The Green Deal Industrial Plan for the Net-Zero Age – challenges for the Bulgarian Industry

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Abstract. On 1st of February 2023, the European Commission presented an Industrial plan in the context of the Green Pact to boost the competitiveness of Europe's zero net emissions industry and support the rapid transition to climate neutrality. The plan aims to provide a more favourable framework for the expansion of EU production capacity for the zero net emission technologies and products needed to meet Europe's ambitious climate targets. The aim of the study is to identify the challenges that this plan poses to the Bulgarian industry. In Bulgaria, industrial transformation is a continuous process. In the context of the overall development of this key economic sector, the importance of the concepts of Industry 4.0 and 5.0 should be considered, along with the assessment of the risks that disruptive technologies bring.

1 Introduction

As a result of the global energy transition connected to the need to avert a climate catastrophe and move to a low-carbon future, we are experiencing significant shifts in the global energy landscape with broad economic, social, technological, political, and geopolitical consequences. The energy transition is a natural, long-term, multidimensional transformation process, whereby one or more energy resources are displaced, and new ones are more widely used under the influence of scientific and technological progress and the complex development of new technologies. As a result, profound and fundamental changes are taking place during the industrial transformation of the whole society and changes in the whole social system, in a wide range of different fields in industry, technology, economy and politics.

The current energy transition represents a gradual and large-scale industrial transformation of the global economy's energy foundations (to the tune of USD 100 trillion), characterised by a shift in energy use practises and an increase in the relative share of renewable energy sources (RES), as well as innovation and deployment of a variety of low-carbon technologies, all with the goal of lowering greenhouse gas emissions. Structural changes are taking place to shape global energy demand and the need for new, greener ways of generating energy, resulting in major changes in the structure of individual countries' energy complexes around the world. The process of "the energy transition" refers to all levels and stages of the energy production chain, the balance of supply and demand in global and

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regional energy markets, actors and their behaviour, financial models and business models, existing laws, regulatory framework, and so on. It significantly modifies existing economic and trade patterns and has an impact on the interstate balance of power, unavoidably resulting in changes in the configuration of existing political, economic, and trade alliances as well as the development of new ones. Furthermore, it creates non-linear and dynamic interactions between geopolitics, national security policies, foreign policy, energy diplomacy, and climate diplomacy. The problem of the energy transition is frequently debated. Still, tensions and conflicts within and between countries about the nature of the transition, its development, and the duration of its implementation have yet to deepen [1].

2 The environment

The energy transition is an objective process that is the natural result of cardinal changes in our environment. The transition is a result of cardinal changes in society and the economy that are happening at a speed and scale unimaginable until recently. Let's not forget the good old Globalisation. The enormous importance of globalization in the economy is determined by the fact that none of the other subsystems of globalizing relations in the world (political, military-strategic, etc.) is so highly related to the necessities of life as economic relations at different levels and aspects (international economic relations and economic relations within nation-states). By their very nature, these relations are fundamental. They are most directly linked to tangible and intangible production and the exchange of its products. An important place among the forms of these exchanges, together with commercial international economic relations, is occupied by a wide network of non-purely commercial relations, such as the regulation of mutual supplies, investments, currency relations, etc. It is no exaggeration to say that the interdependence of the world is most clearly and fully expressed in international economic exchanges. A marked characteristic of international economic relations is that they are directly linked to a particular material structure: raw material sources, energy needs, production base; transport links, etc.

The real life happens in the context of this theoretical framework. And it is as colourful as ever. Now we are immersed in the process of the Forth Industrial Revolution, which further accelerates all processes and begins to be characterized by the notions of exponentiality, convergence and disruption. These notions are the base for explanations of the new and fundamental changes in the political and economic organization of society. The exponentiality of the technologies of that another yet industrial revolution with its speed of change reaches such a scale that it generates emergent consequences, leading to new systemic qualities. One of the main questions here is how different technologies and technological revolutions change the meaning of time in our existence. Attention must be given to the speed of introduction of various technologies and the fact that the new technological stage imposes exponential models. These models accelerate the destruction of reality around us and increases the interdependence of more and more elements of the world around us, which makes everything more uncertain and much more difficult to predict. The exponential technologies are changing the economy. So-called „exponential organisations “come to the fore. The convergence is another leading characteristic of the today industrial revolution. The convergence binds everting to everything and gives rise to growing interdependence of all elements of the social, biological, and physical worlds. The convergent characteristics of the new technologies, the changes that this convergence brings to our life is on the agenda. The next main feature of the Fourth Industrial Revolution is the disruption. The disruption destroys several elements of the existing world [2]. The conceptual and applied forms of technology are non-linear and complex. The creation and deployment of disruptive technologies undermines the position of some professional and social groups at the expense of others, which carries with it significant risks for the effective functioning and development

