Israel National Defense College
47th Class 2019-2020

Final Paper

Future Energy Markets Demand/Supply Trends and Their Geopolitical Consequences on the Middle East

Academic Advisor: prof. Shlomo Hasson

Submitted by: Davide Salerno

April 2020

INDEX

	p.
INDEX	I-III
INTRODUCTION	1
Purpose of the paper	2
Research question	2
Additional questions	3
Importance of the paper	3
Structure of the paper	3
Literature review and conceptual framework	5
CHAPTER ONE: ENERGY AND THE CURRENT GEOPOLITICAL SITUATION IN THE MIDDLE EAST	7
The “oil weapon”	9
The “Libyan Squeeze” and the oil revolution	9
The 1973 Arab oil embargo and the oil revolution	11
Oil and the Middle Eastern State System	12
The Rentier State, domestic politics in the Middle East	13
Oil and international relations in the Middle East	14
External powers influence in the Middle East	15
The US in the Middle East	16
Russia in the Middle East	17
China and India moving West	18
India in the Middle East	19
China in the Middle East	21
CHAPTER TWO: FUTURE TRENDS IN SUPPLY/DEMAND OF OIL AND THE EVOLUTION OF ELECTRICAL VEHICLES AND RENEWABLE ENERGY	24
The Oil Era	24
Oil and Coal: two different models	25

The oil industry and the oil price 27
Types of extraction 28
Oil transport 30
Crude refining 30
Petrochemicals 31
Oil uses 31
Electric Vehicles, Ford Model T, and cart horses 32
Electricity production 38
Battery storage 40
Solar Photovoltaic (PV) and Wind 42
Effects of BEVs and renewables on the hydrocarbons market 46
Is an “electric” disruption in transportation occurring today? 48

CHAPTER THREE: POSSIBLE IMPACTS OF FUTURE ENERGY TRENDS ON THE ECONOMIES OF OIL-EXPORTING COUNTRIES IN THE MIDDLE EAST 54
Implications of reduced demand for the oil industry 54
Impacts on oil fields and infrastructure 57
Impact of reduced oil demand on oil-exporting countries 57
The Persian Gulf countries 58
Saudi Arabia 61
Iran 62
Iraq 62
The UAE 63
Kuwait 64
The need for diversification 65

CHAPTER FOUR: HOW DIFFERENT COUNTRIES IN THE MIDDLE EAST PREPARE FOR FUTURE CHANGES IN THE ENERGY MARKET 66
Saudi Arabia 67
Iran 72

Iraq 73
The UAE 75
Kuwait 76
Diversification and reality 77

CHAPTER FIVE: POSSIBLE IMPACTS OF FUTURE ENERGY TRENDS ON THE GEOPOLITICAL POSITION OF THE MIDDLE EAST 78
Impacts of the oil price drop 81
A new geopolitical balance in the Middle East? 82
China and India in the new Middle East 85
Geopolitics of lithium 86

CONCLUSIONS AND PERSONAL NOTES 88

BIBLIOGRAPHY AND REFERENCES 93

INTRODUCTION

The Middle East is a complex geopolitical region characterized by a geographic area that, historically, has always been of great strategic importance. A gateway between three continents, devoid of natural, solid boundaries, the Middle East is a completely open passageway between Asia, Europe and Africa. Here, for as long as it can be recorded, human societies have always lived the space as a crossway not only between territories but also between cultures. Invasions and infiltrations of different populations have been the norm for all of its history.

In the past century an important ingredient has been added to the mix when the Middle East has become the geographic “core” of the entire world oil industry. The oil economy has moulded the region, guiding and shaping the creation of national states, at the same time acting as a stabilizing and destabilizing factor, while also modeling the strategy of the great superpowers which, during the course of history, have competed with each other for the political control of the region and its resources. Today, oil is of essential importance for nearly every country in the region, regardless if an oil exporter or importer. This natural resource is the undisputed, single driver in the discussions on both foreign and domestic politics becoming, depending on the circumstances, both a blessing or a curse, an invitation to foreign intervention, a multiplier of political corruption and an incentive to militarization.

Today, a number of evolving technologies, such as Electric Vehicles, Autonomous Driving, Solar Photovoltaic, and Battery Storage are on the verge of completely disrupting the oil market by drastically decreasing its global demand. In the next 10

to 20 years, the price of oil could converge to that of coal causing socio-economic turmoil both in oil-exporting and oil-importing countries. The change will be driven by the sheer, inevitable, economic "sense" of the adoption of these new technologies. Oil will not disappear from the global picture, very much so as coal did not when oil became more economically advantageous in the past, but will definitely become much less economically and geopolitically relevant.

The transition away from oil has deep implications. The economic model of many oil-exporting nations would not longer be sustainable in such a world. Even if the probability of such a future is low and the consequences might be of a lesser extent than forecasted, the decline in oil revenues for many oil exporters would still be so large that the expected losses would nevertheless be sizable. Such low oil prices would have major implications on the macroeconomic stability of these countries, particularly in the Middle East, with unpredictable geo-political consequences.

Purpose of the Paper

The purpose of this paper is to verify if a disruption of the world oil market, caused by the future trends in energy supply and demand, is coming into being and, if it is, what will be the geopolitical consequences on the Middle East.

Research question

1. Is a disruption of the energy market, due to new trends in demand/supply of different sources, such as oil, natural gas, and renewables, occurring/imminent and what are the possible impacts of this disruption on the geopolitical position of the Middle East?

Additional questions

1. What are the current relations between energy and the geopolitical position of the Middle East?
2. Examine how different states in the Middle East are preparing themselves to the changes caused by the energy disruption.

Importance of the paper

Both oil-exporting and non oil-exporting countries in the Middle East will be affected from a drastic reduction in global fossil fuel demand. Although Israel's economy is solid and not based on natural resources, the social and geopolitical consequences of a disrupted oil market will have important repercussions on the whole region and ripple effects all around the globe.

It will be critical to be able to see the changes ahead and be prepared to react to them in a timely and effective manner.

Structure of the Paper

This paper will be structured in the following way:

Chapter One: Energy and the current geopolitical situation in the Middle East

The current geopolitical situation in the Middle East will be illustrated, with the main focus on the importance of oil in the social and political development of the region, by reviewing how oil affects the international relations of the Middle East.

Chapter Two: Future trends in supply/demand of oil and the evolution of Electrical Vehicles and Renewable Energy

An analysis of future trends on energy markets will be performed by

presenting current studies[1] showing the evolution of the new technologies related to renewable energies, such as photovoltaic, wind, energy storage systems, electric vehicles, and their impact on fossil fuel global demand. The scope is to verify if the speed of the penetration of these new technologies to the energy market worldwide is fast and large enough to cause a disruption.[2]

Chapter Three: Possible impacts of future energy trends on the economies of oil-exporting countries in the Middle East

A survey of the economies of some of the major oil-exporting countries in the Middle East, such as Saudi Arabia, Iraq, Iran, UAE and Kuwait, will be conducted with the intent to predict the social and economic consequences that a disrupted oil market will cause. The survey will analyze how important oil is in those economies mainly by examining their state budgets and the percentage of GDP quotas related to oil exports.

Chapter Four: How different countries in the Middle East prepare for future changes in the energy market

The disruption of the global fossil fuel market, albeit with uncertainty on its timeline, is a serious possibility and the oil exporting Gulf countries are aware of the danger it may cause to them and are already taking action to minimize the effects on their economies, typically by trying to diversify away from an oil only dependency. These actions will be illustrated and an evaluation on their predicted effectiveness will be presented.

---

[1] R. Cherif, F. Hasanov, A. Pande, IMF Working Paper - Riding the Energy Transition: Oil Beyond 2040, International Monetary Fund, 2017;
Energy Information Agency, (US Department of Energy), www.iea.doe.gov.

[2] J. Arbib, T. S eba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

Chapter Five: Possible impacts of future energy trends on the geopolitical position of the Middle East

The possible major geopolitical changes in the region caused by economies being affected by the energy disruption will be presented.

Literature Review and Conceptual Framework

Today it is possible to access ample literature concerning the evolution and current status of geopolitics in the Middle East and about the importance that oil, and hydrocarbons in general, have gained in the course of the past century in the region. The geopolitics of oil over the past 120 years have played a central role in international relations and some argue that geopolitical competition over access and control of oil supplies has been the source of most of the conflict witnessed in the 20th century (Yergin, 1993[3]).

At the same time, much content can be found about the predicted evolution of global hydrocarbons supply and demand, which will clearly influence the future of the geopolitical balance in the Middle East. The majority of the papers regarding energy however, come from what some define as the "energy establishment" and have the tendency to underestimate the speed and depth of the current energy transition.[4] In their forecasts, leading industry players and analysts seem to persist with a "business as usual" (BAU) view of future demand for hydrocarbons forecasting that future oil demand will continue to be strong. Yet there is evidence that the energy establishment

[3] D. Yergin, The Prize: The Epic Quest for Oil Money and Power, Paperback edition, New York: Touchstone, 1991

[4] Some of the factors explaining this include the institutional culture of the International Energy Agency (IEA) and US Energy Information Administration (EIA) the international oil companies trying to maintain the confidence of shareholders, and the need for OPEC countries to maintain their internal balance of power.

has consistently underestimated the rate of deployment of renewables.

Today the world economy is undergoing an energy transition from "hydrocarbon molecules to electrons" meaning from the use of fossil fuels to greater reliance on low-carbon electricity produced increasingly by renewables. The falling costs of renewable-generated electricity, the rise of electric vehicles (EVs), but also a variety of other technological changes affecting energy demand, such as LED lighting, artificial intelligence, big data and blockchain computing, are all factors contributing to the energy transition.

Only a few publications appear to address the speed of the energy transition, up to the point of properly calling it a "disruption" and these include books from scholars (Arbib, Seba, 2017) or publications from international institutions and Think Tanks such as the International Monetary Fund (IMF WP/17/120) and the Chatham House (Stevens, 2019[5]). Also, some consultant firms, such as Bloomberg New Energy Finance (BNEF) and McKinsey, are more aggressive in their views of the speed and depth of the transition and have been far more optimistic than other forecasters about the penetration of EVs.

This paper will analyze the extent and speed of the energy transition to determine how its consequences will influence geopolitics in the Middle East.

[5] P. Stevens, The Geopolitical Implications of Future Oil Demand, Chatham House Research Paper, 2019

CHAPTER ONE

ENERGY AND THE CURRENT GEOPOLITICAL SITUATION IN THE M.E.

When discussing about the Middle East oil is one of the mandatory topics to be addressed. It has influenced the region's relations with the rest of the world, but also within the region itself, for the past 100 years. By not being evenly distributed, in fact it is highly concentrated, it has influenced domestic policies of the Arab countries, differentiated by those who can produce and export and those who cannot, allowing the consolidation of regimes that probably would not have survived until today in the absence of their huge oil rents.

Oil and oil-related interests have characterized, and very much continue do to do so today, the political economy of the Middle East, both domestically and from the international relations perspective. At the same time, it must be noted that the "black gold" is often considered the only value that matters but it is actually not the only relevant explanatory variable. The geographic importance of the Middle East, connecting as it does continents and oceans and being at the heart of the most populous areas of the planet, is without doubt the most evident one. This part of the world was crucially important for humanity before oil became indispensable, and it will be again when the oil era will come to an end. World governments consider oil a political commodity and are normally concerned with its continued availability, however, contrary to the current perception, oil has always been in abundant supply.[6]

---

[6] G. Luciani, Oil and Political Economy in the International relations in the Middle East, https://www.academia.edu/28854286/Oil_and_political_economy_in_the_international_relations_of_the_Middle_East, 24 May 2015;
Mary Ann Tètreault, The Political Economy of the Middle Eastern Oil, https://pdfs.semanticscholar.org/67a6/b3d396b50a88733c06a527c2abeb65e0e685.pdf, downloaded Nov 3 2019.

The main concern for major multinational oil companies before and the OPEC producers today, has been mainly that of avoiding excess supply with a consequent price collapse. From the 1930s to the 1960s the monopolistic control of the world's largest reserves by few international oil companies allowed them to extract an incredible level of profits. From the 1970s, after the so called "oil revolution"[7] it has been principally the OPEC and non-OPEC countries' governments that benefited, by keeping the prices at high levels, with extraordinary rents from oil.

The role of the Middle East in the oil industry is undisputed with five Gulf producers possessing about 65% of the world's proven oil reserves.[8]

Their oil is also the cheapest to produce and, if oil were a competitive industry, the Middle East would probably be the only source for the entire world. But the oil industry is not a competitive one and production from the Middle East has been kept low, well below what the global reserve share would actually allow. (G. Luciani)

Beginning in the early 1970s some oil-exporting countries took over a business previously controlled by multinational oil companies, and caused a significant increase in oil prices. This event, the so-called "oil revolution," and the related sudden price increases in 1974 and 1979, called the "oil shocks" deeply shook the economies of the oil-importing countries, including big producers-importers like the US, large consumers like most of Europe and Japan, and poor importers of the Third World.

---

[7] Prior of 1973, the oil of most of the OPEC countries was controlled by multinational companies. Following a number of "nationalizations" around the world, OPEC governments became the price setters bringing along the so-called oil price revolution.

[8] https://www.opec.org/opec_web/en/data_graphs/330.htm

The “oil weapon”

The term “oil weapon” refers to the use of oil as a political weapon basically by reducing its availability either though physical means or, more commonly, by embargoing exports. The deployment of the oil weapon in Arab-Israeli conflicts dates back to 1948, when oil infrastructure was blown up in the struggle of the independence war. Arab countries tried again to use it during the Suez crisis in 1956, but the end result was to actually stimulate oil companies and governments to establish procedures to deal with oil supply interruptions. In 1967, Arab countries attempted once more, during the Six Days War, to impose an embargo against the countries supporting Israel but the end result was far from effective. The main cause of this lack of effectiveness was the willingness of other oil producers, including some non-Arab OPEC members, to expand their production during embargoes (in 1967 Iran, Venezuela, and the US increased their production to compensate the Arab’s cuts), but also the capability of the big oil companies to dilute the effects of the embargo by a methodical supply management. One last cause of this lack of effectiveness was disagreement between Arab countries. While all Arab countries were against Israel, only the oil-exporting ones were paying the consequences of self imposed embargoes making the non-exporting ones much more supportive to the employment of the oil weapon than the exporting ones.

The “Libyan Squeeze” and the oil revolution

Although nationalization of oil supplies had already happened in other parts of the world (notably Soviet Union in 1918, Mexico in 1938, Iran in 1951, Iraq in 1961, Burma and Egypt in 1962, Argentina in 1963, Indonesia in 1963, and Peru in 1968) it

was what happened in Libya in 1969, the so-called “Libyan Squeeze”, that made a real difference. First of all, only Mexico and Iran were major oil exporters at the time of their nationalization, and second, many countries had to pay harsh consequences for their actions agains the big oil companies. Iran’s regime, in 1951 under Prime Minister Mohammad Mossadeq, was overthrown by the UK and US governments, which were afraid of the example that nationalization might set to other Middle Eastern oil exporting states.

However, in September 1969, when Muammar Qaddafy led the revolution that replaced the previous pro-western government, he found himself in an excellent position to get a greater return on its oil resources. Libya, unlike other countries, was divided in about 40 different concessions, each with a distinct operating company and its oil was highly attractive because of its high quality (light weight and low in sulfur) and a convenient location in the heart of the Mediterranean.

Queddafy was able to isolate two companies and pretend higher payments from them. For the first time a government was able to force the negotiations in its own favor and, by exploiting the internal rivalries between the different companies, was able to achieve the desired result. The pressure was eventually extended to all the other companies in Libya, which were now forced to agree to higher prices. The Libyan Squeeze did not stop in Libya and soon the Gulf producers started to demand higher prices too.

The oil companies, supported by their corresponding governments, tried many expedients to resist the change, but the revolution had started. At the same time the US economy was deteriorating and in 1971 first, and again in 1973, Nixon was

forced do devaluate the dollar causing a reduction in the "real" oil prices.
Negotiations between governments and companies were still underway when other episodes transformed the price issue into the issue of who controls the OPEC's oil.

The 1973 Arab oil embargo and the oil revolution

The energy crisis that came in consequence of the Yom Kippur war and the use of the oil weapon was, in reality, following months, or even years, of previous events related to the attempt to maintain high revenues by oil companies and western governments.

In October 1973, at the request of the Arab League, OAPEC[9] imposed an oil embargo against Israel's allies. The intention was to be more effective than in 1956 and 1967 and at the same time more discriminating, denying Arab oil to the enemies and allowing it to friendly nations. Politically, the Arab governments appeared strong and effective, and quantitatively, the embargo was successful with total world supplies being cut and local shortages and high prices in many oil importing countries.
However, the discriminating effect did not materialize. Oil supplies were exchanged between and within companies so that embargoed Arab oil was swapped with oil from non-Arab sources with the end result that all importing countries, wether they supported Israel or not, experienced the same amount of shortfalls.
Basically, the most important effect of the 1973 embargo was that of consolidating the oil price revolution.

Finally, the oil revolution was not just a price revolution but it also caused a change in ownership of oil. Before 1973, the oil of most OPEC countries was *de facto*

[9] Organization of the Arab Petroleum Exporting Countries

controlled by multinational companies, after the Yom Kippur war embargo, the decision making power passed from the multinationals to the oil ministries of the host governments.

