Panel Discussion: Environment and Energy

Evan Diamadopoulos[1(✉)] and Jimeno Fonseca[2]

[1] School of Environmental Engineering, Technical University of Crete, 73100 Chania, Greece
diamad@dssl.tuc.gr
[2] Axpo Grid, 5400 Baden, AG, Switzerland

Abstract. Environment and Energy are among the research areas where it is important to make progress in order to achieve the targets set by SDG 12 within the framework of the EURECA-PRO alliance. For this reason, a panel discussion, facilitated by Prof. Evan Diamadopoulos, was held during the 2nd EURECA-PRO Conference on Responsible Consumption and Production. The panel consisted of two expert researchers with complementary profiles that allowed a dynamic discussion on this topic: Jimeno Fonseca, from AXPO GRID (Switzerland) and Carsten Drebenstedt, from the Technical University Freiberg (Germany). The experts answered questions related to environment and energy and how they can help to achieve several of the objectives of the European Green Deal.

Keywords: Environment · Energy · Sustainability · SDG12

1 Introduction

The global environmental problems do not necessarily come from the wrong application of technology, but quite often they are directly related to modern societal expectations: Urbanization, land use, transportation patterns, intense food production (particularly meat production), waste production and disposal, high energy demand based on energy generation from fossil fuels. Therefore, new innovative approaches on global scale are required which encompass sustainability practices, integration of primary and secondary resource material flows and efficient resource use in the frame of Circular Economy. However, technological advances by themselves are not enough: Societal changes are required primarily through the development of an inclusive, borderless and integrated European Education System (Education in the broader sense of the word) as the key to reaching competent and conscientious citizens who can contribute to this grand European societal challenge.

The EU has set very ambitious goals for mitigating climate change: Targeting Carbon Neutrality by the year 2050, carbon emissions should be reduced by 55% in 2030 with respect to the 1990 levels. However, is such a plan plausible, given that, according to Eurostat, 70% of energy needs in 2020 in EU27 were covered by hydrocarbons and coal? This European Green Deal is also a commitment that the EU will be moving towards that direction at a higher rate than any other country or region, while most of EU clean energy infrastructure must be installed in the next two decades.

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It is understandable that Carbon Neutrality or even reduced carbon emissions cannot be achieved in a short period of time, a transition period is needed, in which natural gas is supposed to play a significant role. However, a tremendous increase in the price of natural gas either because of the high demand for it and, of course, the war in Ukraine has been experienced. On the other hand, if the European Union moves towards renewable energy sources, a great deal of mineral resources are needed: raw materials and steel for wind generators, and rare earth and other elements for electronics, batteries and photovoltaic systems, none of which are produced in Europe in sufficient quantities. The EU will have to balance out the need for clean energy, sustainable prosperity with high environmental and social standards, and the fact that Europe depends on other countries and economies with different or even hostile geopolitical priorities.

In order for the EU to be transformed into a resource-efficient, yet competitive economy, the supply of critical elements has to be guaranteed. However, the EU lags in the production of lithium, rare earths, and essential industrial metal elements to the extent that it faces a significant risk of a supply gap jeopardising the plan for clean energy projects and infrastructure. In order to meet its clean energy goals by 2050, the EU will require 35 times more lithium and 7 to 26 times the amount of rare earth metals compared with today's figures. In addition, the energy transition towards Carbon Neutrality will set increased requirements on annual supplies of zinc by 10–15%, aluminium by 30%, copper by 35%, silicon by 45%, nickel by 100%, and cobalt by 330%.

In relation to the Energy Green Deal, Europe faces four essential questions:

1. Can Europe rely on increased imports of critical elements in order to secure the increased demands of them? China, being the leading supplier of refined metals, will make Europe highly dependent on her.
2. Can Europe increase mining production and refining capacity which will lead to a reliable stream of essential metals into Europe? Considering that mining, processing, and refining are energy-intensive (and at times that energy prices are skyrocketing), environmental concerns are high, and production capacity is limited, this scenario cannot provide the required quantities of critical energy elements fast enough to reach the goals set in the European Energy Green Deal.
3. Can recycling of essential energy elements play an essential role in Europe's demand for them given that for some basic metals (for example, aluminium, copper, and zinc) recycling already provides half of Europe's supply? Europe will have to facilitate a new recycling industry for solar photovoltaic panels, as well as electric vehicle batteries, both reaching end-of-life conditions after 2035. Recycling could give Europe a significant supply source, yet new recovery technologies and recycling infrastructure should be developed.
4. Even if Europe guarantees the required supply of metals and other critical elements, what kind of infrastructure must be developed during the transition period in addition to new mines, processing, and refining facilities, as well as recycling industries? New electricity grid networks have to be designed and commissioned. Water reservoirs at different elevations that would act as energy storage have to be constructed. Development of hydrogen production facilities (after testing appropriate hydrogen generation technologies) and hydrogen distribution networks must be implemented.

Computer Artificial Intelligence techniques, Data Analytics, and Digital Twin technologies in the energy sector should provide guidance towards this direction. And finally, administrative complexity in relation to the resource efficiency and carbon neutrality must be minimized.

