Volume 1 Issue 4 September 23, 2019

SYNERGY

Bilkent Energy Policy Research Center Newsletter

Energy Policy Research Center

Recovery Analysis on the Ghawar Oil Field

The attack on Saudi Arabia's Abqaiq Oil Processing Plant on October 14th, 2019, served as a wake-up service for the entire oil market. Nearly 70% of all production of Sadi Arabia, the world's swing oil producer, OPEC's big brother, and the redesigner of the oil market with "netback price" model, stopped for 48 hours after the attack.

More importantly, the vulnerability of the security level of the world's largest oil plant, which was thought to be extremely robust in terms of security, made everyone uneasy. Abqaiq, the most fragile point of production in Saudi Arabia, has faced such an accurate attack, and the fact that those who made the attack could escape without even seeing a response showed us how much of an oil supply could be a daily life issue as much as none of us could realize before.

The primary importance of the Abqaiq plant is the fact that is that it is processing a large amount of Ghawar production, world's largest conventional oil field and that Ghawar oil cannot be exported unless processed here. Although there is no official data for Ghawar's current production, Bilkent University Energy Policy Research Center estimates that it produces around 4.2-4.4 million barrels per day (mmbpd) as of the beginning of October 2019. We may have a better idea to understand the impact of the attack, considering that production has dropped to zero for 48 hours immediately after the Abqaiq attack.

Putting Ghawar back into full production and re-commissioning the Abqaiq plant will be a much more complex and more protracted process than one might think. According to our calculations, the total number of producing wells in Ghawar was around 1,500 before the attack. It is technically not possible to re-commence all of these wells simultaneously. This technical distress is the outcome of both limitations of logistics and thermodynamics. While it is possible to overcome logistical constraints with the power of Aramco, it is not that easy concerning thermodynamic constraints.

Ghawar is an old field, and in fact, it is so big that it is in production in the form of five giant field development projects. It is impossible to develop Ghawar as a single field. That is why we have been hearing complaints that in some parts of Ghawar there has been a significant increase in water production from crude oil for several years due to aging and the difficulty of controlling due to the enormity of the project. These complaints bring some beliefs that the cost of production at some points is much higher than the Saudi Arabia averages and that even in some regions production has come to a halt.

The discontinuation of production in the field after the last attack probably caused considerable damage to the pressure balance of the reservoir. Therefore, if these wells are rushed into production, some wells will no longer be able to produce oil again, causing irreversible conditions in the future production volume and costs. Therefore, the strategy that Aramco will follow is vital.

It has been said that while Ghawar will not be producing at full level, the oil needed will be met by stocks and demand to be cut by local refineries. In this case, two more problems will arise. The first problem is the possibility of an increase in prices due to the necessity of replacing the stocks, that Aramco is currently using to recover its declining export capacity, will downforce either export capacity or production capacity. The second problem is the cut in supply of products due to reduced refinery production will put pressure on the product's market and, hence, on crude oil prices indirectly. Either way, it will surely have an impact on crude oil prices and supply-related risk premiums in the medium and long term. At the moment, we do not feel pressures on prices on the demand side due to the maintenance season at Asian refineries, but we would start to feel it from mid-October.

According to our calculations, it will take 3-6 months for the damage in Abqaiq to be fully repaired and the plant to be operational again at full capacity. According to Aramco's statements, we realize that the production of approximately 3.5 mmbpd will be provided by the use of stocks and cut in local refineries. Assuming that the total local refinery processing capacity is 2.9 mmbpd and that these refineries will be kept at a production capacity of close to 50%, we expect a contribution of 2 mmbpd from stocks. In this case, for a 90-180 day disruption, a stored oil of between 180 and 360 million barrels (mmbbl) must be marketed. Assuming that most of the production cut is from Ghawar, we assume that 80% of Arabian Light crude oil, which is produced from Ghawar field, will be supplied from stocks.

With this account, even if it takes a year to replace stocks - where the pricing impact in the physical market is high in the future, Aramco will require an additional 1 mmbpd production increase. Forcing the Ghawar reservoir, which has been damaged by this recent attack, to further for this additional production capacity will have a negative impact on Saudi Arabia's total output and export capacity in the medium and long term.

As we tried to analyze here, the Abqaiq attack was low initially, but intense in the following days. Understanding the implications of this attack is crucial for understanding the oil markets for the next two years. The outcome of the upcoming OPEC+ meeting will be in parallel with the impacts of this attack. Within the economic competition of the countries in the region, this attack has probably become a blow that is almost impossible to repair for Saudi Arabia; we will monitor this attack and its effects for a longer time.