Oil and the Middle Eastern State System

Oil has had a decisive influence on the consolidation of the national state system in the Middle East. Oil was discovered in Persia by the British businessman William Knox D'Arcy in 1908 and the UK involvement became immediately clear with Winston Churchill, then First Lord of the Admiralty, deciding that the imperial fleet had to convert from coal to oil and hoping for UK's direct control of the important resource. Although not all UK policies were decided based on oil interests, oil considerations were decisive in the post Ottoman Empire re-shaping of the region. Oil has led to the emergence and consolidation of states, like Saudi Arabia and the Gulf states, that would have probably quickly disappeared when compared to states with deeper cultural and historical roots, such as Egypt.

Oil also favored aggregation versus disaggregation, even in countries where the regional allegiance is strong and the national one is weak. Saudi Arabia is a clear example of this because despite the differences between the eastern part of the country and the center/west, no significant separatist desires have materialized. In the UAE, most of the oil resources are concentrated in Abu Dhabi and it is exactly because of this reason and the power that it brings along, that the oil rich region is the political center of the area and has no temptations to secede: because it can be in control. Bahrain and Qatar did not join the UAE project probably because of their more abundant resources allowing them to "secede" from Abu Dhabi.

Oil has been crucial in bringing quick definition of boundaries, with parties accepting international arbitration in contested cases. While the potential for finding oil has led to stronger negotiating stances it has also encouraged quick resolutions. Examples in the Gulf are the cases between Bahrain and Qatar; Qatar, the UAE and Saudi Arabia and the original "neutral zones" between Kuwait and Saudi Arabia and Iraq and Saudi Arabia that have been further divided, showing even more a strong preference to a plain division over a joint use.

As G. Luciani clearly states: "*In this sense, and possibly counter-intuitively, oil has contributed to the peaceful solution of boundary conflicts, rather than to their exacerbation.*"[10]

The Rentier State, domestic politics in the Middle East

The availability of oil resources, or lack thereof, is the main driver also with regard to domestic political order.

The Rentier State Paradigm[11] has become a common tool in explaining the oil-exporting countries societies and politics. In essence, while "normal" states (production states) exist because they are legitimized and supported by society, which is a source of value, and must therefore support themselves by "extracting" internally produced resources through taxation, oil-exporting states (allocation, or distributive, or rentier states) support their society by distributing and allocating an external resource, the oil rent coming from the rest of the world.

---

[10] G. Luciani, Oil and Political Economy in the International relations in the Middle East, https://www.academia.edu/28854286/Oil_and_political_economy_in_the_ international_relations_of_the_Middle_East, 24 May 2015.

[11] Originally proposed by Hossein Mahdavy (1970) and systematized by Beblawi (1987) and Luciani (1987).

In the first type the state needs legitimacy in order to justify its taxation and generally their citizens pretend democratic representation to make sure to be part of the decision making processes ("*no taxation without representation*").

In the second type, the opposite is basically true. They do not need tax, and spending the resources accrued from abroad is their primary function. Generosity, and not accountability, is the main virtue of the rulers. Legitimization by citizens is not a required essential element.

The nature of rentier states makes it difficult for them to change their internal political order and post 2003 Iraq is probably a very good example. What is missing is pressure from below to allow for democratic participation. Even a democratically elected ruler will eventually find himself in a unique position as soon as he acquires control of the rent and the great power that comes with it.

Oil and international relations in the Middle East

Concern about oil has been the main driver in shaping the external attitude towards the region. The subordination of Iraq's independence to the interests of Iraq Petroleum Company, the overthrow of Mussadiq's government in Iran because of the nationalization of Anglo-Iranian Oil Company, the, complex, close alliance between the US and Saudi Arabia, are all excellent examples of how the West tends to "interact" with the Middle East.

Oil exporting countries have taken advantage of this situation, acknowledging the importance attributed to them, by trying to acquire guarantees for their security and access to modern weapons systems.

What western countries consider to be an important political weapon, is eventually

not perceived as such by the oil-producing countries. International oil policy is generally executed by a Minister of Petroleum or Energy which is normally a technical figure, and while it can be discussed in OPEC meetings, it is usually done only with a narrow, again technical, mandate mostly driven by pure economic goals. As previously illustrated, the main attempt of using oil as a weapon occurred in 1973, but the diminished production of the following years came from the recession and the spike in prices and not vice-versa. The perception that Gulf countries are insecure and unreliable is still based on that one decision made in 1973 and persists today despite the fact that producers have since then demonstrated many times that they can deliver all the necessary oil, even when there are conflicts in the region.

External powers' interest in the Middle East has been characterized in the recent past, at least from the US and a number of other western countries, by an attempt to radically change the political landscape through outside intervention. Either motivated by 9/11 terror attack, or using it as pretext, the West decided to intervene militarily in Iraq and eliminate Saddam Hussein and his regime, maybe as an initial move part of a broader attempt to establish democratic regimes throughout the region. Wether the intervention in Iraq was motivated by political considerations or simply by oil interests is still a subject to be debated. In any way, today this event can be considered, without much doubt, a failure that has led to a continuous and costly occupation and to a low level of oil production.

External powers influence in the Middle East

The most influential world powers in the Middle East, today appear to be the US and Russia, with the EU being limited by its complex political decision making process,

not up to par with its formidable economic power, and a growing interest in the region being shown by east Asian powers such as China and India.

The US in the Middle East

The United States began to be involved in the region with the 1956 Suez Canal crisis, the event after which the country truly became a major word power replacing in the role both the UK and France. Since then, the US strategy in the Middle East has encompassed 4 main points:

- avoid the emergence of an hegemonic regional power, which meant limiting the Soviet Union's influence from expanding beyond Syria, Iraq and Egypt during the Cold War, and maintaining a sort of balance of power between the most important players such as Israel, Saudi Arabia, Turkey, and Iran in recent times;
- protect the oil fields in the shiite majority east province of Saudi Arabia, likely not because of actual need of the resource[12], but more with the goal to avoid instability, which might ripple through the region and the whole world, in the major oil producing country sitting over the largest reservoir of the world;
- guarantee security to Israel and Saudi Arabia, its main allies in the region and whose external threats have made them dependent on US support and protection;
- maintain the supremacy of the seas, continuing the famous Anglo-Saxon Thalassocracy, as the UK did before, by controlling some of the most strategically important straits of the world: the Suez Canal, Bab al-Mandab, and Hormuz.[13]

---

[12] Of the US total imported oil, only 10% comes from Saudi Arabia (https://www.americangeosciences.org/critical-issues/faq/how-much-oil-does-us-export-and-import)

[13] These straits are not only important for oil transport but also for the entire world food supply and commerce in general (https://www.ship-technology.com/features/featuremaritime-chokepoints-the-backbone-of-international-trade-5939317/).

While the US continues to play the biggest role in the region, it is also facing important economic and political constraints and will probably soon have to accept increased power sharing with other countries in both the Middle East and Asia.
The recent decisions of the US to reduce, if not disengage altogether, from its military operations in Syria, Iraq and Afghanistan will bring serious consequences with new geopolitical imbalances that Russia, China, India, and minor players, such as Turkey, are ready and well positioned to exploit, even if today none of these players appears capable of assuming the mantle of the US as the regional policeman.
The US will likely remain the dominant military power in the region, but it will eventually have to share some security responsibilities with other players.

Russia in the Middle East

As far as Russia is concerned, the Kremlin has recently shown an increased interest in the Middle East, after a prolonged period of disengagement from the whole MENA[14] region, where the Syrian crisis has provided an open door to return to a region that has always been of geo-strategic importance for Russian foreign projection.
From 2005 to 2007, President Vladimir Putin visited Egypt, Israel, Saudi Arabia, Jordan, Qatar, Turkey, Iran, and the UAE, and Russia gained observer status in the Organization of Islamic Cooperation. Putin's visits to the UAE and Israel were the first by a Russian leader, and his efforts to build relationships with Israel, well reciprocated by Benjamin Netanyahu[15], marked a significant change from previous Russian and Soviet policy.

[14] Middle East and North Africa

[15] As an example, Israel today is the only "western" country not applying economic sanctions to Russia following the Crimea crisis.

Whether the Russian military intervention in Syria was an attempt to exert dominance as a hegemonic power in the Middle East or just a show of force intended to make manifest to the United States and its allies that multilateral negotiations cannot take place in the region with the exclusion of Russia, remains to be established. However, Russia has latched on to turmoil in the Middle East, highlighting what it believes are Western policy failures and unreliability, to present itself as a reliable alternative for traditional Middle Eastern leaders. The likely intent appears that of remaining more actively engaged in the Middle East, showing that probably the involvement is not just an opportunistic one but part of a Grand Strategy, where the essential drivers of Russian policy, such as prestige, trade, and stability, have broadened in diplomatic, economic, and business terms.

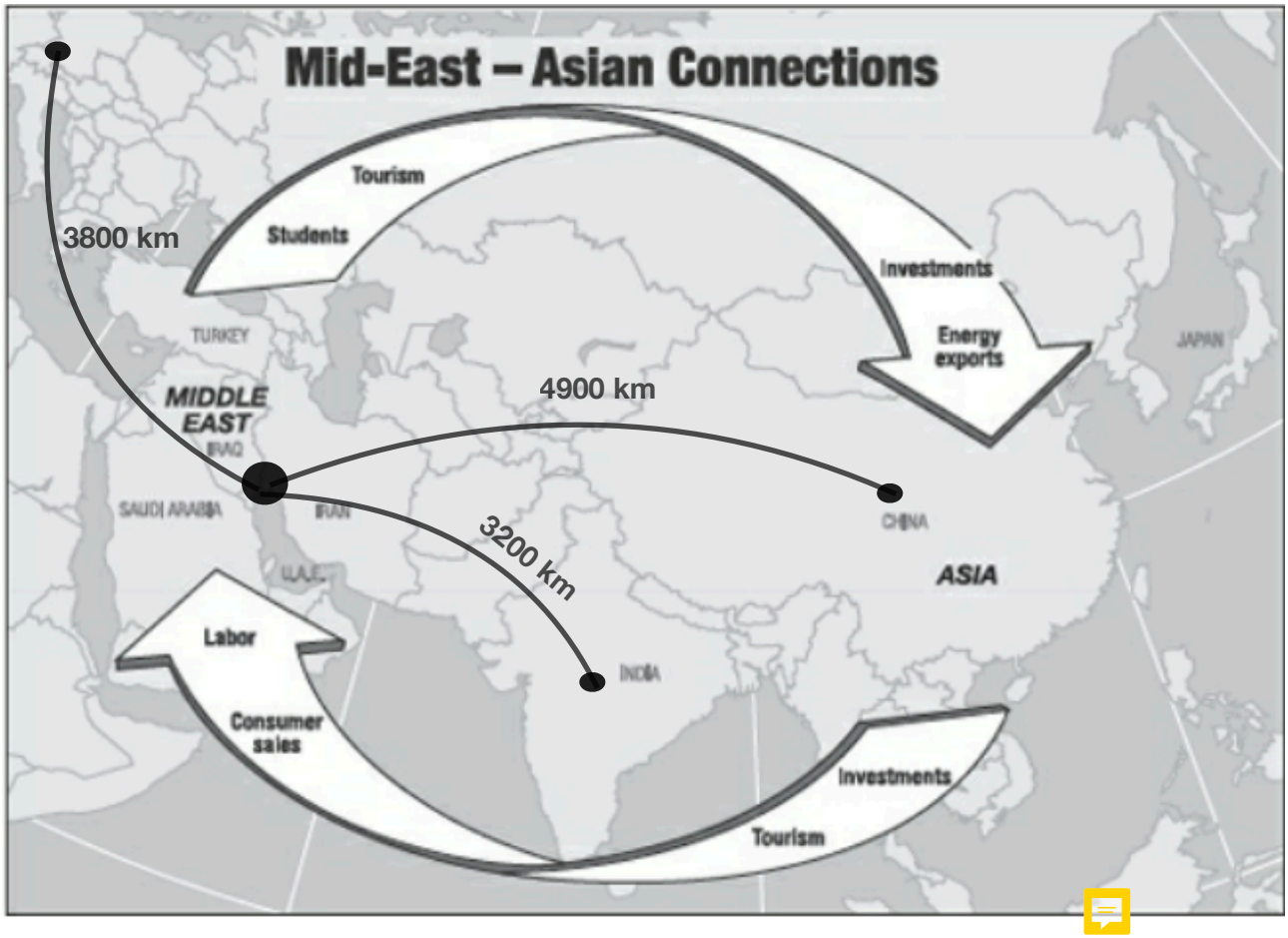
Worth of note, Moscow's engagement in the Middle East does not appear to be motivated by the need of hydrocarbons, of which Russia is a world net exporter with mineral fuels representing 52% of total exports.[16]

China and India moving West

In recent years, Asian states have become more and more important players in the Middle East. While the Western economies were dealing with crises in banking, housing, and employment, industrial growth and economic development have been exploding in China and India. The world's two most populous nations are the biggest reason for the growing footprint of the Asian continent on other global regions, something that is now becoming especially important in the Middle East.

[16] http://www.worldstopexports.com/russias-top-10-exports/

Although India has substantially more familiarity and interest in the region, thanks to its embedded historical dimension, both nations are on the rise and leaving a strong mark on the Middle East thanks to their ties which do not derive only from commercial exchanges, some of which are highlighted in the map below[17], but especially from deep cultural, historical and, particularly, geographical connections.



India in the Middle East

India's economy has been growing steadily and is now under pressure to secure long term access to oil and natural gas resources from the Persian Gulf. Also, Indian firms and policymakers are pursuing opportunities in investment, sale of goods, tourism, and even education[18] throughout the region. Potentially important as well, the

[17] G. Kemp, The East Moves West, Brookings Institution Press, Washington D.C., 2010

[18] India has agreements in place with almost all Gulf countries regarding programs for students to pursue postgraduate and doctoral studies at Indian technical institutions.

military to military contact between India and the Gulf states, while still at a low level, is a factor that could become significant for the overall Gulf security environment. India has been very successful in nurturing good relations with all of the key Middle Eastern countries, being able to work closely with Muslim countries while also developing important military connections with Israel, including the purchase of advanced Israeli military technology.

There is a sizable Indian diaspora residing in the Gulf countries, with about 8.5[19] million Indian citizens[20] working in the GCC countries in 2017, making them the largest expatriate community in the region, representing one of the largest concentrations of migrants in the world. These migrants serve as an important source of income for India through the transfer of remittances whilst also playing an important role in the economic development of the Gulf States.

To sum it up, today India has strong and growing ties with key Middle Eastern countries, particularly in the Gulf and it also has a unique relationship with Israel. Until now, it has managed to avoid being drawn into the complexity of regional conflicts and has been able to maintain good relations with virtually all states in the region. India is expanding its influence and shifting toward becoming a great power, which would involve accepting higher security responsibilities, but still encounters internal resistance from those who would like to maintain India's anti-imperialist tradition. This is why, despite the fact that its policymakers accept the realities of its growing influence in the region, India shows no open desire to play a more assertive

---

[19] Indian Ministry of External Affairs, http://mea.gov.in/images/attach/NRIs-and-PIOs_1.pdf, downloaded 25 March 2020

[20] About 31,5% of the total of 28 million foreign workers in the Gulf countries

role, certainly not to the point of taking sides in the region's many unresolved disputes or of becoming a strategic ally of the United States.

China in the Middle East

For centuries, China’s westward voyages of exploration were a visible manifestation of the its status as a superpower in the Middle East, at least until its last expedition in 1432, when China reordered its national priorities to focus on domestic issues and the land threats coming from Central Asia, abruptly halting its naval explorations. After achieving independence in 1949, the People's Republic of China began to show a new interest in the Middle East, after centuries of little to no influence in the region. Now, with the country’s emergence as a major economic power and the corresponding increased need for energy resources, its traders and diplomats have increased their westward activity.

China now has productive and deepening relationships with many states in the Middle East, including Iran, Israel, Saudi Arabia, and all the Gulf states and has become a major importer of goods from the region, particularly oil, but also military technology from Israel.

China is a good customer and the country needs what Middle Eastern countries are eager to export. China also maintains a strictly “business only” approach to its relationships with its trading partners, refraining from public comment on their domestic policies, providing aid and investments without the demand for “good governance and human rights” normally associated with Western assistance. This greatly appeals to states like Saudi Arabia, and allows China to maintain good relations with states in the region that are nominally opposed to each other. However,

it is not clear how Beijing's influence will develop in the future, and to what point China’s interests in the Middle East will force it to a more assertive role. Right now the main focus is on diplomatic and economic interactions, but in the long run, if China's westward development continues, it will eventually have direct influence on trade and politics in the Middle East.

Today, the most important Chinese enterprise affecting the Middle East is the “Belt and Road Initiative” (BRI) to which some refer to as The New Silk Road. The BRI is an ambitious transcontinental development plan, started by president Xi Jinping in 2013, whose objective is to promote economic integration and connectivity between Asia and Europe through infrastructural investments, new economic corridors, and cultural exchanges. The initiative involves more than 60 countries, representing 60% of world population and 30% of world GDP. In October 2017, the Communist Party of China amended its charter, adding BRI to Xi Jinping’s view on Chinese socialism, thus showing how important the project is for the Chinese establishment.

Experts are trying to grasp the geopolitical significance of the BRI. Whether it is an effort aimed solely at expanding Chinese influence by promoting national economic growth through improved exports and better access to natural resources for its industries, or it will actually bring benefits to other players on a global scale by encouraging economic integration and digital, land, and maritime connectivity at transcontinental level, is yet to be understood. Is it more expansionism or more cooperation? The final answer is probably difficult to determine and might be a mix of all proposed explanations, but it would be impossible to deny that China has clear interests in BRI and the initiative has a tremendous global geopolitical impact.

In the end, while the Chinese role In the Middle East is certainly growing and becoming more important, it appears unlikely that China will directly challenge the power and influence of the US in the region. China has no interest in a serious confrontation with the US in the Middle East and probably has no intention of replacing Washington as security guarantor of the region, nor has the capability to do so, or at least not at he moment. China's political role in the Middle East today can still be considered a marginal one, but things might change quickly in the future.

