economy and reducing dependence on coal poses serious challenges for the Maritsa East complex – and this has not only regional but rather national dimensions. Therefore, only through an integrated approach and a long-term vision can we achieve a balance between economic development and environmental protection. As mentioned, reducing coal mining activities will lead to earlier closure of mines in the country's largest coal mining company – "Mini Maritsa Iztok" EAD. This, on its turn, will lead to a significant socio-economic impact and could lead to job losses and economic difficulties in regions where they are the main employer. In formal terms, locally this effect will be for substantial part of the territory of the country, inhabited by more than 1 million people (out of app. 6.5 million overall). In parallel, continuing coal mining in a way that does not

[6] See concrete details for Bulgaria and other EU countries at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Coal_production_and_consumption_statistics

support broader European climate goals and contradicts EU policy will lead to a significant increase in the risk of sanctions, financial losses and loss of business opportunities and competitiveness.

Therefore, overcoming these challenges requires Bulgaria to develop strategies for a just transition, which should include:

- Economic Diversification: Development of alternative industries and sectors that can create new jobs and stimulate the local economy;

- Investments in Green Technologies: Support for renewable energy projects, energy efficiency, and other sustainable technologies that can replace coal;

- Training and Reskilling: Programs for training and reskilling workers from the coal mining sector so they can adapt to the new labor market conditions;

- Social Protection: Measures to support affected communities and families, F including social assistance and integration programs.

For years there have been already some steps in all these directions, but the problem is still along the lack of clear and unified vision at national level – thus, a long term strategic view should be combined with adequate legislative and organizational steps. And all these are currently missing. In fact, successfully addressing these challenges requires coordinated efforts of a set of players - the Parliament, the government, businesses, local communities, academics as well as international support and funding. Financial assistance to affected regions through the Just Transition Fund will help mitigate negative effects by investing in new technologies and infrastructure, creating new jobs, and providing training. However, the role of the national level decisions and steps is crucial.

DEVELOPMENT OF RENEWABLE ENERGY AND COAL POWER PRODUCTION

The official statistics shows stable trends towards increase of electricity production on the basis of RES (incl. hydro-) and rather unstable trend towards the role of coal. This is visible both in Bulgaria and in Europe. Therefore, there is vivid necessity for adequate national political decisions. To the extent these need to be also justified at European level, the facts should be effectively used not only to justify the relevant policy and economic steps, but also in the context of the policy decision making process.

In 2022, renewable energy accounted for 23% of energy consumption in the European Union. In 2023, lawmakers increased the Union's target for the share of renewable energy sources in gross energy consumption from 32% to 42.5% by 2030, with an aspiration to reach a 45% share. These changes are part of the European Union's efforts to reduce dependence on fossil fuels and address climate change.

In the recent years, Bulgaria has seen a significant expansion in the construction of photovoltaic power plants (PVPPs). According to operational data for the country's energy balance prepared by the Electricity System Operator (ESO) from January 1, 2025, to March 2, 2025, compared to the same period in the previous year, baseload power plants increased their share of electricity generation by 13.16%, while renewable energy sources (RES) production in the transmission network grew by 16.94% and by 16.54% in the distribution network[7]. The share of baseload power plants in the country's energy balance for the same period increased by 25.04%. Electricity production has risen, with consumption also increasing. High participation remains for baseload power plants but not for hydroelectric power plants (HPPs).

Electricity production for the period from January 1 to March 2, 2025, amounted to 8,627,694 MWh, which is an increase of 22.16% compared to the same period last year. For comparison, during the same period last year, electricity production was 7,062,829 MWh.

Electricity consumption for the specified comparative period this year reached 8,277,168 MWh. Compared to a year earlier, this represents an increase of 11.40%. At that time, electricity consumption was around 7,429,847 MWh.

The participation of baseload power plants in the country's energy balance from January 1 to March 2 this year reached 7,254,540 MWh, representing an increase of 25.04% compared to the same period in 2024. For comparison, the share of baseload power plants last year was 5,801,566 MWh.

The participation of RES in the transmission network from January 1 to March 2 this year was 489,506 MWh. This is an increase of 16.94% compared to a year earlier. During the same period last year, the share of RES in the transmission network was 418,605 MWh. Positive data during the specified period of 2025 is due to the participation of photovoltaic power plants (+44.89%), despite the reduction in wind power (-18.71%) and biomass (-17.66%).

The share of RES in the distribution network for the comparative period of 2025 reached 481,385 MWh, which is an increase of 16.54% compared to the same days last year. For comparison, the participation of RES in the distribution network a year earlier was 413,051 MWh. Positive results during the specified days of this year are due to the high share of photovoltaic power plants (+47.13%) and biomass (+14.35%) against the backdrop of a decline in wind power (-21.55%).

7 Updated information is available e.g. at https://www.eso.bg/doc/?39 etc.

Table 1[8]

Participation of hydroelectric power plants (HPPs) for the specified time this year decreased to 402,263 MWh or minus 6.36%. For comparison, during the same period in 2024, HPPs participated in the country's energy balance at a volume of 429,607 MWh. **Electricity Production by Type of Power Plant in 2024**		
Nuclear Power Plants (NPP)	15 780 180 KWh	41,28%
Lignite-fired Thermal Power Plants (TPP)	10 054 820 KWh	26,30%
Gas-fired TPP	2 153 441 KWh	5,63%
Coal-fired TPP (black and brown coal)	527 497 KWh	1,38%
Pumped Storage Hydroelectric Power Plants (PSHPP)	120 949 KWh	0,32%
Hydroelectric Power Plants (HPP)	2 778 516 KWh	7,27%
Renewable Energy Sources (RES)	6 812 111 KWh	17,82%
Wind Power Plants	1 377 086 KWh	3,6% of RES
Photovoltaic Power Plants (PVPP)	5 220 293 KWh	13,66% of RES
Biomass	214 732 KWh	0,56% of RES

Source: ESO

During the winter months, slightly over 19% of the energy was produced by renewable energy sources (RES) in Bulgaria, with photovoltaics playing the largest role. Despite the snow and cold weather, solar power plants produced 12% more electricity than in January and nearly 40% more electricity than last February, mainly due to the increased installed photovoltaic capacity. Even if investments continue in the coming years, the lack of sufficient sunlight during this season will make it difficult for their share to exceed 25-30%. In the winter period, wind power plants also play a crucial role, with their peak production occurring then; however, these investments in Bulgaria are still insignificant.

