CONSIDERATIONS ON THE RELATIONSHIP BETWEEN ENERGY SECTOR TRANSITION AND DIGITALIZATION

CONSIDERAȚII PRIVIND RELAȚIA DINTRE TRANZIȚIA SECTORULUI ENERGETIC ȘI DIGITALIZARE

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Abstract: *This paper intends to evaluate energy sector's transition status taken into account the conclusions of the most recent studies issued by the international organism and of reputed research companies dedicated to this subject. Paper also discusses transition aspects in Romania, based on conclusions of national energy related organizations and authors' experience. Obstacles in front of and risks of transition are identified and some possible solutions are analyzed with the aim of process acceleration by introduction and extension of digitalization in that sector. The role of digitalization is discussed in general and as a help for the Romanian energy sector and its importance is underlined as one of the most powerful tools including the approach of the transition's complex process. Some solutions - including Romanian energy sector - are proposed.*

Key words: energy sector, transition status, transition risks and hurdles, digitalization, artificial intelligence, Industry 4.0 and Industry 5.0.

Rezumat: *Ideea centrală a articolului o reprezintă evaluarea stării de fapt a tranziției sectorului energie global luând în considerare cele mai recente studii ale organismelor internaționale și a unor firme de cercetare reputate. Sunt luate în discuție și aspecte ale tranziției în România, rezultate din concluziile unor organizații naționale de profil și din experiența autorilor. Se identifică obstacole pe care încă le întâlnește tranziția energiei și riscurile pe care le poartă, ca și analiza unor posibile soluții în scopul accelerării procesului prin introducerea și extinderea digitalizării în sector. Se trece în revistă rolul digitalizării în general și cu aplicație în domeniul sectorului energetic românesc și se subliniază importanța acesteia ca unul din cele mai puternice instrumente, inclusiv în cadrul abordării provocărilor procesului complex al tranziției. Se propun soluții, inclusiv pentru sectorul energetic românesc.*

Cuvinte cheie: sectorul energetic, starea, riscurile tranziției, obstacolele din fața tranziției, digitalizare, inteligenta artificiala, Industrie 4.0, Industrie 5.0.

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1. Introduction

Energy sector transition to climate neutrality is a difficult, complex, extensive, and expensive process. It requests a deep redesign of the energy sector from its basis, change of strategies and definition of new national and global policies, use of new disruptive technologies, governments' determination and public participation. Another important characteristic of the process is the need for emergency of this reform's implementation. Main countries' own pledges for emissions reduction and their achievements considering the length of the process and its probable deadline are also important. For example, in case of EU, the final date is considered to be – at least - end of 2050, with some Member States trying to finish the process earlier. For China and India, longer deadlines as 2060 are discussed, in the context of the global targets of Paris Agreement being endorsed by the resolution of recently finished Dubai CoP 28.

Because the process is so complex and technically - as well politically - challenging, there will appear a lot of hurdles to impede it and the result simply could be less than expected. So, analyzing the situation it is normal to identify and understand what are these obstacles and how to remove them. That is why, this paper tries to answer to at least four questions:

- What is transition status globally (climate is for everybody and there are no protected countries against the negative aspects of its change) and for Romania, as a part of the global effort?
- What kind of obstacles have been identified till now?
- What kind of solutions could be used in order to improve the actual situation?
- One of the main solutions is – indubitable – digitalization. How this can be used in the whole transition process globally and – as an example – for the Romanian energy sector?

At this aim, the authors leaned on the conclusions of the most recent studies (year 2023 level) made by international organizations and research companies ([1] – [9]) and their experience in the field of energy and digitalization. The conclusions of this paper could be used for a better understanding of the transition, of its difficulties and risks, and the resulting suggestions are useful for the national governmental and private leaders of energy sector.

2. Status of global transition for the world energy sector

2.1. World energy transition status

A number of studies elaborated by international bodies have been issued during year 2023 (references [1] to [9]) and they deeply analyzed the status of global energy transition. Although their approach is slightly different, their conclusions are similar and will be summarized as follows.

The main conclusion of these analyses is the fact that the transition is delayed and this reality was expressed directly by the study [5][3] : "The transition is still at the starting blocks". That is because some disturbing things happened in the last years: energy prices crisis, the pandemic, different geopolitical instabilities, even wars. For example, there is a consensus in saying that the global emissions generated by energy sector increased instead of reducing and the different previsions say that the emissions peak will come either in 2024 (study [1]) or 2025 (studies [5] and [8]), there will be a plateau a few years, and then will decrease.