of socio-economic systems. With the advent of the Fourth Industrial Revolution and on the threshold of Industry 5.0, technological change is taking place at a much greater speed, accelerating the creation of new markets and value chains, disrupting, or changing previously leading firms, products, business models and consumption patterns.

In the context of the changes thus described, there is the question of a systemic change in the relations between nature, the way the economy, man and society function and are regulated. In the social system, the interconnectedness and interdependence of each of the existing sub-systems is increasing, both in local and national social systems and in the global system. The interconnectedness, networks, systems, dependencies of everyone with everyone, of everything with everything are taking on dimensions never seen before, complicating all processes and regulations, changing their functioning, creating new characteristics, problems, risks. The sharply increased interdependence means that any change in one part of the system with enormous speed has consequences for the other parts. Any risk can quickly become a systemic risk to the planet, as happened with the 2020 Covid -19 pandemic [3].

On top of that, we are witnessing the first global energy crisis. A crisis resulting from the interaction of multiple factors, the combination of which has brought to the forefront the rethinking of the model of functioning and development of the modern economy. This crisis, coupled with the characteristics of modern society outlined above, raises a few questions whose answers must find their adequate solution. One of them is related to the role of industry in the ongoing societal transformation. Industry as it is in the present combined with the industries of the future. Finding workable recipes in this complex process is the responsibility of both industrial business itself and of the states also. The only certainty is that without the participation of industry, any cherished transformations - energy, social, economic, etc., are impossible. For Bulgaria, which has a significant industrial sector, this issue will prove crucial for its future positioning, both in the markets and within the EU.

3 Bulgaria's economic development model

Bulgaria's economic development model still relies on low wages and a low level of education. However, this one is becoming increasingly amortised. Many economic sectors are increasingly affected by the shortage of skilled labour. There is a clear need for new drivers of development alongside support for existing ones. In addition to a host of threats, there are clear prospects for new economic development paths in a changing European and global economy. Bulgarian industry might be one of the most reliable engines of growth. As P. Zhelev stated the strategic national interest requires to be aware of the fact that without the development and implementation of a comprehensive industrial strategy that would contribute to enhancing international competitiveness and realizing sustainable export-led growth, positioning the country's manufacturing sector in the global economy in the long term, Bulgaria will continue to be on the economic periphery of the EU for a long time. Clear objectives, measurable results, rigorous monitoring, proper evaluation, ensuring ownership, legitimacy, realism, flexibility, transparency are some of the ingredients of success.[4]

Most types of industrial production in our country are still dominated by traditional - inherent in the industrial age technologies. However, the fact is that the penetration of various high technologies is increasing. The main question now is - to prepare ourselves so that the technological breakthroughs are not missed, and Bulgarian society does not turn out to be a technological follower and our economy a catching-up appendage of the European and global one.

Such an approach is necessary for several reasons at least. The first is that, agreeing with Klaus Schwab's statement that “The fourth industrial revolution builds on the foundations of the digital revolution and combines a multitude of technologies that lead to unprecedented

changes in the economy, society and the individual" (Schwab 2016), adequate efforts should undoubtedly be made to adapt education in this direction. It should not be forgotten that the future is multivariate and open, but it is most logical to take account of objective development trends. Quite a few of them are increasingly materialising in the direction of the views expressed by Klaus Schwab and the World Economic Forum. The basic characteristics of the new technological revolution described by him and the opportunities and dilemmas it brings with it should be considered in our concrete reality. Awareness of the speed and vast scope of this new revolution can be of considerable benefit to the overall development of our country. However, as long as we do not all remain blind to the shifts in all sectors of the economy brought about by new technologies, business models, restructuring of production, consumption, etc. Social relations are constantly changing - state management and institutions, education and many others are undergoing radical changes. The world, societies, businesses are increasingly networked [5]. The question is what the readiness of Bulgarian society is to direct its future development in an adequate direction.