To conclude this Chapter, it can be safely stated that trying to explain the Middle East as a function of oil production and export would be reductive. This region's geopolitics imply a high number of complex dynamics between countries and world powers that have deeper roots in history and geography than in petroleum, even if recent history is clearly influenced by the presence of states that formed and consolidated basically thanks only to oil rents.

CHAPTER TWO

FUTURE TRENDS IN SUPPLY/DEMAND OF OIL AND THE EVOLUTION OF ELECTRICAL VEHICLES AND RENEWABLE ENERGY

The Oil Era

Clear reasons exist to consider the beginning of the 21st century still belonging to the "Oil Era", meaning a period of time in which the social and economic global system is essentially based on the use of hydrocarbons, such as oil and natural gas.

Human activities continue to be based on the employment of these fossil resources, not only for the production and the transportation of goods and services but also for the comfort in the homes and for leisure activities.

Post WWII world economic development, and more recently the one in the Asian countries, could not have happened so rapidly without hydrocarbons.

Global demand for crude oil in 2018 amounted to 99.3 million barrels per day (MBPD) and is projected to increase to 101.6 MBPD in 2020.[21] When compared to the daily oil demand of 86.4 million barrels in 2010, the increasing demand trajectory is apparently clear.

The outlook for long-term demand estimates that the total global demand for oil will amount to nearly 140 MBPD in the year 2040. Of that amount, developing countries are expected to account for a demand of nearly 67 MBPD, and OECD nations will account for a total of 38.7 million barrels daily.[22]

All the considerations about oil demand that will follow in this paper can be applied

---

[21] M. Garside, Daily Global Crude Oil Demand 2006-2020, https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/ 21 Oct 2019

[22] Ibid.

to natural gas as well, because the considered elements that will be described will equally affect hydrocarbons demand in general.

Oil and Coal: two different models

When, in the beginning of the second half of the 19th century, the first perforations in the US led to the discovery of oil reservoirs, the oil did not have yet a real market apart maybe for illumination purposes. Since the beginning of the industrial revolution the prime source of energy was coal, for both domestic and industrial purposes. Coal was the fuel for boilers and furnaces, industrial facilities, and transportation means such as trains and ships. It was sent to Coking Plants to produce coke for steel or to gas-works to produce the gas used in the cities.

In the oil system, the raw oil and the gas, normally methane, are extracted form the wells; oil goes to a refinery, usually through a pipeline or by ship, where different fuels, used for transport/engines or for heating, and "virgin naphtha," the basic ingredient for all petrochemical products, are obtained. The gas is also transported through pipeline or ship and it is used directly as fuel or as a base for other petrochemicals.

There are significant differences between the oil and the coal models as far as their use to produce artifacts. If we want to make a product (e.g., a pipe) in the coal system, the process begins in the coal and iron mines. Part of the coal is sent to the coking plants where the follow-up byproducts are sent to the chemical industries. The iron is sent to the metallurgic industries together with the coke, which will provide carbon and heat to produce steel, with the gas used as fuel. Coal has a high ratio of volume per weight and its transport is expensive. The industrial production chain is

therefore normally placed near the mines and is generally vertically integrated[23] requiring large factories, huge and heavy machinery and the need for many workers. Compared to coal, the advantage of oil is not just the lower cost of production, but also a simpler, linear, system as no other material is needed to make a plastic artifact. Industry is lighter, with smaller plants which require less capital and workers for unit of product. The production chain can be distributed on the territory because the cost of oil transport is relatively low.

It is now easy to comprehend why the *steel converter*, the basic industrial plant in the 19th century, has been replaced by the *cracker*[24] and polymerization, capable of producing a limitless number of final products.

Coal has been eventually replaced by oil and the introduction of the internal combustion engine (ICE[25]) has revolutionized land and sea transport, making air transport possible.

Oil enabled an economic and social system that, by the end of the 20th century, spread to all countries, rich and poor. No country in the world today is without cars, tractors, or trucks with an ICE.

Oil has become the most transported good in the world and its production is measured in billion of tons per year or millions of barrels per day, MBPD.

---

[23] Coal, coke, iron, steel, mechanical industry.

[24] Petrochemicals are usually manufactured in large scale from petroleum feed stocks using *fluid catalytic cracking*. Naphtha, natural gas, refinery off-gas and gas from coking plants and thermal crackers are good sources.

[25] Internal Combustion Engines are the most broadly applied and widely used power-generating devices currently in existence. Examples include gasoline engines, diesel engines, gas-turbine engines, and rocket-propulsion systems.

The oil industry and oil price

The oil industry can be described as a continuous process that centers on the extraction or production of oil from the earth. The “upstream” (from production) phases include exploration, the search for oil-bearing lands, and development, the construction of production infrastructure like oil wells and gas separators. The “downstream” (from production) phases are transportation, including pipelines, tankers, and railroads; refining, which turns crude oil into usable products like gasoline and fuel oil; and marketing, like gasoline/petrol stations, among other things. Exploration and production activities are the bulk of the oil industry. In these activities the most advanced technologies are developed and employed, and the profits are made, to compensate for the geological risk. There are both a technical risk, that the identified geological structure will not deliver the expected oil quantity or quality, and an economic risk, given by the chance that when production will begin, often years after the initial discovery, the oil price at the time will not make the oilfield profitable.

In general, the production cost depends on the depth of the field and on the complexity in the preparation for production. The ever improving technologies can allow production from reservoirs once impossible to exploit but the cost for this kind of production can be very high. The oil industry today works in the same way as in the past with the big difference that today it is possible to identify a field with great precision in three or even four dimensions, including the temporal one, being able to predict for how long it will be usable.

Finally, the profitability of an oil stream is defined by the quality of the crude oil,

which is not a homogeneous product because every field offers a different kind of oil. Two of the most important quality characteristics are density and sulphur content. Density ranges from light to heavy, while sulphur content is characterized as sweet or sour with the light and sweet oils normally being the most valued. Also, crude oil prices, in addition to normal supply/demand mechanics, react to a variety of geopolitical and economic events, as already shown with shock of prices of 1973.

Types of extraction

Oil can also be classified by the type of extraction method used. While the method does not generally define the physical characteristics of the crude, it has great importance in understanding the costs involved in producing it and the break-even point related to market prices. Assuming the same amount of investment needed to find new deposits, different extraction methods will imply different techniques and hardware required. Techniques and hardware that will give different yields at different costs.

The main distinction is usually made between conventional and unconventional oil. Conventional oil is extracted from underground reservoirs using traditional drilling and pumping methods. Conventional oil is a liquid at atmospheric temperature and pressure, so it can flow through a pipeline, unlike bitumen[26] which is too thick to flow without being heated or diluted. It is easier and less expensive to recover and it requires less processing after extraction. Conventional oil development can be both land-based or offshore.[27] The development of offshore oil and gas production

[26] "Oil sands" oil.

[27] Pumped through a sea platform.

normally takes a number of years to complete and the extraction is a complex process, due to the challenges of operating in remote and sometimes harsh conditions, requiring production facilities capable to withstand the offshore environment and its challenges, including the potential for sea ice and icebergs in some areas.

Unconventional oil is oil that cannot be recovered using conventional drilling and pumping and advanced extraction techniques, such as oil sands mining and in situ development, are used to recover heavier oil that does not flow on its own. Oil found in geological formations that make it more difficult to extract, such as light tight oil (LTO), is also called unconventional oil because non-traditional techniques are needed to extract the oil from the underground reservoir. LTO is found deep below the earth's surface, primarily within low-permeability rock formations including shale[28], sandstone and mudstone reservoirs. This kind of oil extraction uses horizontal drilling and a technique called "hydraulic fracturing".[29]

Generally speaking, conventional oil has a lower cost of production than the unconventional one with great differences depending on the actual type of extraction required and the location of the reservoir. With cost of production also varies the breakeven[30] oil price level. The fields with the lowest breakeven prices today are estimated to be those in onshore Saudi Arabia and the rest of the Persian Gulf, while the highest are those in UK, Venezuela, and the unconventional ones in north America.[31]

---

[28] The term "shale oil" is often also used when referring to tight oil or LTO.

[29] Also known as "fracking"

[30] The price level under which production becomes unprofitable.

[31] Journal News Graphics, Barrel Breakdown, April 2016, http://graphics.wsj.com/oil-barrel-breakdown/

Oil transport

Transport of crude oil happens mainly by sea, although pipeline systems, on land or sea, have developed as an efficient way of transport, both for oil and gas, and are now competing with tanker ships. These tankers today are extremely big, reaching 300.000 tons and more, and can travel at low cost along extremely long routes. Transport cost has reduced over time and is now less relevant due to the relatively high prices of crude oil from 1973 onward.

Oil transport has a great environmental impact, considering the risk of pollution in case of an accident.

Crude refining

Crude oil is refined in specific industrial complexes, the refineries, where the oil is processed and a series of different products are extracted (LPG, virgin naphtha, gasoline, diesel fuel, fuel oil, bitumen). Normally, a refinery is built to specifications related for working on a specific kind of crude (light/heavy, sweet/sour) and to deliver mostly a specific product (gasoline, diesel fuel, etc).

It is important to stress the point that refineries are not all alike and are built differently for specific types of oil and final products. There are more than 150 types of oil crudes processed by more than 600 refineries around the world.[32] Each refinery is designed and built for specific types of crude and efficient reconfigurations are not always easy or even possible. The cost of building a single refinery is measured in billion of dollars and time is measured in years.

[32] Canadian Fuel Association, The Economics of Petroleum Refining - Understanding the Business of Processing Crude Oil into Fuels and Other Value Added Products, December 2013

Petrochemicals

The petrochemical industry is strictly connected to the oil one and in fact most oil companies have activities in both fields. The basic industrial facility is the *steam cracker*, where intermediate products[33] are produced and from which, trough polymerization and other precesses, a great number of intermediate or final products are created. Polymers can be processed in many ways and have excellent weight, durability, and flexibility characteristics that metals rarely match. Price of polymers per unit of weight or volume is particularly low and today the plastic industry is as developed as the mechanical one.

Oil uses

In 2018, according to the OPEC World Oil Outlook[34], about **58%** of the oil globally consumed was destined to the **transport system (**76% of which for road transport and the rest for air, sea, rail).

Cars and commercial vehicles clearly lead the factors determining the level of oil demand. OPEC estimated that in 2016 1.076 million cars and 224 million commercial vehicles, most of them in OECD countries (69% of total cars and 53% of commercial vehicles) existed globally. OPEC also predicted that by 2035 there will be 1.826 million cars and 400 million commercial vehicles but only 43% and 31% respectively will be in the OECD countries. Aviation, meaning air transport of people and goods, absorbs about 6,2% of the total oil consumed, while 4,5% is for sea transport and 2,2 is for trains and internal waters.[35]

---

[33] Ethylene, propylene, mixed C4, pyrolysis gasoline.

[34] OPEC, World Oil Outlook 2040, 2019 Edition, https://woo.opec.org

[35] OPEC, World Oil Outlook 2040, 2017

Oil demand from the **petrochemical industry,** such as production of plastics, synthetic fibers, synthetic rubber, paints, detergents, pharmaceutical products, etc., was **11%** in 2015 mostly from developed countries (65%) but with a prediction that by 2035 this number will go down to 44% (OPEC).

About **15%** of oil is used as fuel for a number of **industrial activities**, such as the production of glass, ceramic, cement, iron, steel, mines, etc (OPEC). In the developed countries the use of oil for these industries is gradually being replaced, starting with the first oil price shocks in the 1970s, by natural gas.

The **residential, commercial, public, agricultural, and fishing sectors** account for **10%** of oil demand, while **electric energy** production accounts for **7%** (OPEC).

With road transport essentially being the main use for oil it can be argued that a reduction in hydrocarbon demand for cars and trucks will have significant repercussions on related global markets and prices.

Electric Vehicles, Ford Model T, and horse carriages

The electric car, or Electric Vehicle (EV)[36] is not a modern invention. EVs were one of the first kind of automobiles to be experimented and commercialized during the 19th century. Right before the 1900, before the massive preponderance of the powerful but polluting Internal Combustion Engine (ICE)[37], electric cars held many records regarding speed and distance and, during the first years of the 20th century,

[36] There are various types of EVs, here are some definitions: BEV, Battery Electric Vehicles, which run on one or more electric engines powered by batteries. PHEV, Plug-in Hybrid Electric Vehicle, which run on both an ICE and a small electric engine that can be plugged into an external charging point. HEV, Hybrid Electric Vehicle, which runs on both an ICE and a usually very small electric engine that can only be charged through the ICE alternator and not from external sources.

[37] An ICE is an Internal Combustion Engine. Unlike BEV, PHEV and HEV, the term ICE refers to the engine itself, rather than the type of car. Normal petrol and diesel cars have internal combustion engines.

were sold in higher numbers compared to gasoline fueled cars. EVs were sold as excellent town cars and they were particularly appreciated for simple, clean, quiet operations. The rapid development of ICE technology, with the improvement of performance and autonomy led to the disappearance of the electric cars from the market. Particularly, it was the rapid rise of a new industry leader that pushed electric cars out of the market: the affordable Ford Model T. Faced with a Model T retailing at about 40 percent of the electric car's price by 1912, combined with a growing road network and the relative ease of expanding gasoline stations in rural areas compared to the electric grid, as well as new oil discoveries that made oil relatively cheap, the electric car could not compete. EVs had essentially disappeared by 1935. Yet in recent years, thanks to many disparate factors, like the great oil price shock in 1973, where the world faced the reality of being completely dependent on fossil fuels, an increased global environmental awareness, and distinctly, an important technological advancement in different fields, such as energy storage and electronic control systems, the EV has begun to rise to a new life. In 1997, the first modern hybrid car with both an ICE and an electric engine, the Toyota Prius, was commercialized. Since then, a slow but continuous improvement in converging technologies offering continuously improving performance at decreasing costs has led to today's EVs.

A century ago, the rise of oil, which happened at the expense of coal, came largely as the result of a transportation revolution as horses were swapped for automobiles. The next transition away from oil is likely to come via a transportation revolution since, as shown above, about 58% of global oil demand comes from transportation. Road transportation alone accounts for 44% of global oil use. In absolute terms, the

penetration of the electric car in the US is already following remarkably closely that of ICE vehicles replacing cart horses a century ago.[38]

The disappearance of cart horses can provide some insight into what a transportation transition could look like. In the span of only 15 years, from 1915 to 1930, horse cart ownership fell dramatically, by a factor of 10. Skeptics of the EV normally do not anticipate the same scenario for cars. However, in order to have a major impact on the oil market, the change does not need to be so substantial. Furthermore, oil demand today is far more dependent on transportation than coal was in 1910 or 1930. Today, nearly 62% of oil used in the OECD countries is for cars, trains, boats, and planes[39] while only 20% of coal demand a century ago was due to the transport sector, mainly steamships and trains.

Today there appears to be a global skepticism towards the potential adoption of EVs. This skeptical approach is actually typical during the introduction of new technologies. The old (current) models are not capable of accurately describing the reality of new technologies and therefore do not allow for accurate predictions. A good example is given by the early days of the cell phone market. In the early 1980s, McKinsey, probably the biggest and most important consulting firm in the world, produced a report for AT&T on the potential world cell phone market. The report identified big hurdles to the adoption of cell phones such as bulkiness of the handsets, short duration of the battery charge, high cost per minute, and lack of coverage. The report predicted a market of 900,000 cell phones by 2000. The actual number turned

---

[38] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

[39] OPEC, World Oil Outlook 2040, 2015 Edition, https://woo.opec.org

out to be 120 times larger than forecasted at 109 million phones.[40]

Similar obstacles such as high cost, lack of infrastructure, and short range are faced by early adopters of EVs. However, these hurdles seem to be disappearing, because technological improvements, which generate better performances in conjunction with lowering prices, are happening at an exponential rate. Making linear predictions when dealing with exponential rates of change can cause serious errors and miscalculations, particularly when evaluating the market penetration of new technologies.

Vehicle adoption is strongly associated with the ability to offer an affordable price, both for the initial buy and for operation costs. Once possessing an EV becomes economically advantageous for the owner, it becomes virtually impossible to stop or limit mass adoption by consumers.

Battery prices, which are normally considered one of the main barriers to electric vehicle commercialization, are already rapidly declining.

Average vehicle lithium-ion battery costs have fallen from above USD 1100/kWh in 2010 to USD 156/kWh in 2019, approximately by 14% per year. Such an exponential trend is expected to continue, as further learning coupled with economies of scale make Li-ion batteries at USD 100/kWh or less by 2023 a serious possibility.[41]

Moreover, the availability of lithium needed for scaling up the production of EVs may not be a binding constraint given the current world lithium reserves and expected technological improvement in battery production and recycling. In the medium to long run, due to new technologies, lithium may not be even needed to produce

---

[40] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

[41] BloombergNEF, Battery Pack Prices Fall As Market Ramps Up With Market Average At USD 156/kWh in 2019, https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/, 3 Dic 2019.

batteries anymore.

Lifetime cost competitiveness is also paving the way for the adoption of electric vehicles. In 2015, the average BEV was already about 2.7 times cheaper to fuel compared to the average motor vehicle, with an equivalent 67 miles per gallon (mpg), compared to an average 25 mpg for motor vehicles. The mpg of a Tesla car was about 90. In addition, as BEVs engines contain much less moving parts than motor vehicles, the maintenance cost for BEVs is 10 to 100 times cheaper than that for ICEs, with the addition of an extremely longer lifespan.[42]

The lack of supporting infrastructure, primarily charging stations, may not be a major hurdle as it does not seem to have hampered the expansion of motor vehicles in the early 20th century. If we compare today's infrastructure problem with the one of a century ago we find that the latter was far more challenging. Not only petrol stations, with the associated transport system, needed to be developed, but also properly surfaced roads. It is actually safe to assume that fast growth of motor vehicles happened despite the lack of infrastructure when less than one-half of all US roads were deemed useful for motor vehicles. Actually, the infrastructure growth came in parallel with the motor-vehicle growth after the 1930s.

