Sustainable Transition of the Chemicals Sector:

Oman, Saudi Arabia and the UAE

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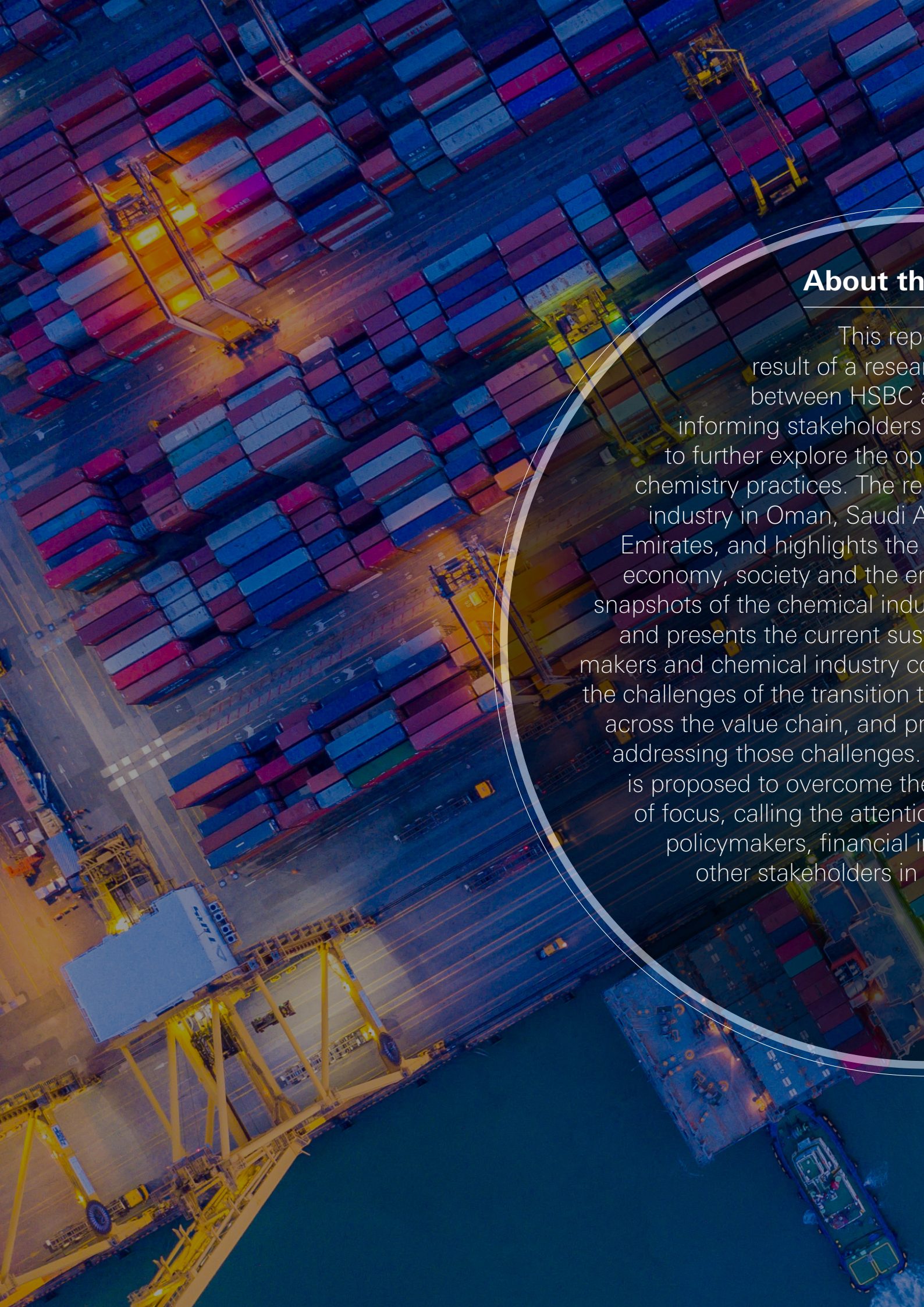

About th

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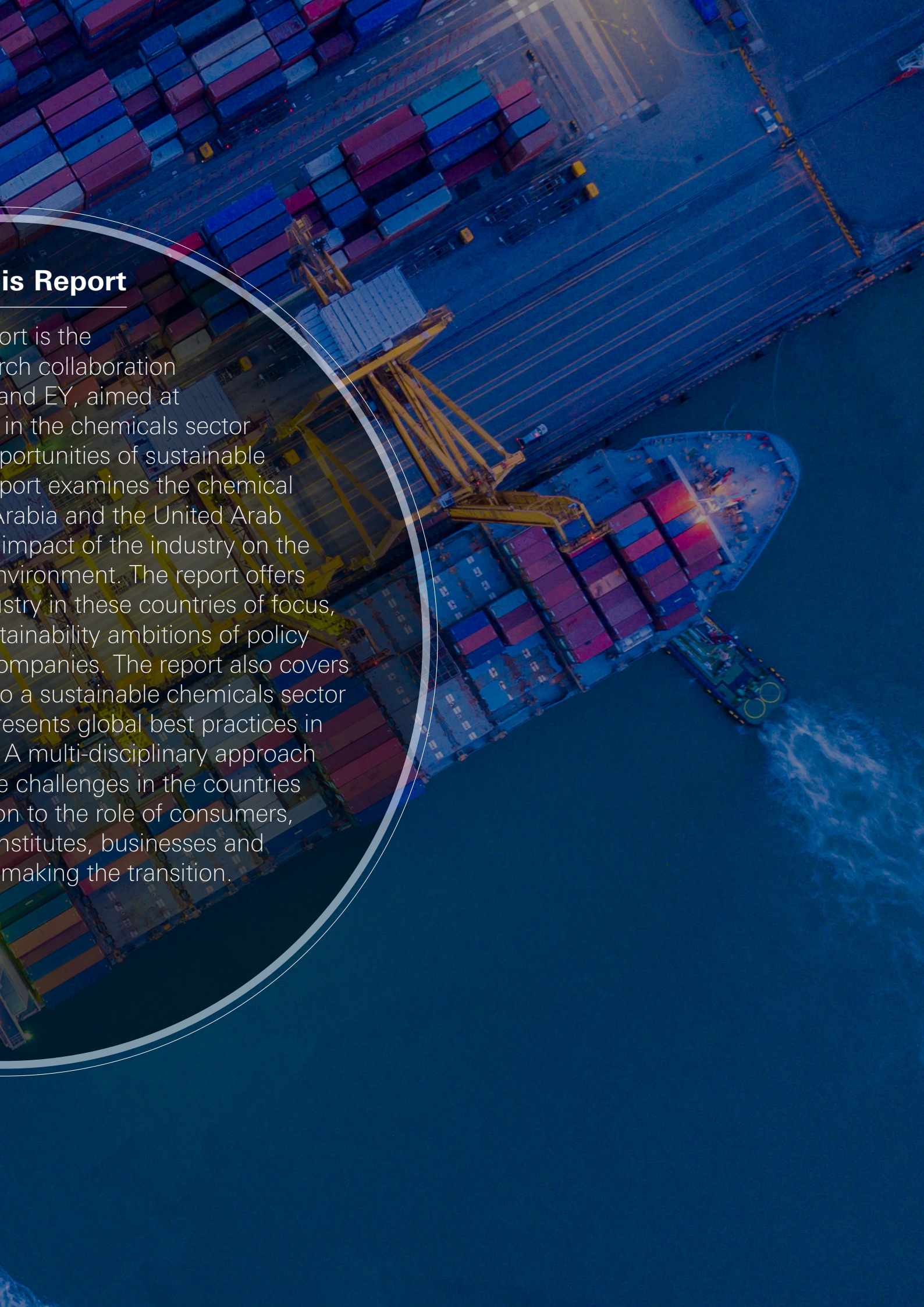

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Arabia and the United Arab
impact of the industry on the
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A multi-disciplinary approach
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on to the role of consumers,
nstitutes, businesses and
making the transition.

Foreword

The chemicals sector is one of the largest and most economically important industries in the world, employing 15 million people directly and over 60 million people indirectly. Chemical products are found in every aspect of modern life – in the energy systems powering our cities, in the fertilisers and pesticides used in modern agriculture, in pharmaceutical development, in construction, and in most of the consumer goods we use on a day to day basis.

There is no doubt that chemicals will remain vital for the global economy well into the future, including here in the GCC, which has seen its share of global production capacity double between 2000 and 2017 to reach 6.6%.

However, what is being increasingly questioned is whether the sector can continue to operate as it has in the past. The chemicals industry has had significant adverse impacts on the environment and is a major contributor to the greenhouse emissions that are responsible for climate change. And these impacts have been felt across the entire value chain. The chemical industry's final energy consumption is the highest of any industrial sector; its operations cause substantial runoff of pollutants into the local environment, air and waterways; and many chemical sector products – plastics and fertilisers are two notable examples – are also causing serious environmental harm.

At the global level, the sector is mobilising to address these issues, with a range of regulatory action and industry-led and initiatives to incentivise more sustainable business models. Leading chemical companies have been making ambitious net zero targets, to align their business models to the Paris Agreement goals, and it is increasingly apparent that this will be the industry standard for the chemical sector in the near future. Actualising ambitious sustainability goals, however, poses several challenges, not least for the chemicals industry in the GCC, which has historically been subject to less onerous environmental regulatory oversight.

This report lays out a multi-disciplinary approach to address these challenges, where various stakeholders including regulators and policymakers, financial institutions, consumers and others have a part to play in supporting the chemicals sector as it transitions to a low carbon future.

3. Executive Summary

Chemicals have helped us improve the quality of our lives. There is an enormous variety of chemical products playing instrumental roles in different sectors including agriculture, energy, construction, transport, consumer goods and pharmaceuticals. The chemical industry is among the largest industries in the world, contributing to the global GDP through the employment of people in the industry's broad supply chain, directly and indirectly.

There are many types of chemicals that are manufactured. Polymers, often referred to as plastics, contribute to roughly 80% of the industry's global output. They are used in many applications such as food packaging, energy efficiency and storage, aircraft and many others. Petrochemicals, the chemical products obtained from petroleum or natural gas, account for 90% of total feedstock demand in chemical production. In the Middle East, the output of the industry is mainly focused on petrochemicals given the easy access to low-cost oil and gas in the region. The petrochemicals sector is the second largest sector in primary oil demand globally, and is perceived to be the demand's most significant growth driver by 2030. Given the high dependence on fossil fuels, the chemical industry is the third largest source of industrial carbon dioxide (CO_2) emissions. CO_2 is one of the major greenhouse gases (GHG) that are considered the primary cause contributing to climate change.

In addition, the continuous compilation of single-use chemical products, also known as plastic waste, is causing adverse environmental impacts. According to the United Nations, more than 800 species worldwide are affected by marine debris, and as much as 80% of that litter is plastic. Recent studies estimated that the cumulative amount of plastic waste, in landfills or in the natural environment, from 1950 to 2016 is around 6,000 million tonnes. From a human health perspective, the chemicals sector is the second-largest source of sulphur dioxide (SO_2), known to harm the human respiratory system and causes difficult breathing.