Countries' contribution is different and efforts are not made with the same pace. Europe shows a determination, however an increase of fossil use for power generation, while the big emergent countries like China and India increased their emissions. Even so, on the last 5 years (2017-2022) analyzed by the studies, globally, renewables raised their contribution to the new power generation demand till 51%. However, in absolute terms, use of fossil is still increased. We think that the geopolitical factors raised their importance and that had contradictory effects: give a boost to renewables, helped the spread of energy efficiency measures, but affected the other two aspects of energy trilemma: security and affordability.

A just transition needs robust and equitable markets, but the reality shows that the markets are tense and volatile. Causes are multiple, the main are connected to the Ukraine war and – obviously - the conflict in Middle East does not help either. All these are graved on the macroeconomic instability with "stubborn inflation", congestions on supply chains, and high degree of debts.

Another important conclusion is the reality that no country is an "energy island" and no country is isolated by the risks of climate change. That is why, a solution has been underpinned: cooperation through international trade and technologies transfer.

The energy efficiency measures at the global level had low effects. Global power demand continues to increase by almost 2% in comparison with 2.4% as

[3] DNV - Energy Transition Outlook 2023. A global and regional forecast to 2050

average annual raise between 2015 – 2019. However, EU had a positive contribution recording a decline of 3.5% in 2022 because energy high prices, strong investments in energy efficiency, raising of public awareness transformed in a better consumers' behavior, and – very important – a mild winter. Concerning China, which had previously the biggest economic growth, in 2022, induced a slowdown of economic growth, especially because its "covid zero" policy.

Many specialists consider that is not possible to reach the climate neutrality in 2050 without taking into account advantages of nuclear energy. Concerning EU, after a long debate, adoption of the proper taxonomy solved these disputes and the increase of its role is expected to be more important: a raise with an average of 4%/year between 2023-2025 comparative with 2%/year between 2015-2019. It is interesting to notice that more than 50% of this increase will be achieved only in 4 Asian countries: China, India, Japan, and South Korea.

The numerous recent episodes of extreme weather showed the importance of supply security measures and initiatives for an increased resilience of energy systems. That is why, more and more, the idea of energy transition is combined with the need to strengthen the other two pillars of Energy Trilemma: supply security and public accessibility because" the push to bring down emissions is a key reason, but not the only one"[4]. So, even if the investment in clean energy has risen by 40% since 2020, the economic case for mature clean energy technologies is strong. As was underlined in some of the cited studies, "energy security is also an important factor, particularly in fuel-importing countries, as are industrial strategies and the desire to create clean energy jobs"[5]. On the other hand, an energy sector that produces a commodity which is not affordable for its clients, has no sense. Consequently, the concept of energy transition became larger and this is better illustrated in the last (2024) World Energy Congress[6] slogan: "Redesigning Energy for People and Planet".

2.2 . Issues of Romanian energy sector

Romanian energy sector needs to find its own way, straight and correct, to the objectives of transition, horizon 2050. Unfortunately, because of multiple reasons, this way proves to be sinuous and the goal is hard to reach: economic and social sequels of the pandemic crisis, Ukrainian conflict (with all collateral effects connected to the distorting prices of energy sources),

[4] IEA - World Energy Outlook 2023
[5] Idem
[6] Rotterdam, April 2024

economic environment distortion accompanied by significant increase of inflation, and especially, for a long time, hesitant and unclear investment policy that carried to insufficient financial injections during the last 10 years. The system – especially, in area of power generation – is still dominated by state owned companies, but the state uses these companies as generators of dividends and taxes, with little new units or modernization of the old ones.

That lead to the fact that functioning conditions became less adequate, consumers' service quality worthened, but also there have been effects on system flexibility, adequacy, and resilience, key elements for a balanced and correct functioning. Transport and distribution areas have faced delays in development, the proposed and imposed targets not being fulfilled.

To these, one can add a hesitant policy, without a needed and requested predictability that did not attracted expected private investment in energy domain. On the other hand, the investment in renewable sources was distorted by the delayed decision on a new support scheme and raised difficulties for the system without a clear provision concerning storage.

