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SYNERGY

Bilkent Energy Policy Research Center Newsletter

Energy Policy Research Center

Energiewende Conference

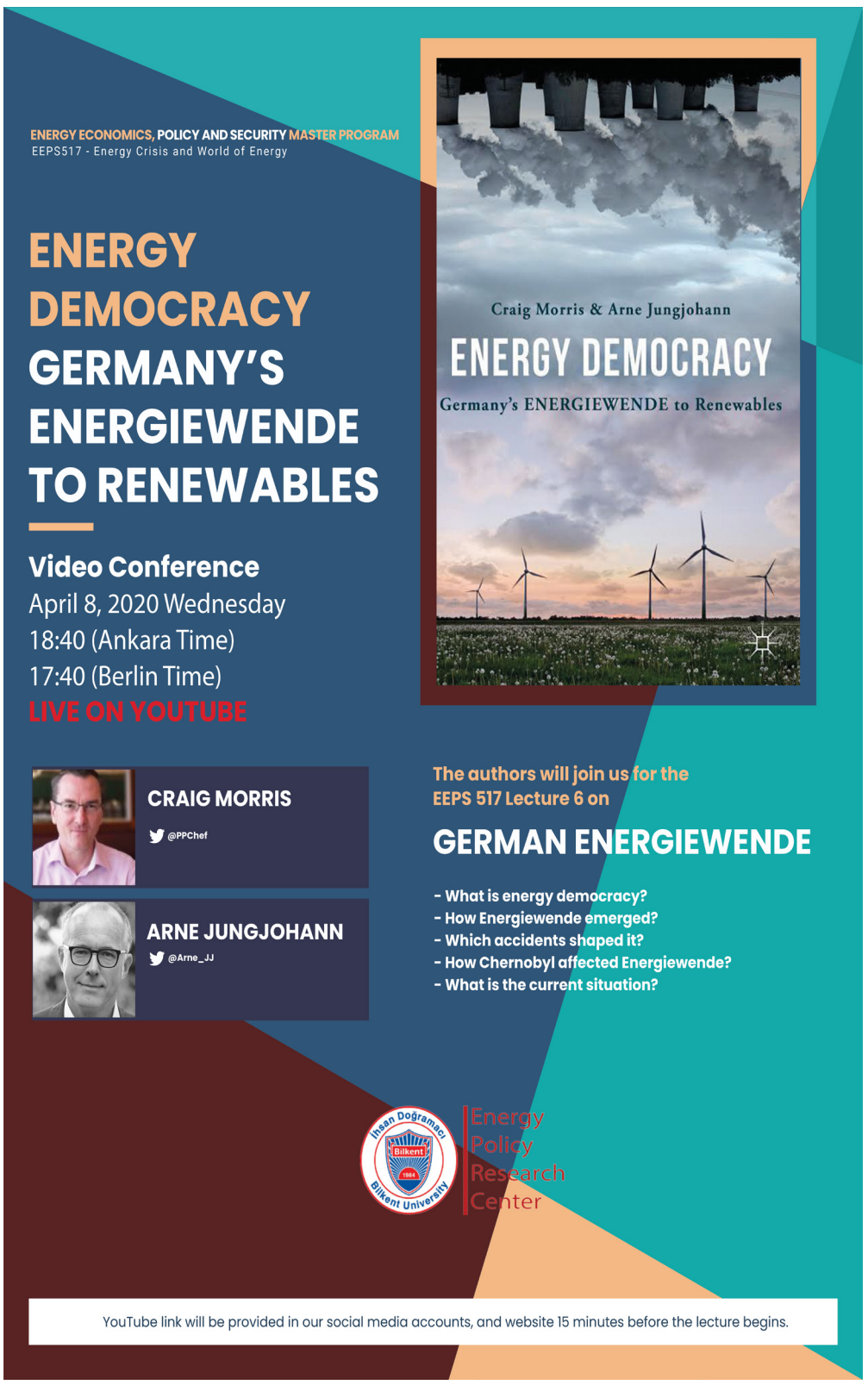
This week, we will have special guests from Germany. Craig Morris and Arne Jungjohann, who are the authors of the Energy Democracy Germany's Energiewende To Renewables, will be with us on Wednesday for the Energy Crisis and World of Energy lecture.