For Bulgaria not to fall behind in the next industrial revolution, we need to know what it actually is. The lesson of the First Industrial Revolution is still valid today - the main factor of progress remains the degree to which a society is ready to embrace the innovations inherent in any era.

The thesis put forward is that for the industrial development of countries like Bulgaria, the application of disruptive technologies and business models is without alternative. On the eve of Industry 5.0, in the conditions of a global energy transition, only such a development model would help to preserve and develop Bulgaria's industrial potential. There are already the beginnings of the implementation of this model and this article will give an example of a successful practice in this direction. This process cannot happen outside the EU's The Green Deal Industrial plan for the Net-zero age. This is primarily because of the first global energy crisis in human history.

4 The global energy crisis and the energy transition

Despite some debate, the first global energy crisis did not start with Russia's military intervention in Ukraine in February 2022, but rather in the summer of 2021. The crisis is determined by the joint effect of numerous elements. According to one of the leading energy experts in Bulgaria, Dr. Yanko Yanakiev (#YankoYanakiev)[6], the most important of which are as follows:

- a significant increase in demand for energy resources because of higher worldwide energy consumption as a result of the more rapid economic recovery following the COVID-19 pandemic. The oil, natural gas, and coal markets began to show signs of supply-demand imbalance difficulties in the middle of 2021, driving up prices. In other words, demand has collided with an already obvious supply shortage. Assumptions and attitudes regarding a global peak in energy demand occurring between 2019 and 2020 have shown to be completely incorrect.
- Insufficient investment in exploring and developing new oil and gas reserves, as well as producing in sufficient amounts. This comes on the heels of previous decisions by oil and gas corporations to restrict investment in new production due to low energy prices in 2014-15 and through 2020, low returns, uncertainty about future demand, and pressure from investors and financial intermediaries to provide more value to shareholders. Even with the incentive of high pricing, many major oil and natural gas producers have failed to raise supply in 2021 to meet rising demand. Underinvestment is also a result of government policy and regulation; investor support for environmental, social, and governance (ESG) concerns; and a lack of significant alternatives to oil and natural gas, which were thought to be available by now.

- Europe's substantial dependency on Russian energy sources. Russian natural gas consumption in the EU has climbed from an average of 30% in 2005-2010 to 40% in 2015-2020. This dependence has long been regarded as an EU strategic weakness. Infrastructure has been created to diversify import sources during the previous ten years, although Russian quantities have remained strong.
- Supply constraints have upset the delicate balance between energy supply and demand. The most apparent example of this was Russia's planned action in autumn 2021, months before the invasion of Ukraine, to restrict its natural gas supply to Europe. There was also an unusual fall in Russian natural gas exports to Europe in January 2022, raising the question of whether this was economically rational or if Russia was attempting to create stress in the European gas market before of the Ukrainian attack.
- Self-restraint policies and a forced transition to a carbon-neutral economy based on the rapid abandonment of traditional energy sources in favour of intermittent renewable ones. This demonstrates indisputably that no energy sector change can occur without sufficient reliable and cost-effective baseload generation capacity. The coexistence of fossil fuels with RES and alternative green fuels is unavoidable in the short and long run.
- The combined effect of these and other factors has resulted in considerable price rises for coal, oil, natural gas, and electricity in the summer and autumn of 2021, respectively. Following Russia's military assault in Ukraine in February 2022, the situation deteriorated into a full-fledged global oil crisis. The war has hastened the rise in energy prices, with natural gas prices reaching all-time highs, directly affecting power pricing in some areas. Oil prices have risen to their highest point since 2008.