Another topic that appears in specialists' debates is the role and – inevitably – connection between two strategic documents: the Energy Sector Strategy (ESS) versus the Integrated National Plan for Energy and Climate Change (INPECC). Some of them consider that INPECC is self-sufficient and can cover the followed aim putting as priority fight against climate change. We consider that, even in these conditions, sector strategy has its important role because it can integrate vision on the whole economic branch and take into account sector's good functioning aspects, including the impact on the whole society and on life quality of Romanian citizens, not only limited to environment. So, if INPECC has as priorities energy effects on climate change and is requested by European Commission (that becomes a key finance provider in its applying), the Strategy, integrating analyses and proposals from INPECC, imposes a global vision and take into account additional elements linked to system's functioning and even the country's geopolitical position.

However, above all discussions is reality. Unfortunately, this reality shows that both documents have difficulties to be done, being delayed because many reasons, that increases the incertitude and instability connected to possible policies, tools, and targets in sector development. In this context, we believe that the sustainability is important, but it cannot be sustained without a powerful sector that ensures supply security of Romanian economy and society and provides a high quality of service at affordable prices. In this context, the new drafts of the Romanian energy sector's documents are

launched for general debate and already there are opinions that, even in this improved form, they show that the transition has some unrealistic proposals. The new targets are more ambitious: 3.2 GW more solar (raise of 43%, in total 7.3 GW) and 2.3 GW more wind (raise of 44%, in total 7.8 GW) till 2030 in comparison with variant of 2020. However, "taking into account the pace of last years' investments and low speed of authorization process, reaching of objectives for 2025 has low probability"[7]. At the same time, there are concerns that because "present legislative environment, slow and non-transparent licensing process, and potential limited profit of renewables commercial projects, these seem to be not attractive"[8]. However, the new support scheme and adoption of bilateral contracts could improve the situation, even if the market is not mature and there still many obstacles to be removed. Another issue is the way how energy markets work especially in the conditions of extreme weather situations met in this summer (negative prices, abnormal prices in balancing market, capped consumers prices). More than that, big unbalance between domestic power production and consumption increased import and requested appeal to more fossil fuel, including coal, with negative effects on emissions and length and timing of transition.

3. Obstacles that impede energy sector transition and associated risks

So, the conclusion of many recent studies is that – globally – the energy sector's transition is delayed if we take into account the pledges stated by countries one by one and there is need to accelerate this process. A detailed analysis can be found in World Energy Council's study "World Energy Pulse, 2023" [9]. The study is based on the opinions provided by a large number of leaders of the sector and the main conclusions are: *i}* transition speed is not enough, the process has to be accelerated, *ii)* access to clean energy is not sufficient, the goal is quality energy for sustainable development, *iii}* it is essential to balance the energy trilemma for a superior quality of life and a healthier planet, *iv}* cooperation among countries is key, concept as "me first" does not work, *v)* free access and affordability are the most important aspects to nave a just transition.

[7] Paper "Comentarii privind PNIESC-ul revizuit al României de la Aurora Energy Research" in Energynomics. Link: https://www.energynomics.ro/comentarii-privind-pniesc-ul-revizuit-al-romaniei-de-la-aurora-energy-research/ , 24 noiembrie 2023

[8] Idem

The main obstacles that impeded energy sector's transition globally are identified as being:

- High capital cost and/or difficult access to investment that could accelerate the transition;
- Lack of proper infrastructure (grids, storage infrastructure, delays in new production capacities building);
- Impossibility for balancing offer with supply for demand and offer of basic materials (metals, minerals, chips, etc.);
- Energy injustice, including affordability, adaptability to climate change, access to energy, new jobs;
- Unhealthy competition between national interests and policies (so-called "green arms race" following the principle "me first"),

However, we may add – for example in Romania's case - the legal difficulties that still lengthen the projects' authorization process, unclear regulatory framework especially related to supporting schemes, and changing fiscal environment itself.