In their study, Morris and Jungjohann first define the German understanding fo energy democracy as followed: Energy democracy is 1) when citizens and communities can make their energy, even when it hurts energy corporations financially; 2) something currently mainly pursued in Denmark and Germany but that can spread around the world during the current window of opportunity; 3) the most often overlooked benefit of distributed renewables in the fight against climate change; 4) something to fight for as the path to a better quality of life with stronger communities and better personal relationships.

From this standpoint of view, the authors show how Germany began its journey on becoming a key player in the renewable energy sector. Even though many people think the policies began after Fukushima or the crisis with Russia, there is a vast background on the transmission process starting from the early 1980s, where the initial goal was to decrease coal consumption rate on the energy sector. After the nuclear accident at Chernobyl, reducing nuclear power and protecting climate becomes popular.

However, the vital aspect of the German energy transition was the people who initiated the process from bottom-up. Protests against nuclear energy plants began in the 1970s against the government, and the companies started investing in wind and solar energy by the 1980s. The technological developments in these sectors happened gradually with minor improvements each time and today made Germany one of the leading countries in renewable energy.

As Germany, Turkey also tries to increase the rate of renewables on energy production. Today, around 60 to 70% of electricity production comes from renewable energy. Even though the authors argue that the goal of the book is not to encourage people to start copying