Given the sizeable impacts the chemical industry has on the environment, the industry has started to address this issue. In line with the Paris Agreement, national and international legislative bodies have started to introduce new regulations for the chemical industry to contribute towards the three dimensions of sustainable development – environmental, social and economic. Global players in the chemical industry are beginning to set ambitions to achieve Net Zero - an overall balance between emissions produced and emissions taken out of the atmosphere. They also started to consider new business models to mitigate the impact of plastic waste through the adoption of circular economy frameworks.

In the Middle East, particularly in the Gulf Cooperation Council (GCC), the chemical industry has grown dramatically in the past decades. As a result of the recent decline in global oil prices, as well as the competition from different countries, the Middle East started to diversify from purely supplying crude oil towards the development of a downstream supply chain. Similar to other regions, the chemical industry in the Middle East is contributing to climate change, plastic waste and human health. The chemical industry in the region also contributes to water scarcity given the lack of freshwater resources needed for chemical production.

In response to the multiple risks to the petrochemicals industry, governments in the Middle East are adjusting their national visions towards sustainability for the chemicals sector, and key stakeholders in the industry have started shifting their strategies to adopt more sustainable practices. However, adopting sustainability ambitions is influenced differently for players in the chemical industry, depending on a range of drivers including stakeholder pressure, portfolio flexibility and organisational capabilities. Taking into account the different factors for each driver, organisations in the sector have adopted different approaches in setting and achieving their sustainability targets, thus facing challenges from various perspectives.

Although there are obvious environmental, economic and social benefits of adopting sustainability for the chemicals sector, there are also numerous challenges that prevent stakeholders from advancing in their journey towards becoming more sustainable. In industrialised countries, sustainable development has been a priority since the 1980s, whereas countries in the Middle East have only recently prioritised this through their national visions. Policy and legislation in the region is not as mature as other regions such as the European Union. Moreover, given investor emphasise on short payback periods and immediate returns for their investments, companies in the region might not find sustainability practices attractive, especially after the recent economic disruptions caused by the COVID-19 pandemic. Another challenge preventing investors from diversifying their portfolio to include sustainable chemistry projects is the limited availability of data for the region. Whilst EU rules require large companies to publish regular reports on the social and environmental impacts of their activities, companies in the Middle East are not obliged to do so.

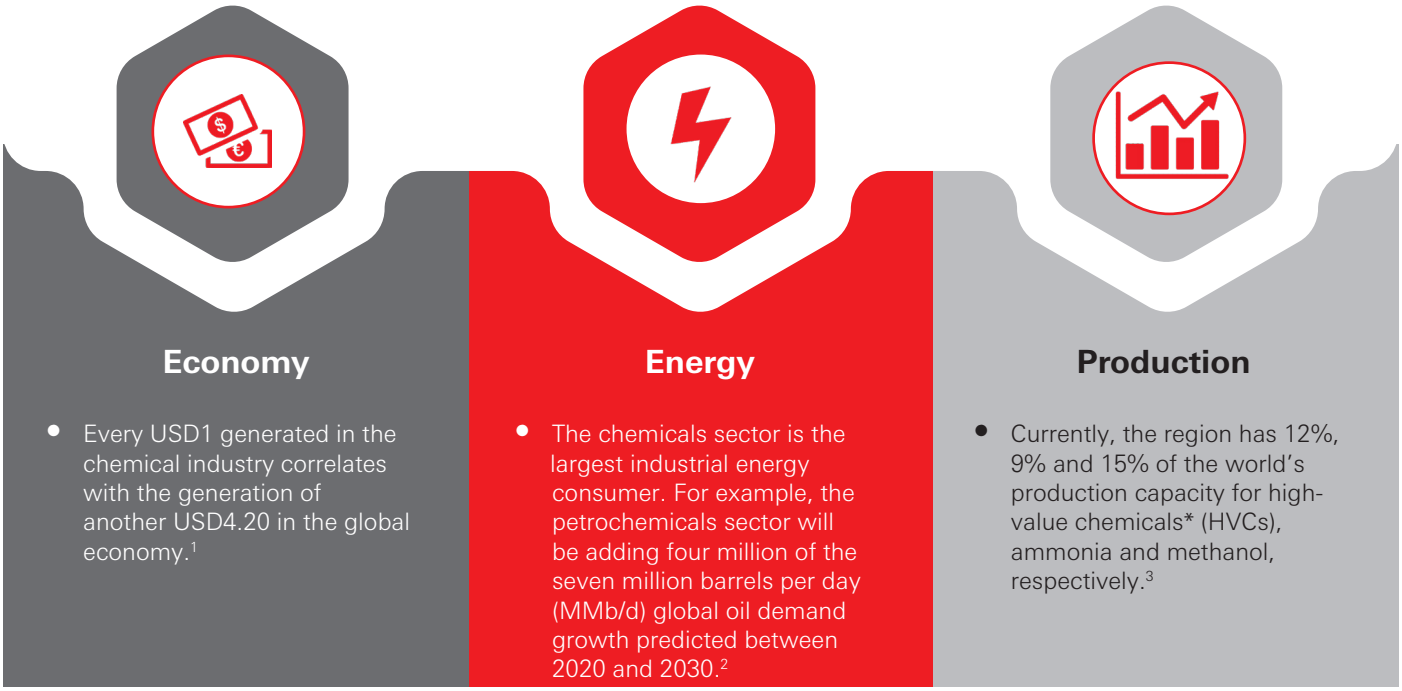
A multi-disciplinary approach is proposed for the chemicals sector to transition. Consumers, for example, can minimise the demand of single-use plastic products, subsequently incentivising chemical companies to develop alternative and circular economy products. Governments can introduce effective policies and legislations are needed to mandate the transition towards a sustainable chemicals sector for companies and consumers. The financial sector can promote sustainable finance by adopting new financial mechanisms such as the transition bonds and loans, and sustainability linked loans; instruments developed specifically for businesses who are trying to make the transition towards a sustainable chemicals sector.

Companies in the region can also start to implement global best practices in their business strategies and operations, including the recent Net Zero strategies by their peers elsewhere.

Other Stakeholders also have an important role in the transition. Investors can also increase awareness for chemical companies on the benefits sustainable business practices. Trade associations, such as the Gulf Petrochemicals and Chemicals Association (GPCA), and non-government organisations can support in promoting sustainability and guiding decision-making for members.

4. Chemicals Today

4.1 Overview



* Chemicals such as light olefins (ethylene and propylene) and aromatics (benzene, toluene and mixed xylenes)

Industrial manufacturing of chemicals started in Scotland before the industrial revolution, in the mid-18th century, with sulfuric acid being the first chemical to be produced in large quantities.[4] Later, the discovery of chlorine as a bleaching agent led to the establishment of new avenue of manufacture.[5] Large scale factories began manufacturing a diverse portfolio of chemicals as the industrial revolution developed.

Currently, the chemical industry is among the largest industries in the world. In 2017, the industry contributed USD5.7 trillion to global GDP through indirect, direct and induced impacts. This corresponds to approximately 7% of the world's GDP in the same year. The chemical industry itself directly employs 15 million people worldwide, and indirectly supports 60 million jobs in the industry's broad supply chain. Moreover, the earnings spent by the global chemical industry and its supply chain have been estimated to support 45 million jobs in other sectors such as local retail and leisure establishments. Every USD1 generated in the chemical industry correlates with the generation of another USD4.20 in the global economy. In 2017, chemical companies spent approximately USD3 trillion on suppliers, purchasing their goods and services for manufacturing chemicals. Additionally, the chemical industry globally invested approximately USD51 billion in Research and Development (R&D). This investment has been estimated to support 1.7 million jobs and USD92 billion in economic activity in 2017 alone.[6]

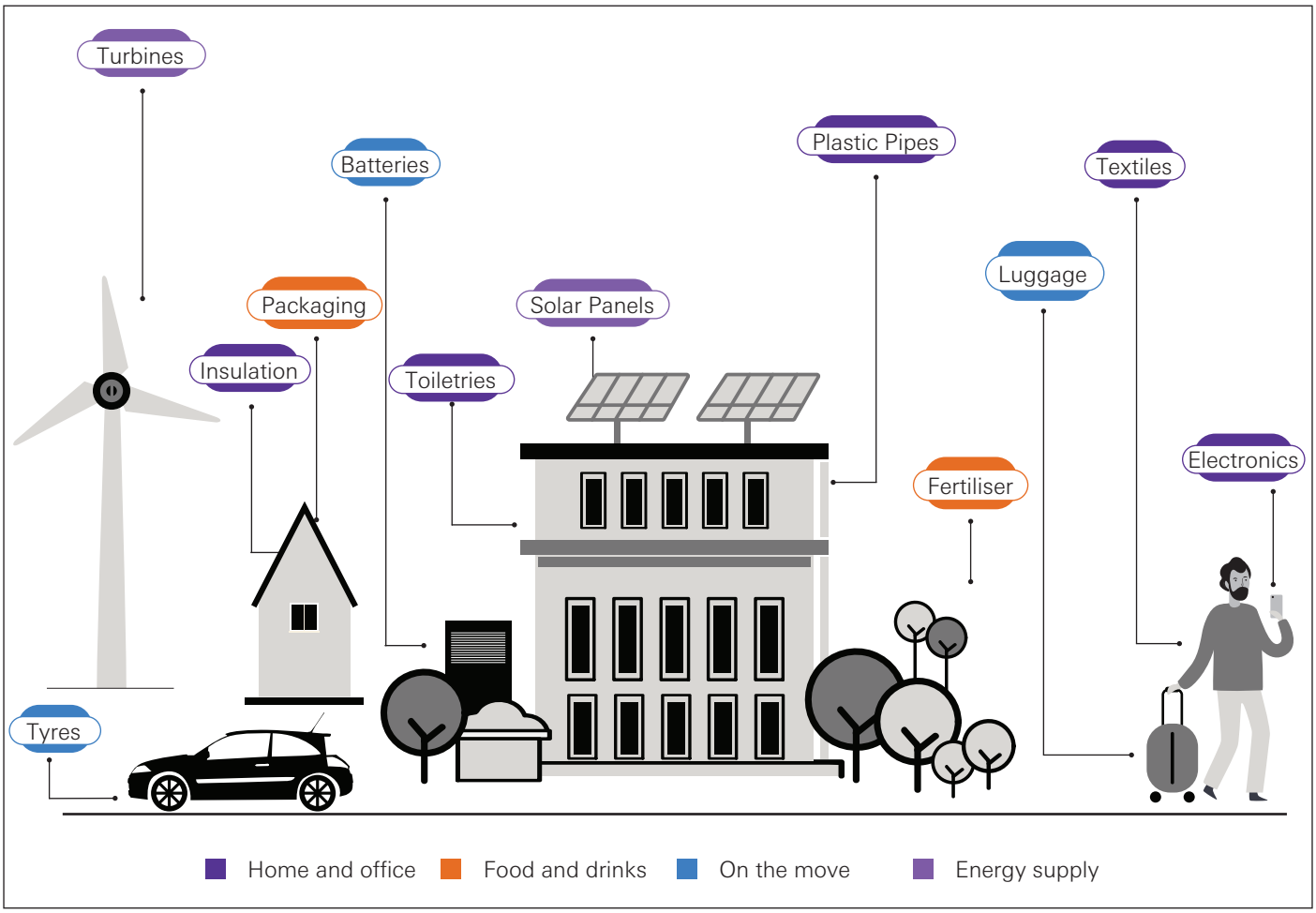


Figure 1: Chemicals in our daily life[7]

