

SYNERGY

Bilkent Energy Policy Research Center Newsletter



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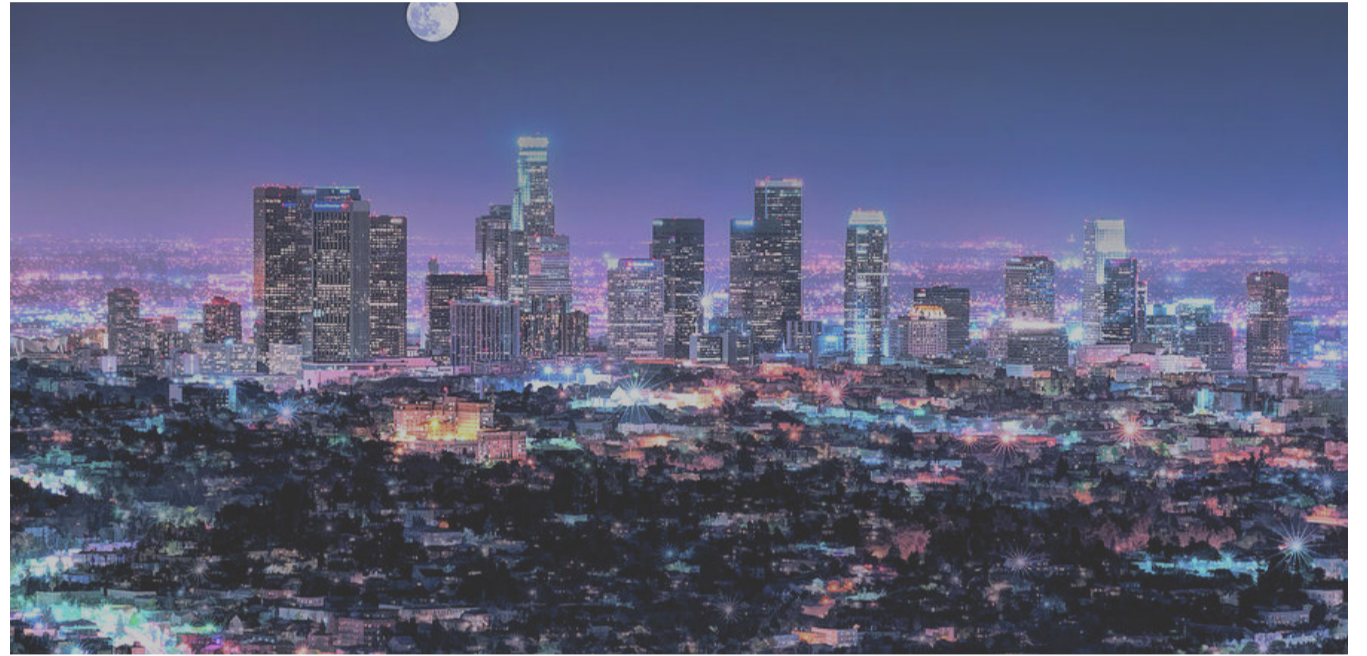
California's Problem With Electricity

New technologies recreate the markets. Electricity markets are in the midst of a big We already said bye to the 100-year-old light bulbs. Then there are electric cars, massive renewable inflows, storage, prosumer... It seems as if we never run out of new concepts in the electricity business. But are the markets correctly pricing the value and effect of these technologies?

As new Technologies penetrate the existing system, the whole operation of the system is disturbed. For example, autonomous cars will change tax, insurance, traffic, licensing, and others. There is no way you can put the genie in the bottle in such transformations. So, especially in electricity, disruptive change has to deal with sluggish development in knowledge, mechanisms, and rules. The acquiring of new knowledge, skills, and experience accelerates with crises. Hence crises are a creative process. Disruptive changes push the rules, mechanisms, and understandings through crises. From my perspective, California's problem is not about renewables but the naïve assumptions for the limits of renewable energy.

We know that you can not cold start a coal plant to full capacity in 5 minutes, neither 5 hours. So our rules and optimizations are designed around these technical limits. You can not rely on hydros for 24/7 generation. The markets should price these limits correctly.

Two years ago, FERC rejected California's proposal for capacity markets. The initiation for the process starts with a gas power plant's request for cost recovery. Wind and solar generation supported by out of market mechanisms have destroyed the value-price relation in the markets. Capacity markets, on the other hand, are very political. It is as if you are trying to put a price on avoiding future blackouts. If you



price it correctly, no blackouts should happen.

The first California crisis was also due to the naïve belief that markets will work as-is. Stephen Littlechild from the UK has inspired early developments in California. The problem then was four folds: bad design, lack of reliability framework, natural gas and emission markets, monitoring. It ended badly. Now the green revolution of California is facing similar problems. It may derail targets in California and may affect renewable sentiment around the world.

To avoid it, we have to look problem carefully. First of all, reliability should be priced correctly. The demand side and other consumer-side tools are not coming as expected. The problem should be solved on the supply side. And on the supply side, the key element for the operation of the system is reliability. Pricing should reflect the emergency and value.

