

SYNERGY

Bilkent Energy Policy Research Center Newsletter



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A World in Turmoil

In the recent World Energy Congress in Abu Dhabi, there were mixed messages. Climate change was as important as ever. There was not a single dissident message. The aims were closer, but the pathways were ambiguous.

One of the underlying themes was the future of hydrocarbons and especially oil. The geopolitical implications of oil demand weakness, in the long run, was disturbing for the oil-producing countries. Renewables and natural gas were the resources for the future. Hydrogen has the potential to be the common energy carrier for lots of new applications.

Digitalization is the future as it was 20 years ago with a pitch on artificial intelligence and new market models. As the ether of the modern industrial world, digitalization powered by the sensors and software with processors is doomed to change the energy landscape forever.

The customer will be empowered by all the digital tools, distributed generation, solar panels, and electric cars. The future is bright, and the rise of the "new" customer is unstoppable.

So what is wrong?

For one thing, there is an optimist world view and a world we live in. Coal consumption today is higher than 20-30 years ago, emissions are increasing despite cheap panels and Tesla revolutions. Yellowjackets were on the street to protest environmental tax regulations. Meanwhile, the EU may impose minimum tax levels for energy commodities, and consumers are expected to welcome these new regulations with joy.

And there are deep currents. They are harder to see, but the flow and the tensions are there. Low oil prices and the implications are a big question for the oil producers. The sustainability of the shale revolution is a much less important one.

The perpetual regulation machines of the energy world are under investigation. What kind of regulation, in which more participants than ever have discussed complexity and cutting the red tape. The regulation eole may have reached its limits, and a contraction may be indispensable

But the harder question was the main question. The theme of the conference was "Energy for Prosperity." A prosperous



world in climate constrained environment with ever-increasing taxes and regulation is questionable for the consumers. Everyone wants to save the planet, but the burden to achieve the aim is an orphan.

Energy transition will not be cheap. Climate change efforts may never be enough. Regulations may not slow down. So who will tell the consumers those bad news? A Mary Poppins song may give a hint: "a spoonful of sugar helps the medicine go down"... So what is the sugar?

From a realist point of view, there is no sugar or at least a sugar that the whole world can reach easily. The aim is precise, but the road ahead may be the hardest of all. A global pilgrimage to a cleaner energy world may not be secure, cheap, or straight forward.

The voyage has started. The concerns are not about the targets but the social, economic, and structural changes waiting for us. There will be losers and winners. Unfortunately, the anxiety for being a possible loser may stress the players more than before. They may end up with the wrong moves.

But all these concerns are minute compared to our aim to leave our children a better world. It is not unreachable, but we need to do more.

Barış Sanlı

Ankara's Garbage is Shining



Did you know that 1 kg of waste is produced per day per person? What happens to all these wastes every day? Mamak Garbage Biogas Power Facilities is a success story which proceeds a journey from garbage to electricity and food (TRT).

Mamak Garbage Biogas Power Facilities was established in 2006. The facility also uses the heat produced in the greenhouse of Mamak Integrated Solid Waste Management facility to grow tomato, cucumber, strawberry, eggplant, pepper, potato and orchid without any hormones or pesticides but bees are commonly used in the greenhouse. Nevertheless, it is not considered as organic food since soilless an agricultural method is used.

First of all, garbage has a selection process. Recyclable products are pressed and sent to recycling. Organic products (kitchen waste) are fermented in tanks. Organic waste causes methane gas emission in fermentation tanks, and this gas is stored in gas holders which are used to produce electricity in energy production plants. While converting methane gas to electricity, carbon dioxide arises, and it is sent to a greenhouse to wipe it out.

Some portion of organic waste is used as fertilizer to support agriculture in the region. Besides, the electricity produced from methane gas in Mamak can feed up to 140 thousands of houses which contributes to 2.4% of the electricity consumption in Ankara (TRT). The warmth arising from electricity production is used to warm greenhouse. Ankara Metropolitan Municipality aims to construct such a facility in other districts (Milliyet). Your lights in livingroom may come from yesterday's dinner (Climate Neutral Group).