The combined effect of these and other factors has resulted in considerable price rises for coal, oil, natural gas, and electricity in the summer and autumn of 2021, respectively. Following Russia's military assault in Ukraine in February 2022, the situation deteriorated into a full-fledged global oil crisis. The war has hastened the rise in energy prices, with natural gas prices reaching all-time highs, directly affecting power pricing in some areas. Oil prices have risen to their highest point since 2008. The global energy crisis in 2021-2022 is unprecedented in its depth and complexity, and it has significant implications for markets, politics, and economies around the world. The current energy crisis is all-encompassing because it has multiple dimensions: fossil carbon resources - oil, natural gas, coal - as well as electricity and climate. Given the extremely interconnected nature of the globalised world economy, it has caused far too much disruption in the global market and important regional energy markets. One of the most crucial causes underlying the current energy crisis is the strengthening, very close connectivity, and interaction with the global geopolitical crises, because of rising political differences, simmering and open confrontations and conflicts, including armed ones. Many countries were also facing a food security crisis and increasingly visible impacts of climate change. In this sense, the world has witnessed the generation, mutual influence and accumulation of energy, market, economic and geopolitical crises. Because of the EU's actions to replace Russian natural gas with significant volumes of LNG, supplies have been diverted away from traditional LNG customers in Asia, resulting in price increases for US, Australian, and Qatari LNG, as well as very high spot prices at gas hubs in Europe and the Far East, and even at Henry Hubs in the US. The European energy crisis has sparked substantial commercial and geopolitical reshuffling on a worldwide scale [7].

5 Energy transition and technological leadership and EU

In the backdrop of global energy and geopolitical crises, the world is currently entering a new period of technological competition. Renewable and low-carbon energy technologies are at the forefront of the world's major economic powers' industrial and investment goals, and they play a crucial role in ensuring a successful energy transition and a climate-neutral economy.

These technologies serve as the foundation for the creation of a new industrial base and are fundamental to modern industrial plans and goals. Low-carbon technologies are getting cheaper, more local, providing more jobs, emitting much less carbon, and providing more energy options for the future because of ongoing investment, advances through learning curves, and supportive government policies. Industrial policy is going through a renaissance, upending global supply chains, altering industries ranging from semiconductors to solar panels, and increasing the non-linearity and ambiguity of global geopolitical and commercial perspectives. Large-scale industrial policy is back on the agenda of policymakers in the world's three largest economies: the United States, China, and the European Union. Renewable and low-carbon energy technologies, as well as the supply networks that support them, are at the heart of the current wave. The consequences of this new era of industrial policy are projected to be profound and far-reaching, notably in four interconnected areas: geopolitics, energy transition, trade, and sustainability.

For more than a decade, the EU has been a global leader in taking bold climate action and establishing regulations to cut greenhouse gas emissions. Nonetheless, the EU's green industries are progressively being squeezed by the industrial power of the US and China, because of a distortion of the level playing field in crucial energy transition technologies and critical raw materials. In the worldwide competition for sustainable technology, the EU has profited from the world's most sophisticated set of climate regulations and carbon pricing, adopting carbon pricing in 2005 with the implementation of its Emissions Trading Scheme (ETS). The EU's industrial policy renaissance has also returned in the 2019-2023 period, despite geopolitical schisms over the role of free trade and supply chain security. In response to these new difficulties, the EU has continuously launched large policy initiatives, programmes, and legislative packages. The European Green Deal (December 2019) is a plan to make Europe a climate-neutral continent by 2050 by supplying clean, affordable, and secure energy [8]. As a direct response to the economic damage caused by Covid-19, the Next generation EU (December 2020) initiative including a "Recovery and Resilience Fund" (RRF) was adopted [9]. Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality (July 2021), the package is a set of proposals and initiatives aimed at revising and updating EU legislation to align it with 2030 and 2050 climate targets [10]. RePowerEU (March 2022) is a response to Russia's aggression in Ukraine and the subsequent energy crisis. The aim is to accelerate Europe's green transition in the critical fight against climate change, but also to end the EU's overdependence on Russia and on fossil fuels in general, whose imports are tied to ever-increasing costs [11].Since early 2023, the EU clean-tech industries have been bolstered by a comprehensive A Green Deal Industrial Plan for the Net-Zero Age (GDIP) (February 2023) and two proposed legislative acts, the Net Zero Industry Act (NZIA) and The European Critical Raw Materials Act (CRMA).