8 the electricity production in 2024 is presented, which illustrates the significant increase in the share of renewable energy sources (RES) in Bulgaria's energy balance

Table 2[9]

Share of Total Electricity Production		
Month	**RES**	**COAL**
I 24	26%	33%
II 24	19%	26%
III 24	21%	22%
IV 24	31%	17%
V 24	42%	18%
VI 24	42%	17%
VII 24	29%	28%
VIII 24	27%	23%
IX 24	24%	23%
X 24	25%	25%
XI 24	19%	40%
XII 24	13%	37%
I 25	16%	39%
II 25	18%	40%

Source: ENTSO-E

On these grounds, it could be noted that during the specified period, there was a significant increase in energy production from baseload power plants. However, the electricity generated from photovoltaic power plants (PVPP) has increased compared to the same period last year, due to the substantial increase in newly connected solar capacities. The total installed capacity of PVPPs in the country has reached 4.7 GW, which corresponds to the actual consumption of the country for most of the year. This puts the production of electricity from coal-fired power plants under great economic and financial risk, which is essential for baseload electricity – and the Bulgarian politicians should adequately reflect this fact both in their steps at national level and in parallel – when presenting the Bulgarian position in the EU

ON SOME KEY NEXT STEPS – FACTS AND CHALLENGES

Over the past years, the state policies and specific commitments made by various governments, negotiating overly ambitious goals and unfounded commitments that neither society in the affected regions is ready to undertake nor the energy system can bear, have led to clear resistance in Bulgarian society and problems in the energy system. All this has resulted in delays in creating an adequate and timely regulatory framework, compromising the transformation and putting the entire process of successful decarbonization in Bulgaria at great risk.

Moreover, Bulgaria's state policy has allowed two very significant oversights:

- No capacity agreement was reached for the availability of coal-fired power plants, which would ensure the operation of the Maritsa East complex,

[9] Monthly Change in the Share of Hydroelectric Power Plants (HPPs) and Coal in Total Electricity Production for Bulgaria from January 1, 2024, to March 1, 2025

guaranteeing the reliability of the energy system and the fairness of the transition;

- An unnecessary national goal was agreed upon to reduce greenhouse gas emissions by 40% compared to 2019 levels.

Negotiating an overly ambitious goal to reduce greenhouse gas emissions by 40% compared to 2019 levels is unfeasible and unjustified. In fact, the Bulgarian state has met the EU's intermediate target of reducing emissions by at least 55% by 2030 compared to 1990 levels, but there is no readiness for sustainable emission reductions of 40% compared to 2019 levels. For comparison, Bulgaria achieved a reduction in its greenhouse gas emissions of more than 50% compared to 1990 levels even before 2019, which is the goal set by the European Commission for 2030. In 2030, Bulgaria will further reduce its greenhouse gas emissions, but it will be difficult to achieve a 40% reduction in harmful emissions compared to their 2019 levels.

In parallel, the process of transforming coal-fired power generation is significantly delayed, without a clear and well-received vision by the general public and the affected regions. The lack of a clear program with concrete actions and reforms that would lead to achieving the intermediate goal of reducing carbon emissions by 2030 leads to spontaneity and unpredictability in the operation of coal-fired thermal power plants (TPPs), determined solely by market behaviour.

As illustrated above, the stability of the electricity system and electricity production in the country are strongly dependent on the necessary baseload energy, a significant part of which is produced by coal-fired TPPs. In fact, for the past three years, a clear trend has emerged wherein Bulgaria's energy system cannot function without electricity produced by lignite-fired power plants during the winter period. Additional factors that exacerbate this dependency include insufficient energy storage batteries and operating pumped storage hydroelectric power plants (PSHPP), limited water resources, low levels of installed wind power plant (WP) capacities, and a small share of gas-fired TPPs. This predetermines the need for functioning coal-fired power plants, while market conditions make the process impossible and lead to significant deterioration of the financial and economic situation and serious losses for companies along the electricity production chain from TPPs.

.... and the transformation of coal mining in the Maritsa- Eeast Complex

Aside the general observations, pointed above, there is particular need to pay due attention to the transformation of coal mining activities in the "Maritsa East" complex. In fact, it is linked to a key aspect of Bulgaria's energy policy aimed at decarbonization and sustainable development, which – as already noted – has also very substantial socio-economic dimension.

Therefore, the success of the transformation, including the transformation of coal mining leading to carbon neutrality, depends on the correct assessment of some major facts as presented below, as well as on reasonable measures and actions that Bulgaria will implement and execute to achieve these two main goals.

The lignite deposit has been developed competently using modern, contemporary mining and transportation technology that takes into account the complex mining-geological conditions. The three large thermal power plants (TPP) from the 'Maritsa Iztok' complex are equipped with modern facilities and technologies for efficient and safe burning of lignite coal, meeting European environmental requirements for air purity. European environmental requirements for coal-fired power plants to protect air quality, which are met by all three power plants operating at the Maritsa Iztok complex, are implemented through directives and regulations that set standards for emissions of pollutants in the air and measures for their reduction. Some of the main aspects of these requirements are outlined in the Industrial Emissions Directive (Directive 2010/75/EU), the National Emission Ceilings Directive (Directive 2016/2284/EU), and the Monitoring and Reporting Regulation (Regulation 2015/757/EU).

The Industrial Emissions Directive (Directive 2010/75/EU) regulates emissions of pollutants from large combustion plants, including coal-fired power plants. It sets limit values for emissions of sulfur dioxide (SO_2), nitrogen oxides, particulate matter, and mercury. The main requirements include:

- Limiting sulfur dioxide emissions through the use of technologies such as flue gas desulfurization;

- Reducing nitrogen oxide emissions through the use of low-NOx burners, selective catalytic reduction (SCR), or selective non-catalytic reduction (SNCR);

- Reducing particulate matter through the use of dust filters and electrostatic precipitators;

- Implementing methods for capturing mercury, such as activated carbon or other adsorbents.

The National Emission Ceilings Directive (Directive 2016/2284/EU) sets national ceilings for emissions of several pollutants, including SO_2, nitrogen oxides, volatile organic compounds (VOCs), ammonia (NH_3), and fine particulate matter ($PM_{2.5}$). The aim is to reduce acid rain, eutrophication, and pollution with fine particulate matter.

The Monitoring and Reporting Regulation (Regulation 2015/757/EU) requires operators of large combustion plants to monitor and report their emissions of greenhouse gases and pollutants. This includes mandatory measurement and reporting of emissions of CO_2, SO_2, NOx, and particulate matter.

The only polluter in the region is Brikel AD, which does not meet some of the European environmental requirements for coal-fired power plants to protect air quality, as its facilities are amortized and its technologies are outdated.

The key problem is that the lignite coal mined by 'Mini Maritsa Iztok' EAD, despite its major role for the energy security of the country, has been left to the serious dynamics of the energy market without a clear strategy and concept. And – needless to say - energy policy and coal transformation without

a clear goal and direction put the coal mining company at great risk and in a state of inability to continue working, providing the necessary coal to the TPPs from the 'Maritsa Iztok' complex. Therefore, it is not surprising that significant difficulties in operations and a considerable worsening of the financial-economic condition of MMI were particularly evident after April 2024 – mostly due to overproduction of electricity from renewable energy sources (RES). Without the unprecedented financial amount of BGN 200 million provided in 2024 as a loan from the Bulgarian Energy Holding (BEH), the company would have been unable to meet its obligations to the state, suppliers, and personnel. The secured additional financial resources ensured the operation of the mines and guaranteed the much-needed base energy during hours when hydroelectric power plants (HPPs) reduced or ceased operations. In 2025, without additional financial resources of BGN 200-250 million and without reforms, the company will again be unable to pay its debts to personnel and suppliers.