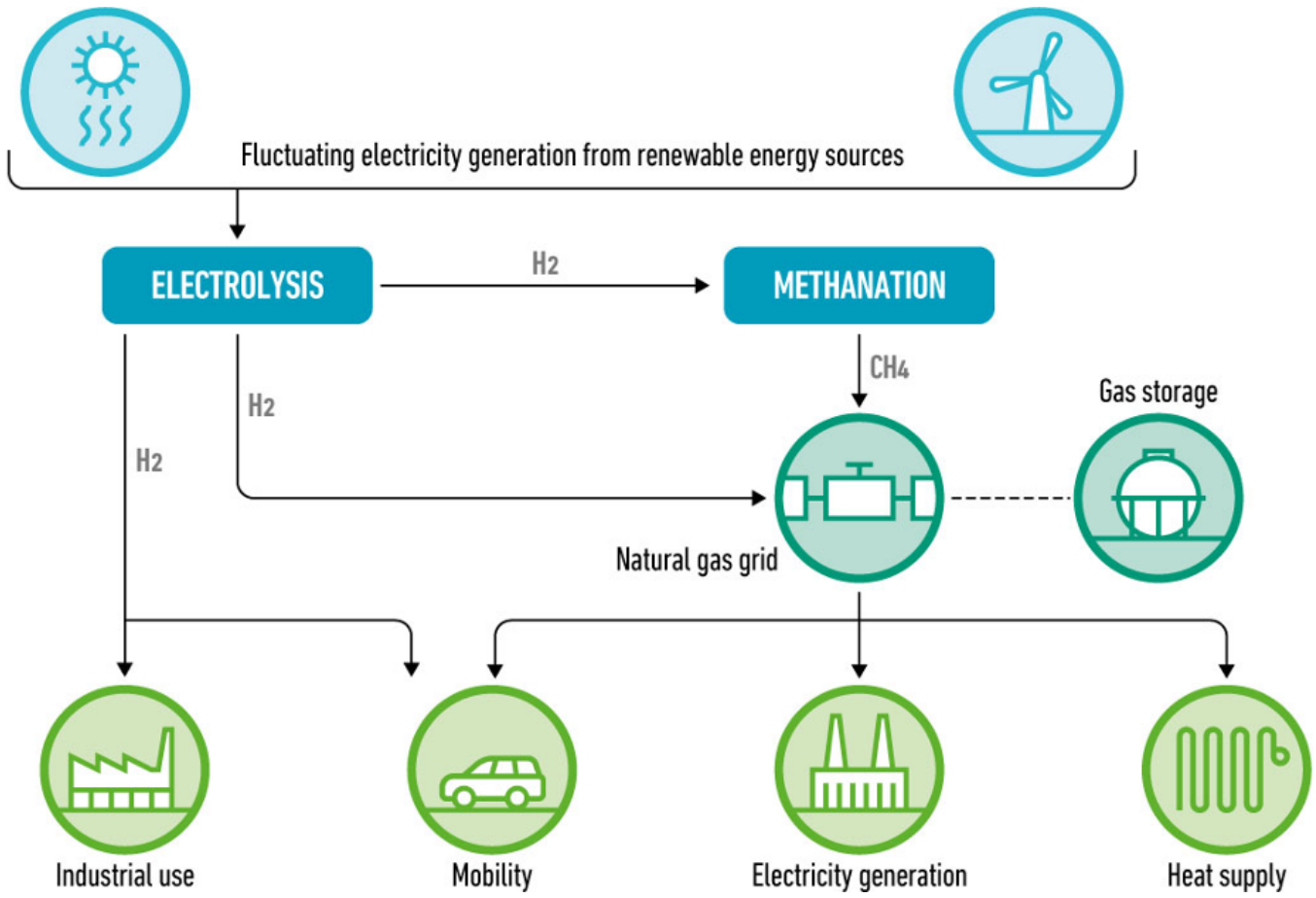


Germany's Energiwende, Turkey can learn from the experience. Instead of solely focusing on the outcomes, we can choose the see the process and struggles to develop our incentive mechanisms on the subject. The conference, therefore, will be valuable for the ones who are interested in the small details behind Germany's success. The book is also available online for Bilkent students. You can download it through our library's website.

The event will be online on YouTube. You will be able to ask your questions to authors by using the live chat tool. We hope to see you virtually on Wednesday.

Gökberk Bilgin

An alternative solution to the storage: Power-to-Gas



Nowadays, a term is becoming a loadstar in the energy transition era: Power-to-X (PtX). The underlying reason why this term became important is the need for a transition towards carbon-neutral energy sources while storing the electricity as well as meeting the Paris Agreement targets. Germany, in particular, dedicated itself to the clean energy transition attempts thanks to its famous transition process, aka the Energiewende. However, from a general perspective, many European countries aim to increase energy efficiency by improving the use of renewable energy sources, nuclear power (this is not the case for Germany), and carbon capture and storage technologies. And, they believe that one of the effective ways to achieve these targets is the PtX itself.

PtX can be summarized as a new kind of technology that is used for the production of synthetic fuels and raw materials from electrical energy. It means that there is a power conversion into some other form of energy. For example, chemical processes can be used to convert electricity into liquid fuel or gas. These processes are known as Power-to-Liquid (PtL) and Power-to-Gas (PtG). PtG is currently evaluated as a possible solution for the electricity storage problem.

When the sun isn't shining, and the wind isn't blowing, the countries run into power supply problems. In contrast, when there is an electricity surplus due to too much sun and wind, unfortunately, this energy goes to waste. It is seen that there is a need for large scale energy storage systems. Today, many electricity suppliers believe that gas can overcome this problem through electrolysis and methanation technologies. Aside from the technical side of this technology, it is thought that PtG can make a significant contribution to industrial needs while causing a tiny carbon footprint. Germany, where renewable sources are becoming more critical day by day, is the pioneer of PtG with more than 30 projects. The USA, Japan, Australia, Denmark, Iceland, and Switzerland also try to put the integrated energy transition with PtG into action. For example, Japan has planned to use the hydrogen even for the torch during the Olympic Summer-Games, which was postponed because of the COVID-19.

Energy storage comes with an enormous cost, so the countries and suppliers will need to find some ways to make this technology cheaper. Moreover, they will also need some technical systems to realize storage on a large scale. The critical topic here would be the existing gas infrastructure use for conversion and storage. If we go back to the German example, we can see that they have a relatively substantial natural gas supply infrastructure with a lot of storage capacity. So, they would use this for energy storage in the future. However, they still need to reduce the cost while increasing supply reliability. Also, lack of incentives to use of synthetic renewable sources in the industry and heating sector is still a problematic issue.

Nevertheless, (1) by supporting general PtX technologies in terms of political, legal and financial as well as technical; (2) by creating stable supply structures to meet demand; (3) by extending the market; and (4) enhancing the cooperation among countries which aim to develop PtX, the renewable storage dream can be built on solid ground. This is not easy, but time is ticking away. So, the countries should make a move now if they care about the global targets on climate change and energy storage.

Yazgı Nur Akın

BRENT OIL	33.22 $/BL	GASOLINE	5.26 ₺/LT
USD/TRY	6.76	DIESEL	5.38 ₺/LT
EUR/TRY	7.30	FUEL OIL	2.23 ₺

U.S. Environmental Law Policies amid COVID-19

The Environmental Protection Agency ("EPA") has taken a sweeping decision on the 26th of March that is heavily criticized among environmentalists. According to the memo, entities will face minimum environmental compliance standards of EPA for the duration of coronavirus (COVID – 19) pandemic.