Selin Güngör

The Circumstantial Nuclear Waste

Everyone has different opinions on nuclear energy and most of us are terrified of it. In this article, I will try to explain nuclear energy by using the basic science theorems and looking into the pros and cons of it through concrete example. Firstly, nuclear energy does not begot pollution or lead to greenhouse gas emissions. To generate one kilowatt hour of energy – the amount a household consumes in 45 minutes – nuclear power plants only emit 12 grams of carbon dioxide which is enough to fill 3 two-liter soda bottles. Meanwhile, to produce the same amount of energy, coal plants emit 820 grams of CO₂, about a full bathtub's worth. Meaning: this technology endows us with free and clean power. On the other hand, it produces radioactive waste as obtained. To simplify, the nuclear power is the energy in the nucleus, the atom; and in order to create electricity, this huge power must be released from the core. There are theoretically two methods of doing that, one is nuclear fusion where atoms join together and the other is nuclear fission where atoms are split apart. However, nuclear power plants do not have the capability to produce energy from nuclear fusion safely and reliably. So nuclear reactors use pellets of the element uranium as fuel to produce nuclear fission and the products create heat by causing a chain reaction. Heat is used to boil the water, and water being the cooling agent produces steam that turns the turbines which generates the electricity.

Although the procedure is very efficient so far, the real danger is where the used fuel waste is stored that produces this energy.

In order to understand the basis of storing the nuclear, we may look at the best dangerous example: San Onofre Nuclear Generating Station because it is in the Shore of Pacific Ocean, connected to Interstate five freeway, has L.A. and San Diego within 5 miles and 8.5 million people inhabit in the area. Back in time, San Onofre plant could power 1.4 million homes at a time. Now, the reactors are retired. Plants operator, Southern California Edison is preparing to dismantle it completely.

The place turned into a pile of containment buildings when one of the steam generators sprung a leak. So, The American government decided to demolish the place down to the ground but firstly, the fuel preserved in the facility must be taken care of. Although the fresh fuel is not that radioactive, when it waits too long in a generator it forms other dangerous radioactive atoms like Cesium-137, Strontium-90,



and as mentioned above: Plutonium-239. First two isotopes having approximately 30 years to decay in the nature, plutonium is the arduous one by taking 24,000 years to be gone.

So what happens to these explosive atoms? After giving it a good cool off, scientists store the used nucleus in earthquake/tsunami/flood-resistant, concrete blocks with no needs of pumps or any active systems to support it. Unless there arises a way to exterminate it completely, this passive havoc facility stays within the earshot of people.

Initially, this whole nuke journey started around sixties when Onofre hit the ground running. All the commercials were selling the America on how safe it was and too cheap even to be metered; also claiming that the entire country would be generated using nuclear energy by 2000. However, no one really didn't know what to do with the nuclear waste, Rob Nikolewski says from the San Diego Union Tribune because it was believed that government would just take all the waste and bury it in Yucca Mountain in Nevada, yet the local politicians hated that idea having the government's promise on wait. By the time, the plants were not only producing 20% of America's electricity but also 2200 tons of waste each year. Consequently, next to the most significant nuclear storage of our time; many people go fishing, swimming, surfing and walk their dogs right in the beach that hosts 1700 tons of spent nuclear fuel. The only closure in mind is whether to keep producing that kind of energy and toxic the world little by little or to go old school and use the coal and oil that pollute the environment directly but with less hazard.

Denis Gürbüz

'Worst Cases' of No-Deal Brexit: "Operation Yellowhammer"

Earlier this week, the U.K. government has released an official paper called "Operation Yellowhammer," which presents the possible future scenarios of No-Deal Brexit. Indeed, it was dated as of August 2019, but it has been recently published by the Members of Parliament's pushes to the government.