Serkan Şahin

Energy Security in the Post Abqaiq World

Last week, one of the most important crude oil facilities in the world has been attacked. The initial reaction of markets to the event was a 20% hike, later settling to much lower figures. The coincidence of such a big event with a world economy in dim outlook has saved the day for now. But the echoes of this event will change the energy security question forever, again.

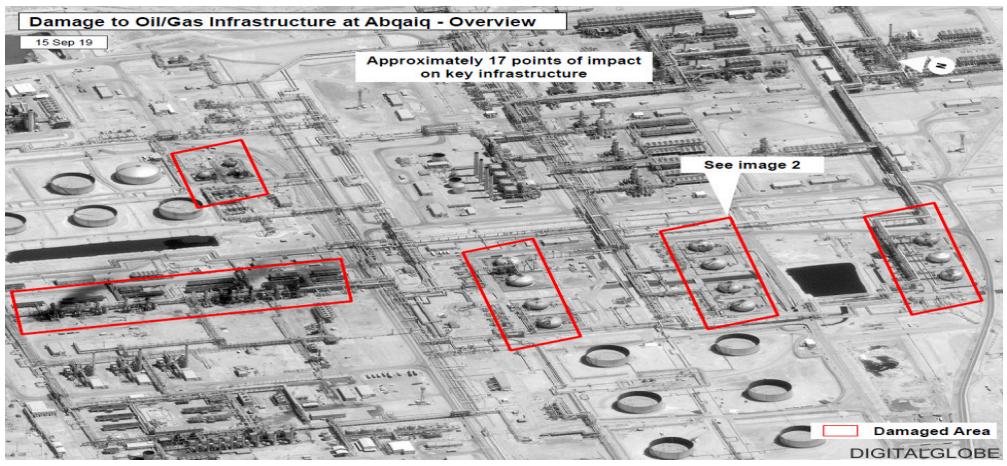
It is hard to predict the full extend of energy crises in the near term. Flow of the information dominates the public mindset and with each bit of information the event is decyrpted. The initial stage is this "understanding" stage of what has happened?. This understanding can only turn into policies and strategies with a certain delay. For the Abqaiq event, we are in the "understanding" stage. Our minds are occupied by the price hikes, pictures and statements. But as the details became crystal clear, it will change institutional, organizational and strategic views about energy security in years to come.

On the 24th Feb 2006, Al-Qaeda has attacked the same facility with two vehicles with explosives. There were terrorists involved in the attack. It was the first direct attack by Al-Qaeda on a Saudi oil installation . But it wasn't successful. 13 years later the same facility has been attacked by 18 drones and 7 cruise missiles, basically with no human on the field . This time the attack has made the damage to the facilities and the world markets.

The main question is the power of innovation on the threat side. Innovation has been generally associated with all the good and bright things like renewable energy, electric cars, digitalization, consumers. As states accelerate the innovative processess, technology may pave the way for a better world. But what if state actors choose to innovate on the darker side? Can they dismantle the welfare and progress we made so far? And what should be the new energy security perspective in the age of innovative technologies and weapons.

The energy security has been related and sometimes synonymous with diversity in the past. It reminds a basic portfolio theory. Don't put all the eggs in the same basket. These eggs were generally geographically seperated actors or suppliers or routes. But when innovation diminish the effect of geographic boundaries, can we surely assume that diversifying is a safe bet?

Unfortunately diversifying may not be enough although it is still relevant. In an integrated world of energy markets, no one can escape from the costs of substantial risks. These risks may translate into domestic risks or economics malaises.



The history shows that when whale oil prices were increased, the quest for the next resource was accelerated. Practically, so called energy transition has gained momentum. As the transition to the crude oil economy evolved then diversification of the resource, routes and geographies made sense. But from whale oil to crude oil, diversification was not the main problem. The main security solution was transition to another kind of technology and energy economy.

Some may think that this transition is another diversification. This is a fair argument. But transitioning to a different energy economy and buying from another supplier are far apart arguments. They may look similar, but a progress and portfolio formation are hardly same.

Are the recent attacks such important? Probably yes and the importance will increase as time passes by. Because this is a new energy world with Asia in dominance, USA in retreat, world is fragmented. State sponsored innovative threats can easily be replicated with lower costs. Geographic diversification can only be a short term physical remedy. Every new technology hailed as game changer is a "threat changer". As the threat factors move like startups, preventive and security mechanisms are as fast as the big organizational structures -like states- resisting change.