6 The Green Deal Industrial Plan for the Net-Zero Age and the challenges for the Bulgarian Industry

The GDIP [12] and its corresponding EU regulations seek to alter the basics of the European economy and industrial model, as well as to safeguard the bloc from external geopolitical pressures and to mitigate the consequences of climate change. They fill the gap left by subsidies and support from governments, leaving the EU far behind China and the United States. This outline for a GDIP is based on four pillars: a predictable and simplified regulatory environment; faster access to sufficient funding; skills; and open trade for resilient supply chains.

GDIP should create a more favourable environment for the EU to grow its production capacity for net-zero technology and goods, boost European industry's competitiveness, and assist the speedy transition to climate neutrality. It builds on earlier initiatives and leverages

the EU single market's characteristics, complementing ongoing work under the European Green Deal and REPowerEU. NZIA should encourage the deployment of clean technology throughout the EU and facilitate the transition to sustainable energy. The new legislation will make it easier to develop net-zero projects in Europe and attract investment. Accelerating progress towards the EU's 2030 climate and energy targets, moving towards carbon neutrality, increasing the competitiveness of EU industry, creating quality jobs, and helping the EU's efforts to become energy independent are all expected to have a positive impact. The NZIA will be implemented with the goal of expanding the EU's clean technology economy and meeting at least 40% of the EU's yearly deployment needs for strategic net-zero technologies by 2030. Solar, wind, battery and storage, heat pumps and geothermal, electrolysers and fuel cells, biogas/biomethane, carbon capture and storage, and grid technologies are among the strategic technologies. CRMA establishes targets for the production, refining, and recycling of key raw materials (CRMs), which are frequently required by strategic industries such as renewable energy, digital, space, defence, and healthcare. These CRMs frequently have a significant level of supply risk and, depending on extraction methods and processes, might have detrimental environmental consequences. The CRMA intends to ensure the EU's supply of CRMs required for green technology. The CRMA should boost local production in the EU by shifting supply chains away from third-party countries (especially China). Through these new efforts, the EU is making an ambitious attempt to play an essential role in the global competition for clean technologies and to become a clean energy technological hub. GDIP is a smart political approach aimed at establishing green value chains in the EU, strengthening the EU's industrial basis for prosperity, and increasing Europe's resilience to global trade disruptions. But what next for Bulgaria, its economy and industry? Are there good practices that can be used as a benchmark for achieving the goals?

It should not be forgotten that in some strictly defined areas the EU can only support, coordinate or complement the action of Member States. It has no power to legislate and cannot interfere with the competence of Member States in this matter. In these areas, the EU has what the Treaties call complementary competence. Industry is just such an area, and the responsibility that both national Member States and the industrial business in each of them bear should not be forgotten. Each country's industrial initiatives, aligned with the frameworks outlined by the EU, will enable specific workable solutions to existing current and potential problems in national industrial sectors. It is natural for Bulgaria these issues to be different from those of other EU and regional countries. However, society needs to realise that without joint efforts and a clear action plan, no significant results can be expected at both national and community level.

Bulgaria has the most energy-intensive economy in the EU, it uses 3.6 times more energy resources per unit of GDP than the EU average rate of energy consumption [13]. In addition, it is the most carbon-intensive EU member state with a greenhouse gas emission intensity, which is 4.3 times higher than the EU average. Bulgaria is also the most resource-intensive economy in the EU, consuming 6.8 times raw materials per unit of GDP than the average [14].

One of the most difficult sectors to decarbonise is industry, where the process of optimising material and energy efficiency requires the introduction and integration of expensive technologies and the adaptation to many different production processes. Among the main drivers of change in the carbon and energy intensity of industrial production is material use efficiency [15].

A special focus in the implementation of new measures as part of the circular economy objectives will be the support for digital technologies. This is in line with the priority “Clean technologies, circular and low-carbon economy” of the Innovation Strategy for Smart Specialisation 2021 – 2027 [16]. This programme aims to incentivise the development and

implementation of innovative products, processes and business models aimed at permanently reducing industrial resource intensity. Priority will be given to companies carrying out activities as part of the EU Strategic Value Chains: clean, connected and autonomous vehicles, low-carbon industry, and the market-uptake of hydrogen technologies and systems.