The memo, which will be effective from 13th of March until further notice, states that this relief does not apply to criminal violations. However, on the side of civil obligations, the memo states; entities should make every effort to comply with their environmental compliance obligations. If compliance is not reasonably practicable, the entities will not be penalized.

The memo sets out obligations such as; acting responsibly to minimize the effects of noncompliance, identifying how COVID-19 was the reason for noncompliance, and return to compliance as soon as possible. This relief is very vague since EPA grants themselves a very flexible room to interpret entities' actions.

Other than a general civil violation clause, the memo contains a clause focused on routine compliance monitoring and reporting by the entities. EPA recognizes the fact that pandemic may cause entities to be unable to perform routine compliance monitoring, integrity testing, sampling, laboratory analysis, training, and reporting or certification. If EPA agrees this inability was a result of the pandemic, it will not be seeking penalties against the entities. For example, if an entity was required to take monthly samples of water and analyze them for some chemicals, they may contain it because of their actions. They send these water samples to a third-party laboratory to analyze its contents.

Still, the laboratory has shut down temporarily due to the outbreak, and finding another laboratory of that size which is still operating even though there is an outbreak would be very time consuming and inefficient, it would not be reasonably practicable to force entities to find another laboratory. Therefore, even though they are non-compliant, the entity would not be penalized.

However, not only that, compliance monitoring standards will not be penalized indefinitely, but EPA will also not require entities to keep records of these months' activities to test them after the pandemic is over. It might result in vast non-compliant activities for the period since even though the general clause requires entities to try their best to comply, EPA will not receive the necessary tests to compare with the entities' prior monitoring to find out if they were even trying to comply with the standards.

Cynthia Giles, who headed the enforcement office of EPA during the Obama administration, called it a moratorium on enforcing the nation's environmental laws and an abdication of the agency's duty. One could say that meanwhile, this is an abdication of the agency's duty; it is also ignoring the environmental laws and ridiculing the intention of lawmakers. Although the world is now in a force majeure, the branches of the government must still consist in an auditory manner between each other.

The executive power should not be able to temporarily disable a law that has passed through two legislative organs in a country that is operated under separation of powers. Some environmentalists expect courts to limit entities' non-compliant behavior even if the EPA does not penalize them.

According to The Guardian, "The relaxation of environmental laws follows lobbying from the American Petroleum Institute, an oil and gas industry group, which sent the EPA a letter two weeks ago calling for the suspension of rules requiring repair of leaky equipment as well as monitoring of pollution."

Furthermore, according to The Hill, before this memo, the oil industry has asked Trump administration to lessen regulations because of the coronavirus outbreak. Therefore, a 10-day lobbying activity might have resulted in unfathomable and undetected destruction to the environment for 3-4 months, or it might create a breathing room for the economy with minimized side effects, prior looks more plausible than the latter.

Lastly, according to some scholars, this action is inconsistent in itself because of the symptoms of COVID-19. These scholars claim damaging the environment and causing air pollution might cause further damage to COVID-19 patients, people with asthma or anyone else that could suffer more and more from respiratory damages since one of the main symptoms of coronavirus is breathing problems, which could lead to other problems with further air pollution.

Canberk Taze

Fooled by A different universe of extremes in energy systems

It is interesting that we were discussing climate-related risks a few months ago, and now the problem we are facing has become the dominant discussion. Although epidemics are nothing new and we have examples like Sars or other flu types, there are hardly any articles about a possible epidemic's effect on energy demand and energy supply.

During events like these, it is useful to look back a little bit and see why we missed it. One of the best journals in the energy area, Nature Energy journal, has a dedicated February 2020 issue to "Extremes in Energy Systems." Before Coronavirus, the whole "extremes" debate was on climate change. Are we so much into the climate risks such that we missed the other "existential risks"?

We have to be fair to the energy modelers. You generally project the possible vision derived from current data and information. A pandemic at the current stage has not been a major issue for energy, leaving aside airline companies during Sars. In the article "Energy modelers should explore extremes more systematically in scenarios" written by D.L.McCollum et al., there are three types of categories of extremes. They are

- Category 1: Transient Events like subprime mortgage (maybe anticipated but not planned for)
- Category 2: Disruptive drivers like mass automation
- Category 3: Unexpected outcomes are "not even on the radar."