Restructuring and reforms within the company are necessary because mining technology, equipment, and personnel for the development of coal extraction at Mini Maritsa Iztok EAD are planned for an annual production of 30-35 million tons of coal over the coming years until the complete depletion of the coal deposit, similar to the record production achieved in 2022. Due to the development of renewable energy sources (RES) and the increase in installed capacities of HPPs and wind farms, and the uncompetitive price of coal-fired power plants, coal production at Mini Maritsa Iztok will decrease in the coming years, ranging between 12-15 million tons annually depending on weather conditions throughout the year.

Further, the winter months of 2024 and 2025 were a major challenge for the country's electricity system, as the maintained operability of the coal-fired power plants provided the much-needed base energy. In certain days, the produced coal-based energy exceeded 47% of the country's total electricity production. Thus, it became necessary to restart two of the four blocks shut down since February 2024 at the American power plant TPP 'ContourGlobal Maritsa Iztok 3'. The restarting of the shut-down blocks was possible due to two main reasons: no real actions were taken to decommission the blocks, and the high price of electricity.

As already mentioned, the role of RES at national level is increasing – and this very much influences the work of the Complex. Factually, in the winter months, from March to November each year, during the daylight hours effective for solar power plants, there will be no need for coal-based electricity. In 2024 alone, photovoltaic (PV) power plants with a total capacity of 938 MW were commissioned. For comparison, in 2023, over 1200 megawatts of photovoltaics were added, and installed photovoltaics in Bulgaria already exceed 4 700 MW. The electricity produced by photovoltaics in the summer period will be sufficient to meet national needs, but in the dark nighttime hours of the summer period and in the winter season, the country's electricity consumption will have to be ensured by coal-based electricity. Such a work regime and organization of the work process will be impossible both for the TPPs and the Mines supplying the raw material – lignite coal. A major difficulty for 'Mini Maritsa Iztok' will

be maintaining the necessary equipment and personnel to ensure maximum extraction for the most loaded TPP blocks in the winter season while also having this personnel and equipment incur costs for repairs and salaries in the summer season without generating any revenue.

Overcoming seasonality in coal mining can be compensated by carrying out repair and maintenance activities on machinery, equipment, and facilities, implementing more annual excavation works according to a preliminary project, and fulfilling the obligation for technical reclamation using their own resources. All these activities, which can be performed during the summer period when coal mining will be minimal, will lack the necessary financial resources.

Bulgaria's geographical location, bordering countries that do not have the obligation to purchase carbon emissions, opened up a unique opportunity for a new market and realization of lignite coal from 'Mini Maritsa Iztok' EAD for the Republic of Serbia. In 2022, 'Mini Maritsa Iztok' EAD signed a two-year contract for exporting lignite coal to this country. For the first time in the history of Bulgarian coal mining, lignite coal exports were realized under very favourable conditions. An export agreement of 1,750,000 tons per year was negotiated, sold at a higher price than the counterparts from the 'Maritsa Iztok' complex, without commitments for their transportation, ensuring additional revenues for Mini Maritsa Iztok. There is also interest in purchasing lignite coal from Bulgaria from the Republic of North Macedonia, which should be well communicated to lead to actual sales.

Based on the above, it is clear that the transformation of coal mining activities in the 'Maritsa Iztok' complex is a multifaceted process requiring coordination between various stakeholders and significant investments. However, there is one evident issue - it is important to ensure a balance between energy security, economic sustainability, and social justice during the transition to cleaner energy sources. The transformation process should replace coal mining with new, modern, high-tech, and environmentally friendly enterprises and renewable energy sources (RES), but part of this process should also involve transforming the 'Mini Maritsa Iztok' EAD itself. For example, the company has many repair bases that can be adapted for producing electrolyzers or solar panels, where workers displaced from coal mining can find employment. Internal transformation should have funding opportunities and would be the largest and most secure guarantee for a smooth and fair transition.

The shift towards green energy has a significant impact on coal mining. The lack of a clear strategy and the implementation of systematic and consistent actions balancing the expansion of RES integration and the need for baseload energy can prove catastrophic, both for the energy system's security and the future of one of the country's most dynamically developing regions – and the described situation in the Maritza – East Complex is evident proof about such conclusion.

Electrical production from coal plants in 2025 in Bulgaria

At the beginning of 2025, the electricity production from coal-fired power plants in Bulgaria was cheaper than gas-fired central production. This happened despite the high price of carbon emissions - 80 euros/ton CO2. During the winter period, the Maritsa Iztok-2 TPP operated all eight of its blocks with a total installed capacity of 1610 MW, while AES Galabovo operated one of its two blocks with a capacity of 345 MW.

In February 2025, the energy system faced a serious challenge, resulting in a 24% higher load on the system compared to the previous year. Coal-fired power plants produced significant amounts of electricity and have had the largest share - 40% of the total mix - for quite some time now.

Table 3[10]

Electricity Production in February 2025	
Nuclear Power Plants (NPP):	35,1%
Thermal Power Plants (TPP):	40,76%
Gas-Fired Power Plants:	5,27%
Photovoltaic Power Plants (PVPP):	9,15%
Wind Power Plants:	3,8%
Hydroelectric Power Plants (HPP)	5,73%

Source: ENTSO-E

The Emissions Trading System (ETS) is the primary key instrument for reducing emissions by setting an upper limit on the total quantity of emissions that can be released. Carbon emission quota prices are the largest expense for coal-fired power plants, making them uncompetitive, especially in regions that do not have the obligation to buy emissions. In the case of Bulgaria this is also valid – as to produce the planned quantities of electricity during the new regulatory period (from July 1, 2025, to June 30, 2026), the state-owned TPP 'Maritsa Iztok 2' EAD, to will emit 10,519,491 tons of greenhouse gases. The entire quantity of carbon credits will be purchased at market prices – and as a result, the power plant will have to spend over 1.4 billion BGN (app. 0.72 billion Euros). Using the average carbon emission price determined by the National Regulatory Authority (, the result is that the state-owned TPP incurs 177.98 BGN/MWh in emission costs, while the cost of electricity without these would be 98 BGN/MWh.

In summary, if all three large national coal fired power plants operate optimally throughout the year, the total sum for carbon credits increases to over 3 billion BGN. This is substantial financial burden, exceedingly twice all other production costs. Financially, it makes the price of electricity produced from lignite coal completely uncompetitive compared to other types of produced electricity, including those from RES.

[10] Electricity Production in Bulgaria in February 2025

RESTORATION OF DISTURBED MINING AREAS

The issue is not only very sensitive, but is also linked to a set of questions, which currently have no answer either at state or at company level.

With a decision of the 49th National Assembly (NA) from April 25, 2024, it was decided that "Mini Maritsa Iztok" EAD would be provided with 1 billion leva from the state budget - for a period of 4 years, 250 million annually, for technical reclamation of the lands disturbed by coal mining. The decision states that it comes into force after receiving a positive decision on state aid from the European Commission (EC) or a decision that the increase in capital is not considered state aid according to Article 107(1) of the Treaty on the Functioning of the EU.