Chemical Products

The chemical industry creates an enormous variety of products which have a significant influence on many important areas of our lives, such as agriculture, energy, construction, transportation, consumer goods and pharmaceuticals. The products manufactured by the industry can be broadly divided into the following four categories:[8]

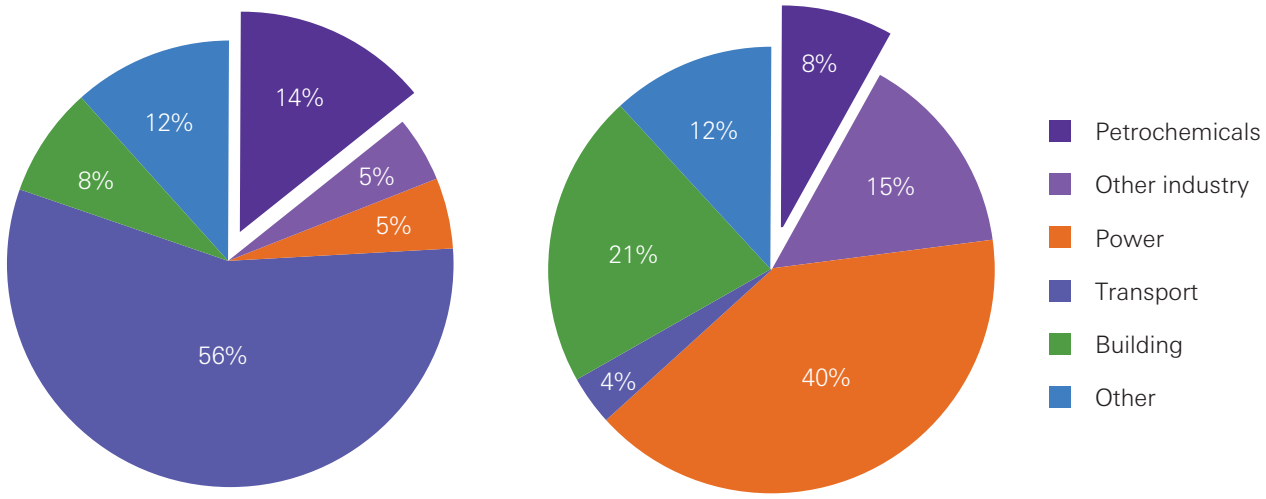
Basic chemicals	Speciality chemicals	Consumer chemicals	Life sciences
Petrochemicals, inorganic chemicals (e.g. ammonia, used to produce fertilisers), polymers, ethylene and propylene, etc. These chemicals are further used by the construction, plastics, and transportation industries.	Industrial gases, coatings, adhesives, catalysts and additives, etc. These chemicals are developed for their specific function and are bespoke for certain processes and customers.	Raw chemicals contained in products such as: soaps, perfumes, food, cleaning products, and cosmetics. The general consumer does not usually come into direct contact with the raw chemical materials used within these products.	Pharmaceuticals, pesticides, vitamins, etc. These kinds of chemical products are produced in much smaller quantities, but they are much more expensive and require large R&D investments.

Petrochemicals

Polymers, often referred to as plastics, contribute to roughly 80% of the industry's global output. Polymers have special characteristics which make them preferred over other materials for many applications. One of their special properties is low thermal conductivity: a measure of a material's ability to conduct heat. As a result, around 90-95% of synthetic insulation materials are plastic-based.[9a] Such properties are necessary for creating energy efficient products to maximise energy saving potential in different applications. For example, low-pressure expandable foams made of polymers can significantly reduce air leakages and heat transfer within the building envelope. It has been estimated that heating and cooling in buildings and industry account for almost 40% of final energy consumption – more than the share of transportation (27%).[9b]

The production of polymers requires raw materials including petroleum, natural gas and coal. Chemical products obtained from petroleum or natural gas are called **petrochemicals**. Today, petrochemicals account for 90% of total feedstock demand in chemical production.[10a] Oil refineries derive petrochemicals from petroleum products, such as ethane and naphtha, allowing them to be used in producing a variety of materials and products, including plastics, detergents, solvents and adhesives, lubricants and synthetic rubber.[10b] Oil refineries also produce compounds such as ammonia, which in turn is converted to urea.[11] Urea, a nitrogen type fertiliser, is the most common in the world with a supply of 42.7 million tonnes in 2017. The global market size for petrochemical products was valued at USD539 billion in 2018 and expected to register a Compound Annual Growth Rate (CAGR) of 8.5% over the period of forecast from 2019-2025. The global petrochemicals market size is projected to reach USD959 billion by 2025.[12]

Chemical Industry Demand for oil and Gas



Note: Petrochemicals includes process energy and feedstock

Figure 2 - Primary oil (left) and natural gas (right)[13] demand in 2017 by sector

However, with the high dependence on petrochemicals, there is also an accompanying burden. The petrochemicals sector is the second largest sector in primary oil demand after transportation, accounting for 14% of the total demand.[14] Petrochemicals production also relies heavily on natural gas, reaching twice the entire transport sector in 2017 (Figure 2). Experts perceive the petrochemicals sector to be the most significant growth driver for global oil demand, contributing 4 million of the estimated 7 million barrels per day (MMb/d) of oil demand growth between 2020 and 2030.[15]

The Dilemma

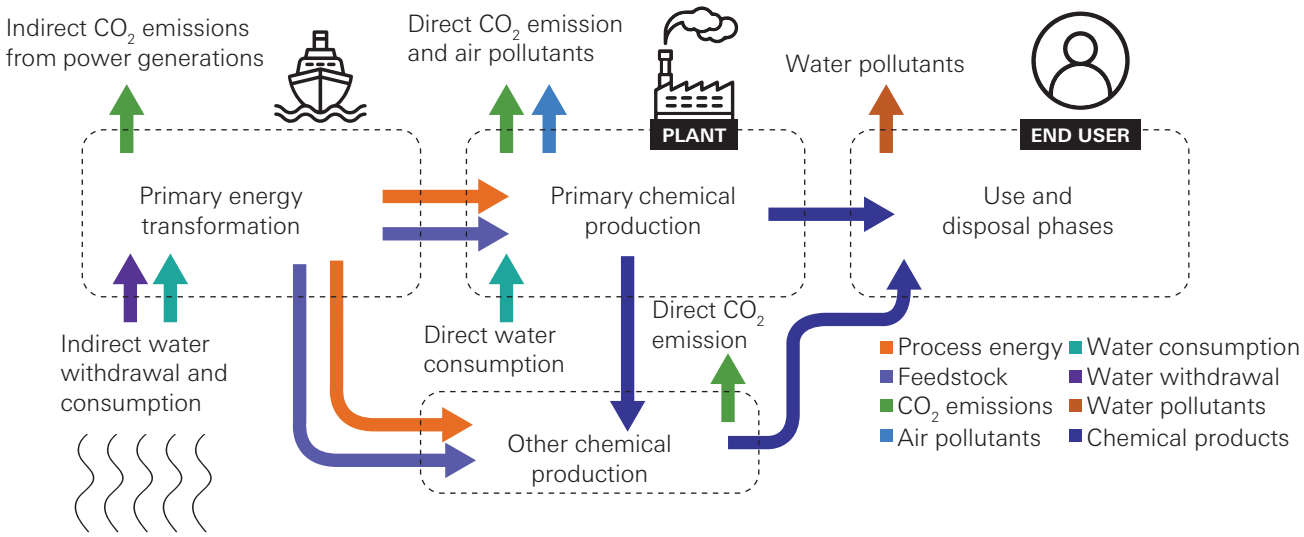
Despite the high energy saving potential of chemical products, the chemical industry's energy consumption is the highest of any industrial sector, ahead of iron and steel, and cement.

Since petrochemicals accounts for the majority of feedstock demand, there will be high dependence on fossil fuels. During the consumption of these fossil fuels, the chemical industry releases carbon dioxide (CO_2), making it the third largest source of industrial CO_2 emissions. CO_2 is one of the major greenhouse gases (GHG) that are considered the primary cause contributing to the climate change.

From the consumer side, further GHG emissions and air pollutants are released during the use of certain chemical products, such as fertilisers.[16] Moreover, the compilation of single-use chemical products, also known as plastic waste, is causing devastation to the environment. According to the United Nations, more than 800 species worldwide are affected by marine debris, and as much as 80% of that litter is plastic.[17] Marine debris injures and kills marine life, interferes with navigation safety, and poses a threat to human health.