So there is a categorization, an abstraction in the journal. Transient events can be part of the models and may have a raison d'etre since there are lots of historical events. Disruptive events are available from TEDx evangelists. Unexpected outcomes are hard to expect, and since they change the historic trends, the direction of new trends are hard to grasp. Major events create such a captive narrative that our mental mindset gets stuck with such events and fails to think outside this universe. Energywise, we even thought about volcano events, hurricanes but not pandemics. Because for the current generations, it didn't create a captive narrative until now.

Interestingly enough article does not mention pandemics or epidemics once. The rest of the articles in that issue is oriented toward climate change, climate change finance risks, other extreme events. Coal bankruptcies, company filings on the risks, and stranded assets are well mentioned but not pandemics. If you think politicians are not ready for such a huge event, guess what the best minds were working on: climate change and related risks. But not other risks.

It is not to belittle the climate change debate, but the dominance of this issue on the political and scientific sphere leaves us vulnerable to other risks. But this is not without reason. Climate change teams have a model and have credible forecasts for a possible future. They were relying on these models. They produced agreements, cooperations, institutions, and economic outcomes. This positive feedback created even more climate change discussions.

On the other hand, pandemics do not even have these professional models, and they do not have strong institutions and solution sets for the next events. The forecast is completely random, and no one has any idea about when the next pandemic will hit, but it will hit. Incorporating such a vague issue in models and calculations is a very hard job. Even if I write here, "there will be another pandemic affecting energy demand and supply, I may act as a perfect forecaster in the next 30 years without giving a timing." It is how undefined these events are.

If we think about what has motivated Nature Energy for an issue on extremes in energy systems, it was probably last summer's wildfires in California and its effect on electricity supply as well as the bankruptcy of PG&E. Practically we can conclude that the issue was more about the lessons from past events.

Futurewise, there was no expectation of pandemics since a-no close pandemics happened, b-it was not a US issue. That concludes us to the geopolitical meaning of "extremes."

The difficult issue is how to add "extreme forecasts" to our current energy modeling practices. We probably have to look at the issue in the tandem view. The first one is the standard modeling that is based on normal economic growth and energy demands. The second one should be a different regime than the first one. If we try to explain the "extremes," there will be thousands of such events in this connected world. It is better to define normal forecasts as boundary and then change the regime to "beyond normality boundaries" modeling for risk purposes.

Even if our models correctly predict extremes like – 20% drop in world oil demand in a matter of months- there is little to do in terms of modeling practice. The timing, geography, and vector of this extreme are important. But we can create buffers for such hard hits. Also, there is an ever interconnecting constant across each extreme event, energy prices, and the effects on consumers and producers as well as a consumer-producer effect on energy prices.

Modeling is an exercise to simplify complex events into a bunch of mathematical and logical relations. It is a mental model of the real world. While simplifying the real world, we may miss a lot. But extremes are not limited to climate change or weather, yet we are not sure what to expect. The modeling practice for "unknown unknowns" does not exist, but we are living inside one of them. We should better learn to look in more abstract terms and beyond normality claims to have better models.

Barış Sanlı

A High-Impact Low-Probability Analysis

While all the news headlines are focused on the devastating effects of the COVID-19, there are different matters also evolving in the background. The pandemic has created immense load on the health services we had not experienced in recent history, and the wreckage it created in the economy is striking. It would be time to assume that the recovery will take a long time. Managing the crisis on hand is requiring substantial resources from governments, whether it is funding, provision of services, or the enforcement of the quarantine measures. Naturally, some could say that the effective versatility capabilities and responsiveness of governments have been impaired when compared to pre-pandemic times, and this is already creating a gap in other vital areas such as international security.

How does this reflect on our analysis? With regards to the current oil market share rivalry that arose because of the disagreements between Saudi Arabia and Russia, but the United States had made one which will likely hit the U.S. producers hard, numerous calls for a mutual agreement in the OPEC+ pact. While President Trump himself has expressed his displeasure with what OPEC is and potentially keeping the U.S. off of any joint cuts with the OPEC, the future may bring out a new series of failed talks. Given his track record in the trade war with China, we can likely expect President Trump to keep to his words when he says he wants to save the nation's energy industry. In the event of new talks failing, how might the U.S. try to protect its producers? Tariffs on oil imports are frequently talked about, but for this analysis piece, we'll focus on a potentially different measure.