Texas's and operating reserve demand curve is an attractive choice. The problem is the political nature of high prices. In California's example, the state is facing drought and needs the fossil capacities to make up for hydro. But these plants had to earn enough money to provide reliability figures like 1 hour of blackout for every Ten years.

Especially the systems with large hydros are vulnerable to drought and extreme drought periods. These events may happen more frequently in the future. So hydros turn into another vulnerable resource. And then, there is the virtual inertia problem with inverter-based systems. The problem is huge.

Why energy transitions take 50 or more years? Not because capitalists block the development of new resources and technologies. New technologies change the techno-economic systems built in years. These systems are a crystallized accumulation of past experience, problems, and knowledge.

A good starting point should be pricing reliability more accurately. To weather the high prices, paper products for hedging or establishing a reliability fund to insure against these events can be important.

California was very ambitious before the first energy crisis, but the ambitions worldwide have been hit due to crises. Now we have this second crisis falsely related to renewable energy. We should not let the green ambitions to be wounded again. We should design the markets to match our ambitions.

Bariş Sanlı

How Will It Effect Us? – A General Outlook

The announced gas discoveries in the Black Sea point to a changing reality in the Turkish energy policies. While the news of the discoveries is great, these sites' material effects will show themselves once the production starts up at the wells. Being a rather reserved sector, the public opinion on the subject seems to have created numerous questions as to if and how these discoveries will affect our daily lives, which is where the work gets interesting.

The natural resource wealth is a contentious topic that has been studied extensively to understand the relationship between countries' international standing and the source of their national incomes. Some people point out the cases of Venezuela and Nigeria while others pinpoint Norway and the Netherlands. However, no single case is identical to one another when the matters on hand are this large and complex. The economic and political standing of Turkey is unique to itself and should not be mixed with those of other countries when making comparisons.

The benefits of having large scale offshore hydrocarbon production will reach further than just bringing in funds through the exploitation of the resource. The investments to be made in human capital and the development of side industries that support this sector will flourish in the coming years. Businesses spanning across the subsea engineering expertise domain, whether it is drilling, construction, or vessel management, are just some of the prime areas where we will see investments being made



in their direction.

On the other hand, the knowledge gained in the offshore O&G sector is transferrable to other sectors. While it may come as a surprise to some, but offshore wind farms share a lot of similarities with offshore O&G supply chains. Currently, the service providers in the North Sea Oil Fields have begun to also support the offshore renewables operations in the U.K..

It is one of the many signs of how the industry is capable of adapting itself to changing realities. How does this reflect on Turkey? With ambitious renewables generation goals, Turkey could, in the future, start the development of offshore renewables itself. If not that, then the Turkish service providers could very well provide these services elsewhere in the region to other offshore developers.

The dawn of subsea mining is also presenting opportunities for the industry. While the operation

components are likely to be completely different, the mode of it is very similar. Utilizing underwater ROV mining robots and drillships to perform the excavation activities, any knowledge gained in the offshore subsea industry today will have positive consequences in the next 50 years for the Turkish mining industry. It should be reiterated again that these actions/operations do not necessarily have to be conducted in Turkey but could be provided as services to third parties/countries.

The list of side-industries that will benefit from the establishment of offshore developments is easily expandable and goes further than generalizations in single paragraphs. For this reason, in the upcoming weeks, I'll take a look at how the expansion and development of local offshore hydrocarbon reserves might affect a nation's economic and political standing.

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BRENT OIL	42.13 \$/BL	GASOLINE	6.74 ₺/LT
USD/TRY	7.78	DIESEL	5.93 ₺/LT
EUR/TRY	9.06	FUEL OIL	3.59 ₺

Hydrogen: A New Way

As a hot topic in the modern energy world, hydrogen is under the power industry's focus and the technology and investment companies.

When we consider hydrogen only as a "fuel," it can be seen that it has the highest energy content, among other fuels. The energy per unit mass is three times that of natural gas. However, there is no harmful waste that will harm the atmosphere and the environment due to the combustion of hydrogen. Also, after the burning phase, water that does not harm the environment is released.

One of the biggest challenges in using hydrogen as a fuel is its storage. However, hydrogen can be easily stored and transported today with new developing technologies. It can be stored in compressed gas, liquid, or metal hybrid form. Another difficulty with hydrogen is that it cannot be found in pure form in nature. In other words, it is necessary to separate it from other compounds to obtain hydrogen.

Hydrogen is produced in several ways, and these are called the grey, blue and green types of hydrogen. Firstly, hydrogen can be produced by fossil fuels, and this is the grey method. According to the latest statistics, almost 96 percent of hydrogen is produced from fossil fuels. Although there are different ways of producing hydrogen, one of the cheapest ways is to separate it from methane gas or produce gasification of coal.

The second way of production is the blue production of hydrogen. In this production, fossil fuels are still in use; however, the difference between the grey and blue types is technology. In this method, carbon capture technologies are used in order to restrain power plants from causing CO₂ emissions. In the third type, the green one, the method is the electrolysis of water. In brief, hydrogen is separated from water thanks to the direct current flowing through the water. The green type is the desired



production of hydrogen due to its prominent role in the zero carbon emissions.