Energy security concepts of the 20th century is tested by the innovative new threats in the 21st century. Diversification is still relevant. However it is a weaker solution then before. Innovation and energy transition can be the only viable options for the foreseeable future. As we settle with the energy economy of digital, clean tech and etc, then a new energy security concept will be the zeitgeist of that age.

Barış Sanlı

Recent News on the Energy Sector

Africa

- Egypt is building one of the world's largest solar parks. The Benban Solar Park will create thousands of jobs and it will provide clean energy to 320,000 Egyptians.

Americas

-Climate activists plan to block traffic in U.S. capital. They are seeking to pressure U.S. politicians to fight climate change aim to blockade major traffic hubs in the U.S. capital on Monday, drawing attention to a U.N. Climate Summit that will be attended by leaders from about 60 countries. (Reuters)

- Climate change: Impacts 'accelerating' as leaders gather for UN talks The signs and impacts of global warming are speeding up, the latest science on climate change, published ahead of key UN talks in New York, says. The data, compiled by the World Meteorological Organization (WMO), says the five-year period from 2014 to 2019 is the warmest on record. Sea-level rise has accelerated significantly over the same period, as CO2 emissions have hit new highs. (BBC)

-Iran's oil attack presents most critical test yet for Trump's foreign policy. Iran's audacious drone and cruise missile attack last weekend on Saudi Arabia's oil producing facilities has provided the most critical test yet for the Trump administration's foreign policy. A successful response will require both nerves and vision in a world of emboldened adversaries and perplexed allies. (CNBC)

- Saudi Aramco has notified Japan's top oil distributor about a potential change in shipments, stoking concerns about the kingdom's ability to supply crude following attacks on its major refineries a week ago. State-owned Aramco did not say why it wants to change the oil grade it supplies to JXTG Nippon Oil & Energy from light to heavy and medium, starting in October, JXTG officials said. (Nikkei)

-Saudi Arabia's pledge to fulfill all commitments to oil buyers after a strike on the giant processing plant at Abqaiq means the world's largest crude exporter must continue to draw heavily on its inventories until production capacity returns. State oil company Saudi Aramco has more than enough oil to get it to the end of the month, when it's promised to restore normal levels of production. But if that timetable slips, things could get trickier. (Bloomberg)

Europe

-Turkish renewable energy company, Guris, launched its first wind energy power plant in Odessa, Ukraine, the top official of the company told Anadolu Agency during the opening ceremony of the plant on Sept. 21.Güriş became the first Turkish energy company to invest in Ukraine with its €55 million wind plant, Ovid, Cem Ozkok, deputy manager of Guris Holding, said.(AA)

Fracking and the Controversy Around It

Fracking is drilling the ground to a certain point and then directing a high-pressure mixture of water, sand, and chemicals to the ground to release the gas inside it. The term comes from fracturing the rock with the pressurized water. With this method, the USA and other countries that are in the trial process of fracking, gain valuable natural gas. Natural gas is the cleanest gas that is crucial for countries to achieve their goals of low greenhouse gas emissions.

Fracking requires high amounts of water to be transported to the drilling site. It, of course, carries significant environmental risk, and companies should work towards achieving the same result with lesser amounts of water or a different method. Other potential dangers about fracking are earth tremors, and in case of bad practice, carcinogenic chemicals may escape during the exercise. These are, of course, substantial environmental risks and should be eliminated worldwide to preserve our earth.

On the other side of the spectrum, according to an article by The Philadelphia Inquirer, the economic gain from fracking is 41 billion USD in Pennsylvania alone. For comparison, that is 1/20th of Turkey's GDP and comes from one sector in a state with 12 million population. It has created, directly and indirectly, 300 thousand jobs in the state. It also helps with the USA's policymaking because since fracking began, they stopped being dependent on countries like Saudi Arabia or Russia.

What is infuriating about fracking is the controversy behind it, but what is more lovable about Americans than their failure to find a middle ground in anything and unnecessary radicalness about every controversial subject. There are many solutions to the environmental effects of fracking. Because fracking creates an economic boom, they could be taxed at a higher level or not be subject to tax cuts. With this money, USA could for once care about other countries and give this money to UNEP (UN Environment Programme) for them to help the

investors in other countries that are contaminating drinking waters only because they are undeveloped. By this way, at worst, they could find the equilibrium between the water they use for fracking and water they are saving for world usage. UNEP could also invest in highly needed renewable energy opportunities in other countries.

If it is assumed that US doesn't want to donate their money to UNEP for no reason(!), the taxes could work towards a fully renewable energy program for the US to eliminate the fracking industry by a specific date. The US could also require the companies to increase their budget on their Research and Development Department to decrease the amount of water needed or decrease the possibilities of earth tremor and release of carcinogenic chemicals.