The problem of range in BEVs seems to be a far more psychological than a technical one. A recent MIT research[43] on micro-level driving patterns suggests that nearly 87% of daily trips taken in the US are short enough to be made with an *existing* electric vehicle. Essentially, 60 percent of gasoline consumption, even without further

[42] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

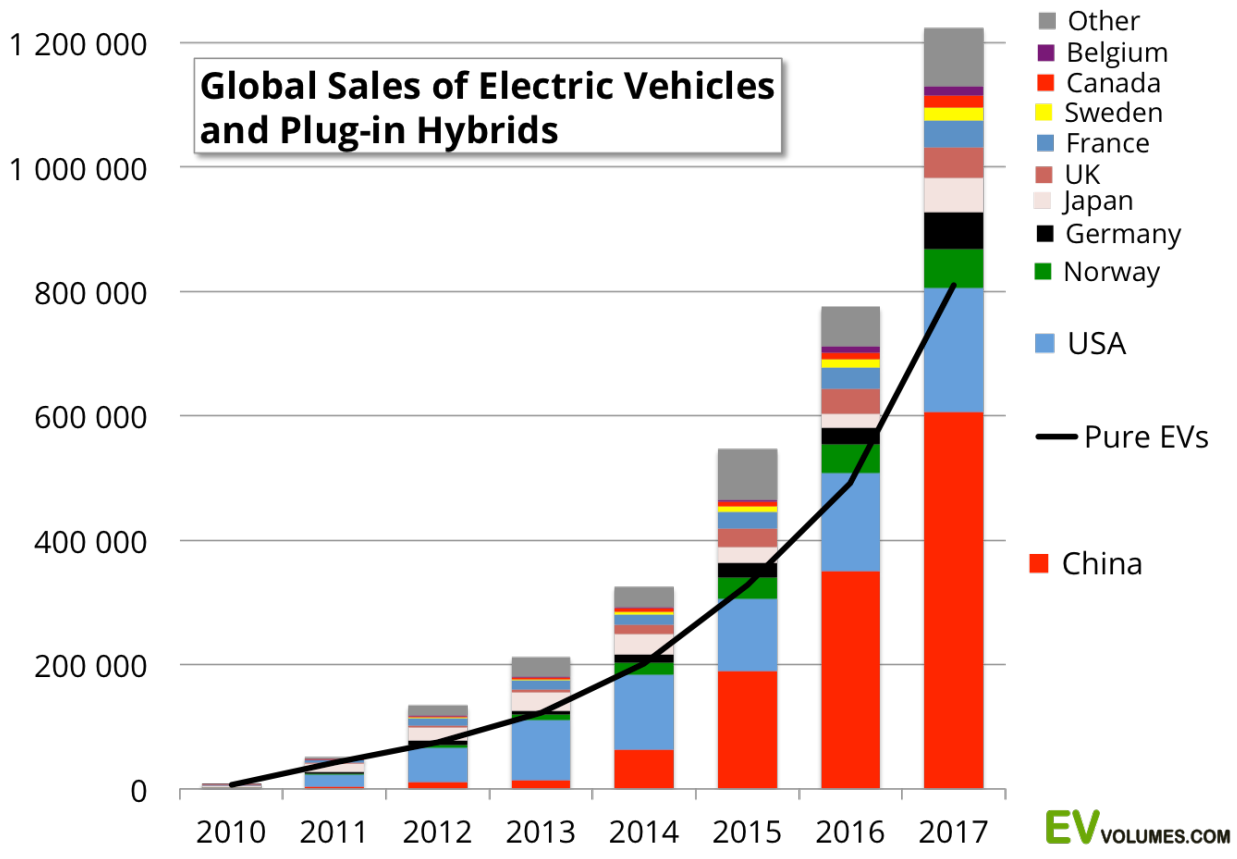
[43] David L. Chandler, Can Today's EVs Make a Dent in Climate Change?, ://news.mit.edu/2016/electric-vehicles-make-dent-climate-change-0815, downloaded 17 Dec 2019.

improvements in electric vehicle range, and completely ignoring the penetration of PHEVs, could be theoretically replaced today.

Now, another technology, particularly if joined with BEV, could disrupt the automotive market even more: autonomous driving. Even if the number of BEVs does not increase as fast as predicted, the advent of autonomous vehicles may still displace a significant number of motor vehicles. All major car manufacturers have announced plans to mass-produce fully self-driving cars by the early 2020s. A study of the potential effect of autonomous driving showed that the fleet of more than 13,000 yellow cabs in Manhattan could be replaced by 9,000 self-driving vehicles.[44] Relative simplicity of highway driving and labor cost provide an incentive for America's USD 700 billion trucking industry to eliminate its more than 3 million drivers in favor of autonomous trucks. Eliminating drivers would instantly make ride-sharing cheaper than car ownership, increasing the scope for electric car diffusion. Lastly, motor vehicles and EVs are much closer substitutes than horses and motor vehicles, and the choice between owning an electric car or a motor vehicle is very similar to switching to a smartphone from an ordinary cell phone, which happened quite rapidly. As BEV prices converge to the average motor vehicle price, the substitution could take place very fast. The environmental consciousness of consumers and climate change concerns further give credibility to a fast adoption of EVs.

---

[44] An MIT study estimates that as low as 3,000 cars could serve 98 percent of taxi traffic in New York City based on new ride-sharing algorithms, see Adam Conner-Simons, Study: Carpooling Apps Could Reduce Taxi traffic 75%, https://www.csail.mit.edu/news/study-carpooling-apps-could-reduce-taxi-traffic-75



Electricity production

One might argue that if BEVs were to take over road transportation, a substantial increase in demand for electricity should be expected. Fossil fuels could still play a major role in the electricity generation, as coal does today. However, renewables are growing rapidly enough to provide the increasing demand for electricity and potentially replace existing fossil energy sources.

The potential increase in demand for electricity because of a significant rise in EVs would still lead to a decrease in oil demand. If the whole stock of motor vehicles in the US were transformed into electric vehicles in 2015[45], it would require increasing the production of electricity by about 30 percent. If all the extra electricity needed by al new EVs were generated by oil, it would require 5.4 million barrels per day, compared to 9 MBPD used to produce gasoline in 2015. In other words, with the

[45] About 253 million vehicles.

technology available in 2015, switching all motor vehicles to electric vehicles and generating all the electricity needed to power them from oil alone would still have decreased US demand by 3.6 MBPD in 2015.[46]

But the most promising solution resides in renewable sources coupled with storage systems as a primary energy source.

Renewable energy capacity seems to be following the linear trend of previous power technologies. In 2015, total global renewable power capacity, inclusive of hydropower, finally outstripped coal-fired power capacity. Renewables are now projected to make up 28 percent of global power generation by 2021. Unsubsidized solar and wind, already competitive in 30 countries, is projected to become cheaper than coal and natural gas in over 60 percent of the world in the next few years.[47]

Although oil use mostly involves the transport sector, power generation still plays a significant role, making up, as already shown, 7 percent of total oil consumption. Most current generation takes place in the oil-rich Middle East, but even this is disappearing as the Gulf states are beginning to transition to renewable energy.

The main objections raised against solar and wind viability focus around capital cost and the current lack of storage capability for such intermittently available electricity. Photovoltaic (PV) panels and wind power are already benefiting from economies of scale. Both technologies are competitive *without* subsidies in some areas of the US and installation and maintenance costs are expected to come down as the market grows. Germany, for example, provides solar power at a significantly lower cost even

---

[46] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

[47] R. Cherif, F. Hasanov, A. Pande, Riding the Energy Transition: Oil Beyond 2040, IMF Working Paper WP/17/120.

as module prices are roughly similar.

Intermittency concerns might also be a non-problem in the foreseeable future. As already discussed, lithium-ion battery prices continue to fall, with projections that stationary storage prices will drop below the critical point of USD 100/kWh by 2023.[48] Combined with demand-response policies, a more interconnected grid, the so called *smart grid*, and complementary natural gas plants, this could effectively eliminate the intermittency problem.

Europe and some developing nations are leading the adoption of renewables. Germany's *Energiewende* has allowed it to generate over 35 percent of its electricity from non-hydro renewables, while the UK, France, and Italy have reached more than 19 percent. In 2015, the G-20 derived 8 percent of its electricity from renewables, about a 70 percent increase since 2010. China is advancing fast with the sheer scale of its transition. It accounted for nearly half of global wind and a third of renewables capacity growth in 2015. On the transportation front, China also became the world's largest market for electric vehicles in 2015.[49]

The current energy transition is already underway in China, India, and Sub-Saharan Africa, which may well “leapfrog” investing in fossil-fuels altogether in favor of renewable energy.

Battery Storage

Storage prices are dropping much faster than anyone expected, due to the growing

---

[48] BloombergNEF, Battery Pack Prices Fall As Market Ramps Up With Market Average At USD 156/kWh in 2019, https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/, 3 Dic 2019.

[49] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, Amazon Fulfilment, USA, 2017.

market for consumer electronics and demand for electric vehicles. Major players in Asia, Europe, and the United States are all scaling up lithium-ion manufacturing to serve EVs and other power applications.

A McKinsey research[50] has found that storage is already economical for many commercial customers to reduce their peak consumption levels. At today's lower prices, storage is beginning to play a broader role in energy markets, moving from niche uses such as grid balancing to broader ones such as replacing conventional power generators for reliability, providing power-quality services, and supporting renewables integration.

Further, the idea of combining solar with storage to enable households to make and consume their own power on demand, instead of exporting power to the grid[51], is beginning to be an attractive opportunity for customers. These markets will continue to expand, creating a significant challenge for utilities faced with flat or declining customer demand. Eventually, combining solar with storage and a small electrical generator allowing for "full grid defection" will make economic sense. This will happen in a matter of years, not decades, for some customers in high-cost markets and, more gradually, also in lower cost ones.

Cheap solar energy is already proving a challenge to "business as usual" for utilities in some markets. But cheap storage will be even more disruptive because different combinations of storage and solar will likely be able to override any variable rate design that utilities create.

---

[50] McKinsey & Company, Battery Storage: The Next Disruptive Technology in the Power Sector, June 2017, https://www.mckinsey.com/business-functions/sustainability/our-insights/battery-storage-the-next-disruptive-technology-in-the-power-sector

[51] The so-called "partial grid defection".

Full grid defection, meaning completely disconnecting from the centralized electric-power system, may not yet be economical today, but at current rates of cost declines, it may make sense in some markets earlier than anyone now expects. Of course, economics alone will not dictate how much and when customers choose to disconnect from their utilities, but this dynamic will affect business-model and regulatory decisions sooner than expected.

Utilities are now beginning to understand how low-cost storage is changing the future. They will have to change their approach to develop and engineer the grid in order to accommodate the need of full grid deflection and make the grid itself valuable and appealing, as in granting greater flexibility during high peak demands, to the customers going for solar and storage while at the same time taking advantage of the decentralized production. This in turn will probably make solar and storage even more attractive to other customers initiating and sustaining a virtuous cycle.

Solar Photovoltaic (PV) and Wind

The speed of solar and wind deployment and their steeply declining cost curves have surprised even the most optimistic industry players and observers. Wind and solar power have become competitive with conventional generation technologies across the top global markets, even without subsidies. At the same time, the demand for renewables is inexorably growing. Solar and wind power now come closest to meeting three energy consumer priorities: reliability, affordability, and environmental responsibility.

Wind and solar have reached *grid price parity*[52] and are moving closer to performance parity with conventional sources. In fact, the unsubsidized levelized cost of energy[53] (LCOE) for utility-scale wind and solar PV generation has dropped even with or below most other generation technologies in much of the world. While traditional power plants such as combined-cycle gas turbines (CCGT)[54] have more flexibility to follow the load curve, increasingly affordable battery storage and other innovations are helping smooth the effects of wind and solar intermittency, giving them more of the reliability required to compete with conventional sources. From a price perspective, wind has become the world's lowest-cost energy source for power generation, with an unsubsidized LCOE range of USUSD 30-60 per MWh, which falls below the range of natural gas (USUSD 42-78 per MWh) which is the cheapest fossil fuel.[55]

By the end of 2017, onshore wind capacity had more than doubled over the 2011 capacity of 216 GW. A total of 121 countries had deployed nearly 495 GW of onshore wind power, led by China, the United States, Germany, India, Spain, France, Brazil, the United Kingdom, and Canada, and onshore wind had reached price parity in these nine countries. Globally, the lowest costs are in the nine leading countries, as well as

---

[52] Grid parity (also socket parity) occurs when an alternative energy source can generate power at a levelized cost of electricity (LCOE) that is less than or equal to the price of power from the electricity grid.

[53] The levelized cost of energy (LCOE) is a measure of a power source that allows comparison of different methods of electricity generation on a consistent basis.

[54] A combined-cycle power plant is a highly efficient plant that uses both a gas and a steam turbine together to produce up to 50 percent more electricity from the same fuel than a traditional simple-cycle plant.

[55] Global Renewable Energy Trends, Deloitte Insights, 2018, downloaded at https://www2.deloitte.com/content/dam/Deloitte/my/Documents/risk/my-risk-sdg7-global-renewable-energy-trends.pdf, downloaded on 12 Dec 2019.

Eurasia and Australia.[56]

Utility-scale solar PV is the second-cheapest energy source. The high end of solar PV's LCOE range (USD 43–53/MWh) is lower than that of any other generation source. A record 93.7 GW, more than the total capacity in 2011 (69 GW), was added globally in 2017 across 187 countries, bringing the total capacity to 386 GW, led by China, Japan, Germany, the United States, Italy, India, and the United Kingdom. Solar has reached price parity in all these markets except Japan, one of the world's highest-cost solar markets, primarily due to high capital costs. As Japan transitions to competitive auctions, solar price parity is expected between 2025 and 2030. In the United States, the lowest costs are in the southwestern states and California. Globally, Australia has the lowest costs for solar PV and Africa has the highest due to investment costs.[57]

Beyond the leading countries, wind and solar price parity is also within sight worldwide as the cost gap widens between these and other generation sources. Except for combined-cycle gas plants, the LCOEs of all conventional sources and non-intermittent renewables have either remained flat, like for biomass and coal, or increased, for geothermal, hydropower, and nuclear, over the past decade, while the LCOEs of onshore wind and utility-scale solar PV have, respectively, fallen by 67% and 86% as the cost of components has gone down and efficiency has increased, two trends that are projected to continue. According to Bloomberg New Energy Finance[58], onshore wind and solar PV generation costs have already fallen 18% in the first half

---

[56] Global Renewable Energy Trends, Deloitte Insights, 2018.

[57] Ibid.

[58] Bloomberg NEF, New Energy Outlook 2019, https://about.bnef.com/new-energy-outlook/

of 2018.

Upgrading, or “re-powering,” wind turbines in the developed world is also pulling global average costs downward by raising capacity factors. In addition, developing world costs could fall as global developers and international organizations team up to facilitate project development. Such partnerships are helping resolve the resource dissonance created by the fact that Japan, Germany, and the United Kingdom have some of the poorest solar resources but are global solar leaders, while Africa and South America, respectively, have the greatest solar and wind resources, but these remain largely untapped. As wind and solar capacities grow, many conventional sources will start operating at lower capacity factors, causing the LCOEs of both existing and new-build conventional projects to increase. The cost of new solar and wind plants could eventually be not just lower than the cost of new conventional plants, but also lower than the cost of continuing to run existing plants globally. This was already demonstrated by Enel’s, the Italian multinational energy company, winning bid last year to build a combination of wind, solar, and geothermal plants in Chile that will sell power for less than the cost of fuels for existing coal and gas plants.

One of the most often cited obstacles to the deployment of solar and wind energy has been their intermittency. The situation today is actually reversing: wind and solar may soon cease to appear as problems to be solved, but rather as solutions to grid balancing. Indeed, renewables have not been as difficult or costly to integrate as anticipated. On the contrary, they have demonstrated an ability to strengthen grid resilience and reliability and provide essential grid services.

Finally, new technologies involving automation, artificial intelligence (AI), and blockchain, as well as advanced materials and manufacturing processes, can further accelerate the deployment of renewables. The technologies range from those streamlining the production and operation of renewables, such as automation and advanced manufacturing, to those optimizing their use, such as AI in weather forecasting, improving the market for renewables (blockchain), and transforming the materials of solar panels and wind turbines (advanced materials). These technologies support the current trends by helping to further decrease costs and facilitate integration.

Effects of BEVs and renewables on the hydrocarbons market

What are the implications of the development and diffusion of BEV, autonomous driving, renewables and storage for fossil fuels? By the late 2020s the stock of motor vehicle in the US, and by extension in other advanced OECD economies, would potentially decline by 24%.[59] Then in the next 15 years, the stock of motor vehicle could fall by another 90%.[60] In terms of oil consumption in the transport sector in advanced countries, this represents a decrease of about 6 MBPD by late 2020s and a further decrease of 15 MBPD by the early 2040s.

The implied total drop in oil demand coming from transportation in advanced countries is about 21 MBPD by early 2040s. Even assuming that oil demand for non-transport sectors in OECD economies remains constant, which is conservative, the projection is still a large drop in oil demand in OECD economies.

---

[59] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, USA, 2017.