All these issues raise important challenges in front of developers:

- Alignment and adaptation of financial system to the sustainable development's requirements for a accelerated transition. ESG concept can help, but it seems to be insufficient.
- Extended use of disruptive technologies. This challenge is considered normal by almost 20% of the energy leaders, however - in Asia and North America - this is perceived as a more important challenge.
- Acceleration of social awareness and deployment of the best practices concerning transition and transformation at the local level are also important. New concepts for companies, for example, "greenwashing" to reach the neutrality towards climate change.
- Energy bills affordability (impacted by costs of transition) represents – as expected – the main concern. The WEC concept of "humanizing energy" illustrates very well this goal including access to stable and competitive markets. The last years markets' volatilities demonstrated this simple fact.
- A new challenge, more and more full of significance these years, is the real problem of qualified labor in the sector for the new jobs generated by the transition.
- Other concerns identified by the leaders in the energy sector are new concepts of involvement: the new voices (young specialists and women), communities, especially the vulnerable ones, active consumers, etc.

- Re-emphasizing the role of energy efficiency applying the concept of "energy efficiency first". This is not a new trend (see for example, the "integrated resource planning" concept of years '90), however its potential is still not used properly.

Importance of all these issues was underlined by paper [11]:" The need for greater global ambition is growing. As successive reports by scientists for the Intergovernmental Panel on Climate Change (IPCC) and United Nations Environmental Programme (UNEP) show that climate change is currently occurring faster than anticipated, the impacts and damages are greater than foreseen, and the time for remedial action is rapidly narrowing".

4. Digitalization and its role in energy sector's transition

4.1. Generalities on digitalization concept

Digitization has its source as a technology of the present and the future in the concepts of *Information-based society* and the *Knowledge society*. From these conceptual forms, it then naturally moved on to two important stages of the industrial revolution defined as Industry 4.0 and Industry 5.0, the last of these stages prefiguring a close human-machine cooperation with the already well-known aim of obtaining high quality products, exploring new materials, products and technologies of great refinement. Digitalization is the basis of these stages of the industrial revolution.

It is worth mentioning that this notion of digitization is not always used in the correct, though "fashionable" way, and that is why we think that a brief clarification is needed. The notion of digitization/digitalization since its appearance in the discrete systems science a hundred years ago has evolved over time. At first, the notion of digitization meant the conversion of an analogue parameter into a discrete (numerical, digital) size. This conversion involves a double operation: sampling in time and quantization in amplitude. The theoretical-engineering development of discrete systems, including computer systems, has led to the transformation of digitization into a **concept**. At present, digitization can be defined within the framework of the set theory as follows:

Digitalization = {AI, AR, VR, 3D design, IoT, IIoT, blockchain, drones, robotics, cloud, quantum}

where: AI is artificial intelligence; AR - augmented reality; VR - virtual reality; 3D - 3D design; IoT - internet of things; IIoT - industrial internet of

things. This definition will certainly be enriched with new terms and new elements.

From the definition it is clear that the transformation of digitalization from a notion to a concept has been sustained by several elements:

- the development and generalization of Information Society paradigms;
- the need to manipulate massive amounts of data;
- real-time applications for many areas of socio-economic-technical activity.

Lately, a special attention is given to the element of AI. A discussion among those interested in achieving energy goals showed that a prudential approach is being taken in this area as well, as a generalization of IA in the energy sector is absolutely necessary. There are specific applications, and there is a turning point in the *democratization* of the AI concept, a *specialization* of AI niches, and a *customization* by domain.

Looking through the lens of the Cyber Physical System (CPS) concept, the energy system is a collection of physical, computer/cybernetic subsystems and communications systems. In general, measures are taken within the communication system to ensure the correct transmission of information, using encryption techniques.

A problem - subject of wide-ranging discussions - is that digitalization, while bringing a number of advantages, also creates an increased vulnerability to unauthorized access in power systems. In particular, beyond the current techniques used to ensure the security of energy systems operation, a series of discussions point out some possibilities regarding even the use of paranormal techniques for unauthorized access to these systems by means of the human operator attract attention.

4.2. Digitalization and energy sector

Energy sector is an appropriate area where digitalization can prove its advantages and can help solving a lot of problems because the sector became more complex, connected, smarter, more efficient, reliable and – as transition wants to achieve – sustainable. All these need big data manipulation, high speed decisions and proper reactions, a better reliability and adequacy in functioning, a more rapid reaction to climate changes, and a better efficiency, So, as mentioned in paper [15]: “Digitalized energy systems in the future may be able to identify who needs energy and deliver it at the right time, in the right place and at the lowest cost. But getting everything right will not be easy”.