Let's recall the early days of 2020. The contentions between the U.S. and Iran had reached dangerously new levels in the Gulf, and the possibility of a military confrontation was what had dominated the headlines. While the military activity in the region has visibly waned, it probably did not stop. Concerning what we mentioned early on in this piece, the capacity of nations to respond to international matters has possibly diminished. If that is of any indication, then it is likely that numerous proxy organizations in the M.E. could be building up in the fog of the COVID-19 crisis. In recent news pieces I've come across, there seem to be good indications of increased military activity in the region, and they included the deployment of advanced defense systems, which does not signal that the perceived threat is solely from proxy organizations by different nations.

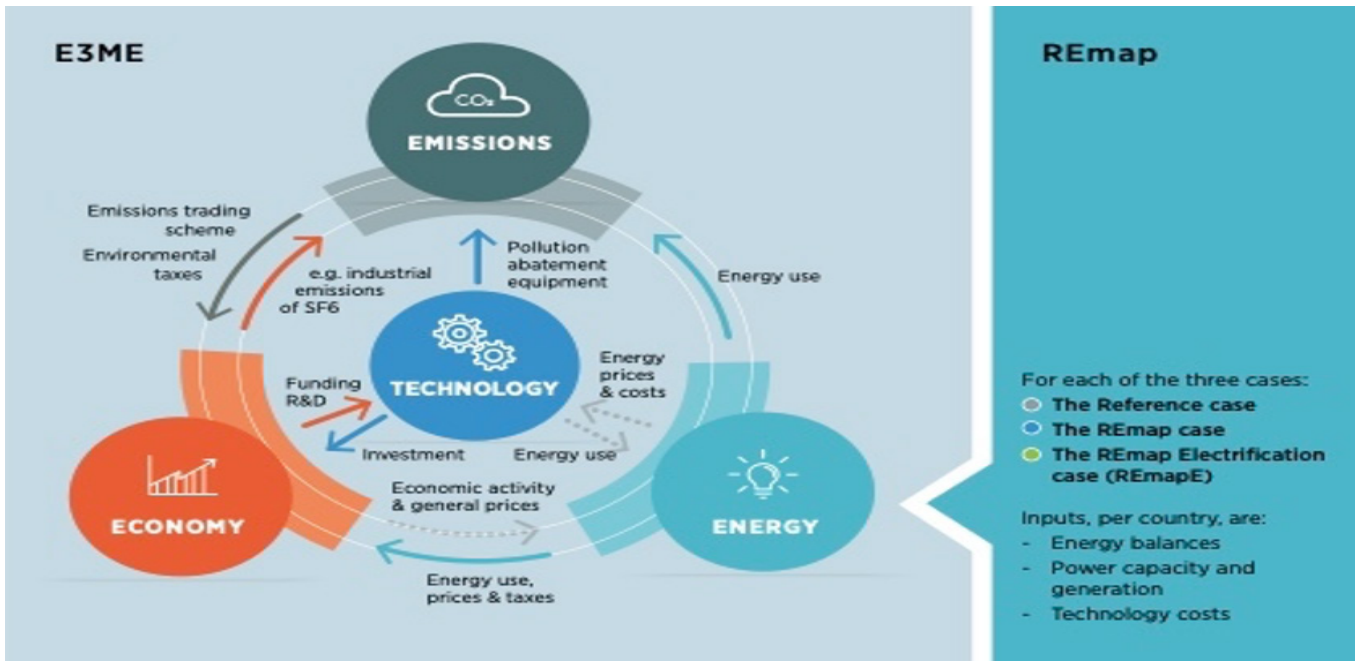
What does this have to do with our analysis of the oil market share contentions? The U.S. senators had recently expressed possible measures against Saudi Arabia with differing levels of intensity. One of them included the removal of U.S. forces from the kingdom, but last week I discussed why that would be a bad idea under the current conditions. What could other events trigger and deliver a proper response from the U.S. point of view? In a scenario where the U.S. feels a buildup of hostile forces against its presence in the M.E. (possibly in Iraq), then it may choose to send a message similar to one it did early on in the year. Where might that happen? With regards to the threat posed onto its producers by the current market share rivalry, increasing the tensions right in the Hormuz Strait would allow the U.S. to temporarily halt the international oil shipments flows out of the region, drastically cutting the supplies out of the region.