The request with the motives for the EC's ruling was sent on May 2, 2024, but no notification has been received so far. Correspondence has been exchanged with the EC, but reaching a positive decision will be difficult because the NA's decision states that the funds will be provided for technical reclamation of the lands disturbed by coal mining. Reclamation is the responsibility of the mines under the Concession Agreement and must be carried out with the financial and technical capacity of the company performing the mining, based on the "polluter pays" principle.

Currently, there are approximately 25,000 decares of free, unreclaimed land in the concession area of the mines. According to market practices and prices, to spend 250 million leva, it is necessary to reclaim 62,000 decares each year. Technically reclaiming 62,000 decares is impossible to achieve in one year due to a lack of both capacity and available unreclaimed land. Throughout its entire 73-year history, "Mini Maritsa-Iztok" EAD has reclaimed a total of 47,000 decares of disturbed land. The sum of 250 million leva per year is too large for the possible annual activities related to technical reclamation.

In public discourse, it is being discussed that "Mini Maritsa-iztok" EAD will have to cease operations earlier than planned, but the date for ending coal mining has not been changed in its Concession Agreement.

However, in case there will be relevant formal steps and a decision that mining activities at "Mini Maritsa-iztok" should end earlier than the term in the current Concession Agreement, then the mines in the complex will enter a period known as the "process of gradual cessation of mining activities". The overall plan for mining activities for the new period will need to be revised, so that working, non-working, and spoil heaps must be brought into a state of "long-term stability". As a result, there will be need for additional spoil capacity, with existing external spoil heaps needing to be raised in height, and possibly also in area. This means that additional areas will be required, and the process of releasing new areas for reclamation will stop during the first years of gradual cessation. In practical terms this means that there will be no additional areas to be reclaimed over the next 2-3 years; and the financial resources allocated for reclamation will not be able to be used for this purpose.

In parallel, additional financial resources are needed for "Mini Maritsa-iztok" EAD for all those additional activities that will arise as a result of the earlier cessation of coal mining and will be clearly stated in the new projects and annual plans. However, forcing the entry into a process of artificially slowing down mining activities, without mining-technological calculations and clear plans for the gradual cessation of coal mining at "Mini Maritsa-iztok" EAD, carries huge risks. These risks are linked to lack of funds and the resulting inability for carrying out basic activities to ensure the safety and stability of the working and non-working mining slopes. In practical terms, the process of gradual cessation and stopping of coal mining activities takes a minimum period of 10-15 years and must be carried out according to a precise, new General Plan, with corresponding annual engineering and business plans.

The facts show clearly that the coal mining company is practically already operating in a mode of forced cessation of mining activities and gradual shutdown. In recent years production has decreased from 34.3 million tons in 2022, to 19 million tons in 2023, to 13.4 million tons in 2024. The expected output for the current 2025 is unlikely to exceed 10-12 million tons of coal unless significant changes occur.

Thus, it is evident that the process of ceasing coal mining, essentially the gradual cessation of mining activities, has begun, but without any plan and without real analysis of the ecological, energy and economic risks that could have a major negative impact on the country. The basic assessment show that = as to carry out their activities over the next 5-10 years - the mines will need around 300 million leva in additional funds, which must be secured. This goes in parallel to the development of adequate principal strategy and clear vision for the development of new industries that will gradually absorb workers and specialists displaced due to the decreasing coal mining and thermal power plants.

In addition to the concrete activities resulting from the earlier closure of the mines, financial resources will also be needed for the ecological and technical restoration, and for strengthening of the terrains affected by mining activities. The latter cannot be categorized as reclamation, as they are procedurally mandatory after such steps, so that the areas released from coal mining can be suitable for the construction and development of new industrial enterprises. Besides, in real terms, technical and biological reclamation, which is the responsibility of the mines, on loosely dumped earth masses, will not be sufficient to make these terrains stable and suitable for other economic activities and enterprises.

A WRAP UP – COAL TRANSFORMATION IN THE NEW GEOPOLITICAL CONDITIONS

Bulgaria's responsibility is to successfully manage the transformation of coal mining activities, taking into account all local specifics, while in parallel follows its European – linked obligations. Additionally, the country needs to also consider the new processes and serious geopolitical turbulences that are happening and are yet to come in the world.

During the years of democratic transition, Bulgaria's its leading role and recognition as an energy leader in the Balkan region changes substantially. Bulgarian energy significantly retreated and irreversibly delayed reforms, turning from an exporter into a net importer of electricity. All neighbouring countries, to which Bulgaria previously exported electricity economically advantageously, have become exporters of necessary electricity. The main reasons are that these are countries that are not members of the EU and the commitments made for carbon neutrality differ from the goals of EU member states.

The most significant reason for lower electricity prices in neighboring countries that are not members of the EU is the absence of the obligation for their coal-fired power plants to purchase carbon emissions. In practice, electricity produced by coal-fired power plants located in Turkey, North Macedonia, or Serbia is about 70-90 euros cheaper (the cost of carbon emissions) than the energy produced by coal-fired power plants in European countries such as Bulgaria, Greece, or Romania. During certain periods of the year over the past two years, a very interesting phenomenon occurred frequently: Bulgaria, through Mini Maritsa Iztok EAD, exported lignite coal to the Republic of Serbia while simultaneously importing cheaper electricity produced by Serbian coal-fired power plants using raw materials–Bulgarian lignite coal.

In recent years, Türkiye, from which Bulgaria often purchases electricity produced largely from coal, is expected to become carbon neutral after 2053, as President Recep Tayyip Erdogan announced at COP-29. Serbia has not declared when it plans to become carbon neutral.

At the same time, the picture within EU is different. France e.g. confirmed its desire to reduce greenhouse gas emissions by 50% by 2030 compared to 1990 and, to achieve this goal, will significantly reduce the share of fossil fuels in its final consumption, according to a report by the Ministry of Ecological Transition, cited by Agence France-Presse. Bulgaria has reduced its greenhouse gas emissions by more than 60% compared to 1990. Germany closed its coal mines and power plants, but keeps some of them in reserve so that, if necessary and in case of a shortage of baseload energy, they can be reactivated, ignoring the risks to the security of its energy system[11]. In 2024, Germany frequently imported electricity from Poland and the Czech Republic, where coal-fired power generation is significant. A similar situation exists in the Netherlands, following Germany's example. Europe emits only 7-8% of greenhouse gases. If it stops emitting these quantities, the global effect would be insignificant. Only the annual increase in CO2 emissions in India and China exceeds these amounts many times over /just for comparison, I will note that in 70 years at Mini Maritsa Iztok EAD, slightly more than 1 billion tons of coal were extracted, while in China, 1 billion tons of coal are extracted in just one year/[12].

The leaders of India and China declare that they will not follow the example of the United Kingdom and close their coal-fired power plants in

[11] According to information from a meeting of the Executive Committee of EUROCOAL
[12] According to information from a meeting of the Executive Committee of EUROCOAL

the foreseeable future. They officially prioritize the security and accessibility of energy supplies over emissions, although both strive for more diverse technologies for electricity production. At the concluding phase of COP-29, Saudi Arabia and the United Arab Emirates refused to confirm their commitment to abandon fossil fuels.