Hydrogen-sulfur, which is excessively found in the Black Sea depths, is another source of hydrogen. Since its electrolysis is easy, it is considered as a very efficient source. Due to the Black Sea being exposed to many waste brought by various rivers flowing into it, there are many harmful elements in the seabed like H₂S. However, it can be used to obtain hydrogen gas to use in electricity generation and sulfur in the industry. In addition to all these, according to the researchers, it is likely to produce green electricity from hydrogen while removing the contamination accumulated in the seabed. Furthermore, besides the Turkish natural gas discovery in the Black Sea, a focus on the other clean fuel like hydrogen can also boost Turkey's economic and technological interests in the following years. This kind of step in the energy sector will also be important in regards to Turkey's green energy policy.

The rise of developing vehicle technologies together with hydrogen, are seen as factors that will stimulate many green and smart city policies, especially in European countries. The

production of hydrogen-powered automobiles and public transport vehicles and the construction of hydrogen stations will increase employment and support the sub-industries. At that point, it will be a sine qua non for large oil and gas companies to prepare themselves for the newly formed sector and be agile when necessary. Likewise, airline companies and aircraft manufacturers' fuel consumption models will also change due to the feature of hydrogen that enables aircraft to travel much longer distances when compared with the jet fuel.

Taking all this into account, it can be stated that the probability of a hydrogen-focused energy world and industry, technology, and employment that will gain momentum in the following years is extremely high. At that point, the collaboration among the public, companies, industrial and trade unions, civil societies, academia, and others is one of the most important and necessary factors that spring to mind. In the next article, this topic will be researched and presented to the readers of Bilkent Synergy.

Yazgı Nur Akın

A Missing Point in Energy Debates: Northern Iraq Gas

As it is known, the Middle East is a region that is famous for its natural resources reserves and conflicts/disagreements, which emerge as consequences of them. Saudi Arabia, Qatar, Kuwait, United Arab Emirates, and Iran have authoritarian regimes and natural resource-based economies. In addition to all these, we have a case that differs from given countries with its fragmented society, critical geopolitical location, unstable domestic politics, and structure, which is extremely open to foreign intervention, Republic of Iraq. In this essay, the main focuses are natural gas, which becomes of secondary importance due to the oil and repercussion of Iraq's fragmented type of society: Kurdistan Regional Government (KRG).

Northern Iraq is a region that attracts the attention of world public opinion and different regional/international actors because of its oil reserves in consideration of the critical role of oil in production processes. According to Deloitte's report on oil and gas review in the KRG, the amount of piped export of crude oil is 160,306,283 bbls, and the gross value of crude oil sold is 8,349,749,733 USD. However, another natural resource necessary for heating, motor fuels, electricity production, and so forth is natural gas, and Northern Iraq is rich in natural gas reserves. KRG is able to produce 400 million cubic feet of gas per day in Khor Mor (gas field in Northern Iraq). CEO of the Dana Gas company, the operator of Khor Mor, said that doubling natural gas production may export surplus to either Iraq or Turkey. In this context, it can be said that natural gas reserves and production of the region are



also worth considering besides oil production.

KRG is a political entity that is located in a geopolitically significant region. Since it has borders with both Turkey and Iran, the region plays the role of a transition point. The Russian energy company, Rosneft, invested in KRG to build a gas pipeline planned to transfer the region's natural gas to Europe over Turkey (2018-2019). This project's route and investor show the region's natural gas potential concerns many players in the energy market, and they understood the importance of natural gas trade.

When we move from foreign trade relations to the internal dynamics of Northern Iraq and the central Iraq government, we can approach this issue from two different angles. Firstly, according to Harry Istepanian, an analyst from Iraq Energy Institute, presents an opinion that the existence of natural gas in the northern part of the country can be interpreted as a chance for alleviating Iraq's energy dependency on neighboring countries Iran. Iran is a country that is influenced adversely by American sanctions, but Iraq is an exception due to its fragile economic structure. So they have a waiver for trade relations with Iran. As it is mentioned before, if natural gas production in KRG

increases, then Iraq will have a priority for importing the gas. This means a decrease in Iraq's import item from Iran. The second aspect of the issue is about KRG. Natural gas is a resource that can be used for electricity production. Prime minister Masrour Barzani says that they have improved themselves regarding energy production. At the same time, he clarifies that they cannot reach their full capacity (6,500-7,000 megawatts) due to the shortage of fuel to operate fields. They are able to operate 3,500. In this context, solidarity between Erbil and Baghdad can benefit both of the governments. Not only for their consumption but also it will have positive effects on electricity import from Iran, which is related to the first aspect.

In conclusion, the natural resources wealth of KRG cannot be reduced to oil. However, the region has facilities about natural gas. If Iraq takes the lead in improving activities about natural gas in Northern Iraq (extracting, operating, etc.), then international actors can support this move with foreign direct investments. In this context, focusing on natural gas resources can be a cure for some problems of KRG and Iraq Republic. At the same time, international players may benefit from Northern Iraq's resources via trade relations.

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