4.2 Chemicals and Sustainability

The Value Chain of the Chemical Industry



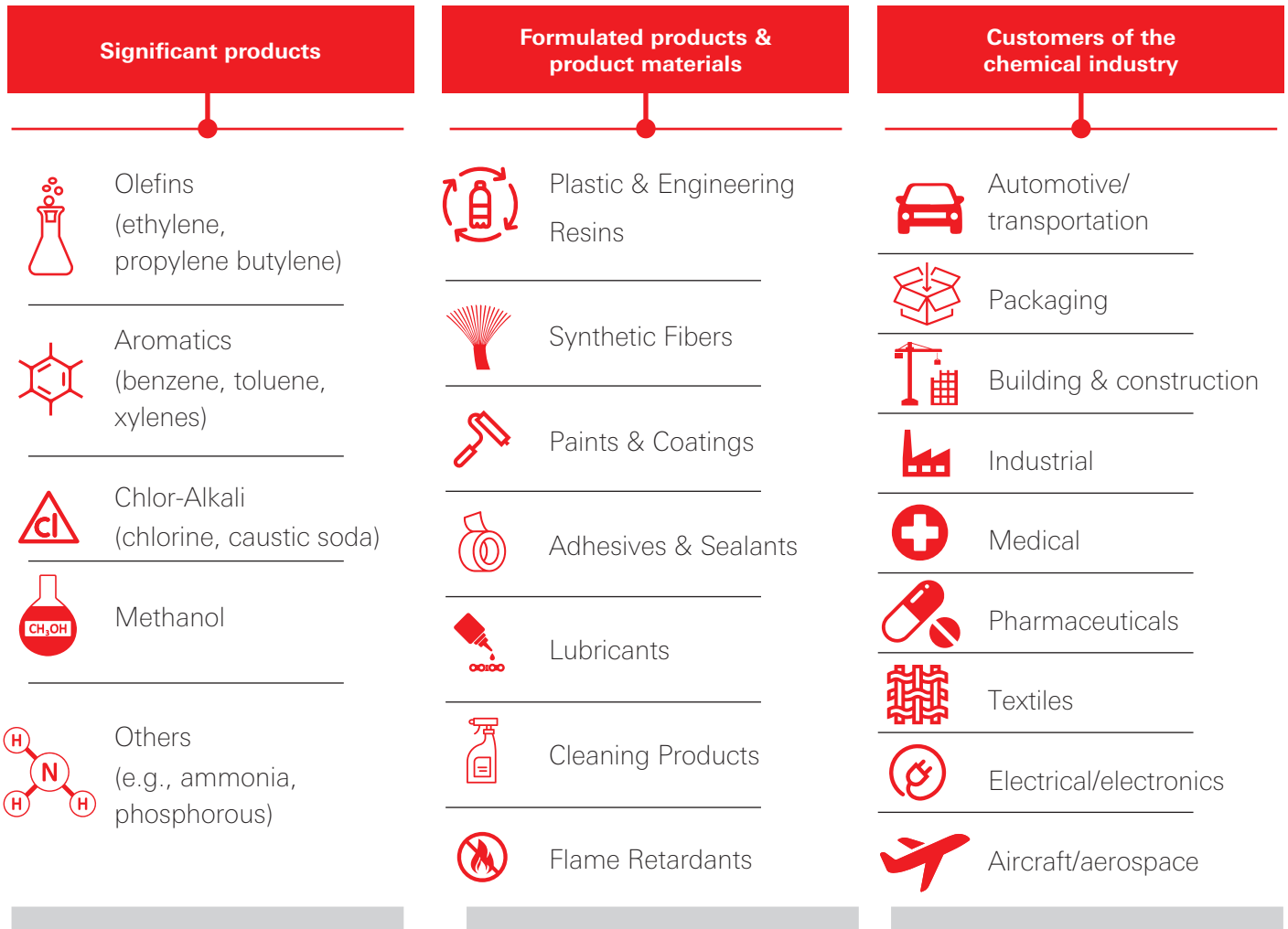
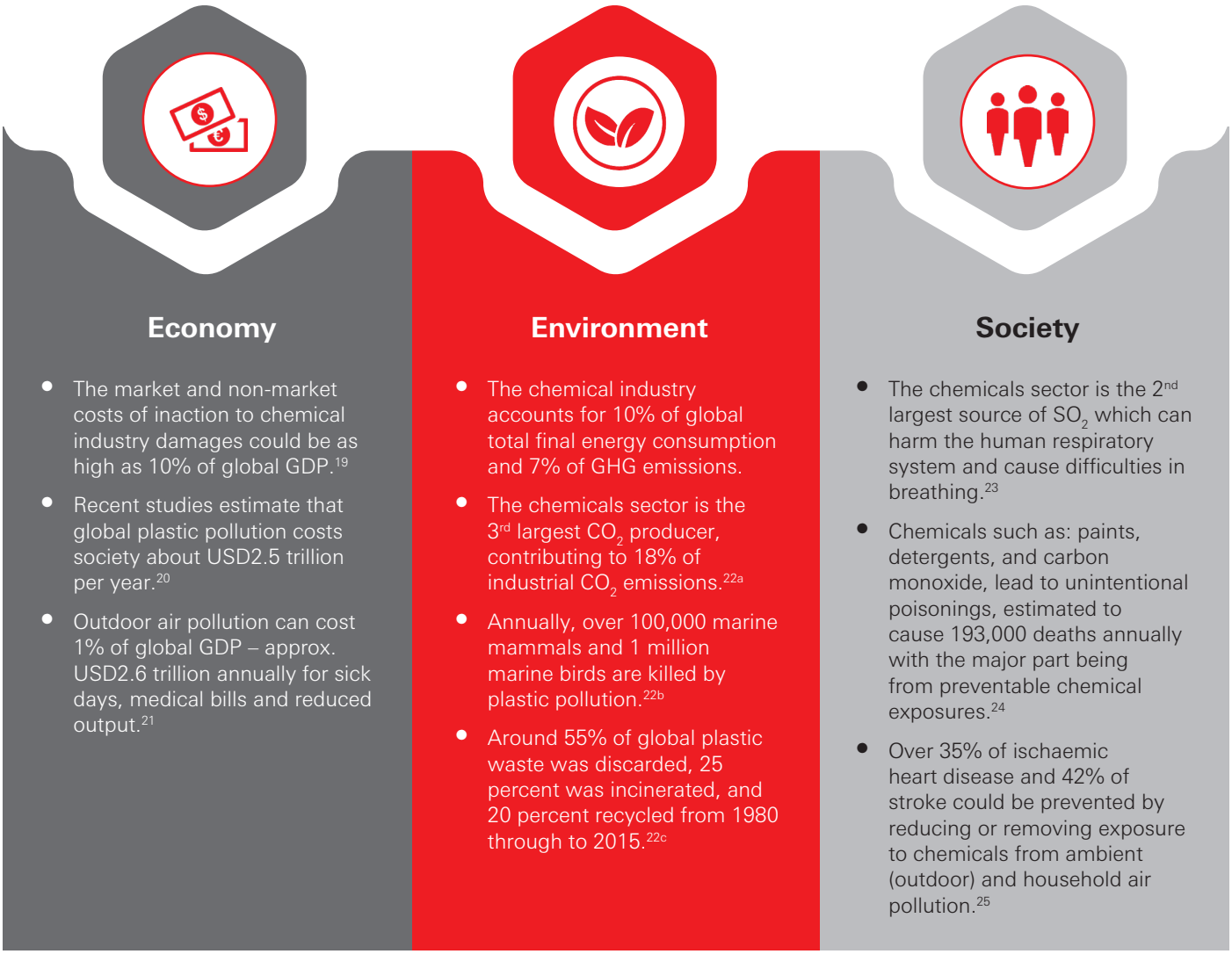


Figure 3 - Chemical Industry Value Chain[18]

Key figures and information:



The Relation to Climate Change

The production of plastics and fertilisers has broader impacts on our lives. As a result of chemical production, primary and secondary, direct GHG emissions are released into the atmosphere from chemical plants, in addition to different types of air pollutants. The Greenhouse Gas Protocol (GHGP) refers to all direct emissions as Scope 1 emissions. In 2017, global direct CO_2 emissions from the chemicals sector production amount to 1.5 giga tonnes of CO_2 per year - 18% of industrial CO_2 emissions (Figure 4). Chemical production requires energy (electricity, steam) to be generated from other sources, releasing indirect GHG emissions, or what is called Scope 2 emissions by GHGP. As the largest energy consumer sector, the chemical industry's scope 2 emissions are estimated at around 110 million tonnes of CO_2, equivalent to 8% of the direct CO_2 emissions from chemicals production.[26] Other indirect emissions are also released to the atmosphere through the value chain from other related activities like products transportation, use and disposal, usually referred to as Scope 3 emissions. With the petrochemical and plastic industries planning to expand their production, the emissions are forecasted to increase by more than 30 % by 2050, with two-thirds of this increase taking place before 2030.[27]

Although the chemical industry is a significant contributor to global GHG emissions, there are a variety of chemical products that can cut the emissions in other sectors such as power generation, energy storage, buildings and even transport. For example, the concept of using lightweight materials in the transport sector to improve fuel efficiency is known as "light weighting", which involves the use of polymers and high-tech foams.[28] This example illustrates both advantages and disadvantages of the chemical industry, adding more complexity to mitigating global climate change.

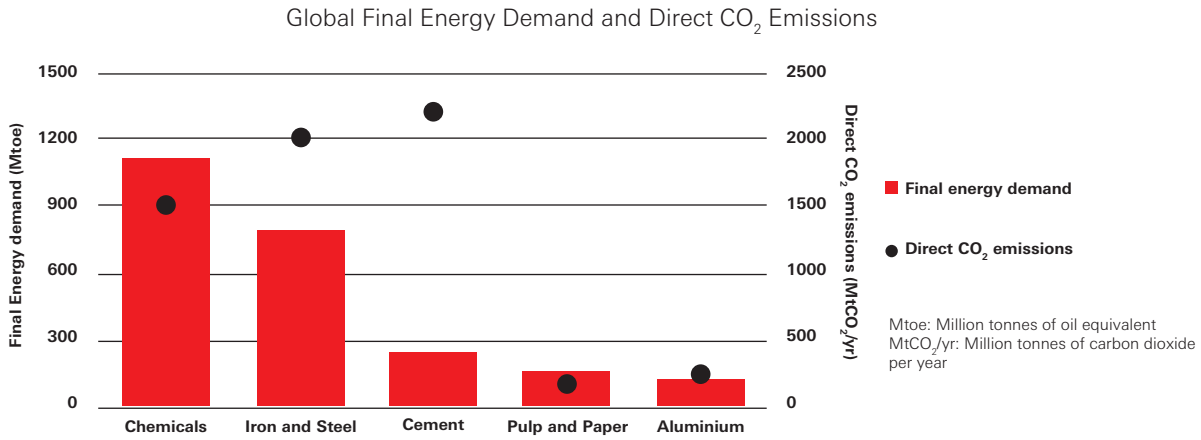


Figure 4 - CO_2 Final energy demand and emissions per sector in 2016[29]

The Plastic Waste Problem

Climate change is not the only challenge that chemical industry contributes to. Every day, approximately 8 million pieces of plastic pollution end up in water bodies. Around 5.25 trillion pieces were estimated to be floating in open oceans, weighing up to 269,000 tonnes.[30] Plastic accumulation in the marine environment generates several negative consequences, ranging from the aesthetic impact of litter and the economic costs of beach cleaning, to the damaging biological and ecological effects.