In general, politics in the world are rapidly changing - and so are the politics in Europe. In geopolitical terms, the major change is the shift towards securing resources rather than markets. There is clear and categorical focus on raw materials – and when it comes to energy, in Bulgaria this is lignite coal being the primary local resource.

Traditionally, the application and use of this main resource is solely for electricity production. However, lignite coal contains rare earth elements that have not been studied yet and the effectiveness of their extraction has not been proven. This is a direction that is justified to be explored through geological surveys in the concession area of "Mini Maritsa-iztok" EAD. Thus, if the effectiveness of extracting rare earth elements found in different layers is proven, a suitable technology should be developed and their extraction initiated.

In general, the transformation process must be adapted and aligned with the new, dynamic, and substantial global changes. Indications of what is happening and the shifts from purely market attitudes to resource security lead to the main conclusion - the coal mining in the world will not disappear, nor will it stop in Europe after 2050, but it will be more limited. Therefore, the priorities should be directed towards solving problems with harmful emissions, but not by stopping coal mining, which is the main and only local energy resource in Bulgaria.

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Ms. Chinkova has held various roles in public administration and the finance sector. From 2002 to 2005, she worked at the Ministry of Agriculture and Forestry as Director of the "Financial and Accounting Activities and Property Management" Directorate. Between 1991 and 2002, she worked at the National Bank, where she held several positions, including Automation and Electronics Specialist, Project Coordinator for Automation and Economics. She has also worked for a period at the State Agency for Metrological and Technical Supervision.

NUCLEAR GLOBAL REVIVAL AND BULGARIA'S READINESS FOR EXPANSION

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Introduction: Nuclear Power's Global Resurgence

The world is witnessing a resurgence of interest in nuclear energy, driven by ambitious climate goals, energy security concerns, and the need for reliable baseload electricity. The Net Zero Nuclear[1] (NZN) initiative of the International Atomic Energy Agency (IAEA), World Nuclear Association (WNA) and Emirati Nuclear Energy Corporation (ENEC) and global commitments[2] to triple nuclear capacity by mid-century are reshaping energy strategies worldwide. Nuclear power was formally included in COP28's First Global Stocktake[3], acknowledging its role in decarbonization, while financial institutions have recognized nuclear as an ESG-compliant asset class, making it eligible for green financing.

Currently 417 nuclear reactors are in operation worldwide and 62 are in construction. Every year 5-6 GW new capacity is connected to the electricity grid, however in order to triple nuclear capacity by 2050, higher pace of 31GW yearly is needed. This is achievable having in mind that in 1984 and '85, 33 reactors were connected each year to the grid[4]. This also translates into increased investments from the current level of 65 billion USD yearly to 150 billion to triple nuclear capacity according to IEA[5].

In the region of Southeast Europe, the nuclear revival is also actively considered. Countries such as Romania, Türkiye , Bulgaria, Slovenia, Greece, and Serbia are either expanding existing nuclear programs or initiating new projects, marking a regional shift towards nuclear-based energy security and sustainability.

In this context, e.g., Bulgaria, with its longstanding, 50 years of nuclear expertise and the envisaged expansion at Kozloduy NPP with two new AP1000 reactors, is positioning itself as a key player in the region's nuclear future. However, the country must ensure its nuclear infrastructure readiness to successfully deliver on this ambition.

The Global Context: Nuclear Energy as a Key Pillar of Net Zero and its Inclusion in Climate and Energy Strategies

The rapid political, technological and economic changes worldwide lead to

[1] https://netzeronuclear.org/
[2] https://world-nuclear.org/images/articles/Declaration-to-Triple-Nuclear-Energy-_-COP28-_-28-November-2023-FINAL.pdf
[3] https://unfccc.int/documents/636608
[4] https://pris.iaea.org/pris/
[5] https://www.iea.org/reports/the-path-to-a-new-era-for-nuclear-energy

unprecedented reconsideration of the energy sector – and its nuclear dimension is not an exception. COP28 (2023) in Dubai, UAE, came with historic concluding consensus document Stocktake, where Nuclear was formally, for the first time, recognized as a key part of the clean energy transition on global scale.

Further, at the above-mentioned forum in Dubai, 25 + nations signed ministerial declaration to triple nuclear capacity by 2050, which was supported by the IAEA, OECD-NEA, and WNA, this goal aims to deploy advanced reactors, Gen3+, SMRs, and next-generation technologies. At COP29 in Baku six more countries endorsed the declaration, and the number of signatories reached 31[6].

The global nuclear related considerations require some additional attention to nuclear technologies development; this refers in particular to the small modular reactors (SMR). The topic itself deserves separate analysis – nonetheless, there are few points, which I deserve making in the current context. The IAEA has launched in 2021 the SMR Platform and the Nuclear Harmonisation and Standartisation Initiative (NHSI)[7], along side the SMR Regulators Forum[8] launched in 2015. The Nuclear Energy Agency (NEA-OECD) has established an Experts Group on SMRs, and launched the NEA SMR Dashboard[9] to have stock of readiness level for the different SMRs designs.

Thus, there is concrete progress in relation to the implementation of SMRs and preparation for First-of-a-Kind (FOAK) demonstration of several designs, and commercial deployment beyond 2030. The speedy move of the technologies forward will lead to rapid increase of their role, including in areas beyond electricity, like hydrogen production, industrial heat and district heating and cooling. Respectively the states are actively preparing for this from policy, regulatory and technological perspective.

Green Taxonomies: The EU, Canada, UK, South Korea and other financial markets now classify nuclear as a sustainable investment[10], unlocking funding from sovereign funds, ESG (Environmental, Social and Governance) investors, and green bonds. As of 2024 more then 5 billion USD green bonds were issued for nuclear life time extension projects and refinancing nuclear projects in operation. Few weeks ago, the European Investment Bank (EIB) for the first time after years of abstention to finance nuclear projects, sign loan agreement with French company Orano to expand its uranium enrichment capabilities.

Last but not least, 14 major Banks[11] issued a joint statement supporting nuclear investments. Recently Big Tech companies like Microsoft, Google, Amazon announced investments in nuclear powered Data Centers. Large

[6] https://world-nuclear.org/news-and-media/press-statements/six-more-countries-endorse-the-declaration-to-triple-nuclear-energy-by-2050-at-cop29

[7] https://www.iaea.org/services/key-programmes/smr-platforms-nhsi

[8] https://www.iaea.org/topics/small-modular-reactors/smr-regulators-forum

[9] https://www.oecd-nea.org/jcms/pl_73678/nea-small-modular-reactor-smr-dashboard

[10] https://www.gen-4.org/resources/reports/nuclear-energy-esg-investable-asset-class-2021

[11] https://world-nuclear.org/news-and-media/press-statements/14-major-global-banks-and-financial-institutions-express-support-to-triple-nuclear-energy-by-2050-23-september-2024

energy users, including Big Tech companies made a pledge[12] supporting tripling nuclear capacity goal.