The current problems in the industrial sector in Bulgaria are analysed in detail in Review of Industrial Transition of Bulgaria [17].

The most difficult decarbonization challenge for Bulgaria, however, lies in lowering the energy and carbon intensity, as well as fostering green innovations in industry. The fuel mix and the efficiency of materials are among the key drivers for reducing GHG emissions and the energy demand of industrial processes [18].

A significant example in this direction is what has been happening in the last few years in the industry localized in the city of Devnya, Varna region. The main industrial producers in the region are already looking for joint solutions to their real energy transition related problems. one of the innovative projects is ANRAV. ANRAV has the ambition to be the first full-chain CCUS (Carbon capture, utilisation, and storage) project in Eastern Europe, linking CO2 capture facilities at the Devnya cement plant in Bulgaria, through an onshore and offshore pipeline system with offshore permanent storage in a depleted gas field in the Black Sea.

The Agropolichim fertiliser plant and the Solvay Sodi soda ash producer in Devnya are joining forces in a project that will see large quantities of waste from one company being recovered and converted into a product with the help of carbon captured by the other. The project, called Sapphire, is undergoing a feasibility study. The project aims to utilise the phosphogypsum produced in the production of phosphate fertilisers at Agropolichim, while helping Solvay Sodi to “lock in” its carbon emissions [19]. The successful implementation of the project could make it a global reference in the industry and be applied by other enterprises. Energy efficiency and the reduction of greenhouse gas emissions are crucial for Agropolichim's products to remain competitive in the market. This is why the company has focused on such projects in recent years. With the construction of an ammonia terminal, the plant has replaced natural gas as a raw material and reduced its consumption by 98% over the past five years. In addition, the thermal energy for production is entirely green, as only biomass (straw) is used, and separately the plant reuses a huge part of the heat released from production.

Agropolichim was the first company in Europe to introduce technology in 2005 to reduce greenhouse gas emissions in nitric acid production, which has subsequently become a European standard. At that time, a pilot project was carried out to install catalytic technology to capture and reduce emissions of diazoxide (a strong greenhouse gas) in nitric acid production. As a result, the plant reduced its emissions by more than 500 thousand tonnes of carbon dioxide equivalent per year, and a few years later the technology became a reference best available technology and is now standard in all similar plants in Europe [20].

Unfortunately, the most types of industrial production in our country are still dominated by traditional - inherent in the industrial age technologies. However, the fact is that the penetration of various high technologies is increasing. The main question now is - to prepare ourselves so that the technological breakthroughs are not missed, and Bulgarian society does not turn out to be a technological follower and our economy a catching-up appendage of the European and global one. It is vital for countries like Bulgaria to seek solutions to their current problems and new development trajectories.

The implementation in Bulgaria of a strategy based on the principle of survival through development founded on the application of disruptive technologies and business models provides opportunities for accelerated economic development and the realization in practice of the circular economy concept.

7 Conclusion

The good practices are already in Bulgaria, what remains is to multiply them and look for their synergy effect. This is the way to effectively tackle the problems of the present that the energy transition brings us. But do we really want it?

The delayed energy transition in Bulgaria poses many complex social, political, administrative, regulatory, and economic governance challenges.

For Bulgaria to introduce costly new technologies to adjust to more sustainable production, lower energy intensity, and optimize resource efficiency, its government needs to adopt a roadmap for a circular economy and a low-carbon industrial transition in line with the major objectives of the EU Industrial Strategy. The good practice that has been presented is only a starting point for analysis and follow-up actions to be taken by all stakeholders at all levels. However, this whole process needs to take place on a principled and clear basis. It is obvious that the government would need to increase the incentives for businesses in developing circular economy supply chains with high material efficiency.

The achievement of whole transition goals, especially those ahead the Bulgarian industry is possible only with the adoption of a national low-carbon industrial strategy. Maybe it is time such one to be developed.

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