[60] Ibid.

The substantial drop in OECD oil demand may not be compensated by an increase in demand coming from emerging markets. Given their large weight in non-OECD economies, China and India would play a crucial role in the future of oil demand. As non-OECD economies continue their growth and become richer the assumption is that BEVs will equally spread as in OECD countries.

The US EIA[61] and OPEC[62] projected about 24 percent increase in oil demand in non-OECD countries between 2015 and 2025, 35 percent over 2015-2030 and 54 percent over 2015-2040. In contrast, the consultancy Wood Mackenzie[63] predicts a global oil demand peak at 2035, while the World Energy Council[64] forecasts the year of 2030. OPEC considers the prospect of oil demand peaking in 2029 if COP21 (Climate Change Conference) targets are fully implemented.

In fact, the EV penetration rate globally is not largely different from that in the US. China in 2016 was already the biggest market for BEVs[65]. Moreover, late adopters of energy technology are often faster in shifting energy sources. There is no reason to assume that high and sustained growth in non-OECD countries would take place without a fast adoption of both energy and transportation technologies, such as renewables and BEVs.

Oil demand may or may not decline much in the next 10 years through late 2020s,

---

[61] US Energy Information Administration, Annual Energy Outlook 2016, https://www.eia.gov/outlooks/aeo/pdf/0383(2016).pdf

[62] OPEC, World Oil Outlook, 2016 Edition, https://www.opec.org/opec_web/static_files_project/media/downloads/publications/WOO%202016.pdf

[63] The Rise and Fall of the Black Gold, https://www.woodmac.com/news/feature/the-rise-and-fall-of-black-gold/

[64] World Energy Scenario 2019, https://www.worldenergy.org/assets/downloads/Scenarios_Report_FINAL_for_website.pdf

[65] EIA, Annual Energy Outlook 2019, https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf

and other factors could mitigate the effect on prices, for example a drop in supply, although the development of shale technologies makes this possibility unlikely.

However, over the long run, from the late 2020s to the early 2040s, global oil demand might fall substantially, by about 28 MBPD.[66] Some experts even argue that oil demand will peak in 2020 at around 100 MBPD and drop to 70 MBPD in about ten years with an incredible, and quite sudden, 30% decrease.[67]

Beyond the expected decrease in the global demand for oil, the transportation revolution would also lead to a deep shift in the oil market configuration. Losing its role as essentially the only fuel source for road transport, oil would no longer be considered "black gold." While oil might still be used, it would have to compete as a close substitute in an already crowded energy market with natural gas, coal, nuclear, and renewable energy. Losing its exclusivity to fuel motor vehicles, oil could become the new coal, with ample recoverable reserves and an elastic demand.

In a scenario where oil loses its role as the main fuel for transportation, oil price should eventually drop substantially and converge to a level around 15 dollars per barrel in 2015 prices, along with coal and natural gas[68]. This could happen as early as 2030 and, moreover, renewables could take over the whole energy market, driving the price of oil and other fossil fuels even lower.

Is an "electric" disruption in transportation occurring today?

Is a new electric mobility paradigm really happening, of is it still a matter of "if" over

---

[66] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, USA, 2017

[67] Ibid.

[68] Ibid.

"when"? To answer this question it might be helpful to take a look at how EVs are unfurling around the world. Sales, revenues, but also technology, policies, and other factors' recent developments will now be illustrated, together with the discussion of some of the barriers that might affect the process of adoption.

EVs sales. Over 2 million electric vehicles were sold in 2018, up from just a few thousand in 2010, and there appear to be no sign of slowing down.[69] Also, BEVs sales are pulling away from PHEVs as the market is moving from a relatively even mix between the two to where BEVs have a very clear advantage.[70] By the end of 2019 there were about 10 million electric vehicles on the road worldwide, which is an extraordinary progress in a relatively short period of time, and also about 500 different models available from auto makers globally.[71]

EVs revenues. Not just sales of EVs are going up, but also the revenues from these sales are rising really quickly. From USD 75 billion in revenue in 2018, the estimate for 2020 is over 100 billion, and while revenue is very different from profit, it can still give the scale of the opportunity for markets and industries.[72]

Battery charging times. Over the last 10 years the range and charging times of EVs showed a constant improvement. Clearly there is still room to do better but battery energy density keep improving having almost tripled since 2010, with battery pack prices falling down 87% from 2010 to 2019 and moving fast to the USD 100/kWh

---

[69] BloombergNEF, Electric Vehicle Outlook 2019, https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport

[70] Ibid.

[71] Ibid.

[72] Robert Keough, Globally And In The US EVS Are Getting Charged Up, https://www.tdworld.com/electrification/article/20973181/globally-and-in-the-us-evs-are-getting-charged-up, Oct 2019.

threshold.[73]

BEVs range. The average range of BEVs sold in 2012 was of 166 km while vehicles sold in 2019 had an average range of 379 km.[74] Average charging speed is also increasing moving from 100 kW charging and now coming in at 150 kW with some pushing up at 350 kW charging for very high-end market products. More auto makers are also partnering on energy supply deals to try and make the whole process of switching to the mobility smoother for customers. The charging network is also improving at fast pace. Today there are almost 1.000.000 single charging points in the world from about 75.000 in 2012.[75]

Policies. An important aspect that has a huge impact on new technologies implementation is how national[76] policies approach the issue. Right now the market of EVs is about 2 to 5% of total vehicles with about 2% in the US and 5% in Europe and China, and normally subsidies become much too expensive for countries above this level of market penetration. There is now a general tendency of moving away from the expensive "direct purchase" types of incentives in order to go more toward much larger mechanisms, such as, for example, CO2 reduction limits to be achieved for new vehicles.[77] This tendency is actually slowing down the global sales growth

---

[73] Battery Pack Prices Fall As Market Ramps Up With Market Average At USD 156/kWh in 2019, https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/, 3 Dic 2019.

[74] BloombergNEF, Electric Vehicle Outlook 2019, https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport

[75] Ibid.

[76] Not only national policies though. Also single city policies, imagine the highly populous ones in China for example, will be a significant driver making the use of ICE vehicles more difficult to buy and use.

[77] EU Parliament's CO2 Emission Target requires a 15% reduction by 2025 and a 37.5% reduction by 2030, moving from 134.3 gCO2/km to 70.5 gCO2/km. Only EVs will likely allow reaching these targets.

rates, which have generally been in the 60/70% annual rate in the past decade, to about 10% in 2019 over 2018.[78] It looks like a drawback but it is actually making the EVs sales growth more sustainable for the future.

Digital ride-hailing services.[79] Digital ride-hailing services are growing extremely fast and today count about 1.3 billion users globally. Services like Uber, Lyft and Didi are becoming a significant driver in car transport electrification. one of the largest, Didi, operating in China, today owns almost 1 million EVs (out of a total of 4 million in China) and plan to own 10 million by 2028.

Electric buses. The e-buses market is already huge in China where many cities are completing their conversion to electric buses and also Europe and, to a lesser extent, the US and Latin America are also beginning to ramp up e-buses introduction.

Delivery vans. Amazon and the EVs manufacturer Rivian recently announced a 100.000 vehicle deal[80] and UPS a 10.000 one.

Two car owning families. Families owning two cars are a perfect example where the new technology can be implemented virtually without any issues[81]. One of those cars can go electric very easily with almost no compromises for the people involved and today in the US there are about 70 million households with two cars or more.[82]

Battery manufacturing capacity. With regard to some of the barriers that might stop or

---

[78] BloombergNEF, Electric Vehicle Outlook 2019, https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport

[79] Services such as Uber, Lyft, or Didi.

[80] Elijah Shama, Amazon Is Purchasing 100.000 Rivian Electric Vans, https://www.cnbc.com/2019/09/19/amazon-is-purchasing-100000-rivian-electric-vans.html, 19 Sep 2019.

[81] Probably only a basic economic advantage would be needed

[82] Matt Schmitz, How Many Cars Does The Average American Own, https://www.cars.com/articles/how-many-cars-does-the-average-american-own-1420694459157/, 15 March 2017.

slow the EVs adoption, the ability to manufacture the required number of batteries is currently much debated. Factories to produce batteries are under construction in the US and all over the world. These factories are normally relatively easy to scale-up and therefore this does not appear to be a real constraint. It takes about 9 to 12 months, with less than a year lead time, to build a new factory able to produce multiple gigawatt-hours of battery capacity.[83]

Mineral supply for batteries. The availability of minerals to be used in battery manufacturing is often seen as a potential key constraint for EVs. On the one hand, the processes involved in opening a new lithium or cobalt mine and developing the required battery-grade refining capacity are complex and can take a few years. On the other hand, many experts agree that the supply volumes required to meet future demand curves are achievable.[84] Current global lithium reserves exceed 30 million tons and estimates predict that 1 million tons per year will be required by 2030.[85] Furthermore, it needs to be taken into account that lithium mineral supply risk can be mitigated through the recycling of retired batteries, and that currently there are many promising technology developments that involve the use of other types of minerals.[86]

Based on what presented above, it is probably safe to assume that for EVs the past decade has been the era of increasing the performance, concentrating on passenger vehicles and with supporting infrastructure seen as a hurdle.

The next decade will likely be instead the one of reducing prices, opening to

---

[83] Simon Moores, https://www.benchmarkminerals.com/price-assessments/

[84] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, USA, 2017.

[85] Us Geological Survey 2017, Lithium.

[86] Will L., Come As You Are - Lithium, Cobalt and Tesla's Battery Problem, Harvard Business Review, 2016.

segments of transport other than passenger cars, and where supporting infrastructure will become an opportunity for business. Global EVs diffusion is likely irreversible and is now a matter of "when" more than "if".

Finally, the disruption in transportation has already began and will not stop because its main drive is purely an economic one. Adopting the new way of moving will simply make an economic sense. It will happen because of the huge cost savings that families and companies will experience when they will choose to change their car or truck fleet or their way to produce electricity. Furthermore, the modern global environmental awareness and the advantages for oil-importing countries in becoming less dependent on imports, with obvious national security advantages, will increase the likelihood of the disruption, despite possible lobbying against by oil industries. This energy disruption will be a positive one and will create opportunities[87] in the long term, but in the short to medium term it will likely cause a number of heavy consequences on established business and jobs related to oil energy and transport. The hardest economic repercussions will strike the oil producing and exporting companies and countries, with different countries experiencing different level of economic damage mostly depending on the type of their economies and their dependance from the oil rent.

[87] New businesses, increased income availability for consumers, better public health due to better environment, etc.

CHAPTER THREE

POSSIBLE IMPACTS OF FUTURE ENERGY TRENDS ON THE ECONOMIES OF OIL-EXPORTING COUNTRIES OF THE MIDDLE EAST

The previous chapter has shown that a substantial change in the way transportation by land, with cars and trucks, both private and commercial, and electricity generation, altogether representing more that 50% of global oil consumption, is likely to happen in the foreseeable future, possibly even within the next decade. This change will drastically impact global oil demand, and now it is the time to try and predict what this change will actually imply for the world oil industry and the countries that most depend on its rents.

Implications of reduced demand for the oil industry

The combined effects of a new energy paradigm based on renewables and storage systems, with the great change that a widespread diffusion of EVs will bring to energy markets worldwide, have the potential to be extraordinarily significant and possibly even devastating. The repercussions of such a dramatic decrease in demand will ripple through the whole value chain, causing systemic disruption from oil fields to transport systems and refineries, posing a serious existential threat to the entire oil industry.

If this is true, and if the effects have the potential to appear by the end of the next decade, it can be stated that the implications on the oil market have not yet been fully recognized by the markets. As a matter of fact, current valuations of listed oil companies show that stockholders still forecast growth in revenues, cash flows, and

return on previous investments, for decades to come.

A major switch, both in OECD and developing countries, from ICEs vehicles to EVs and the increased use of renewables for energy production, will cause a number of consequences for all oil producers, the most important ones being a price collapse, a volume collapse, and a demand composition disruption.

An extreme price collapse must be expected with oil prices going as low as USD 25 per barrel by 2030[88] and USD 15 per barrel by 2040[89] heavily affecting, as already mentioned, the entire supply chain and driving out of the upstream sector the most expensive producers. The infrastructure that was built to service high-cost specific sectors will have to deal with lower revenues as well.

A volume collapse in demand will cause disproportional impacts along the oil supply chain with certain high-cost producing countries and companies suffering more than others, up to the point of seeing their entire production basically wiped out.

A dramatic change in the composition of demand for refined products will also contribute to disrupt the value chain. On average, a US refinery produces 19 gallons of gasoline, 10/12 gallons of diesel fuel, and 4 gallons of jet fuel from each 42 gallon barrel[90], meaning that about 69% of each oil barrel goes to gasoline and diesel. When a sizable chunk of gasoline and diesel demand is removed from global markets, the effect on crude production might then move in a disproportionate way along the oil value chain. Oil markets are complex, and simple averages do not necessarily apply. As already mentioned, many types of crude oils exist and they are processed by

[88] J. Arbib, T. Seba, Rethinking Transportation 2020-2030, USA, 2017

[89] R. Cherif, F. Hasanov, A. Pande, IMF Working Paper WP/17/120, Riding the Energy Transition: Oil Beyond 2040, International Monetary Fund

[90] US Energy Information Administration, Oil: Crude and Petroleum Products Explained, 2015

numerous, specific, refineries around the world which vary widely in their complexity and ability to adapt to shifting changes in oil supply and fuel demand composition. As demand for gasoline and diesel drops, many refineries will not be able to adapt to new market conditions by shifting processes to other by-products such as jet fuel, heating oil, asphalt, petrochemicals or kerosene. Some will be forced to shut down or face massive investments in order to retrofit them to the new market needs.[91]

Economics dictates that if a drop to 70 MBPD in oil demand happens, in a competitive market it will be the cheapest 70 million that will be produced while the barrels that are more expensive to produce than the 70-millionth-cheapest will have no market value and will be left in the ground. All assets and infrastructure associated with extracting and transporting those expensive barrels will essentially become valueless.

The decrease in oil price will not be swift and/or smooth. A high volatility is to be expected with possibly even price spikes. There is clear uncertainty on how the short-term pricing will play out. If companies and investors become aware, then investments in exploration, production, shipping, refineries and infrastructure will begin to dry up and this might cause bottlenecks in global oil markets with consequent local short-term supply constraints which will cause the price spikes.[92] At the same time, oil producers might decide to collectively reduce production to maximize short-term cash flow, or some might opt to continue to pump unprofitable

---

[91] A new refinery might take 5-7 years to commission and cost up to USD 18 billion, while retrofitting an existing one might take USD 3 billion.

[92] T. Randall, Her's How Electric Cars Will Cause the Next Oil Crisis, Bloomberg, 25 Feb 2016.

oil in the hope of a recovery in demand or future price increase.

Impacts on oil fields and infrastructure

The extent of the implications for infrastructure in general depends on which type of oil fields they are related to. As said, countries producing low-cost oil from conventional fields, like Saudi Arabia and the rest of the Persian Gulf countries will barely feel any impact in terms of decreased volume. Other countries, with a larger share of shale oil, oil sands and offshore oil will see a higher relative proportion of uncommercial oil.

All the infrastructure associated with fields that are uncommercial will see the greatest volume reduction and will therefore be heavily impacted. Oil field structures and pipelines will become unusable and become stranded. The refineries associated with uncommercial fields will likely become financially unviable, facing the need of expensive retrofits or be shut down. It is important to understand that these considerations apply not only to existing infrastructure but also to the ones being planned right now and to which invested money from governments and companies is being allocated right this day.

Finally, oil shipping will certainly be impacted as well by the decreased production of expensive oil. This will lead to oversupply of tankers and possibly a decline in freight prices which, in turn, might lead to lower demand for new oil tankers with repercussion on the ship-building value chain.

Impact of reduced oil demand on oil-exporting countries

Different countries will be affected differently depending on whether their oil will become uncommercial under the new prices. Countries where production is more

expensive, like the UK, US, Canada, Venezuela, Brazil, Mexico, Norway will be most affected while most of Gulf countries, where production is cheaper, will not.[93] Compared to today, by 2030 global oil production will probably become more concentrated in Russia and in the Persian Gulf countries.

The Gulf countries will be less affected by volume of production but will still suffer major consequences because of their dependence from an oil rent which, with substantially lower price levels than today, will decrease dramatically. Rent from oil production is less than 1% in the US, compared to about 40% in Saudi Arabia and Iraq, and around 20% in Iran, Qatar, and the UAE. Even if oil production will maintain relatively high levels in the Gulf countries, the low prices will drive revenues and profit margins down.

Significant impacts on government spending and economic growth are to be expected in all oil producing countries.

The Persian Gulf Countries

The early 20th century was a crucial point for the development of the Middle East. Prior to 1950, the region exhibited low levels of socioeconomic development and it was the discovery of the vast oil reserves that has catalyzed the rapid creation of wealth. The economies of oil-rich countries were transformed from largely agricultural to rentier economies, which derive a substantial part of their revenue from the outside world, and where the accruing of external revenues are allocated and redistributed by their governments.

Since then, modern Arab oil-exporting economies have become heavily dependent on

[93] Journal News Graphics, Barrel Breakdown, April 2016, http://graphics.wsj.com/oil-barrel-breakdown/

fossil fuels. Hydrocarbon and government activities account for the majority of total GDP in nearly every Middle Eastern country. Oil accounts for 80% of total exports in half of the oil-exporting economies.[94]

In all of these countries, economic activity, fiscal revenue, export earnings and foreign exchange are directly and indirectly dependent on oil production to a very large extent.

Hydrocarbon and government activities are heavily funded by oil revenues as well, accounting for the majority of total GDP in almost all countries. Furthermore, activity in non-government, non-oil sectors is often dependent on oil as well.