The New Role of Nuclear in the European Context

It would be important to recall that such an approach was also formalized at European level by the European Commission with the Net Zero Industry Act[13], where SMRs are identified as net zero technology and regulatory simplification is foreseen.

In 2023 under the French initiative 12 nations, members of the EU, form EU Nuclear alliance[14]. The European Commission launched in February 2024, European Industrtial Alliance on SMRs[15]. Its primary goal is to accelerate the development, demonstration and deployment of SMR projects in Europe in the early 2030s.

The same year, the first ever Nuclear Energy Summit[16] took place in Brussels, jointly organized by the Belgium EU presidency and the IAEA. Leaders and representatives from 32 countries at the *Nuclear Energy Summit* backed declaration[17] covering areas such as financing, technological innovation, regulatory cooperation and workforce training to enable the expansion of nuclear capacity to tackle climate change and boost energy security.

The declaration further reads „We, the leaders of countries... reaffirm our strong commitment to nuclear energy as a key component of our global strategy to reduce greenhouse gas emissions from both power and industrial sectors, ensure energy security, enhance energy resilience, and promote long-term sustainable development and clean energy transition."

„We are determined to do our utmost to fulfil this commitment through our active and direct engagement, in particular by enhancing cooperation with countries that opt to develop civil nuclear capacities in order to reduce greenhouse gas emissions in a nationally determined manner, including for transitioning away from fossil fuels in energy systems, in a just, orderly and equitable manner, accelerating action in this critical decade, so as to achieve net-zero by mid-21st century in keeping with the science, as outlined in the First Global Stocktake of the 28th United Nations Climate Change Conference."

It's worth underlining the main reasons why EU took these important decisions:

[12] https://world-nuclear.org/images/articles/Large%20Energy%20Users%20Pledge_FINAL.pdf
[13] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en
[14] https://presse.economie.gouv.fr/declaration-of-the-eu-nuclear-alliance-meeting-of-march-4th-2024/
[15] https://single-market-economy.ec.europa.eu/industry/industrial-alliances/european-industrial-alliance-small-modular-reactors_en
[16] https://www.world-nuclear-news.org/Articles/Leaders-back-nuclear-at-summit
[17] https://fdn01.fed.be/84ac0426969186399594892f272c38d/NES_Declaration_on_Nuclear_Energy.pdf

- To accelerate the Net Zero transition mobilizing all available low carbon sources

- To reinforce its energy security policy dimension, taking into account its fossil fuels import dependency and vulnerability.

- To return to its industrial base and rediscover industrial policies and improve its competitiveness at the global market.

Regional Momentum: **Southeast Europe's Nuclear Expansion**

Looking at the region of SEE, one can easily list a set of new and planned nuclear related projects. Here are some examples.

Romania, partnering with Canada and the U.S., works on Cernavoda Unit 3 & 4 CANDU and deploying NuScale SMR, VOYGR-6.

Türkiye is in advanced construction phase of Akkuyu NPP (4 x VVER1200). The first unit is scheduled to become operational late 2025, early 2026 and planned second (Sinop site – APR1400 or VVER1200) and third in the European part (Igneada site – HPR1000) nuclear plants.

Bulgaria is moving on along construction of new units at Kozloduy site; 7 & 8 (AP1000), while also considering SMRs.

Slovenia is expanding Krško NPP with one or two units[18].

Greece and Serbia are exploring the nuclear option, including potential SMR deployments.

The region has well integrated grids with active cross border trade - and this supports options for regional collaboration and initiatives including, inter alia, in the following areas:

- Joint Fuel Supply & Waste Management Initiatives: Establish a regional fuel supply network to optimize procurement & security. Develop shared spent fuel storage or repository solutions.

- Workforce Development & Mobility Programs: Balkan Nuclear Training Alliance for operator and regulator certification. Cross-border workforce sharing to address skilled labor shortages.

- Regulatory and Licensing Harmonization: Align safety standards & licensing processes across Bulgaria, Romania, and Slovenia. ENSREG and WENRA-facilitated cross-country licensing coordination.

- Joint SMR Deployment and Investment Strategies: Explore regional SMR fleet development for smaller grids (Serbia, Greece). Develop joint EU funding applications for nuclear R&D etc..

[18] Krško NPP is jointly owned by Slovenia and Croatia (50-50).

Bulgaria's Nuclear Infrastructure Readiness for Kozloduy 7 & 8 new build

The topic of nuclear in Bulgaria has been on the core of the public and political attention for years. Although the nuclear sector has benefited by overwhelming public support, the next steps in this relation are still to be actively discussed at different levels. In general, however, there is a clear political and administrative will to move towards expanding the nuclear capacities of the country. The steps in the recent years give strong indication for this trend. When it comes to the nuclear development, Bulgaria demonstrates a strong will for changing its energy sector and moving towards capacity expansion and diversification.

Specific information on the current status will be discussed below as to illustrate these moves – in particular, it refers to nuclear infrastructure issues, as fuel supply and waste management, the supply chain and local participation, some financial aspects, the human resources issue as well as some legal aspects and nuclear liability.

New Build project progress and status

Thus, on December 18, 2023, the Bulgarian National Assembly adopted decision[19] to prepare for the execution of new nuclear build at Kozloduy site of two units with AP-1000 technology. It assigned Kozloduy New Build PLC, subsidiary of state-owned Kozloduy NPP PLC, as project company to lead the project development and implementation. The decision also injected 1.5 billion BGN (~830 mln. USD) into the company equity and allocated the future revenues from saling the long lead equipement supplied for Belene NPP project to Khmelnitski NPP in Ukraine (~700 mln. USD). The decision also has an indicative project timeline that provides breakdown of key activities, including: Project structuring, licensing, and financing steps (2023–2025), Engineering and procurement milestones (2025–2028), Construction and commissioning phases (2029–2034)

With the site license for Unit 7 already granted (and renewed on 21 Feb. 2020) and ongoing environmental assessments for Unit 8, the project is progressing toward the deployment of two Westinghouse AP1000 reactors at Kozloduy. In this context, a set of concrete steps has been taken, including e.g.:

- Hyundai Engineering and Construction (Hyundai E&C) was selected on February 2024 as the sole eligible bidder to proceed in the expressions of interest process for constructing the new reactors

- An engineering service contract between Hyundai E&C, Westinghouse and Kozloduy New Build was signed on 04 November 2024 with the duration of 12 months.

- Final Investment Decision (FID) is planned to be achieved by the end of 2025.

Important consideration during the phase of Engineering, Procurement

[19] https://www.parliament.bg/bg/desision/ID/165271 (in Bulgarian)

and Construction (EPC) contract preparation, signing and implementation is to review and address outstanding issues related to nuclear infrastructure and de-risk the project implementation.