It has to be reminded that between energy and digitalization is a strong connection, a **symbiotic** one: no digitalization without energy and – of cause - digitalization is an essential tool for a more effective and sustainable energy sector. At the same time, digitalization can help energy transition, but digitalization is also raising new security and privacy risks. Through digitalization we have changing markets, businesses and employment and new business models are emerging [6]. More, unfortunately, digitalization could have some negative externalities on energy sector's sustainability, through increase of electricity consumption and because the need of special materials requested by its implementation.

As showed in chapter 3 of this paper, energy sector's transition faces many uncertainties and obstacles that delay the process. In order to overcome these difficulties, digitalization can play an essential role:

a) One important challenge faced by energy sector leaders is the lack of proper infrastructure (grids, storage infrastructure, delays in new production capacities building). As power systems become increasingly complex and decentralized, the decision makers can solve a lot of problems using digitalization and making grids more reliable, with better network and congestion management, assisting with the renewable generation intermittency problem, allowing more effective network monitoring and more efficient network operation. It also provides digital platforms for demand response, and Peer-to-Peer (P2P) energy and carbon credit trading [6]. Specifically, for Romanian energy sector, a smarter grid is essential for solving the multiple issues generated by the development of renewables and large dissemination of distributive electricity production.

b) Decentralized power production market – as a critical solution for active consumers existence cannot be managed without use of blockchain technology. According to a recent WEC study [16], in Romania, as a consequence of transition, there is a significative increase of prosumers: at the end of 2023 year, the number of them has been around 100,000 and the expectations for the end of 2024 are to reach 220,000. Controlling and balancing this distributed production is impossible without deep digitalization.

c) Demand side issues solving needs a lot of digital instruments, for example internet of things with industrial and household (IIoT and IoT) applications that enhance the visibility and responsiveness of grid-connected devices, enabling meaningful data gathering and system optimization. On the other hand, in Romania, "energy efficiency first" principle is not used at its real potential. Digitalization can help to make more realistic and efficient decisions for saving energy, time, and money.

d) One fundamental principle of transition is a “just transition”. Digitalization can help not only to solve the technical problems. Much more, digitalization can alleviate transition burden, especially on vulnerable consumers. It can be involved in overpassing energy injustice, including affordability, adaptability to climate change, access to energy, and it can generate new, especially high qualified jobs.

e) Digitalization is recognized by the World Energy Council as being one of the five indispensable solutions for a smooth and just transition (one of the “five D’s”).

In relation to the concept of digitalization in increasing the efficiency of electricity and its contribution to a greener economy, we reiterate the idea that digitalization exists and "silently" is used and applied through its components methodically, with thoughtfulness and prudence.

Figure 1 shows a possible proposal for extending the use of digitization in the Romanian Electrical Power System (SEE) through several components:

- At the National Energy Dispatcher (DEN), AI should be used only in off-line programs, the on-line area still remaining to operate according to current customs and solutions.

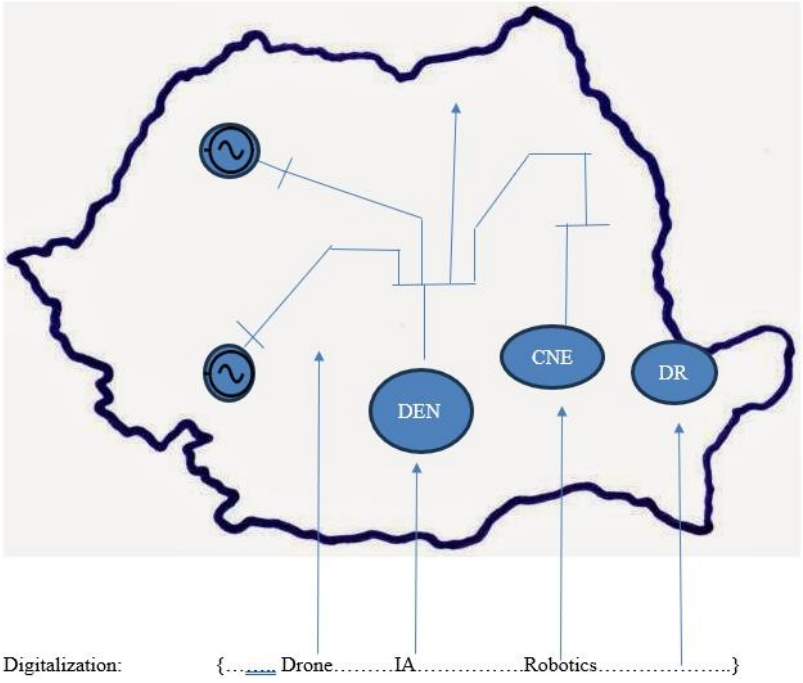

Fig. 1. Possible implementation project through digitization

- In the electric grids, drones can be used for monitoring and localization and examination of faulty situations.