Reflecting the predominance of the oil sector, economic diversification is generally low in oil-exporting Middle Eastern countries. Although some countries have made more headway than others in diversifying their economies, most indicators of economic complexity, diversity, and export quality are lower in oil-exporting economies than in many emerging market economies, including other countries in the region and commodity exporters in other regions.

The private sector in most oil-exporting countries also remains small in size with many firms state-owned and operated in public related services. By measures of average firm size and new firms per 1000 residents, the private sector of oil-exporting Middle Eastern economies tends to be largely informal or relatively underdeveloped in reference to non-GCC[95] countries.

---

[94] Annual Meeting of Arab Ministers of Finance April 2016, https://www.imf.org/external/np/pp/eng/2016/042916.pdf

[95] The Cooperation Council for the Arab States of the Gulf, originally, and still colloquially, known as the Gulf Cooperation Council (GCC), is a regional intergovernmental political and economic union consisting of all Arab states of the Persian Gulf except Iraq, namely: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. (Wikipedia)

The size of the economies and GDP per capita varies significantly across countries. Saudi Arabia has the largest economy, with a nominal GDP in 2017 of USD 683 billion while Bahrain is the smallest of all, with a GDP of USD 35 billion in the same year. The disparity in per-capita-GDP is very large: in 2017 Qatar had one of the highest per-capita-GDP in the world at close to USD 68.800, while Iraq had only USD 5.800. However, when oil and government sectors are excluded, the remaining GDP per capita is fairly low in most countries and only a few Arab oil exporter economies would have per capita GDPs above the world average.

Although their sizes vary considerably, populations in most oil-exporting Arab countries are young and fast growing. The source of population growth relies heavily on migration for labor. Around 12 million migrants[96] are present in Saudi Arabia, a third of the total population, while other GCC countries also host large numbers of expatriates, often more than half of total population. In general, the share of children ages 15 and younger in the national population is high, although the large expatriate presence shifts the overall population more towards working ages.

In many oil-exporting Middle eastern economies, the public sector is a major source of employment. In Iraq for instance, the public sector absorbs more than 40% of total employment. On average, elsewhere in the world, about 90% of the jobs are provided by the private sector.[97]

The fiscal cost of government employment is mostly financed by oil revenue. At the same time, the vulnerability to world demand of oil resources jeopardizes the

---

[96] The so-called “expats” represent a wide range of foreign workers with different skills, from blue to white collar and are a fundamental drive in the economies of all the Gulf countries.

[97] World Bank, 2012.

sustainability of public employment in the long run while the domestic workforce in many oil-exporting countries is typically young and set to continue growing rapidly. An overview of the general state of the economies of some of the major oil-exporting countries in the Middle East, namely Saudi Arabia, Iran, Iraq, UAE, and Kuwait, will now be introduced.[98]

Saudi Arabia

Saudi Arabia counts a total population of about 34 million people, about 38% of which are immigrants. In 2017, nominal GDP was USD 683 million of which 42% due to oil revenues, and GDP per capita USD 23.300.

Saudi Arabia has an oil-based economy with strong government controls over major economic activities. It possesses about 18% of the world's proven oil reserves, ranks as the largest exporter of petroleum, and plays a leading role in OPEC. The petroleum sector accounts for roughly 87% of budget revenues, 42% of GDP, and 90% of export earnings.

Approximately 6 million foreign workers play an important role in the Saudi economy, particularly in the oil and service sectors. At the same time, however, the country is struggling to reduce unemployment among its own nationals.

In 2017, the Kingdom incurred a budget deficit estimated at 8.3% of GDP, which was financed by bond sales and drawing down reserves. Although Saudi Arabia can finance high deficits for several years by drawing down its considerable foreign assets or by borrowing, it has cut capital spending and reduced subsidies on electricity, water, and oil products and recently introduced a VAT[99] of 5%.

---

[98] Most of the following data taken from the CIA World-Factbook, https://www.cia.gov/library/publications/the-world-factbook/, downloaded on 25 Jan 2020.

[99] Value-Added-Tax

Iran

Iran has a population of about 84 million people. In 2017, nominal GDP was USD 439 million of which 20%[100] due to oil revenues, and GDP per capita USD 5.600. Iran's economy is marked by statist policies, inefficiencies, and reliance on oil and gas exports, but Iran also possesses significant agricultural, industrial, and service sectors. Following Saudi Arabia, Iran ranks second globally in natural gas reserves and fourth in proven crude oil reserves[101]. Government expenditures, therefore, rely heavily on oil prices. The Iranian government directly owns and operates hundreds of state-owned enterprises and indirectly controls many companies affiliated with the country's security forces.

The United States has played a large role in exploiting Iran's dependence on oil. Since the 1950s, US foreign policy in Iran has aimed at taking advantage of Iran's oil-rich markets. Though US sanctions against Iran have been in place since 1979, new sanctions were introduced with the discovery of Iran's nuclear program. This program has been extremely costly for the Islamic Republic. It is estimated that Iranian intransigence on the nuclear issue may have cost Iran over USD 500 billion in lost oil revenues due to sanctions, cost of construction, research, and operation.[102]

Iraq

The population of Iraq counts 38.8 million people of which 75-80% are Arab, and 15-20% Kurdish. In 2017, nominal GDP was USD 198 million of which 47% due to

---

[100] One of the lowest ratio in the Middle East oil-exporting countries together with the UAE (30%)

[101] http://www.worldbank.org/en/country/iran/overview

[102] http://www.businessinsider.com/irans-nuclear-program-has-been-an-astronomical-waste-for-the-country-2015-6

oil revenues, and GDP per capita USD 5.800.

Iraq's oil production was nationalized in1972. Shortly thereafter, in 1979, oil production reached its peak at 3.5 MBPD.[103] The outbreak of war with Iran in 1980 depleted Iraq's foreign exchange reserves and left the country saddled with more than USD 40 billion in debt. Subsequently, Iraqi oil took an additional hit when, under the regime of Saddam Hussein, decided to invade Kuwait. Despite having the third largest reserves of oil, Iraq dropped to 13th place in the international oil production table. Since then, Iraq has tried to revamp oil production to pre-Gulf War levels. In 2014, Iraqi oil production averaged at 3.4 MBPD. This production growth accounted for nearly 60% of the production growth among OPEC countries.[104] Oil revenues accounted for 47% of Iraq's total GDP and 95% of Iraqi government revenue. Similarly, oil exports accounted for more than 90% of total exports.[105]

Iraq's GDP growth slowed to 1.1% in 2017, a marked decline compared to the previous two years as domestic consumption and investment fell because of civil violence and a sluggish oil market.

The UAE

The United Arab Emirates have a population of about 10 million people of which immigrants make up 87.9% of the total. The ethnic groups are so subdivided: Emirati 11.6%, South Asian 59.4% (including Indian 38.2%, Bangladeshi 9.5%, Pakistani 9.4%, other 2.3%), Egyptian 10.2%, Filipino 6.1%, other 12.8%. In 2017, nominal GDP was USD 382 million of which 30% due to oil and gas revenues, and GDP per

[103] http://www.globalsecurity.org/military/library/report/crs/crs_iraq_economy.pdf

[104] https://www.eia.gov/todayinenergy/detail.php?id=19911

[105] http://www.imf.org/external/np/pp/eng/2016/042916.pdf

capita USD 43000.

The UAE has an open economy with a high per capita income and a sizable annual trade surplus. Successful efforts at economic diversification have reduced the portion of GDP from the oil and gas sector to 30%.

Since the discovery of oil in the UAE nearly 60 years ago, the country has undergone a profound transformation from an impoverished region of small desert principalities to a modern state with a high standard of living. The government has increased spending on job creation and infrastructure expansion and is opening up utilities to greater private sector involvement. The country's free trade zones, offering 100% foreign ownership and zero taxes, are helping to attract foreign investors.

Kuwait

Kuwait's Public Authority for Civil Information estimates the country's total population to be 4.4 million in 2019, with non-Kuwaitis accounting for nearly 70% of the population. The ethnic groups distribution is as follows: Kuwaiti 30.4%, other Arab 27.4%, Asian 40.3%, African 1%, other[106] 9%. In 2017, nominal GDP was USD 120 million of which 58% due to oil revenues, and GDP per capita USD 34.000.

Kuwait has a small, but wealthy, relatively open economy with crude oil reserves of about 102 billion barrels, more than 6% of world reserves. Kuwaiti officials plan to increase production to 4 MBPD by the end of 2020. Oil accounts for over half of GDP, 92% of export revenues, and 90% of government income.

[106] Includes European, North American, South American, and Australian.

The need for diversification

In 2012, the price of oil was above USD 125 per barrel and remained at the same high levels, above USD 100, until September 2014, then it began to fall sharply, until it went below USD 30 by January 2016. The causes of this sudden drop were numerous, including increased production from North America's shale oil, global growth slow down, and internal OPEC rivalries, but the end result was finally an excess of supply.[107]

The 2014 "oil price crash" has had a variety of extremely impactful effects on major oil-producing countries and has shown them that over-reliance on oil is a serious vulnerability. Given that basically all Middle Eastern oil-exporting countries are heavily dependent on the revenues from oil production and exports, the fall in prices has caused very difficult economic situations for both governments and citizens and has acted as a "wake up call," showing that their economies need to become more diversified if they want to be less exposed to future price crashes, regardless if due to excess supply or reduced demand.

Economic diversification would unlock job-creating growth, which today is almost entirely based on public supported employment, and, most importantly, increase resilience to oil price volatility and improve prospects for future generations while at the same time broaden the base for government revenue, in this way making the economy more flexible and resilient to oil price shocks.

[107] R. Ellwanger, B. Sawatzky, K. Zmitrowicz, Factors Behind the 2014 Oil Price Decline, Bank of Canada Review, https://www.bankofcanada.ca/wp-content/uploads/2017/11/boc-review-autumn2017-ellwanger.pdf downloaded 15 March 2020

CHAPTER FOUR

HOW DIFFERENT COUNTRIES IN THE MIDDLE EAST PREPARE FOR FUTURE CHANGES IN THE ENERGY MARKET

Chapter Two has shown how a disruption in land transport and electricity generation will cause, in the next decades, a significant global reduction in demand for oil with very notable impacts on its price. The last Chapter has then illustrated how the economies of the Middle Eastern oil-exporting countries are dependent from oil and that the need of diversification had already emerged from previous price crises. Basically, all the oil-exporting Gulf countries have taken some sort of initiatives intended at becoming less oil reliant. If these initiatives will prove successful, it can be assumed that future oil price drops, whatever the causes, will bear reduced consequences on their economies and therefore on the entire Middle East. At the same time, it must be noted that each country also faces unique challenges which further complicate the domestic and regional economic situation. Also non-oil activities in oil-exporting Middle Eastern countries are to some extent dependent on funding from oil revenues and even if by now basically all governments acknowledge the need to diversify their economies it is clearly easier said than done and the actual results are not that impressive. The challenge is to grow truly self-sufficient non-oil sectors capable of providing a sustainable source of growth and employment. The need is not even a new one because it follows the same reasons used to prepare for when oil resources would eventually become depleted. The huge difference now is time, because depletion, if it will ever happen, was not forecasted to occur before decades.

Shifting complex economies, that have always been based on oil and energy, to new activities, modifying their entire economic and financial state systems is not an easy task and most oil-exporting countries have been trying for some time now. While some countries have made more headway than others in this endeavor, the energy sector is typically highly capital intensive and remains dominant in many economies. Energy economy creates few jobs directly, and oil revenue is often used to finance an oversized public sector. Over-reliance on oil also tends to exacerbate macroeconomic volatility. When oil prices drop, as it will be the case if global demand slows down, the related decline in fiscal revenue will require cuts in public spending, which will dampen growth in the non-oil sector and strain the sustainability of public jobs.
Let us now take a look at how different Gulf oil-exporting countries are approaching the issue of economy diversification.

Saudi Arabia

In Saudi Arabia, the fall in the prices of oil complicated both the social contract of lavish perks, jobs, and subsidies in exchange for an authoritarian political system as well as an active, anti-Iranian foreign policy, causing far more damage than simply lower economic growth. Its economic, domestic, and foreign policies are all intimately connected with petroleum, and the drastic decrease in the price of oil in 2014-16 has had significant effects on the country's domestic policies, as well as the future implications for regional politics and markets.
For decades, Saudi Arabia has been at the center of the global oil market, especially as an active member of OPEC, which sets production targets for each member nation in an attempt to control oil prices. Some have argued that Saudi Arabia has played the

role of a swing producer, changing its quantity of oil production in order to stabilize the price in response to market changes.[108] Regardless, Saudi Arabia has been a major presence on the world oil market for over 40 years. Saudi Arabia is clearly economically dependent on oil, and in past years, the government has failed to diversify its economy, as a recent study on Saudi infrastructure spending has shown.[109] The dependence is compounded by the implicit social contract between the Saudi royal family and the Saudi Arabian citizens, typical of a rentier state, where the government controls nearly the entire economy and employs two-thirds of the workers, providing subsidies and jobs in exchange for an authoritarian political system. The vast oil wealth of Saudi Arabia allows this social contract to continue as long as oil prices remain relatively high. Furthermore, this wealth allows Saudi Arabia to finance its foreign policy goals, most notably its bid to contain Iranian influence in the Middle East.

Saudi Arabia is encouraging the growth of the private sector in order to diversify its economy and to employ more Saudi nationals. The steep fall in the price of oil in 2014-16 had a massive impact on Saudi Arabia's economy and social structure. In contrast to its action in previous periods of oil price drops, Saudi Arabia, along with the rest of OPEC, chose not to cut production in order to increase the oil price. In contrast, it aimed to maximize market share by continuing its production levels in an attempt to force other producers, especially north-American shale producers, out of the market. After a lengthy period of low oil prices, the Saudi economy has struggled. In 2016, Saudi Arabia's budget deficit was 13.5 percent of GDP, and oil still

---

[108] http://www.ecfr.eu/page/-/Connectivity_Wars.pdf

[109] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.652.9939&rep=rep1&type=pdf

accounted for almost 90 percent of government revenues. The fall in the price of oil has also led to a sharp reduction in Saudi currency reserves and increased government borrowing to make up for the budget shortfalls.

At the same time, the fall in the price of oil has led to substantial changes in Saudi Arabia's economic plans as well as its foreign policy. Faced with severe budget shortfalls and a weakened economic base, Saudi Arabia's government has responded trying to diversify its economy while reducing government spending. These reforms are part of an ambitious plan called Vision 2030 through which the country hopes to become one of the 15th largest economies in the world, increase the private sector's contribution from 40% to 65% of GDP, and raise the share of non-oil exports in non-oil GDP from 16% to 50%.[110] Saudi Arabia has focused diversification efforts on power generation, telecommunications, natural gas exploration, and petrochemical sectors. More recently, the government has approached investors about expanding the role of the private sector in the health care, education and tourism industries. Specific plans include floating a small stake in Saudi ARAMCO, which is the world's largest oil company, creating the world's largest sovereign wealth fund to enable investment in new sectors of the economy, increasing the role and number of women in the economy, and exploiting ways to reduce government spending, including reducing subsidies for gasoline, electricity, and water, and imposing taxes on luxury goods and sugary drinks.[111] These measures, however, have already been criticized both from conservative clerics, who do not support the increased role for women, as

---

[110] https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/07/Saudi-Arabias-Vision-2030-Oil-Policy-and-the-Evolution-of-the-Energy-Sector.pdf

[111] https://www.bloomberg.com/news/features/2016-04-21/the-2-trillion-project-to-get-saudi-arabia-s-economy-off-oil

well as from Saudi citizens, who clearly do not like the reductions in subsidies and jobs and employment provided by the government.

Aramco is central to the Crown Prince's reform plan in several ways, not least because its planned partial privatization will generate income for the reforms. The company has also been involved in most of the kingdom's high-profile deals in the recent years as it increased investment in oil refining and petrochemicals, in an attempt to increase its downstream investments versus its upstream ones. Aramco has also announced at least USD 50 billion worth of investments in Saudi Arabia, Asia and the United States.[112] It aims to almost triple its chemicals production to 34 million tons per year by 2030 and raise its global refining capacity to 8-10 MBPD from more than 5 million MBPD.

Overall though, plans to move Saudi Arabia's economy away from oil have advanced slowly. A USD 200 billion solar power-generation project was announced by the Public Investment Fund (PIF)[113] and Japan's SoftBank in March 2018 but since then little detail has emerged. It is unclear how or when the project will be executed, and Saudi's Arabia's energy ministry is moving ahead with its own solar projects.

The image of Saudi Arabia and the reputation of the Crown Prince have been damaged by the murder of journalist Jamal Khashoggi in the Saudi consulate in Istanbul in 2018, resulting in leading businessmen and politicians boycotting an investment forum meant to showcase the kingdom's new future away from oil.

---

[112] Including deals to invest in refineries in India, South Korea and Malaysia and a petrochemical complex in China.

[113]The PIF is the sovereign wealth fund of Saudi Arabia. It is among the largest sovereign wealth funds in the world with total estimated assets of USD 320 billion. It was founded for the purpose of investing funds on behalf of the Government of Saudi Arabia.