Recent studies estimated that the cumulative amount of plastic waste, in landfills or in the natural environment, from 1950 to 2016 is around 6,000 million tonnes; which would grow from 260 million tonnes per year in 2016 to 460 million tonnes per year by 2030. And by 2050, there will be around 12,000 million tonnes of plastic waste, almost double the 2016 figures.[31]

Human Health

Chemical products, such as fertilisers and plastic packaging materials, play a vital role in food production and preservation, allowing us to maintain adequate food supplies globally. Food additives can, for example, prolong the shelf life of foods to preserve the nutritional value delivered to consumers. However, chemical products can take a toll on human health. Although the chemicals sector activity tends to take place outside urban centres, its emissions can still have a significant impact on human health and the environment.[32] The chemicals sector is the second-largest source of sulphur dioxide (SO_2); short-term exposures to SO_2 can harm the human respiratory system and difficult breathing, especially in people with Asthma.[33] At high concentrations, SO_2 can also harm trees and plants by damaging their leaves, thus impacting growth.[34] It is estimated that 14% and 17% of lung cancers are attributed to ambient (outdoor) pollution and household pollution respectively.[35] Chemicals products themselves can cause serious damage when they leak into the environment, contaminating food chains and reaching our bodies. A recent study conducted by the European Environment Agency (EEA) estimates that out of the 345 million tonnes of chemicals consumed in the European Union, 62% pose a human health hazard.[36]

The Global Response

Given the increasing concern about the adverse impacts of various industrial sectors, the chemical industry has started to mobilise on this issue and began to adopt the concept of sustainable chemistry. In line with Paris Agreement, national and international legislative bodies have also started to introduce new regulations for the chemical industry to contribute towards the three dimensions of sustainable development – environmental, social and economic. As plastics production and the incineration of plastic waste were estimated to have approximately 400 million tonnes of CO_2 per year, the European Commission (EC) has adopted a new **Circular Economy Action Plan** by announcing initiatives along the entire life cycle of products, including plastics and packaging, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used stays in the EU economy for the longest time possible.[37]

The Organisation for Economic Co-operation and Development (OECD) has defined "Sustainable Chemistry" as a scientific concept that seeks to improve the efficiency of the use of natural resources to meet human needs for chemical products and services through the design, manufacture and use of efficient, effective, safe and more environmentally benign chemical products and processes.[38] For example, Sustainable Chemistry involves the prevention of pollution and waste, the inclusion of the entire life cycle of a product, and the enhancement of a product's recyclability and durability. Thus, Sustainable Chemistry is essential for long-term sustainable development, improving the quality of human life within the carrying capacity of the world.[39]

Adjusting visions to adopt sustainable development was not limited to governments. The International Council of Chemical Associations (ICCA) is a global association consisting of federations, companies, and other smaller associations. One of the most popular ICCA initiatives is **Responsible Care®**, a voluntary commitment launched in 1995 with the vision that "All chemicals will be produced and used in ways that minimise risks for human health and the environment".[40] In addition to global associations, non-profit organisations such the **Alliance to End Plastic Waste (AEPW)** has been founded to help solve the issue of plastic waste entering the ocean every year. AEPW has nearly 50 member companies who have committed to invest USD1.5 billion towards solutions that will prevent the leakage as well as recover and create value from plastic waste.[41]

Moreover, some global players in the chemical industry have started recently to set ambitions to achieve Net Zero - an overall balance between emissions produced and emissions taken out of the atmosphere. In June 2020 the global chemical company Dow announced new targets for their future carbon emissions. Dow aims to reduces their net carbon emissions by 5 million tonnes, a 15% reduction compared to their 2020 baseline, and intends to be carbon neutral by 2050.[42] International Oil Companies (IOCs) such as BP, Shell and Total have also announced their ambition to get to Net Zero by 2050, consequently lowering direct and indirect emissions of the chemical industry.

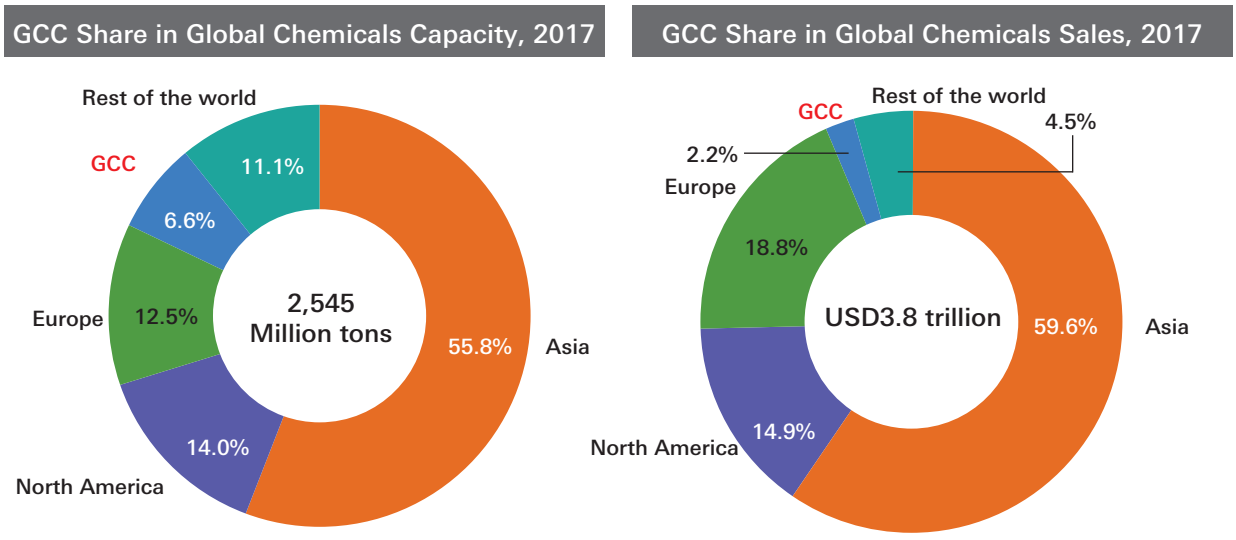
4.3 Chemicals in the Middle east

Market Overview

The chemical industry in the Middle East, particularly in the Gulf Cooperation Council (GCC), has grown dramatically in the past decades. Between 1978 and 2017, GCC chemical production expanded at a CAGR of 10.7%. Figure 5 highlights the GCC share of global chemicals capacity and sales in 2017. Compared with 2000, the GCC share in global capacity has more than doubled, reaching 6.6%.[43] Moreover, around 31% of the manufacturing sector's value added was contributed by the chemical industry, which is the second highest sector after refining. The output of the industry in the Middle East is mainly focused on basic chemicals, particularly petrochemicals, given the easy access to low-cost oil and gas.[44] The industry is the second largest manufacturing sector in the region, producing over USD108 billion worth of products a year.[45]

The increased demand of chemicals by the GCC producers across the globe added 13.3 million tons to production capacity of the GCC chemical industry in 2018.[46] By 2027, capacity additions are expected to be the highest for Oman, Saudi Arabia and United Arab Emirates (UAE) reaching 34.5, 11.5 and 7.3 million tons respectively. These additions include new products, estimated around one quarter of the total capacity additions. The GCC chemical industry is projected to grow by 3.4% per year over the next decade, driven by investment activity on the back of rising export demand.[47]

GCC Chemical Industry's Contribution to the Global Economy



Source: ICIS, CEFIC, GPCA, 2018
Note: Latest available information

Figure 5 - GCC shares in the Global Chemical Industry of 2017

As a result of the decline in global oil prices, as well as the competition from different countries, the Middle East started to diversify from purely supplying crude oil towards the development of a downstream supply chain. Moreover, the abundance of other natural resources, such as phosphate rock and sulphur, gave rise to the establishment of new industries that position the GCC as a leading global production and export hub for chemicals and fertilisers.[48]

COVID-19 Pandemic

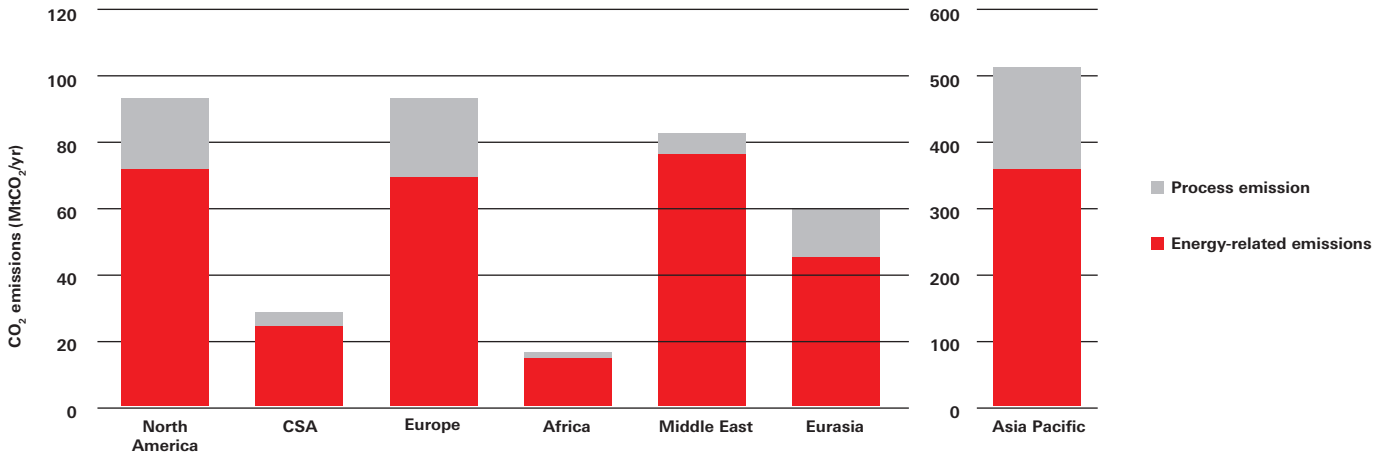
The recent world disruptions have impacted all sectors of the global economy, many of which are highly correlated with the chemicals sector. The COVID-19 pandemic resulted in a reduced economic activity that will significantly affect the sector in the short term. The pandemic is expected to lead to a full-year volume demand drop of up to 10% on average, depending on the markets; higher demand reduction in industrial and infrastructure, limited or none for packaging and some of the specialities such as food, health, and hygiene products.[49] Nevertheless, the overall impact on the sector might be different than expected as of other factors. For example, although the pandemic has resulted in a drop of sales in the chemical industry, crude oil prices have also declined in the same period resulting in lower feedstock costs for chemical production.[50]

Impacts of Chemical Industry

The business expansion in petrochemicals has contributed significantly to the region's economy. By 2018, the industry created more than 600,000 jobs (directly and indirectly), and resulted in approximately USD80 billion in total gross value added.[51] However, the industry in the region, as in the rest of the world, has also a direct impact on the environment and human health.

The chemical industry emissions in the Middle East is a significant contributor to climate change. Figure 6 illustrates the share of CO_2 emissions for different regions in the world. The figure also reveals how the Middle East emissions are in the same range of North America and Europe, despite the difference in geographical area. In 2018, the industry's total CO_2 emissions accounted for almost 5% of the total GHG emissions from all sectors in the GCC – very close to the share of petroleum refining and cement production. This indicates the level of chemical industry impact in a region heavily focused on petroleum activities.