2 Panellist Discussion

2.1 Jimeno Fonseca

The role of technology in the energy transition goes pretty much hand in hand with socio-economical change. Technology makes processes more efficient and bring us together. On the other hand, the implementation of any technology depends on socioeconomic factors, such as capital, land, labor, and acceptance. Would technology alone help us to reach the goals of the energy transition, such as carbon neutrality or adaptation and mitigation for climate change?

This question is rather difficult to answer, but it reminds me of 2016, where the book "Energy Efficiency Strategies for Urban Communities" [1] portrayed four alternatives for cities to reach carbon-neutrality in Switzerland. These included energy efficiency, infrastructure retrofits, clean energy and land-use re-/allocation. While the first three relate to technology, the last is a socioeconomical decision of high impact. According to the book, land-use can already constrain 30% of the future demand and production of energy in cities, other factors such as technology remain the same. After all, land constrains services, which constrain transportation, water, food, and energy too. Despite its potential, such a socioeconomic strategy, if considered, is pretty much far from easy.

Another socioeconomic strategy to reduce the strains on energy systems and fossil fuel consumption widely studied is behavioral change. The truth is that from all possible nudges meant by energy saving campaigns, price signals have demonstrated to be the only strategy due to make an impact at scale. I decided to make a small test during the Eureca-Pro Conference of October 2022. There, 90% of the participants were already drastically saving energy at home as a result of the high energy costs in Spain. The percentage was just 10% one year ago, despite the multitude of ongoing campaigns about energy, climate change and decarbonization. While effective, the problem with socioeconomical strategies such as demand management, is that they are inflationary and may even lead in most cases to social unrest, as seen in France last year.

Since socio-economical strategies prove rather difficult to be applied or sustained, and most of all, work towards setting up restrictions instead of opportunities, I prefer to rather look at the vast number of opportunities that innovation in digital technologies can lead us to the future of the energy system. It is not rare to find companies in the energy supply business such as Axpo [2] to heavily invest in technology as the means for increasing the efficiency and sustainability of their business. Such technologies can be divided into three categories: Hardware, Software and Processes. What I like of all these three categories is that small improvements can be measured, replicated and be understood at scale.

In terms of Hardware, we decided at Axpo to modernize our grid by doubling the voltage of our power lines some time ago. This brings today the possibility to cut to a fourth the transmission losses of our network, while getting us ready to attend a growing demand of energy. What made such an increment on efficiency sustainable is today a small, yet powerful Innovation called the iTAK System (Insulated Suspension Chains) of Axpo [3]. In the past, we had to remove masts to locate new power lines to increase transmission capacity. Thanks to this chain, we can now do it at a fraction of the cost while reutilizing our masts.

In terms of Software and technological processes, companies in the energy sector advance their capabilities to better generate, manage and extract value of their data. The advent of technologies such as Cloud Technology, Data Analytics and Building Information Modelling make this possible. Cloud Technology hast been adopted to a great extent to better inform customers, suppliers as well as every employee. Integrated Asset Management platforms such as Insights [4], for example, serve as the "google" of digital assets, making possible to connect all wealth of information to a single location. Bringing thousands of terabytes of information to a single clear spot is key for improving the operational efficiency of big energy companies and making a service of the highest quality possible. On the other hand, Building Information Modeling, or the BIM-Method [5] at Axpo is transforming the whole way how energy infrastructure is planned and built. On the principle of "Build first digital, then physical" engineers in energy companies are improving the efficiency of their entire planning and construction process with the use of information models instead of 2D printouts. The BIM-method and its digital tools improves transparency, facilitates decision and helps to early identify and mitigate failures, which in return leads to better safety, material and time savings.

Digital technologies represent a clear opportunity to improve the efficiency of energy infrastructure not only during planning and construction. During the operation stage of infrastructure, a gain in efficiency results in better production capabilities, less costs, a more sustainable business, and when done right, a positive impact on the environment. A clear example of improvements for energy companies is the advent of automated inspections of their assets with Unmanned Aerial Vehicles (UAV) or drones [6]. Damages to power lines are critical for every society. Until recently, preventive inspections were carried out by climbing on poles or with helicopters in remote and sometimes dangerous locations. The process was time consuming, costly, and required a built up of permits. Companies such as Axpo bring today these digital technologies such as UAV and software for image recognition successfully to the field. Together, they allow to semi-automatically inspect and identify damages of infrastructure in record time. The results of "From Mast to Monitor" are astonishing and have made the whole inspection process double accurate and faster.

To conclude, digital technologies play an important role in improving the efficiency and sustainability of energy companies. Examples of Hardware, Software and technological Process are becoming widespread. Key technologies in this realm such as Cloud computing, Data Analytics, Building Information Modeling, and Unmanned Aerial Vehicles are becoming an intrinsic part of the operations of the energy sector. While socio-economic factors such as land-use reallocation and behavioral change do represent an important aspect of the energy transition, they lie beyond the tangible, and feasible scalation of strategies that we need to build a sustainable future.

3 Conclusions

As Europe, are we ready to move towards a Carbon Neutral environment without jeopardizing the high economic, social, and welfare standards we experience here in Europe? Can we achieve this strictly by technological change or it is important to raise citizen awareness towards responsible consumption patterns, sustainable transportation, and nature-based solutions? How can we cooperate with other countries and regions worldwide in order to be effective on global scale? Of course, all these questions are difficult to be answered, but the time to work on them has reached us all.

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