In the document, disruption in energy, shortage in food and medicine, rise in fuel prices, and protests in the society are taking part as 'reasonable worst-case planning assumptions.' Although Prime Minister Boris Johnson sees these assumptions as of speculative fears, they have been seen as dangerous and very possible scenarios.

No-Deal Brexit refers to the U.K.'s immediate left from the European Union without an agreement unless they can reach one, until the end of October. After the no-deal process, the U.K. would leave the market and the trade relations through EU and EU institutions immediately. Undoubtedly, U.K.'s divorce from the EU without any transition period would devastate not only the U.K. but also the members on several counts.

On the Energy Side?

According to Energy U.K. (2018), which is a trade association for the energy industry, the U.K. is one of the most important allies for the Internal Energy Market. The internal market enables all members to reach the security of supply and benefit from close cooperation and collaboration in energy trade. Therefore, the U.K.'s disunion from the EU will impact them mutually.



As government's Yellowhammer contingency assumptions say, even though the supply of electricity or gas of the U.K. will not be ceased immediately, the prices for electricity and gas are likely to increase remarkably. It also pointed out that this rise in the costs for both domestic and business consumers may lead the participants to exit the market. Britain will need to deal with the economic and political consequences of the price increases eventually. Likewise, according to Climate Home News (2018), U.K.'s energy trade will last in the case of Brexit since it is not restricted to the membership to EU; but by the time, the consumers will be affected negatively because of the high prices.

After the deadline of the Brexit, 31 October; we will see whether these assumptions are only fear scenarios or will turn to reality throughout the time. Still, it is evident that there will be consequences both for member states and the U.K. in various areas, including energy.

Feyza Ünal

Game Changers: IoT & AI

Internet of Things (IoT) technologies, which has come into our lives with various applications, have been attracting the attention of the players in the sector with its wide usage area and tremendous benefits it brings. From sensors for home technologies to complex applications that control the energy applications in complex systems, it creates efficient, productive, and connected systems. The system consists of web-enabled smart devices that use sensors and embedded processors to communicate, share data, and sometimes act on the information they receive from each other.

The way of communication affects the way energy companies do business. For instance, smart meters have become a widespread solution as a highly efficient IoT application. With the help of smart meters, users' energy usage is instantly accessed and kept in the central system of the energy provider. But this technology can reach beyond intelligent meters.

One of the most trend topic one is smart grid which is two way of communication between utility companies and customers where electricity and information can be exchanged. Utilities can cut down and backup power plants and use less reliable, intermittent but cleaner sources like PV panels and wind turbines as utility companies can adjust the type of source according to the customer demand. According to the environmental defense fund it is expected to reduce air pollution 30% by 2030. Also, Florida smart grid implementation resulted in 3.4 million dollars in productivity savings, 99.98% service reliability, and according to the Business Insider, financial gains could reach up to 160 million dollars.

Utility companies can manage the electricity according to customer demand as they have instant data. Analyzing the data by computer system swift responses will be given by the system then with the human intervention and analysis the system will be able to respond. But the question is why there is a need for human intervention. The



advanced technology answers this question by artificial intelligence (AI). Today's smart devices, which automatically detects the demand levels in the network and reduce energy, are strengthened by AI and made recordable with blockchain. It is possible with AI to balance the web with its powerful system, to negotiate actions by managing demand and to provide a range of new products and services by improving itself.

There exists a similar application at Google. Google stated that it had reduced its energy consumption by 15 percent by using DeepMind, AI technology in computing centers. Google has achieved a 40% savings in the use of energy consumed for cooling using AI.

As a result, utilities can manage the supply and demand while optimizing energy given to the grids and reducing waste. When the benefits of the system and Turkey's dependency on energy are considered, the application of the system has a crucial role in Turkey. Investments in smart grid projects will increase the use of renewable energy as well as reduce Turkey's foreign dependency on energy. It will also ensure the efficient use of energy while contributing targets about global warming.