- At Nuclear Power Plants (CNE), the replacement of the current reactor fuel loading mechanism with a robotized system could be studied

- Educating or training operating or execution staff through VR etc.

Also, Fig.1 illustrates only a few representative elements of digitization. Engineering practice shows that applications in energy are combinations of two or more elements of technology having relationships with functional system elements, e.g.:

- secure data handling relates to the start grid system but also to optimization aspects of electricity and/or thermal energy production, transmission and consumption;

- the blockchain with the decentralized energy market but also with aspects of data flow security;

- augmented reality and virtual reality combined with power system design but also with the training of energy personnel;

- IIoT and IoT with consumption optimization;

- Use of complexity algorithms as combined control of voltage-frequency.

Coming back to the AI component, it is possible (see fig.2) to use the current AI for testing and forecasting off-line driving programs, and in the future, when we may reach general AI, we may also - with caution - approach on-line programs, [19].

In Fig. 2, there is a representation of CPS (Cyber Physical System) for operating an Energy Power System at general level of running blocks for a General Dispatching Center or a specific subsystem. CPS plays the monitoring and online or offline driving functions, that can be applied to National Power System. Basis systems: process interface, validation, evaluation, a sure data basis, process software for driving process (on and offline) are kept and adding operation modules in a possible future of AI use. CPS is a digital system.

5. Conclusions

Transition is a complex phenomenon with many unknown issues. But one thing is certain: it will happen! In order to make it properly, we must take into account a multitude of factors that were discussed in this paper. From the

very beginning, it must be remembered that our civilization is based on technology, technology that is intended to achieve socio-economic progress for people. This involves energy, especially electricity, which is becoming more and more important as technology advances. In this sense, whether we like it or not, the transition in the energy sector is becoming mandatory in order to compensate for this "energy famine" and pollution reduction. And there is something else interesting in this period: 70% of young people say they are willing to pay more for sustainable products or services, [18]. One of the obvious solutions is digitalization.

Digitization must be treated, like other technologies applied in energy, carefully, without haste, with consideration because it is a revolutionary technology, but not a technological revolution. This is all more so since "*those who develop and deploy new destructive technologies will not wait for policy makers to catch up*" (going by the following logic: "*It is better to ask for forgiveness than permission").* However, AI, a component of digitalization, must not become a fetish. It must be applied in well-thought-out combinations with the other elements of digitization: AI- IoT, AI-AR, etc. It is true that most energy specialists but also all other "actors" consider digitization as a powerful tool, however **not the only one** that could solve the problems of the transition of the energy sector. The path to energy sector's transition is not simple, it faces multiple obstacles that reduce its pace, and it needs a fresh approach and appropriate instruments. It is clear that everywhere, including in Romania, digitalization is such an instrument. Solving the problems - identified in global and national studies and surveys - needs a better involvement of digitalization also in energy sector of Romania. This is desirable and possible because there is an urgent need for transition acceleration and Romania is one of the leading countries in the world in terms of the number of highly skilled IT&C specialists, it has an important number of entrepreneurs capable of designing, installing and commissioning modern digital systems in the energy sector. So, Romania is in a good position to accelerate energy transition using digitalization. We consider that it has advantages in this respect both through high qualified labor force and investments already started in energy sector.

However, the summer of 2024 showed that a new challenge appeared: episodes of extreme weather amplified both as intensity and length, and the need to adapt to the new situation imposed desperate solutions, such as appeal to more polluting fuels (including coal) and that is an additional hurdle to the need of transition's acceleration.

Another issue is the relation between digitalization and the electricity consumption requested by it. More digitalization means more electricity consumption that – in the present fuel mix, both globally and national – is translated in more emissions, so transition tends to slow its pace. Increased need of special materials is another issue.