One-third of the global oil shipments are made out of this region. With the current calculations of the COVID-19's demand impact being estimated to lead to a slump of around nearly 20 million barrel-per-day in April, this could skyrocket the prices in a short period. The same action would also block a considerable amount of Saudi Arabia's oil exports, sending a strong message that could force production cuts in the kingdom if the said confrontation prolongs. The so-said intervention by the U.S. does also not have to be a full-scale military action. A heavily localized but accurately conducted intervention at the passageways would be enough to stop the flows out of the region. Given the effects the pandemic has had on funding capabilities of nations, such an event would unlikely spiral out of control and likely remain in the same level of confrontation as the events that unfolded in Iraq.

The reputational harm this may have on the U.S., on the other hand, could be considerable. In this regard, the players in the region need to carefully thread their paths as not to provoke each other into causing the workings of this scenario. Hopefully, things do not evolve into this stage, and an agreement can be made between OPEC+ and the United States. Aggressive regional policies should also not be sought in such drastic times, or the responses by different nations could be unpredictable because of the delicate domestic economic and social balances being heavily shaken in the current times. While this is strongly a low-probability scenario, precedent events have shown us that no event can be considered out of possibility and should be held in regard when making analyses that stem across multiple spectrums, including economy and international security.

Alpcan Efe Gencer

Use of Data Mining in Energy



Energy plays a critical role in global economic activity—the need for energy increases in direct proportion to the rise in the expansion of the human population. Therefore decisions made on producing energy is depending on a list of costs and benefits. Renewable energy, such as solar, geothermal, biomass, hydroelectric, and wind energy, is the right choice for producing electricity, considering low-carbon investments and the impacts on the environment. It involves a complex network system composed of energy transformation, energy transportation, and energy consumption. Even though the current network system provides an excellent way for energy transportation and change, the process is still very complicated.

Energy organizations need to evaluate and track energy consumption and production to enhance their perception about their energy needs, allowing better real-time decision making for energy usages while maintaining enough energy resources for the forecasted demands. The relation between data analytics and renewable energy arises from the fact that huge data streams are increasingly needed to be observed and studied in real-time to achieve the main target of energy saving.

Data mining is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems. Data mining is the analysis step of the "knowledge discovery in databases" process. Aside from the raw analysis step, it also involves database and data management aspects, data pre-processing model and inference considerations, interestingness metrics, complexity considerations, post-processing of discovered structures, visualization, and online updating.

Data mining has the power to transform enterprises, and it helps in analyzing and summarizing different elements of information. A mining process is a form in which all the data and information can be extracted for future benefits. To get a better understanding of the data mining method and its effects on renewable energy, wind energy generation can be investigated. In specific, it refers to the process of using wind to generate electricity or mechanical power.

There are a lot of studies that show the usage of data mining in energy consumption and/or energy saving. In the article, *Data Mining and wind power prediction: A literature review*, the authors suggest that: Wind power generated by wind turbines has a non-schedulable nature due to the stochastic nature of meteorological conditions. Hence, wind power predictions are required for a few seconds to one week ahead in turbine control, load tracking, pre-load sharing, power system management, and energy trading. To overcome problems in the predictions, many different wind power prediction models have been used to achieve in the literature. Data mining and its applications have more attention in recent years. The same study has been evaluated in consideration with their prediction accuracies and deficiencies. It is shown that adaptive neuro-fuzzy inference systems, neural networks, and multilayer perceptrons give better results in wind power predictions.

Another example of these studies is renewable energy potential in Romania using a clustering-based data mining method. In the article *An assessment of the renewable energy potential using a clustering-based data mining method. Case study in Romania,* the available data on installed capacity, level voltage, type of renewable technology, and geographical location the renewable energy potential for electricity generation was divided into representative zones using the K-Means clustering algorithm. For each zone, the possibility was assessed on voltage level and renewable energy generation technologies (wind, solar, hydro, biogas, biomass, and cogeneration). The zones obtained can be a useful working tool for retrofitting substations, upgrading of transmission and distribution lines, and also for redesigning them at different parameters concerning the overload. This information may enable the creation of specific programs to improve the planning and development of the electric networks in Romania.

As can be seen in the examples given, the data analytic approaches that have been applied in the field of renewable energy studies, as vast amounts of energy data are required to be analyzed to produce power on demand efficiently. Limited efforts have been investigated to apply data analytics to renewable energy data, especially wind energy. Therefore, more studies should be addressed towards data analytics for wind energy for the optimization of the wind farms' design to predict the power generated efficiently. Good energy policy is built on useful data, and a sustained commitment to collecting adequate data is critical to meeting the world's future energy needs. To do that, the data mining method must be understood very well by the authorities.

Hande Mert

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