When it comes to the practical steps in this relation, Bulgaria also benefits from its membership in the IAEA, using key guidelines concerning the structuring of such projects and ensure the required enabling environment. In this context, the IAEA has developed a guiding document, "Milestones in the development of National Infrastructure for Nuclear Power" (IAEA Nuclear Energy (NE) Series No. NG-G.3.1 (Rev. 2), 2024) and assessment methodology "Evaluation of the Status of National Nuclear Infrastructure Development" (IAEA Nuclear Energy (NE) Series No. NG-T-3.2 (Rev.2), 2022). Some highlights for Bulgaria along these guidelines, which should be further analyzed in the process of decision-making, are specified below.

Bulgaria is founding member of the IAEA from 1957 and in 2024 celebrated, 50 years from the beginning of the operation of its first nuclear power reactor. Currently two units VVER1000 are in operation at Kozloduy site and their life time was extended after modernisation. In 2024 the first batch of Westinghouse fuel was loaded in the core of unit 5, giving practical start of the fuel diversification away from Russian fuel.

Consequential Bulgarian governments have demonstrated a clear commitment towards expanding nuclear energy, as e.g. evidenced by the parliamentary decision in question to proceed with the construction of new nuclear units. However, to further strengthen its commitment, Bulgaria would benefit from developing and adopting a long term Energy Strategy, long overdue legal requirement. Adoption of such document by the Parliament would provide important element of predictability for large, capital intensive projects like new nuclear plant. Normally, the strategy development is accompanied by economic and demand scenario reflecting the expectation – and these are some of the criteria, important for lending institutions when negotiating the loan agreements.

Thus, one should consider the risks arising from lack of long term strategy supported by scenario analysis – in practical terms, this lack can delay the processing of Bulgaria's loan applications from the engaged financing institutions.

Another very important topic in the Bulgarian context is related to the Regulatory Framework and the readiness of the Bulgarian Nuclear Regulatory Agency's (BNRA).

"In principle, Bulgaria has a comprehensive and robust regulatory framework for nuclear and radiation safety covering all facilities and activities", concluded the 2025 IAEA, IRRS[20] Mission. During the mission, there were several key recommendations such as:

[20] IRRS – Integrated Regulatory Review Service https://www.iaea.org/newscenter/pressreleases/iaea-mission-says-bulgaria-is-committed-to-a-high-level-of-nuclear-and-radiation-safety-sees-areas-for-further-enhancement

- adoption of national policy and strategy for safety;

- adequately increase of BNRA's budget to cater for regulatory activities associated with the planned power programme expansion;

- ensure that there is a comprehensive long-term strategy for human resource development and

- finalize the revision of the Strategy for Spent Fuel and Radioactive Waste Management etc.

Inviting an IRRS mission prior to signing the EPC contract was certainly timely – in fact, it is good practice for identification of possible gaps and preparing for regulatory oversight of the expected expansion of Bulgaria's nuclear power programme.

Further in the regulatory context, it should be noted that under the Intergovernmental Agreement (IGA from 2024) between Bulgaria and the U.S., BNRA and the US Nuclear Regulatory Commission (US-NRC) are working on regulatory harmonization to ensure a smooth licensing process. Regulatory cooperation is critical for nuclear power plant licensing in new jurisdiction even when based on proven design (6 units in operation, 4 in China and 2 in USA) and reference plant (Vogtle 3&4). Particular attention should be paied to align the regulatory and licensing approches, e.g. performance vs prescriptive, in preparing for regulatory oversight.

Since NRC has already licensed the AP1000 in the U.S. (Vogtle 3 & 4), BNRA can accept NRC's design certification and safety evaluations as a baseline. NRC's Final Safety Evaluation Report (FSER) for AP1000 can serve as a key reference for BNRA's performance-based review.

In summary in this aspect, it should be pointed out that the risk of BNRA regulatory delay due to regulatory differencies is with moderate likelihood - however the impact can be critical. The mitigation plan should include close regulatory cooperation, staff training and use of technical support organisation.

Nuclear Fuel Supply & Waste Management

Following a Parlamentarian vote in November 2022 to secure an alternative to Russian-supplied nuclear fuel, the government signed a 10-year contract with Westinghouse to supply fuel for Kozloduy unit 5. The first batch was loaded in 2024. BNRA licensed the Westinghouse fuel thuse reducing the regulatory uncertainty for AP1000 fuel qualification. In fact, Bulgaria has already transitioned to Westinghouse fuel for its VVER reactors, demonstrating regulatory and operational readiness to support AP1000 fuel loading.

An additional agreement for fuel supply to Kozloduy 6 during 2025-2034 was signed with Framatome.

Currently Kozloduy NPP operates wet and dry spent fuel storages on

site where the VVER440 and VVER1000 fuel is stored. However, there is still active contract for spent fuel reprocessing in Russia including high-level waste, without the fissile material, return for disposal. The return of vitrified high level waste from Russia should be integral part of the long term waste disposal strategy.

The use of new fuel trigger the national discussion for the backend of the fuel cycle. An updated National Strategy for Spent Fuel Management has been filled for discussion[21]. It should include, a comprehensive roadmap for spent fuel interim storage and disposal considering AP1000 fuel characteristics as well.

Aside the described relations with companies outside the EU, Bulgaria's commitment to the international legal regime and EU regulations and taxonomy requires the updated National spent fuel and radwaste management strategy to be adopted as soon as possible. Nonetheless, in this process one should take into account Westinghouse fuel for VVERs and AP1000, including plans for interim storage and final disposal.

On the Industrial & Supply Chain Readiness

AP1000 construction requires modular assembly and compliance with ASME[22] codes and standards, which differ from Bulgaria's EU-based regulations and standards.

Westinghouse has begun in 2023 the process of selecting local partners and currently is partnering with 6 local engineering companies. The signed MOUs outline the potential for manufacturing of key components, including instrumentation and controls (I&C) systems, radiation monitoring systems, as well as providing various engineering, consulting and construction services. The suppliers include OSKAR-EL, Glavbolgarstroy, ENPRO Consult, EnergoService and EQE Bulgaria.

Anyhow, the most important steps in this relation should provide that the supplier qualification programs must ensure Bulgarian manufacturers can meet AP1000 component standards. Depending on the level of local participation, which is currently anounced at the minimum level of 20%, specific lift-off programme for Bulgarian companies will be required.

Hyundai E&C has already signed a memorandum of understanding with Glavbolgarstroy, and will strive to maximize the participation of Bulgarian companies for the successful completion of the project. After Engineering Procurment Contract contract signature following Final Investment Decision, Hyundai E&C and Westinghouse plan to enter in dialogue with local companies and teams during the preparation period and to share accumulated experience and technology.

[21] https://www.moew.government.bg/static/media/ups/tiny/EO_OVOS/EOOVOS-2023/update%20en.%20version%20New%20Strategy.pdf

[22] ASME – American Society of Mechanical Engineers https://www.asme.org/

The ASME compliance is a high likelihood, critical impact issue requiring attention and early mitigation. It can be mitigated trough developing regulatory crosswalk for ASME compliance in, and providing supplier training.

Financing & Economic Considerations

Currently a State-backed financing model with attraction of Export Credit Agencies (ECAs) from supplier countries seems to be the preference. As this is a multi-billion-euro project, dialog on the topic with a set of financial institutions had started.