Nilay Büşra Yurtseven

Time to "Sum"mit Up

Today 4 years, in other words, 42 months, 195 weeks, and 1396 days ago, the Paris Agreement signed among 195 countries which valued as the most extensive agreement that has ever been signed. The goal of the Paris Agreement was and still is to reduce the earth's surface temperature and prevent it from coming up above 2 Celsius degrees.

Although this agreement signed by numerous countries, the heat of the earth continues to rise. The

reason is that some countries terminated the contract while some states have not fulfilled the necessities of the agreement. While some severe polluters like Russia refused to sign the deal, the USA, which considered one of the biggest polluters of the World withdrawal the agreement for political reasons. Another necessary provision of the Paris Agreement is the carbon dioxide emission rates of the countries. Repeatedly, its main aim is to reduce carbon dioxide as well.

Gases such as carbon dioxide and methane are harmful. As the presence of these toxic gases increases in the atmosphere, the ozone layer continues to rupture rapidly. The ozone layer is responsible for absorbing ultraviolet rays sent by the sun to the earth and the surface. Thanks to this feature of the ozone layer, both the world and the living creatures can live without facing any harm from the sunlight.

Since the effect of the ozone layer is diminishing due to the increase of harmful gases in the atmosphere, the temperature of the planet is increasing as well. It triggers climates to change and natural disasters to occur more frequently, which creates much more serious problems for the living creatures.



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"Every year, natural disasters kill around 90 000 people and affect close to 160 million people worldwide. Natural disasters include earthquakes, tsunamis, volcanic eruptions, landslides, hurricanes, floods, wildfires, heat waves, and droughts. They have an immediate impact on human lives and often result in the destruction of the physical, biological and social environment of the affected people, thereby having a longer-term impact on their health, well-being, and survival." according to the World Health Organization (WHO).

Even though the health sector is developing with the improvement of technology, still not enough to avoid natural disasters to occur and lots of people to die.

Four years have passed since the Paris Agreement was signed and the danger bells have begun to ring again for our planet. Plus, to end of the Paris Agreement 10 years remain. For this reason, the United Nations Secretary-General António Guterres announced that there would be a UN Climate Action Summit 2019 in New York on the 23rd of October. This summit is going to be crucial because, by 2020, there will only be ten years remain for the target year of the Paris Agreement, which is determined as 2030.

The less time left, the more dangerous the situation of the countries involved in the project will be. For this reason, to prepare the future decade's facilities, it is crucial to acknowledge, to what extent countries have reduced their carbon dioxide emission targets and do they have behaved in parallel with the plans they have previously reported?

Consequently, to visualize the future of our planet, to plan what to do in the energy sector, to search for the mistakes that have done in last five years, to find crucial answers to some essential questions and to compromise, the UN Climate Action Summit is going to be vital.

Bartu Çelebi

A Tool to Consider for Energy Investments and Policies: Energy Return on Investment (EROI)

Many different approaches are used to determine the break-even point for a project and many cost-benefit analysis methods are available for the energy industry. One indicator to use when making such life-cycle analysis for an energy resource or fuel is the Energy Return on Investment (EROI). The term refers to the ratio of the usable energy returned during a system's lifetime, to all the invested energy needed to make this energy usable. It is first coined by Charles Hall who is a systems ecologist (Gupta, 2018).

Hall et al. state that energy surplus is a must to be achieved for any species' survival and further growth. It is a key factor for biological evolution and also the development of civilization. However it is more of an optimization process rather than just going for the maximum since efficiency and productivity are also to be considered (Hall, Balogh, Murphy, 2009).

There are numerous factors to consider before investing in energy. As carried out by Arda Batmaz (2013), some of the decision making criteria can be grouped as technical (efficiency, reliability, capacity, operational risks, local know-how and exploitability), economic (CAPEX, OPEX, realization time, financial indicators, service life, policies, risk, confidence, macro economic markets, availability of funds), environmental and social aspects (emission rates, land use, noise, social acceptability, job creation, safety for human life).