Comparison of Middle East Direct CO_2 Emissions to other Regions for the Chemicals Sector



Note: CSA - Central and South America

$MtCO_2/yr$: Million tonnes of carbon dioxide per year

Figure 6 - chemical industry direct CO_2 emissions by region[52]

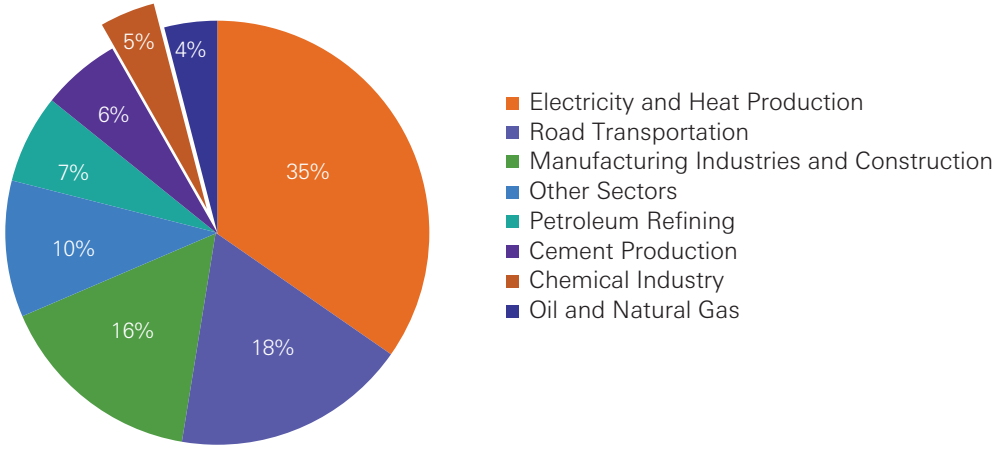


Figure 7 - CO_2 emissions in Middle East per sector[53]

The chemical industry in the region also contributes to water scarcity. Most of the basic chemical production in the Middle East is located on the coastline of the Gulf, one of the most water-stressed regions in the world. Increased primary chemical production, which requires water in its processes, may cause countries like Oman, Saudi Arabia and UAE to rely more on energy-intensive forms of water supply, i.e. desalination.[54] Figure 6 also shows the ratio of energy related-emissions to process emissions in the Middle East, having a higher value compared to the other regions with the highest emissions.

The impact of the chemical industry goes beyond production activities. Plastic waste has been a recent concern in the region, especially after the new regulations introduced globally. In January 1st, 2018, China banned imports of 22 types of low-grade waste, including plastic waste. Since the GCC exports a significant amount of plastic waste to China, the environmental risks of waste disposal are on the rise.[55] Although countries like Oman, Saudi Arabia and UAE tend to manage waste better than other MENA countries, this may not be enough to ensure environmental preservation. GCC countries still produce a relatively higher waste per capita compared to other MENA countries (Figure 8), and the recent Chinese plastic ban prompts the need to adopt new strategies to deal with waste.

Similar to some regions, including Asia and Africa, the World Health Organisation (WHO) has found that citizens in Middle East breathe much higher levels of air pollutants compared to many parts of the world.[57] Along with the high concentrations of Particulate Matter (PM) arising from sand and desert dust, the emissions generated by the chemical industry and other industries contribute to several health problems afflicting the residents of the Middle East.

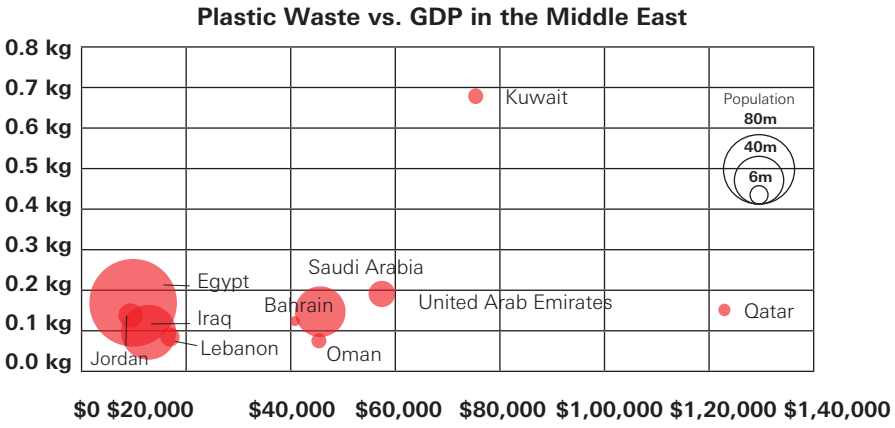


Figure 8 - Plastic waste per capita vs. GDP per capita (Data source: Jambeck, 2015)[56]

New Visions for the Region

In response to the multiple risks to the petrochemicals industry, governments in the Middle East are adjusting their national visions towards sustainability for the chemicals sector, and companies in the industries have started shifting their strategies to adopt more sustainable practices in their businesses and operations. Moreover, the Gulf Petrochemicals and Chemicals Association (GPCA), which has more than 250 member companies representing 95% of the total chemical output, has also adjusted its vision towards sustainable development. GPCA has also adopted the Responsible Care® guidelines to ensure their implementation by its members and embrace the development and application of sustainable chemistry.

Chemical industry in Oman*

Oman's chemicals sector has the highest contribution to GDP among the GCC countries, at 5.1% in 2018, double the average figure of the region. This achievement is attributable in part to the manufacturing sector being inscribed within the top five sectors identified by Oman's National Programme for Diversification.[58]

Significant products	Revenue is mainly driven by basic chemicals and polymers in Oman. Although fertilisers production has significant physical output, it only has a revenue contribution of only 20%.[59]	
Contribution to manufacturing value added	49%	
Current Production	10.8 million tons[60]	
Forecast	A Growth of 18% is expected for the total capacity addition between 2017 and 2027, reaching a production capacity of 22.4 million tons.[61]	
CO_2 Emissions (Direct)	9.1 million tonnes	
National Response	In 2019, the Environmental Strategy 2040 was launched in the Sultanate of Oman. The strategy aims to reach a green and circular economy that is responsive to national needs and consistent with the global direction of adapting to climate change. The vision also aims to reach more than 90% of non-oil share of GDP.[62]	
Key Players Response	Orpic (Oman Oil Refineries and Petroleum Industries Company)	• Implement ambient air quality monitoring programme • Developing a comprehensive groundwater monitoring programme covering all Orpic facilities to monitor waste disposal and ensure that all its industrial waste is managed well • Constructing wastewater treatment plant (WWTP), which checks liquid effluent for compliance against pollution parameters as stipulated by Ministry of Environment and Climate Affairs (MECA)

*Source: EY Analysis

Country snapshots

Chemical Industry in Saudi Arabia*

Saudi Arabia has maintained its global position as one of the top ten exporters of chemicals. It also accounts for the largest volume output and chemical sales revenue in the region. Saudi chemical industry is also a leader in terms of portfolio diversification, reaching more than 126 products.[63] As part of the diversification efforts, the largest foreign direct investment in the Saudi petrochemicals industry led to the development of the world's biggest integrated chemicals complex built in a single phase, Sadara chemicals complex.[64] By 2027, revenue is forecasted to increase by 19%, reaching USD65.8 billion.

Significant products	80% of Saudi chemical products revenues are from the polymers and value-added chemicals segments	
Contribution to manufacturing value added	30%	
Current Production	113 million tons	
Forecast	Production capacity is expected to rise by 2.7% per year to 147.5 million tons by 2027.	
CO_2 Emissions (Direct)	46.3 million tonnes	
National Response	In Saudi Arabia, the new Saudi Vision 2030 seeks to protect the environment by enhancing waste management efficiency, establishing recycling projects and reducing all types of pollution. The vision also promotes the optimal use of water resources.[65] As part of the vision's road map, there will be focus on diversification of the economic landscape away from over-reliance on oil and promote downstream industries including the chemical industry.[66]	
Key Players Response	Chemanol (Methanol Chemicals Company)	• Achieve full accreditation to the Responsible Care Programme of the Gulf Petrochemicals and Chemicals Association
	Farabi Petrochemicals Company	• Setting 20% GHG emission intensity reduction target by 2023 compared to 2013 baseline
	National Industrialisation Company (TASNEE)	• Implemented GHG reduction measures and achieved 8% decrease in GHG emissions between 2016 and 2018 • Adopting strategies to comply with Royal Commission emission and water discharge limits, and reduce energy consumption to meet the Saudi Energy Efficiency Centre (SEEC) targets.
	Rabigh Refining and Petrochemical Company (Petro Rabigh)	• Adoption of strategies to comply with regulations from the General Authority of Meteorology & Environmental Protection (GAMEP) and global institutions such as the World Bank • Cooperating with third-party waste contractors to provide services for the management and disposal of its waste
	Sadara Chemical Company	• Adopt Product Stewardship in their strategies to covers the whole life cycle of products • Implemented a robust Waste Management Programme, including the construction of a Wastewater Treatment unit designed to receive all production plant wastewater streams.
	Saudi Basic Industries Corporation (SABIC)	• Became a member of the Responsible Care® Global Charter • Creating partnerships to convert low-quality mixed-plastics waste into a reusable feedstock for the production process • Settings targets to reduce GHG and energy intensities by 25% from 2010 levels, and achieving a reduction of 10% in GHG intensity and 6% in energy intensity in 2018 • Reducing flaring emissions by approximately 40% • Co-founding the Alliance to End Plastic Waste (AEPW)

*Source: EY Analysis

Country snapshots

Chemical Industry in UAE*

The chemicals sector in the UAE is characterised by rapid development, with 77% of the current production capacity being launched in the last decade. The UAE's chemical industry is the second largest employer gaining almost 18% market share in regional employment in 2018.[67] The sectors demonstrated positive revenue growth at a 22% CAGR per year for the seventh consecutive year, reaching a new high of USD5.1 billion.

Significant products	In 2018, basic chemicals represented one third of UAE chemicals output (33%), followed by fertilisers (30%) and polymers (28%).[68] In terms of revenue, polymers represent almost 90% of sales, followed by fertilisers with 8% share.	
Contribution to manufacturing value added in the country	23%	
Current Production	13.6 million tons[69]	
Forecast	The anticipated growth rate for the UAE chemical industry is 4.4% per year throughout 2017-2027, reaching 20.7 million tons.	
CO_2 Emissions (Direct)	6.8 million tonnes	
National Response	The UAE has a vision with ambitious targets for waste treatment, development of renewable energy and water recycling, which are all policies to support a transition towards a more circular economy.[70] In March 2020, Abu Dhabi Emirate Single Use Plastic Policy has been introduced by the Environment Agency – Abu Dhabi to declare Abu Dhabi free from single-use plastic bags in 2021.[71]	
Key Players Response	Abu Dhabi Polymers Company (Borouge)	• Introducing new innovative plastics solutions to meet 2021 sustainability targets, including the award winner Anteo™ which resulted in lowering energy consumption during production[72] • Setting reduction targets for energy and water consumed per tonne produced to 9% and 6% respectively by 2021 • Setting reduction targets for flaring and hazardous waste, 60% and 40% respectively • Becoming a member of the Responsible Care® Global Charter • Obtaining certifications for environmental management systems
	ADNOC (FERTIL)	• Setting CO_2 emissions and flaring targets • Becoming a member of the Responsible Care® Global Charter

*Source: EY Analysis

Business Drivers of Chemical Industry

Adopting positions towards sustainability is driven differently for businesses in the chemical industry. The different trends of the industry's response suggest that there are three main business drivers that influence organisations positions on the sustainability issues:

- **Stakeholder pressure:** The pressure on an organisation to adopt a position on sustainability topics in the countries of operations as well as in its markets. Government ownership, regulators, Investors and customers are examples of the factors that have an impact on this driver.
- **Portfolio flexibility:** The ability of an organisation to diversify their products while remaining competitive in the market. This driver depends mainly on availability of raw material, existing products in market and the level of value chain integration.
- **Organisational capabilities:** The ability to integrate sustainability considerations as well as to create a unique sustainability narrative (lower carbon future, reduced plastic waste, etc.). Several factors contribute to this driver, such as scale of operation, technology deployment and process carbon intensity (or GHG intensity) and access to capital.