The partial privatization of ARAMCO through an IPO[114] has been less than satisfactory. It was expected to provide the PIF with around USD 100 billion in foreign money from the flotation of 5% of the company valued at USD 2 trillion. Instead, after being delayed several times, it ended up pulling off only USD 25.7 billion selling only 1.5% of a total of USD 1.7 trillion valuation. The idea was to attract to foreign investors, but only a portion of the offer ended up being sold to non-Saudis, with some of them likely to have been wealth funds from nearby Kuwait and Abu Dhabi. Although Aramco didn't disclose the split, it is estimated that non-Saudis made up at most 10% of the institutional demand. There were plenty of reasons for foreigners to hang back, from Saudi's poor human rights record to the fact that ARAMCO is unlikely to be worth more than $1.6 trillion.That leaves the crown prince in a less-than-ideal position. First, it suggests that the country cannot count on an ecstatic reaction if it should decide to privatize other industrial assets in future. Second, and more importantly, it turns ARAMCO stock into a political problem. Should the company's share value fall, it would be one thing if foreign institutional investors get hit by it, but almost complete disaster if this happens to the local retailers who bought one-third of the stock, often funded by loans from local banks. Now the citizens' wealth is tied up in an investment whose value fluctuates publicly minute to minute, and the Saudi government might find itself more focused on ensuring maximum oil production, rather than improving the health of the general market. In that case, ARAMCO's IPO was not a step away from fossil fuel dependency, but a step closer towards it.

---

[114] IPO, Initial Public Offering, or stock market launch, is a type of public offering in which shares of a company are sold to institutional and retail (individual) investors.

Finally, it appears that PIF's main investments over the past years were in equity shares in companies such as electric car makers Tesla and Lucid Motors, and the Gulf e-commerce platform *noon.com*. Such deals, although excellent ones on the side of pure market investment, would not necessarily attract foreign investment, help develop industries or create jobs.

Iran

The lifting of most nuclear-related sanctions under the Joint Comprehensive Plan of Action (JCPOA) in January 2016 sparked a restoration of Iran's oil production and revenue that drove rapid GDP growth, but economic growth declined in 2017 when oil production plateaued. The economy continues to suffer from low levels of investment and declines in productivity since before the JCPOA, and from high levels of unemployment, especially among women and college-educated Iranian youth.

In May 2017, the re-election of President Hasan Ruhani generated widespread public expectations that the economic benefits of the JCPOA would expand and reach all levels of society. Ruhani will need to implement structural reforms that strengthen the banking sector and improve Iran's business climate to attract foreign investment and encourage the growth of the private sector. Sanctions that are not related to Iran's nuclear program remain in effect, and these, plus fears over the possible re-imposition of nuclear-related sanctions, will continue to deter foreign investors from engaging with Iran.

The landmark Iranian nuclear deal in 2015 produced less of an economic boost than was predicted, since jobs were scarce and foreign investors were still wary. The oil production in 2015 soared to 3.8 MBPD 6 months after sanctions were lifted.

Like many oil-rich states, Iran has a robust subsidy program. Prior to the Iran deal, it cost an unsustainable USD 40-100 billion per year in energy, fuel, water, and food.[115] In 2010, President Ahmadinejad enacted a reform plan that would cut USD 20 billion in subsidies.[116] With falling oil prices, it will be extremely difficult for Iran to sustain such a program. The oil plunge has hit the country hard. In order for Iran to balance its budget and avoid deficit, barrel prices need to be above USD 100.[117] Putting economy aside, Iranian foreign policy for the past decade has largely been dictated by its reliance on oil and with oil prices dropping, Iran will see a further reduction in its leverage in diplomatic negotiations with the international community.

With the US withdrawal from the JCPOA the economic situation in Iran is not getting any easier, despite the country's capability of "surviving" international sanctions, discouraging even more foreign investments.

Finally, distortions, such as corruption, price controls, subsidies, and a banking system holding billions of dollars of non-performing loans, weigh down the economy, undermining the potential for private-sector-led growth.

Iraq

Iraq is making slow progress enacting laws and developing the institutions needed to implement economic policy, and political reforms are still needed to assuage investors' concerns regarding the uncertain business climate. The Government of Iraq is eager to attract additional foreign direct investment, but it faces a number of

---

[115] https://www.cia.gov/library/publications/the-world-factbook/geos/ir.html

[116] http://www.nytimes.com/2010/04/06/world/middleeast/06iran.html

[117] http://www.vox.com/2014/10/14/6975977/which-countries-suffer-most-when-oil-prices-plummet

obstacles, including an extremely weak political system and worries about security and societal stability. Growing corruption, outdated infrastructure, insufficient essential services, skilled labor shortages, and antiquated commercial laws discourage investments and continue to constrain growth of private, non-oil sectors. Unemployment remains a problem throughout the country despite an inflated public sector. Overregulation has made it difficult for Iraqi citizens and foreign investors to start new businesses. Corruption and lack of economic reforms, such as restructuring banks and developing the private sector, have inhibited the growth of the private sector.

Iraq's largely state-run economy is dominated by the oil sector, which provides the majority of government revenue and of foreign exchange earnings, and is a major determinant of the economy's fortunes.

There is an intimate link between the price of oil and Iraq's domestic institutions, and the decrease in oil prices in 2014 had a severe political and economic impact. Significantly enough, 2014 saw the beginning of the offensive in Iraq of the Islamic State of Iraq and the Levant (ISIL). ISIL was successfully attacking northern Iraqi oil facilities, reducing both production and refinery operations.

Given the enormous dependence on oil, the drastic drop in its price had severe effects on Iraq's economy. Basic economics shows that a drop in price without a comparable increase in sales, exports in this case, will reduce revenue. Indeed, though Iraq experienced relatively stable export levels, as a result of falling prices, 2015 oil revenues decreased by nearly USD 35 billion compared to 2014.[118]

---

[118] http://www.worldbank.org/en/country/iraq/overview

Prior to the drop in prices, oil profits fed a corrupt political system based on patronage. Rather than invest in public services, the money fed "*an unsustainable expansion of government payrolls, and with it, a rise in consumer spending*."[119] Investment and key sector diversification are crucial components to Iraq's long-term economic development but require a strengthened business climate with enhanced legal and regulatory oversight to bolster private-sector engagement.

The UAE

The UAE is one of the most diversified countries in the Gulf Cooperation Council, but its dependence on oil is still seen as a significant long-term challenge.

The global financial crisis of 2008-09, tight international credit, and deflated asset prices constricted the economy in 2009. The crisis hit Dubai hardest, as it was heavily exposed to depressed real estate prices. Dubai lacked sufficient cash to meet its debt obligations, prompting global concern about its solvency and ultimately a USD 20 billion bailout from the UAE Central Bank and Abu Dhabi Government that was refinanced in March 2014.

Low oil prices have prompted the UAE to cut expenditures, including on some social programs, but the UAE has sufficient assets in its sovereign investment funds to cover its deficits. The government reduced fuel subsidies in August 2015, and introduced excise taxes, such as 50% on sweetened carbonated beverages and 100% on energy drinks and tobacco, in October 2017. A five-percent value-added tax was introduced in January 2018. The UAE's strategic plan for the next few years focuses on economic diversification, promoting the UAE as a global trade and tourism hub,

[119] https://www.nytimes.com/2016/02/01/world/middleeast/battered-by-war-iraq-now-faces-calamity-from-dropping-oil-prices.html

developing industry, and creating more job opportunities for nationals through improved education and increased private sector employment.

Kuwait

With world oil prices declining, Kuwait realized a budget deficit in 2015 for the first time more than a decade; in 2016, the deficit grew to 16.5% of GDP. Kuwaiti authorities announced cuts to fuel subsidies in August 2016, provoking outrage among the public and National Assembly, and the government was dissolved for the seventh time in ten years. In 2017 the deficit was reduced to 7.2% of GDP, and the government raised USD 8 billion by issuing international bonds. Because of Kuwait's dependence on oil, the government is trying to cushion itself against the impact of lower oil prices, by saving annually at least 10% of government revenue in the Fund for Future Generations.

Kuwait has failed to diversify its economy or bolster the private sector, because of a poor business climate, a large public sector that employs about 74% of citizens, and an acrimonious relationship between the National Assembly and the executive branch that has obstructed most economic reforms. The Kuwaiti Government has made little progress on its long-term economic development plan first passed in 2010. While the government planned to spend up to USD 104 billion over four years to diversify the economy, attract more investment, and boost private sector participation in the economy, many of the projects did not materialize because of the uncertain political situation and delays in awarding contracts. To increase non-oil revenues, the Kuwaiti Government in August 2017 approved draft bills supporting a Gulf Cooperation Council-wide value added tax scheduled to take effect in 2018.

Diversification and reality

Almost all Middle Eastern oil-exporting states are making great efforts towards economic diversification, especially after the sharp decline in oil prices in 2014-2016. The decline in oil prices exposed the structural weaknesses of Gulf economies in their heavy dependency on oil and gas and showed the need for radical changes in the economic system.

The political will of these countries to diversify their economies by shifting resources and investments from the energy sector to non-hydrocarbon sectors, also recognizing the vital importance of the private sector as an engine of growth and effective tool for economic diversification and development, must be acknowledged. However, there are still a number of key challenges that must still be addressed and resolved.

The huge increases in oil prices since the early 1970s have led to huge investment in the energy sector and energy-intensive industries such as petrochemicals, chemicals, fertilizers, and more recently, GCC countries have made significant investments in infrastructure, with construction and real estate sectors leading by far all other economic sectors in terms of investment and growth.

Basically, the high expectations for industrialization have not been realized, despite the abundance of capital and cheap energy. The industrial infrastructure that could form the base for industrial and technological development has not emerged, except for the petrochemical industry, which still results heavily subsidized, and most GCC countries still import almost 98% of their needs from international markets.[120]

Despite the multi-decade plans, such as Vision 2040 in Oman, Vision 2035 in Kuwait,

[120] M. Ashraf, Challenges of Economic Diversification in the GCC Countries, Gulf Research Centre Cambridge, 2018

and Vision 2030 in Saudi Arabia, all basically emphasizing new economic activities and the private sector as engines of sustainable growth and development in a "post-oil" future, and calling for the GCC states to become centers of excellence in tourism, finance, or other services, economic over-dependence on hydrocarbons still persists. Although GCC economies today have in fact a diversified economic base, through their sovereign wealth funds (SWFs) as well as their non-oil sectors, these have yet to meaningfully contribute to export revenue or fiscal diversification, due to structural constraints and economic distortions, with multiple factors constraining the ability of GCC governments to reduce over-dependence on hydrocarbons revenues, including lack of taxation, concentration of capital in the energy industries and abroad in SWFs, widespread oligopolistic structures, dominance of the public sector, and concentration of the local labour force in the public sector.[121]

Probably there has been so far a desire to create more a service-based economy than to develop a more complex industrialization program. Also, economic diversification is likely still seen as a long-term strategy, with no willingness to disrupt the economic system as long as the oil rents will continue to be the main source of government revenues for the foreseeable future.

As shown in the previous chapters though, this vision might be a viable one if the aim were to prepare for a predicted (distant) depletion of the oil reserves, but today a very serious (and faster approaching) threat is on the horizon: the electric transport and electricity generation disruption.

---

[121] M. Shehabi, Slowing The Pump? Why GCC Economies Have a Diversified Base But Remain Overly Hydrocarbon-Dependent, Economic Diversification in the MENA, Oxford Energy Forum - Issue 118, June 2019, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/06/OEF-118.pdf

CHAPTER FIVE

POSSIBLE IMPACTS OF FUTURE ENERGY TRENDS ON THE GEOPOLITICAL POSITION OF THE MIDDLE EAST

Many Middle Eastern oil exporting countries, as anticipated in the previous chapter, have launched initiatives over the years to support a more diversified economy but today these plans still do not appear to be developed enough. Among other struggles, these initiatives appear to be still long-term strategies that will not be able to cope with the fast EVs disruption, which is already happening today and whose exponential growth will became unbearable for all economies based on oil rents.

In general, declining oil demand and low prices will create political instabilities in all those parts of the world that are highly dependent on oil, and shifts in balance of power in world politics are to be expected. Many oil fields will cease production but low oil prices will also affect the revenue of countries that will continue to produce. Oil-dependent countries will clearly be impacted more than those with diversified economies and large financial reserves, while net importers will benefit from lower costs for imports and a reduced dependence on oil producers.

The oil net exporters countries will be most affected by the disruption depending on the amount of their financial "safety nets". With a continuing oil market downturn, some countries will incur in increased debt, cuts in social welfare expenditures, and growing poverty and inequality.[122] Rentier states, where the oil industry is, in a certain measure, the reason for their existence, will be affected in the deepest way because the oil industry decline will almost automatically imply a political

[122] The Hidden Consequences of the Oil Crash, Politico Magazine, 21 Jan 2016

destabilization rising directly from their societal model. Diversification alone, even if accomplished to a large enough extent, and in a timely manner, will not be enough to make the oil-exporting states truly independent from oil revenues. As already happened with the oil price drops of 2014, when most of the countries were forced to cut social benefits and subsidies and increase taxes, the social response to these actions might jeopardize the essence itself of the state systems.

A final consideration must be made about the capacity by producers to control prices by modulating supply. As seen in Chapter One, this has always been the ultimate goal of oil exporters and oil companies in a market characterized by, contrary to the common knowledge derived by the oil shocks of the 1970s, a factual plentifulness of resources. Countries like Saudi Arabia, that were once able to manipulate prices, with OPEC agreements and with their willingness and capability to be a swing producer, appear to have lost this ability in part because other producers, especially those already in deep trouble, like Venezuela, or those coming back online, such as Iran when sanctions were relieved, must chase the market share by pumping freely if they want to increase revenues. Today, if a major producer finds allies, even outside OPEC, willing to cut production, it might get an outcome opposite of the desired one. If prices go up, this would re-energize US shale entrepreneurs and other high-cost producers, who had to cutback investments due to low oil prices, but who are agile enough to re-enter the market quickly by pushing production back up and limiting the impact of restraint elsewhere.[123] The final result would be a total production increase that might reach a point at which supply control becomes virtually impossible.

[123] The Hidden Consequences of the Oil Crash, Politico Magazine, 21 Jan 2016

When global demand will drop, these issues will be amplified because the margins to influence the market by controlling supply will be further eroded. Likely almost all hydrocarbon producers will try to maximize their revenues, before prices drop below sustainable levels, by producing more and thus driving prices even more down.[124]

Impacts of the oil price drop

Most likely, longstanding low oil prices will be a catalyst for rising global political conflict and confrontation. Cheap oil will translate into huge revenue losses and increased poverty in most oil exporters countries. In the OPEC countries, where oil comprises more than 85 percent of export revenue, the consequences will be especially dire. Where regime stability rests on a classic "oil pact" that is, the provision of economic benefits to key constituencies in exchange for political support, low prices will create a toxic mix of weak currencies, inflation, growing debt, budget and trade deficits, rising food prices, cuts in essential services and soaring poverty. These consequences might cause the downfall of fragile governments and, maybe, even of regimes that appear stable.

Oil-related violence characterizes almost all of current major hotspots, even conflicts that appear ethnic or religious in nature, including the Syrian Civil War and its spillover into Iraq, the tensions between Iran and Saudi Arabia, and the continued civil unrest in Yemen, Afghanistan, South Sudan, Nigeria, Algeria, Somalia, Libya and the Sahel, Russia and Ukraine, and Venezuela. Many of the involved governments, including Russia and Saudi Arabia, have also a clear incentive to take

[124] If a producer country believes that the energy transition is imminent, it would make sense for it to maximize production from its reserves to take advantage of prices before they begin to fall. If a number of producers apply this policy at the same time without effective coordination by OPEC/ OPEC+, it would cause crude oil prices to fall.

aggressive nationalist political action abroad to deflect attention from deteriorating economic conditions at home.

Geopolitically, the impact of low oil prices will be concentrated in the Middle East, where political structures are delicate and based on oil wealth-supported patronage and where Gulf countries have invested billions in social programs and subsidies to discourage Arab Spring-like protests. The fall in oil prices will both intensify pressures and cause economic hardship of its own, and ultimately both regional and international affairs will be greatly impacted by the way these countries respond to these pressures.

When it is no longer possible to deliver food, energy and water security, then it is pretty difficult to deliver internal stability. Urban populations, when their expectations are not met, riot, and then the basic structures of the state fall apart.

If a currently stable oil-producing country in the Gulf suddenly becomes a failed state, it would not only be a disaster for the country itself and the region, but it will have huge implications for the entire world.

A new geopolitical balance in the Middle East?

Massively lower oil and gas prices are normally a good thing for American consumers and US foreign policy, but low prices have a cost too and will bring lower profits for private oil companies.

One of the great weaknesses of American foreign policy is the usually slow pace at which it evolves as the world changes. Radical reordering of the global energy market might open the United States to new foreign policy options.

For decades, the US had to embrace the foreign policy agendas of the Gulf sheikhs

because of the need of their oil and their support in the confrontation with the Soviet Union. The drop in oil prices and sharp rise in domestic production, along with the end of the Cold War, freed the US from that constraint, but they still chose to remain sort of “trapped” there. The crisis ensuing the energy transition would be an ideal time for the United States to shape an agenda of its own in the Middle East, one that follows its own security needs rather than those of its partners.

However, if the main goals of US strategy in the Middle East presented in Chapter One hold true, namely to avoid the emergence of an hegemonic regional power in the region, to protect the oil fields in the shiite majority east province of Saudi Arabia with the goal to avoid instability, to guarantee security to Israel and Saudi Arabia as main allies in the region, and to maintain the supremacy of the seas, by controlling the straits of the Suez, Bab al-Mandab, and Hormuz, it can be noted that, even without oil in the picture, they would not change, or if the case, only minimally. If protection of the oil fields would certainly become less importan would not be so for avoiding instability in the region, although the way to achieve this goal would probably become increasingly more complex and maybe less strict.

The political impact of low oil prices, as already mentioned, is likely to be strongest among countries in the Persian Gulf that have invested billions in social programs and subsidies to discourage Arab Spring-like protests.