Elizabeth Warren, one of the Democratic Party's possible front runners, promises to eliminate fracking if she is chosen for office. With the economic gains of fracking, there is no possibility of a politician getting a lead in the swing states if they promise to ban fracking as a whole, since 1/12 of the GDP comes from fracking in one of those states, Pennsylvania. This is why finding the middle ground is essential for fracking issues because if they don't see the middle ground, fracking is going to win and continue at full force, wasting precious water.

Canberk Taze

Did Turkey Become The First Country To Shoot Down A Drone With A Laser Weapon?

On 4th of August, a Turkish-made laser weapon destroyed a Chinese-made Wing Loong II unmanned combat aerial vehicle operated by the United Arab Emirates' forces in Libya according to prominent Belgium-based military news website Army Recognition. As per the writer of the said article, Alexander Timokhin, the system was mounted on an off-road vehicle supported by Aselsan made electro-optical targeting systems. If the allegations are true, this incident will mark the 50kW platform as the first combat-proven laser weapon system in the world.

The ability of these systems to shoot down drones and missiles became even more critical today given that just only a week ago Iran-backed Houthi rebels attacked one of the most vital oil facilities in Saudi Arabia with drones and missiles. Today, it is far easier for non-state actors to get their hands on guided missile systems and weaponized drones. Therefore, protecting critical infrastructure and power plants against these attacks becomes harder and harder. It pushes the states to invest in researching and developing laser weapon systems.

Laser weapons for certain militaries of the world are no longer a dream but rather a necessity to counter and destroy incoming hostile missiles and drones to protect critical infrastructures.

By the year 2023, the US Army is expected to operate hundreds of armored personnel carriers that are mounted with a 50kW laser weapon system. Germany is developing a laser weapon system for marine applications whereas Israel, on the other hand, is planning to upgrade its Iron Dome defense system with lasers to provide better protection against its cities.

Then where is Turkey in this race for beams? Well, first publically available reports emerged in 2015, stating that TUBITAK, the scientific research agency of Turkey, had developed a laser weapon system similar to that of its US equivalents, it was designed to provide point-defense to military installations.

Below you can see two separate programs. First, one to the left is Roketsan's Directed Energy Weapon System (YESS) that is mounted on a truck, first revealed in May 2019; and on the right is Aselsan's Laser Defence System (LSS) mounted on an armored MRAP vehicle.

Aside from TUBİTAK, Aselsan and Roketsan's separate laser programs, there are also two companies from the private sector that are also developing laser weapon systems. Given the frequency of field tests, a diverse pool of weapon types developed and the strategic vision of all three branches of the Turkish Armed Forces, it is very likely that Turkey will not only be operationally deploying laser defense systems, but also it will be one of the leading exporters of the platforms' stationary point-defense variants.

These systems can be very suitable to protect Turkey's critical infrastructure and power plants from drones and missiles operated by terrorist groups.

Ercan Emre Çelik

Ledding The Villages, Ledding The Lifes

A few years ago, I was watching a documentary on the Discovery Channel, which I couldn't remember the name of the documentary at the moment, but the subject and the assessment astonished me. The theme was about a few people who were trying to provide light to an aphotic village where is located in the foothills of a mountain in China. Plus, the assessment was to provide light to that dark village. The transportation to the town was robust since the town was located in the foothills of a mountain, but a group of people voluntarily managed to reach to the village single-mindedly and achieved to provide light to them. While they provide light to that village admirably, the tools they have used are a few volunteers, batteries, solar panels, a few donkeys for the transportation and light-emitting diodes (LED).

LEDs have a "standard" size of 5 mm in diameter. It has a shape of the round-cross section. Another type of light-emitting diode is the smaller sized ones that have a scale of 3 mm in diameter, and its form is again the round cross-section. The standard-sized LED is the most popular one that has been used, but 3 mm diameter sized LEDs are also becoming popular. The LED light bulbs can be found in different colors from green to purple and from warm white to soft white.

There are a few reasons and advantages of why the volunteers of the project decide to use light-emitting diodes. Firstly, LED light bulbs are long-lasted objects. It can enlighten for many years without any wear and tear. Secondly, LED light bulbs are durable, which makes them hardly broken. Thirdly, since they are long last and permanent, in the long-term they are less expensive; hence, it is a pocked friendly light bulb. Fourthly, it is portable and practical in use. It can be relocated quickly and switched rapidly. Lastly, it is less power consuming. The LED light bulbs include lower infrared and ultraviolet outputs which make the LED light bulbs more environmentally friendly. Moreover, LED light bulbs do not bring out carbon dioxide emissions and do not contain any toxic material. The only adverse effect of the LED light bulb is its expensiveness of initial purchase in the short run, but its price has been fallen year by year as it can be seen in the graph.