These drivers have a significant influence on the organisation's need for change, ability to change and the gauge of impact. Depending on the different factors for each driver, organisations in the sector have adopted different approaches in setting and achieving their sustainability targets, thus facing different challenges from different perspectives. For example, the scale of the company, market of operations and other factors determine the restrictions imposed on the company - international companies face more restrictions compared to local companies. An analysis for the drivers of chemical industry companies in Oman, Saudi Arabia and UAE has been conducted and compared to international key companies in relation to climate change.

In Oman, Saudi Arabia and UAE, the pressure from stakeholders, such as regulators and investors, is relatively lower compared to international major companies. Moreover, the portfolio of Middle East companies is not as diversified as global ones – the Middle East has a high share of upstream chemicals production, reaching almost half of the total capacity (Figure 10). On the other hand, international major companies have stronger business drivers towards implementing sustainable practices. This stems mainly from the international regulations imposed and the level of value chain integration in the industry**. Nevertheless, peers in the Middle East have competitive organisational capability compared to other international peers, and they have operations in other regions including Europe, North America and Asia, which also impose additional regulations compared to their home country.

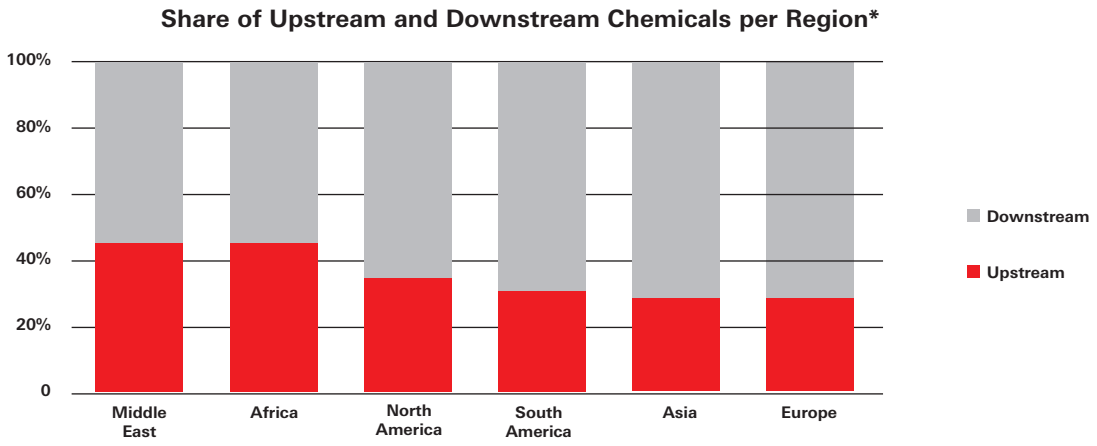


Figure 10 – Ratio of primary chemicals per region[73]

*As per IEA definition, Upstream Chemicals are: Ethylene, Methanol, Ammonia, Propylene, Xylenes, Benzene, Toluene. Other Chemicals are considered Downstream.

To summarise, companies are not driven equally towards sustainability - each company's path towards sustainability has its own unique challenges, and the solutions will be very dependent on the context of the country, the market and even the businesses themselves.

** Value chain integration refers to the level of collaboration of organisations within a shared market segment to plan, implement and manage the flow of goods, services and information along the value system.

5. Transition to a Sustainable Chemicals Sector

5.1 The Challenges

There are obvious environmental, economic and social benefits of adopting sustainability for the chemicals sector. Pollution and waste can be minimised through the enhancement of a product's recyclability and durability. In addition, GHG emissions can be reduced to tackle the global climate change. Moreover, natural resources can be preserved more by improving production efficiency. All of these benefits will result in improving the quality of human life within the carrying capacity of the world.

Nevertheless, there are also numerous challenges that prevent companies from advancing in their journey towards becoming more sustainable, especially in the Middle East. In industrialised countries, sustainable development has been a priority since the 1980s, whereas relatively Middle East countries have only recently prioritised this through their national visions in the past decade. Recent transformation efforts of the countries have been driven by domestic rising demands and short-term financial benefits. Compared to other regions, the Middle East is still considered an under-performer with regards to implementing the global sustainability agenda.[74] For the chemicals sector, the region is still facing challenges in making the transition towards sustainability. Governments, chemical companies, supply chain and customers have significant influence on the trends in the sector, resulting in complex dynamics that are not straightforward to manage.

Policy and Legislation

One of the main challenges that hinders the transition is **the lack of effective policies and legislation to promote sustainability**. Although Oman, Saudi Arabia and UAE have adjusted their visions towards the sustainable development goals (SDGs), effective policies have not been implemented yet in order to support the transition in chemicals sector. There is a disproportionate number of policies and related legislation in the GCC region compared to the EU. For example, the Circular Economy Action Plan adopted by the EC introduces legislative and non-legislative measures to bring a real added value from the action plan, aiming to make sustainable products the norm in the EU, empower consumers and public buyers, ensure less waste and many other benefits. A similar legislation is something yet to be seen in the Middle East.[75]

Moreover, such legislative measures might limit the share of global sales for Oman, Saudi Arabia and UAE output as of new product requirements. An example of this can be seen by the recent and growing ban on single-use plastics such as bags, plates, cutlery and bottles in many countries.[76] Manufacturers of single-use plastic will need to either refocus their sales on countries that have not yet set such a ban, make alternatives to single-use plastic items or consider investing in producing sustainable products made of alternative materials.

Policies to mitigate other issues such as climate change have been already implemented by the other regions. In 2008, EU's first package of climate and energy measures was agreed, and GHG emissions reduction targets have been set for 2020. By 2018, GHG emissions in the EU has been reduced by 23% compared to 1990 baseline, 3% above the initial target of 20%. An emissions trading system (ETS) was used to cut down GHG emissions from energy-intensive industries and power plants. Although the chemical industry in the Middle East is considered more energy-intensive compared to EU (as seen in Figure 7), similar schemes have not been adopted yet in the region. Oman, Saudi Arabia and UAE have already committed to control or reduce their GHG emissions as part of the Paris Agreement or market mechanisms such as an ETS, but there are still no binding emission reduction targets set in the region.

Access to Capital

Integrating sustainable chemistry practices can create significant opportunities for investors. For instance, it has been estimated that implementing recycled plastic into the chemical value chain can create a global profit pool of USD60 billion per year by 2030. However, implementing plastic recycling requires a large amount of investment capital. The petrochemical industry will need to invest around USD15-20 billion per year; almost 20% of the sector's global average investment in the past decade.[77] Despite the significant level of investment required, the cost of inaction is even higher; by 2040, businesses can face approximately USD100 billion of annual financial risk if governments require them to cover waste management costs at expected volumes and recyclability.[78]

A number of financial instruments have been developed to incentivise organisations from across different sectors, including chemicals, to transition towards low-carbon business practices. An example of such instruments are green bonds, specifically issued for climate change and environmental projects. Green bonds have been in the market since 2007 and are estimated to have a global issuance value of USD1 trillion by 2021.[79] However, issuing green bonds has limitations. The company profile must have a sufficient number of green projects for which they can possibly use bond proceeds. If the chemical company has just started its sustainability journey, investors and banks will still doubt if the bonds will be really green.[80]

Currently, leading multinational chemical corporations (such as DOW, BASF, etc.) can afford the 'expensive' option to become more sustainable; as they are backed by the business model and targets focussed on sustainability. In addition, they have a requirement to meet the policy and binding obligations in their countries of operation. Although key companies in Oman, Saudi Arabia and UAE also have high profit margins, investing in sustainable projects is not considered a high priority as most companies and their shareholders largely emphasise on short payback periods and immediate returns for their investments. Such investments is even more challenging for the small and medium companies. Moreover, the recent economic disruptions caused by the COVID-19 pandemic have created **immense pressure on companies** in the chemical industry. Therefore, companies will be forced to seek other alternatives to access capital to meet their financial obligations.

Another barrier for investing in sustainable projects stems from investors themselves. HSBC's recent survey "Sustainable Financing and Investing" revealed that investors in the Middle East are not as determined as their counterparts to invest in

sustainable projects: only 54% of investors find environmental and social issues very important, the lowest share across all regions.[81]

Business Strategy and Operations

Leading chemical companies have already started adopting new **business models** to meet their Net Zero commitments. Multinational chemical corporations like Dow and BASF are considering circular economy framework across their value chain – from production to use and disposal. In the case of Dow, plastic waste is a material topic to be addressed – the company aims to have 100% of their packaging products to be reusable or recyclable by 2030. Dow also has committed to "stop the waste" by enabling 1 million metric tons of plastic to be collected, reused and recycled through direct partnerships (leading academics, NGOs, etc.).[82] Technology partnerships are also being considered to incentivise the development and commercialisation of low-carbon products and technologies to target scope 1, 2 and even scope 3 emissions.

Although chemical companies in Oman, Saudi Arabia and UAE have started adjusting their strategies towards sustainability, there are still many areas that can be further improved. A considerable number of major companies in those countries have set targets to reduce their GHG emissions; mainly scope 1 (direct emissions) and scope 2 (indirect energy emissions) but did not consider other topics such as scope 3 (other indirect emissions) such as plastic waste in the value chain. Moreover, the targets set by the companies in the Middle East are short-term compared to global players targets. As discussed earlier, this might be a result of variable business drivers such pressure from stakeholders, companies' portfolios and organisational capabilities.

One of the challenges for transitioning to a sustainable chemicals sector is the limited investment in sustainable product innovation and operational sustainability. Globally, large international chemical companies have shown that sustainable **product innovation** and sustainable operations are both possible and feasible. BASF, for example, has reduced its GHG emissions by almost 50% over the last three decades, while doubling its production volumes in the same period.[83] This was accomplished through the increase in process and energy efficiency, as well as the use of their patented catalysts for reducing nitrous oxide emissions. Despite their successful proven implementation, not all companies have been focusing on their adoption of those technologies. In the case of the Middle East, typical energy efficient technologies may not be financially feasible given the lower costs of energy use during oil and gas extraction. Oman, Saudi Arabia and UAE are rich in oil and natural gas and, with most petrochemical companies owned by state governments, the energy required to run the plants is even further subsidised. Retrofitting a chemical plant to include the latest technologies for energy optimisation might require higher investment capital and operating costs compared to the business-as-usual scenario of using non-renewable energy, making it unattractive for companies to invest in.