In parallel, the ongoing Engineering Service contract with the consortium between Westinghouse and Hyundai E&C has to be completed by November 2025 and to provide data needed for taking the Final Investment Decision (FID). Besides, the competent authorities are planing to finalise the discussions with the financial institutions involved by then.

However, it is still unclear what kind of revenue model the Government will adopt. Nonetheless, it is expected that by the beginning of 2026 a Contract for Diference (CfD) mechanism should be introduced in the national legislation as to support the capital-intensive technologies, including nuclear. Alternatively having in mind the maximum loan repayment period of 22 years for ECAs, applicable to nuclear projects, an Power Purchase Agrrements should be foreseen.

Based on the above, it might be advisable that the Mitigation measures could include creation of Joint Financing Coordination Group to sinchronize the lending institutions due diligence process and define the preferred revenue model.

Human Resource Development

Bulgaria has wide variety of knowledge-sharing opportunities as member of European Nuclear Safety Regulators Group (ENSREG[23]), West European Nuclear Regulators Assosiciation (WENRA[24]), IAEA and their initiatives and tools. In addition, Bulgaria is already also member of the OECD Nuclear Energy Agency.

The development of competent Human Resources is considered as long lead item requiring early planing in nuclear power programmes. In 2022, Bulgaria adopted National HR Strategy[25] in the nuclear field. It foresees inter alia wide collaboration with universities and training centers and will be essential to expand nuclear engineering expertise.

Bulgaria has traditions in education and training its workforce required by the nuclear industry in several universities in the country. Further, in 2025, new two years Master programme on “Nuclear technologies, management

[23] https://www.ensreg.eu/
[24] https://www.wenra.eu/
[25] https://bnra.bg/media/national-strategy-for-human-resources-development-in-the-nuclear-field-2022-2032.pdf

and innovations", certified by the IAEA, was launched by the Faculty of Physics and Business faculty of Sofia University. Besides, Sofia University became member of ENEN (European Nuclear Education Network).

In concrete, however, AP1000 operator training is needed to upskill workforce and certify BNRA inspectors for Westinghouse Structures, Systems and Compenents and Hyundai construction and engineering practice.

In practical terms, mobilizing the number of personnel needed during the pick of construction efforts (~10 000 people) will require solutions that are not limited to the local workforce. Such mobilization efforts need to be carefully planned in advance and aligned with the local labour codes. The concurant projects with AP1000 in Poland at the same time will further put pressure on the availability of qualified workforce.

Development of project specific education, recruitment, and training programme should be integral part of the operational readiness preparedness of the Operating organisation. Specific training for regulatory staff and technical support organisations will be required.

Legal Framework and Nuclear Liability

As founding member of the IAEA Bulgaria is party of most of the Conventions under the auspices of the IAEA. Thus, the Nuclear Legal Framework is aligned with Bulgaria's international commitments including as member of the European Union from 2006.

As to assure full legal adequacy in this complex international and European nuclear legal regime, the company in charge of the construction of the new nuclear units (Kozloduy New Build PLC) hired international law firm in Oct. 2024 as legal adviser for the contract negotiations, the EU permitting process and for licensing process support.

When it comes to Bulgaria's current nuclear liability cap (96M BGN), it should be noted that currently it seems to be too low compared to international standards (~1B EUR). Therefore, it would be advisable to plan for increase to nuclear liability cap and ensure compliance with EU norms and export credit agencies requirements.

In this aspect, it could be underlined that complete gap analysis of the existing nuclear and non-nuclear national laws and regulations and the current international requirements and best praticies is necessary. The availability of significant descripancies may affect lenders' due diligence process and project implementation.

- **A wrap-up:**

With a strong nuclear track record, regulatory experience, and strategic location, Bulgaria has the potential to become a regional hub for nuclear expertise, technology deployment, and energy security.

Carefull preparation is critical for the success of large infrastructure projects as Nuclear Power Plants. Bulgaria might benefit from conducting detailed self-evaluation of the infrastructure readiness based on existing methodologies provided by the IAEA. Further more the country can invite an Integrated Nuclear Infrasrtructure Review (INIR) mission offered by the IAEA to review and advise on potential inftrastructure gaps.

Bulgaria's decision to deploy two AP1000 reactors at Kozloduy aligns with the global nuclear expansion wave, the Net Zero 2050 targets, and regional energy security needs.

CONCLUDING REMARKS

Historically, the nuclear boom came at the time of the first 1973 and the second 1979 oil crisis as mean to adress energy security concerns and ensure affordable energy. At the pick of nuclear deployment 1984-1985, 33 reactors where connected to the grid each year. Even several accidents like Three Mile Island 1979, Chernobile 1986 and Fukushima 2011 lead to public misstrust and oposition and regulatory overburden, nuclear remains the safest energy source with excellent safety record and availability. Several drivers are currently in place to boost again the role of nuclear in the global energy mix: climate change and the need for clean energy, energy security and scalability of baseload energy source with 24/7 availability. New technolgies and new business models are under development and demonstration and global harmonisation and standartisation initiatives are in place to cut the regulatory red tape and facilitate deployment. The last several years significant policy shift is observed globaly, in Europe and in the countries of SEE.

Critical elements for responsible deployment like the global nuclear legal regime, the harmonisation of the regulatory framework, the alignment of codes and standards in support of the supply chain are important enablers for global accelerated deployment. However it remains national reponsibility to construct, commission, operate and decommission nuclear power plants in safe and secure manner and respective national nuclear infrastructure should be in place.

Maintaining strong political commitment, a robust regulatory framework, and financing from international partners, Bulgaria is well-positioned to lead Southeast Europe's nuclear resurgence. Successfully implementing AP1000 technology at Kozloduy will strengthen Bulgaria's role in the global nuclear energy transition while reinforcing its energy independence and industrial competitiveness.

Milko Kovachev *has extensive experience in formulating and implementing policies in the energy and nuclear sectors in Bulgaria and the EU, managing programs and developing nuclear infrastructure at the IAEA, structuring and financing projects with international financial institutions such as the World Bank (IBRD), EBRD, EIB. Throughout his professional career, he has worked closely with OECD-NEA, WANO, IFNEC to improve nuclear safety and promote nuclear energy worldwide. Mr. Kovachev is currently a member of the International Bank for Nuclear Infrastructure (IBNI) initiative, which advocates the establishment of a new international financial institution focused on nuclear energy.*

In the Government of Bulgaria, Mr. Kovachev served as Minister of Energy and Energy Resources (2001-2005) and Minister of Economy (2005). During his term of office, important reforms in energy and nuclear energy policy led to the country's preparation for EU membership. He has experience in the field of European policies, having been Head of the Department of European Integration in the Administration of the Council of Ministers of Bulgaria in the period 2000-2001 and headed the Department of European Integration and International Relations in the Energy Committee (1994-1997), as well as in the EU Phare Nuclear Safety Program, aimed at inrpoving the safety of the Kozloduy NPP. From 1979-1982 he worked as a senior reactor operator.

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