EROI might come in handy since an elaborative analysis is crucial for both the investors and the policy makers when determining the type of energy resource to opt for.

A preliminary protocol for determining the EROI was proposed by Murphy et al. in 2011. While developing a formal methodology and nomenclature for such an analysis; a price based method might have shortcomings of not emphasizing global warming potentials enough, whereas an exergy based method might also not be able to consider greenhouse gas emissions plus economics and financial matters (capital, labor, ease of transport, infrastructure etc.) too.

The problems with the price based method can be ameliorated to some extent with the adjustments by price caps and gas emissions trade programs. For the time being, Divisia Index which is set to coal as the reference fuel was proposed (Murphy, Hall, Dale, Cleveland, 2011).

EROI values are also dependent on time since they are closely related with the technological advancements and availability of the resource. For example EROI values for oil have been showing a decline (Hall, Lambert, Balogh, 2013) since more easily exploited reserves have been getting depleted.

Further developing on the idea, Jessica G. Lambert created the Lambert Energy Index (LEI) to consider factors like EROI, Gini Index, and Energy Use Per Capita all together. (Lambert, Hall, Balogh, Gupta, Arnold, 2013).

There is no one tool that is collectively accepted when it comes to decide on an energy investment or policy yet. There have been many suggestions and other studies considering and centering around the concept of EROI ever since (a simple google scholar search for the exact phrase returns ~900 results per year since 2013) and time will show if it becomes a standard tool for industry to us.

Hasan Gürsel

Movie Review: The Iron Orchard



The Iron Orchard is based on a novel. In 1966, Texas born and bred, The Iron Orchard is an adaptation of the 1966 novel by oilman Edmund Van Zandt Jr, who wrote the sprawling tome under the nom de plume Tom Pendleton. This film is important to influence from the early '30s to 50's oil industry.

Ty Roberts is directed The Iron Orchard from a script by Gerry De Leon, Duncan Thum carries the musically part of the film. He takes us along on a stream of chains and important chords. The impressive vintage cars and clothes remind how were beautiful old times, combined with a pretty cast make the film endless visual feast.

Lane Garrison, who is an important actor in American film industry performs Jim McNeely, an ambitious, has not enough money. He has a relationship with girl Mazie (Hassie Harrison) who is the daughter of a rich family, but he was rejected because his revenue is not enough to continue a marriage. So he decided to go out to Texas where is the mine of black gold (oil) to be in the future rich in the oil business. Because those days oil industry has a big impact on the American economy. If you found oil, you would probably be rich in people's perspective.

These reasons carry Jim McNeely to work in an oil company as a pipeliner. Predictably, he has to begin at the bottom working for the heavy, indifferent Bison Oil Company. Committed to a work gang digging and setting up tools in the cruel sun, he was pushed around and picked upon by the sun freckled veterans, and finally took lessons to stand up for himself.

Dent Paxton (Austin Nichols), who is the well-educated supervisor, unexpectedly meet and improve their friendship with Jim. At first, Dent supervises Jim to break it off but sees a headstrong ridge inside of Jim he could not admire. Eventually, the strength of their friendship covers a lot of ground, leading to conflict. Eventually, Jim fell in love with other women, whose name is Lee (Ali Cobrin). After a short time, Jim save up enough money to open his own oil company. He is buying an astonishing house where he lived in his childhood and attending to make a show all the bullies who gave him a hard time in the past.

The great look of the Texas and mention about West Texas Intermediate (WTI) makes film incredible. Also, there are a lot of beneficial scenes that include drilling operations. Touching on uses of the birdcage in oilfield makes this film endemic. To sum up, The Iron Orchard contains a lot of nostalgia about Texas and it is a good one which addresses to the oil industry.

Baran Can Yücel

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Publisher: Bilkent Energy Policy Research Center

Editor: Gökberk Bilgin

Contact: eeps@bilkent.edu.tr

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