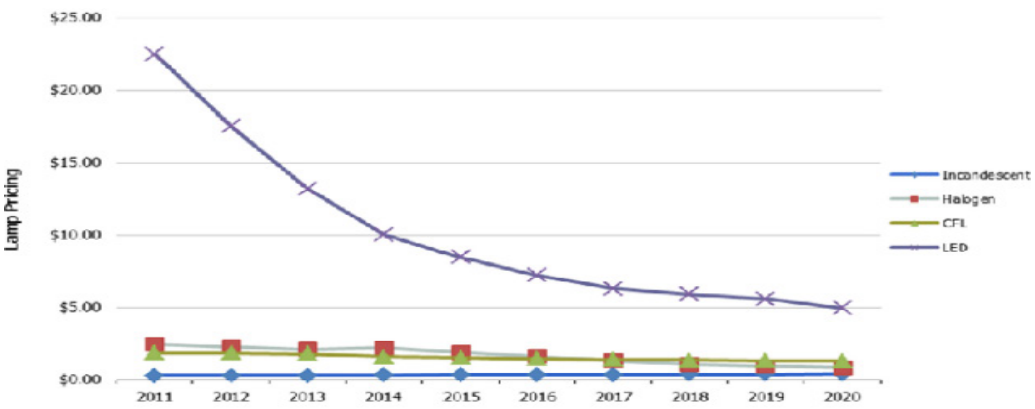


Figure 2. 60 Watt LED light price Trend

To conclude, after finishing watching the documentary, I went into a muse. Thinking about a brighter and cleaner future, without any person living in dark cities or villages; enlightening the life, the hope and the dream of everyone and everywhere with LED light bulbs. Thanks to the volunteers who provide electricity and light to that village; the peasant can survive much more quickly and take a step forward towards the modern age and more importantly, the children can read and get the education they need. Seeing the warm smile of those people in their eyes was a very privileged bliss for them, and I think this is the main reason why the volunteers decide to actualize this project.

Bartu Çelebi

This Week's Hot Topic: #ClimateStrike

Climate strike movement brought to international media's agenda by the Swedish teenager Greta Thunberg's efforts over a year ago. The night before the UN Climate Summit in New York protests fired up once again and spread all around the World.

Millions of people all around the World pour into streets to demand their governments to take action against global warming immediately. Even in Australia, which is known by the World's biggest coal and LNG exporter, approximately 300.000 people attend a climate strike (Aljazeera).

So far protestors took the climate change issue to streets in 110 towns in an estimated 185 countries in 7 continents (the guardian). From New York to İstanbul, Kabul to Guatemala City, London to Cape Town hundreds of people from different socio-economic and cultures gathered for the same purpose. They all demand their leaders improve climate change mitigation strategies such as adopting more renewable resources instead of fuel fuels. These demonstrations created the World's most massive climate protest. By 2050 lots of states plans to obtain their energy from 100 % eco-friendly, renewable energy resources. Costa Rica, Sweden, Denmark can be given as an example to these countries.

•In the past five years, Costa Rica obtained nearly 95% of its electricity from renewable resources such as solar, hydro, wind, and geothermal power. Costa Rican government aims to become 100% carbon-neutral by 2021.

•Sweden aims to become the first 100% renewable country in the World. The Swedish government is planning to eliminate all fossil fuels form electricity generation within 21 years.

•Windmills provide half of Denmark's electricity. Denmark's next goal is to become 100% fossil fuel-free till 2050.

•Saudi Arabia invested over 50 billion dollars to renewable energy resources as a part of its 10-year green energy strategy. Due to their geology spending on wind energy seems to be the most profitable option among the other renewable energy resources. If they continue to invest in renewable energy resources, it is expected for Saudi Arabia to be 100% green by 2050.

•Globally, China invests the most money into renewable energy, yet its carbon emission rates are still higher than expected.

Even though states are investing more in renewable energy sources, carbon emission rates are still increasing. According to the International Energy Agency's (IEA) studies, worldwide energy-related CO_2 emission is rising. We do hope that states come up with more effective strategies to meet the demands of the protestors and take the necessary precautions to reduce the CO_2 emission.

Yüksel Yasemin Altıntaş

SYNERGY
Publisher: Bilkent Energy Policy Research Center
Editor: Gökberk Bilgin
Contatct: eeps@bilkent.edu.tr
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