In the Gulf, Saudi Arabia’s foreign policy has generally involved two main objectives: an alliance with the United States, and an opposition to Iran. The US-Saudi alliance is largely based on oil, and therefore when the US and the world will not be quite so dependent on Saudi oil it remains to be seen how that will change.

Also in relation to the priority of Saudi foreign policy to reduce the power of its rival, Iran, the fall in the price of oil will forcefully restrain Saudi ambitions and probably cause large policy changes. For Saudi Arabia it will be difficult to maintain an aggressive foreign policy and to continue its efforts to counteract Iranian influence, most notably in Yemen, and in Syria.

The political impact of the energy transition will also be strong in Russia, which needs oil prices above USD 100 per barrel to meet its budget projections and where a response to economic hardship is often to mobilize nationalist sentiment with foreign adventures, as likely has happened with Putin's campaign in Syria. Russia, still affected by the Ukraine related international sanctions, will likely run out of money and it is very difficult to predict what the reactions of this very strong military power will be. Putin will probably see his window for geopolitical gains closing as revenues diminish and this suggests that Russia might become especially aggressive in the future. Many Russians remember that falling oil prices contributed to the collapse of the Soviet Union, and president Putin has described the development of green technologies as a one of the "main challenges and threats" to the economic security of Russia.

For Iran, low oil prices mean that any economic boost, even if sanctions might come to an improbable end, will be far smaller than expected, and may lead to a public outcry. Greater repression in Iran can be expected with the regime likely becoming weaker and weaker.

But the Middle East is not only a cockpit for great power rivalry. Other Middle

Eastern powers might re-assert themselves as players in the game, especially Turkey, with its ability to make its own destiny regardless of what great powers want, as recent events around Cyprus in east Mediterranean, and Libya demonstrate. Great powers often forget how resourceful and effective smaller powers can be in playing off great powers one against the other, in order to maximize their own room for maneuver. China and India did the same during the Cold War weighing in international disputes trying to steer a course between the two superpowers of the time. With the West less interested in the region, it might be the new Asian great powers filling the void while the Middle Eastern regional powers might have their own ideas about the proper order of things.

China and India in the new Middle East

Many of the large oil and gas exporters can be considered as politically unstable. So the faster the energy transition, the greater the drop in gas and oil revenues, the more disruptive it is going to be and the possibility for a number of states to fail, oil-exporting or not, cannot be dismissed.

In such a scenario the raising Asian powers might decide, or be forced, to become more assertive in the region, having to assume a stronger role more up to par to their historical heritage. As illustrated in Chapter One, today both China and India keep a "low profile" in the Middle East steering away from hard decisions and interventions that might make them appear less popular to some factions rather than others.

China's interest in the area is beyond any doubt, given the fact that the Belt and road Initiative is one of the more intense international plans ever brought forward by Beijing. The BRI is not "just" a commercial endeavor, but it involves actual, solid

infrastructure, and solid infrastructure sooner or later might require physical protection and direct involvement.

India's biggest involvement in the region today is manifested by providing its huge diaspora to the Gulf countries. The Indian expats are an essential double-link between the big asian power and the Middle East. Without those workers the Gulf countries would not be able to exist as they are, but what will India do when those countries will not be able to provide all the jobs that allow so many remittances to flow back home?

All these factors then need to be weighted with the actions that other powers will initiate both in the Middle East and in the Pacific region. The US is already showing some less interest in the Gulf and an increased one in the Pacific and its economy will probably be less affected by the energy transition, at least in the medium term.

Geopolitics of Lithium

EVs production requires a certain amount of key materials, such as lithium, nickel, cobalt, and cadmium. In particular today lithium-ion batteries are by far the most critical piece of hardware for EVs. Some argue that, due to booming demand for such materials in order to manufacture EVs, new geopolitical issues might arise. But lithium geopolitics is completely different from oil geopolitics, because lithium is a material stock, only needed to build the batteries, while oil, as the fuel to operate an ICE vehicle, is a material flow.[125] Scarcity of lithium would only affect new vehicles production, while the existing fleet would still operate. The scarcity of oil instead, would immediately reflect on the entire transport fleet even stopping it, as it

[125] That is why oil production is always measured in quantity over time (MBPD)

happened during the oil shocks of the 1970s.

Lithium is constrained by the relative long lead times[126] required to open new mines and refining factories rather than shortage in the raw material. In the short term, geopolitics of lithium supply is much more less critical than the oil one. Furthermore, while it is true that lithium reserves and production are concentrated in few countries[127], lithium-ion batteries only contain 2% lithium in volume and generally there are many types of batteries, using different minerals and in different quantities depending on the specific product requirements.

Finally, recycling technologies are continuously improving and both internal materials and entire batteries can be recycled for new batteries or secondary uses.[128]

[126] 3 to 5 years

[127] Lithium reserves in million tons: Bolivia 9, Chile 7.5, US 6.7, Argentina, 6.5, Australia 1.7, China 5.1. Us Geological Survey 2017, Lithium

[128] Today EV battery packs at 80% capacity are already being recycled as storage for utilities

CONCLUSIONS AND PERSONAL NOTES

This paper had the aim to try and respond to the question if a disruptive energy transition is occurring and what its consequences on global oil markets and the geopolitical balance in the Middle East would be.

I believe that Chapter Two has extensively demonstrated that the energy transition is well ongoing and that most likely it will also happen very fast, probably within the next 10 years. As the Corona Virus spread around the world is showing, it is very difficult for human beings to understand, cope, and sometimes even accept, exponential growth, but new technologies always penetrate markets in this way. This type of growth happens very slowly in the beginning but then, at some point, it suddenly accelerates so quickly that it becomes almost impossible to react in a timely manner. The rate at which exponential growth moves in technology markets has actually increased over the years. It took the telephone 75 years to reach 50 million users, but the radio reached 50 million in about half the time, 38 years. The television did the same in a third of the time it took the radio, 13 years, and the computer tablet reached 50 million in about a sixth of the time it took the radio: 2 years.[129]

Disruptions happen because they make economic sense to the user. We did not change from coal to oil because we ran out of coal, but because oil was better, cheaper and more efficient. The same will happen with EV's and electricity generation through renewables and storage. We will not move out of oil because we will run out of it, but because we have found something better.

---

[129] M. Kamath, To reach 50 million users Telephone took 75 Years, Internet took 4 years however Angry Birds took only 35 days!, March 2015, https://www.techworm.net/2015/03/to-reach-50-million-users-telephone-took-75-years-internet-took-4-years-angry-birds-took-only-35-days.html

Previous experiences also show us that there is a tendency from "experts" and "insiders" not only to fail to recognize exponential growth but also to minimize the impact of new technologies on "business as usual". As previously mentioned, when in 1985 the American telephone company AT&T asked McKinsey to forecast what would be the cell phone adoption by the year 2000, the biggest and most important consultant agency of the world missed the prediction by 2 orders of magnitude!

Another excellent example is the diffusion of the iPhone. Why would anyone buy a 600 dollar phone when he could easily get a 100 dollar Nokia? These are just some expert opinions from 2007:

"*There is no chance that the iPhone will get any significant market share. No chance…*" - Steve Ballmer, CEO Microsoft, 2007.

"*The iPhone's impact will be minimal. It will only appeal to a few gadget freaks. Nokia and Motorola have nothing to worry about.*" - Bloomberg Analyst, 2007.

If these declarations sound familiar with what today we hear about EV's and renewables, then we probably have a problem.

In the year 2000, Kodak[130] was recording incredible financial results with revenues over USD 14 billion and net profits of USD 1.4 billion, printing over 100 billion pictures over the entire world. In 2012, the same company filed for bankruptcy, completely overwhelmed by digital photography.[131]

While these examples of failed predictions and reactions to market changes probably caused a number of issues connected with job losses (but at the same time also a lot of new opportunities) they are not even comparable to what might happen with a

[130] At the time world leader in producing camera film and photo print.

[131] Worth of note, digital photography was invented by a Kodak employee!

disruption of the global oil market.

In Chapter Three and Four I concentrated on the impacts of the disruption on the oil producers in the Gulf and the efforts that these countries are trying to make to diversify their economies. The impression though, is that these efforts are not happening at the needed pace, if they happening at all, for many different reasons. The geopolitical consequences are going to be immense and, although I made a very timid attempt at predicting what might happen to the Middle East in the last chapter, the future con only be hypothesized with a high degree of uncertainty as international relations are not an exact science and they are subject to a multitude of factors.

It will be important to continue researching the possible changes while at the same time closely monitor EV's penetration globally, both in OECD and in emerging markets.

A country like Israel, with its economic and social peculiarities that make it stand out from the rest of the region while being still profoundly part of it, will have to react promptly to the geopolitical changes and being aware of these changes possibly happening is the first step.

As a European writing this paper from an Israeli institution I have had the unique opportunity of looking at the research question from a privileged point of view.

First of all I have had the chance to glimpse at the complexity of a region that, although geographically not distant from Europe, is hardly fully understood by most Europeans.

Secondly, by researching the evolution of global oil markets, I have discovered how this resource is not at all a scarce one and how the oil price shocks of the 1970s were

not caused by scarcity or by the Arab-Israeli conflicts, but were in fact the natural consequence of a process started years earlier where the producing countries looked at a way to become independent from the powerful multinational oil companies in order to increase their revenues and rents. Clearly the Arab-Israeli conflicts had a fundamental role but it was probably that of acting as a catalyst more than that of a root cause.

Finally, I have learned that the East, namely China and India, are closer, in every possible sense, to the Middle East than I could imagine, and that the great Asian powers have the potential to become key players in the region.[132] Again, most Europeans tend to see the relations of Western powers either with China and India or with the Middle East, failing to evaluate the interconnections coming from the West-China/India relations through the Middle East and vice-versa, and they mostly end up failing to properly take into account Asia when discussing about the Middle East. Researching for this paper proved crucial in realizing how the Middle East and the Asian powers are closely linked and connected together and how it is essentially impossible today to analyze one region without considering the other.

Any economic repercussion that may affect the Gulf countries in case of longstanding low oil prices[133] will not only reverberate on the West from the Middle East but also through its effects on Asia, and this in turn will have the potential to unbalance the ever more important Asia-West relations.

---

[132] It is significant to note that a number of organizations, including the UN and the Indian and Chinese foreign policy establishments, regard the term “Middle East” as Eurocentric and instead refer to the region as West Asia. The term “Middle East” is usually attributed to the American strategist Alfred T. Mahan, who was one of the key geopolitical thinkers of the nineteenth century.

[133] The author of this paper believes that this will happen in the near future due to a revolution occurring in land transport, caused by Electric Vehicles, and in electricity generation, caused by renewable energy sources such as solar and wind coupled with efficient energy storage systems.

To conclude, as I mentioned in the beginning of the paper, I believe that the Middle East was geopolitically important before the oil era and this fact will not change after the energy transition. Its geographic position and characteristics, connecting oceans, continents and cultures, will remain of invaluable importance for the rest of humanity's history.

BIBLIOGRAPHY AND REFERENCES

1. D. Yergin, The Prize: The Epic Quest for Oil, Money, and Power, Paperback edition, New York: Touchstone, 1991
2. J. Arbib, T. Seba, Rethinking Transportation 2020-2030, First Edition, Amazon Fulfilment, USA, 2017.
3. P. Stevens, The Geopolitical Implications of Future Oil Demand, Chatam House Research Paper, 2019 American Council on Renewable Energy, The Role of Renewable Energy in National Security, Issue Brief October 2018.
4. Luciani, G (ed.) The Arab State, Berkeley and Los Angeles: University of California Press, 1990.
5. Stocking, G. W., Middle East Oil, Knoxville TN Vanderbilt Univ. Press, 1970.
6. R. Cherif, F. Hasanov, A. Pande, IMF Working Paper WP/17/120 - Riding the Energy Transition: Oil Beyond 2040, International Monetary Fund, 2017.
7. M. Ashraf, Challenges of Economic Diversification in the GCC Countries, Gulf Research Centre Cambridge, 2018
8. J. Bartlett, What Are the Costs and Values of Wind and Solar Power? How are they Changing?, available at https://www.resourcesmag.org/common-resources/what-are-costs-and-values-wind-and-solar-power-how-are-they-changing/
9. J. Ellsmoor, Renewable Energy is Now the Cheapest Option. Even Without Subsidies, available at https://www.forbes.com/sites/jamesellsmoor/2019/06/15/renewable-energy-is-now-the-cheapest-option-even-without-subsidies/#18af33775a6b
10. Geoffrey Kemp, The East Moves West, Brookings Institution Press, 2010
11. G. Luciani, Oil and Political Economy in the International relations in the Middle East, https://www.academia.edu/28854286/Oil_and_political_economy_in_the_international_relations_of_the _Middle_East, 24 May 2015
12. Mary Ann Tètreault, The Political Economy of the Middle Eastern Oil, https://pdfs.semanticscholar.org/67a6/b3d396b50a88733c06a527c2abeb65e0e685.pdf, downloaded Nov 3 2019
13. https://www.cia.gov/library/publications/the-world-factbook, data downloaded 20 Feb 2020

14. Global Renewable Energy Trends, Deloitte Insights, 2018, downloaded at https://www2.deloitte.com/content/dam/Deloitte/my/Documents/risk/my-risk-sdg7-global-renewable-energy-trends.pdf, downloaded 12 Dec 2019
15. US Energy Information Administration, Annual Energy Outlook 2016, https://www.eia.gov/outlooks/aeo/pdf/0383(2016).pdf PPT
16. OPEC, World Oil Outlook 2040, 2019 Edition, https://woo.opec.org
17. OPEC, World Oil Outlook, 2016 Edition, https://www.opec.org
18. M. Garside, Daily Global Crude Oil Demand 2006-2020, https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/ 21 Oct 2019
19. Adam Conner-Simons, Study: Carpooling Apps Could Reduce Taxi Traffic 75%, https://www.csail.mit.edu/news/study-carpooling-apps-could-reduce-taxi-traffic-75, downloaded 7 Jan 2020
20. David L. Chandler, Can Today's EVs Make a Dent in Climate Change?, https://news.mit.edu/2016/electric-vehicles-make-dent-climate-change-0815, downloaded 17 Dec 2019
21. Canadian Fuel Association, The Economics of Petroleum Refining - Understanding the Business of Processing Crude Oil into Fuels and Other Value Added Products, December 2013
22. BloombergNEF, Battery Pack Prices Fall As Market Ramps Up With Market Average At USD 156/kWh In 2019, https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/, 3 Dic 2019
23. R. Cherif, F. Hasanov, A. Pande, Riding the Energy Transition: Oil Beyond 2040, IMF Working Paper WP/17/120
24. McKinsey & Company, Battery Storage: The Next Disruptive Technology in the Power Sector, June 2017, https://www.mckinsey.com/business-functions/sustainability/our-insights/battery-storage-the-next-disruptive-technology-in-the-power-sector
25. US Energy Information Administration, Oil: Crude and Petroleum Products Explained, 2015
26. T. Randall, Her's How Electric Cars Will Cause the Next Oil Crisis, Bloomberg, 25 Feb 2016

27. Wall Street Journal News graphics, Barrel Breakdown, April 2016, http://graphics.wsj.com/oil-barrel-breakdown/
28. BloombergNEF, Electric Vehicle Outlook 2019, https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport
29. Us Geological Survey 2017, Lithium
30. Will L., Come As You Are - Lithium, Cobalt and Tesla's Battery Problem, Harvard Business Review, 2016
31. Robert Keough, Globally And In The US EVS Are Getting Charged Up, https://www.tdworld.com/electrification/article/20973181/globally-and-in-the-us-evs-are-getting-charged-up, Oct 2019.
32. Matt Schmitz, How Many Cars Does The Average American Own, https://www.cars.com/articles/how-many-cars-does-the-average-american-own-1420694459157/, 15 March 2017.
33. Elijah Shama, Amazon Is Purchasing 100.000 Rivian Electric Vans, https://www.cnbc.com/2019/09/19/amazon-is-purchasing-100000-rivian-electric-vans.html, 19 Sep 2019.
34. American Geosciences Institute, How Much Oil Does US Export And Import, https://www.americangeosciences.org/critical-issues/faq/how-much-oil-does-us-export-and-import, downloaded 18 mar 2020.
35. Maritime Chokepoints: The Backbone of International Trade, https://www.ship-technology.com/features/featuremaritime-chokepoints-the-backbone-of-international-trade-5939317/
36. http://www.worldstopexports.com/russias-top-10-exports/
37. CIA World-Factbook, https://www.cia.gov/library/publications/the-world-factbook/, downloaded on 25 Jan 2020
38. Indian Ministry of External Affairs, http://mea.gov.in/images/attach/NRIs-and-PIOs_1.pdf, downloaded 25 March 2020
39. R. Ellwanger, B. Sawatzky, K. Zmitrowicz, Factors Behind the 2014 Oil Price Decline, Bank of Canada Review, https://www.bankofcanada.ca/wp-content/uploads/2017/11/boc-review-autumn2017-ellwanger.pdf downloaded 15 Mar 20
40. M. Shehabi, Slowing The Pump? Why GCC Economies Have a Diversified Base But Remain Overly Hydrocarbon-Dependent, Economic Diversification in the

MENA, Oxford Energy Forum-Issue 118, June 2019, https://www.oxfordenergy.org/ wpcms/wp-content/uploads/2019/06/OEF-118.pdf

41. M. Kamath, To reach 50 million users Telephone took 75 Years, Internet took 4 years however Angry Birds took only 35 days!, Techworm 13 March 2015, https://www.techworm.net/2015/03/to-reach-50-million-users-telephone-took-75-years-internet-took-4-years-angry-birds-took-only-35-days.html
42. World Bank, Remittance data outflows, April 2018 revision