Concerning the high qualified labor force, the Romanian Universities are – in general - well anchored in the reality of engineering practice in terms of command-control-protection-signaling systems in the energy sector. However, there is no integrated coordination of activities in the energy field, activities that should be under the "university umbrella". We understand by this "umbrella" an action similar to the Snagov Pact in 1995, which launched a Strategy with a set of paradigms for building the Information Society in Romania. Concretely, this consisted in the realization of a committee that would achieve a concrete and stable cooperation between the academic environment – Romanian Academy, universities - political parties, Government and the real economy. We consider that the future governments should take these recommendations into account indifferent of the parties they belong. However, prudent policies in the implementation of new digital technologies must be pursued. Also, it is recommended that there should be research into the future deployment of technologies such as quantum technology, neuromorphic engineering, paranormal systems, etc., also in the context of assuring cyber security. The energy sector needs to be prepared for future technological mutations, we list some of the possible future challenges as: quantum communications to ensure security of data transmission in the power system; possible unauthorized access using unorthodox procedures; development and application of ergonomic science in the functionality of an electro-energy system; complexity driving algorithms for MIMO approaches. In particular, beyond the current techniques used to mitigate the security of the functioning of energy systems, there are a series of discussions considering unauthorized access to these systems through the human operator. So, the human operator was and remains "Achilles' heel". It seems that in the future we need to think very seriously about the use of quantum transmission, which, at least so far, provides 100% secure transmission

So, in a nutshell, the use of digitalization in a system so complex (as the energy sector is) can be a real benefit for climate neutral transition, but it bears multiple challenges that we are forced to deal with. We have to be aware about the risks, we have to build specific tools and frameworks to overcome the hurdles, and properly use them, including within Romanian energy sector.

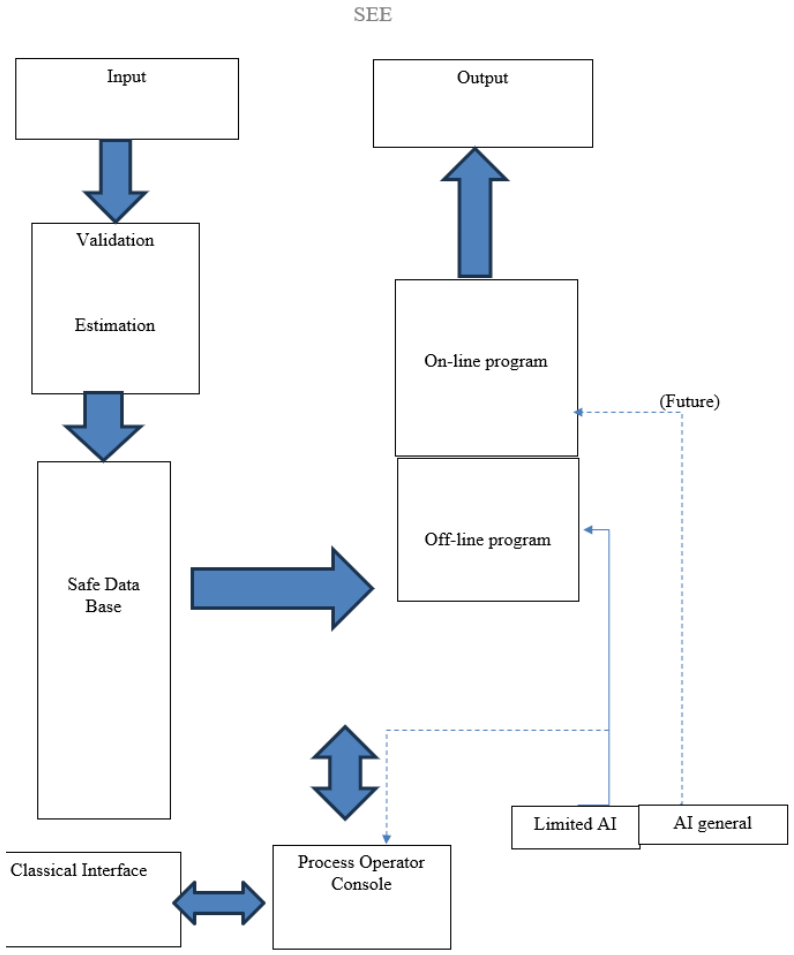

Fig. 2. Possible developments of digitization skills in the operation of SEE at dispatching center or system level.

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