Data Availability

A challenge preventing investors from diversifying their portfolio to include sustainable chemistry projects is the limited availability of data for the region. Investors have also hesitated to make decisions regarding investment in projects, such as plastic waste management, as a result of the missing track record of profitability and growth in the region.[84] Data analysis is rarely available and when it does exist, it remains confidential as proprietary information. In the case of the Middle East, the petrochemical industry lacks consistency in **non-financial reporting**. Whilst EU rules require large companies to publish regular reports on the social and environmental impacts of their activities, companies in the Middle East are not obliged to do so. Consequently, evidence-based strategic decision-making will be limited, preventing investors from entering new markets.[85]

5.2 Suggested Approach

Given the complexity of the various challenges facing the chemicals sector, a multi-disciplinary approach is needed for appropriate interventions across the sector - from primary chemical production to waste management.[86] All stakeholders in the sector have an important role to play in overcoming those challenges.

Role of Chemical Industry Stakeholders

Figure 11 - Chemical Industry Stakeholders

Consumers

Consumers have a direct impact on the demand of chemical industry. Automakers, manufacturers and agricultural companies are few examples of the many chemical industry customers that drive the demand of chemicals production. Therefore, chemical companies are not the solely responsible for the various impacts of chemicals on the environment. Companies across the value chain must consider the environmental impact of their operations when consuming chemical products. For customers in other sectors, this can include adjusting their operations to improve **waste management practices**. Moreover, manufacturers can focus on increasing material efficiency in their production process, minimising the overall demand for chemicals. Manufacturers can also demand more sustainable substitutes, creating the market demand for the chemicals sector to develop more sustainable or efficient products.

Individuals also drive the total chemical production, and their behaviour is a key factor correlating to the high volume of plastic litter in the environment. Therefore, it is necessary for consumers to **change behaviour** to produce significant shifts in social practices. A change in consumer behaviour can influence chemical companies to minimise their single-use plastic production, or even to switch into other products with lower environmental impact. They can also minimise the plastic waste accumulation at the disposal side through proper waste management practices.

Changing consumer behaviour can be done through different means. A change can start by an intention set by consumers themselves, or triggered through consumer-awareness campaigns. Although some research suggest that awareness campaigns is unlikely to change behaviour, other means can be introduced by other stakeholders, such as governments, to drive consumers from intention to action.[87]

Governments

A change in the current situation is unlikely without considering the potential impact of policy measures. Effective policies and legislations are needed to mandate the transition towards a sustainable chemicals sector. Global best practices can guide countries in the Middle East in their transition. The EU can be used as a role model in crafting or updating the policies and legislation for the local markets in the Middle East. Polices and legislations are needed for different sustainability topics, and should be comprehensive and applicable to both the supply chain and other stakeholders of the chemical industry.

Recommendations of Oman, Saudi Arabia and UAE include local and regional incentives to push for the invention and implementation of energy efficient technologies. As an energy-intensive region, **tax reductions** can also be offered to chemical companies for establishing an energy management system, such as the International Organisation for Standardisation (ISO) 50001 standard and demonstrating the energy efficiency improvements. The adoption of ISO 50001 helps companies in improving their overall energy requirements, and is considered a component of industrial energy efficiency policies in Korea, Germany, Canada and the EU.

Carbon taxes can be another measure to be considered for chemical companies. Depending on the carbon footprint, switching to lower-carbon fuels in power generation will be

reconsidered. A USD40 per tonne tax will generate a potential revenue of USD2.9 billion, USD22.8 billion and USD11.1 billion for Oman, Saudi Arabia and UAE respectively.[88] However, fossil fuels prices in the Middle East are lower than other regions, and carbon taxes might not be enough to incentivise chemical companies to switch to other energy sources.[89] This can be mitigated by targeting the existing energy subsidies for oil and natural gas that are common in the region. In the chemical industry, fossil fuel subsidies might inhibit shifts towards feedstocks that are less carbon intensive or are renewable. Therefore, **energy subsidies must be adjusted** when designing effective policies for reducing the carbon footprint. Energy trading systems (ETS) can also be considered as another measure in regulating the GHG emissions of the industry.

Another mechanism that is currently being used by leading oil and gas companies is **carbon pricing**. Exxon, Shell, BP and Total are all internally pricing their carbon footprint, and referring to this as carbon cost, fee or price. Companies can use this mechanism as a planning tool to help identify revenue opportunities, risks, and as an incentive to drive maximum energy efficiencies to reduce costs and guide capital investment decisions.[90]

Regarding waste management, a **circular economy framework** can also be adopted for the Middle East. Unlike the traditional approach "take-make-use-dispose", the circular economy is designed to maximise the value and utility of materials over their lifecycle and keep them inside the value chain for as long as possible. This is done by creating a closed loop for materials that aims to prevent waste and minimise resource consumption.[91] The European Commission has recently introduced a framework which includes an objective of ensuring that all plastic packaging is recyclable by 2030.[92] In 2020, the UAE introduced a new policy on single-use plastic waste which can also be considered by Oman and Saudi Arabia in their waste management. Such policies are required as a first step towards reaching a holistic circular economy framework.[93] Governments can also mimic global best practices in waste management policies; fiscal instruments, such as revenue-neutral plastic consumption tax, would allow the proceeds to be directed at preventing and mitigating plastic pollution.[94] The UAE has recently made a first step towards circular economy by forming a coalition of government, NGOs, global and local private companies.[95] The coalition pledged to tackle the problem of packaging waste pollution and develop a circular economy in the UAE.

Through the European Commission, the EU developed legislation for the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). REACH aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. Manufacturers and importers are required to collect information on the properties of their chemical substances and to register the information in a central database. The legislation operates on the principle "no data, no market", which places responsibility on the industry to manage the risks from chemicals and to provide safety information on the substances.[96]

Financial Institutions

Banks play a crucial role in accelerating the development of sustainability projects. They provide businesses around the world with **sustainable finance** - any form of financial service which integrates environmental, social and governance (ESG) criteria into business or investment decisions. Recently, new financial instruments have been developed specifically for "brown" businesses – those that have high GHG emissions and are environmentally polluting. In 2019, AXA IM has called for "transition bonds" – a new financial instrument that allows companies to become "green".[97] Transition bonds are a new instrument in the banking sector, allowing sustainable finance to be not only a green but also a transition finance. The International Capital Market Association (ICMA) also recently launched a guidance document to provide clear guidance and common expectations to capital markets participants on the practices, actions and disclosures to be made available when raising funds in debt markets for climate transition-related purposes.[98]

Companies in the chemical industry can raise capital by issuing transition bonds with the goal of becoming more efficient and decreasing their adverse environmental impacts. In June 2020, Castle Peak Power Company Limited (CAPCO) announced that it has successfully issued a USD350 million energy transition bond under the Climate Action Finance Framework (CAFF) of its parent company CLP Holdings Limited (CLP). The well-supported bond has a coupon of 2.20%, recognising the importance of energy transition finance to enable meaningful action on climate change. This bond is a relatively new type of financing mechanism; however, with the issuance of the ICMA guidance recently, the uptake for this mechanism is expected to increase further.[99]

Another financial mechanism that has been developed to help companies in their transition is the Sustainability Linked Loan (SLL),[100] where the interest rate moves up or down in line with the achievement of sustainability performance targets of the borrower (e.g. ESG score, GHG emissions intensity, water intensity, waste intensity or gender ratios). The SLL principles were developed by the Loan Market Association (LMA), comprised of representatives from leading financial institutions that are active in the global syndicated loan markets. SLL enables lenders to incentivise the sustainability performance of the borrower if the ESG-related sustainability targets were achieved.[101] The incentive mechanism is the main advantage of SLL, and the use of proceeds is not a determinant in its categorisation and can be used for general corporate purposes. SLLs are gaining popularity since they are flexible as the borrower can choose to apply the proceeds towards any activity rather than restricting to green projects and they have a good reputation for demonstrating a company's ESG credentials.

One form of SLL put into practice in the chemicals sector was in the form of almost USD2.25 billion revolving credit facility by an international bank in collaboration with the Belgian chemical company Solvay that linked the credit facility to its environmental commitments. A positive incentive loan mechanism was used to link the cost of the credit to Solvay's GHG emissions.[102]

The burgeoning sustainable finance market can support the sustainable transition of the chemicals sector. Companies in the Middle East, especially the less profitable small companies, can consider financial mechanisms such as transition bonds and SLLs to access financing needed for investments in research and development, operational efficiency and the development of more sustainable products.

Businesses

Leading global businesses have begun demonstrating their commitments towards sustainability by setting ambitious Net Zero goals to fulfil national obligations under the Paris Agreement and meeting the 2030 Agenda for Sustainable Development. In order to reach their targets, they are adopting **new business models** to address sustainability topics throughout the entire value chain. The chemicals sector in the GCC will also need to make significant changes to their existing business models to meet the sustainability goals of their respective governments as well as the Paris Agreement.

BASF has developed a unique concept called "Verbund"; a principle on intelligent interlinking of energy flows, production plants and infrastructure, implementing resource efficiency in BASF's production sites. Customers and know-how are also intelligently connected to each other. The principle creates efficient value chains extending from basic chemicals to high-value-added products such as crop protection agents and industrial coatings. By-products of one chemical plant can be used as raw materials for another, resulting in lower energy consumption, higher product yields and higher resource conservation. BASF also minimises its emissions, exploits synergies and cuts logistics costs. The Verbund principle also applies to waste heat produced in a plant's production process, which is used as input energy in another plant, saving BASF approximately 12.4 million MWh and 2.5 million metric tonnes worth of carbon emissions in 2019.[103]

Moreover, major companies have been adjusting their operations to meet their long-term commitments. **Process and energy efficiency** are examples of areas that global companies such as BASF and Dow have been investing in to minimise their GHG emissions. Although some peers in the Middle East have started shifting towards maximising their process efficiency, others can implement new processes to advance their transition. One example that can be adopted by the regional companies is what Dow has recently introduced - a new line of mechanically recycled plastic resins for flexible and rigid plastic packaging applications. Such process can reduce application carbon and energy footprints by up to 20-30%.[104] In Saudi Arabia, Sadara has improved their production process by implementing recycle and reuse programmes, saving up almost USD6.6 million. **Investments in R&D** is also important in order to innovate new efficient processes.

Another area which has been targeted by global companies is the source of energy consumed in production. **Renewable energy** sources are being considered for manufacturing facilities to minimise the indirect emissions of the production process. The chemical industry is highest energy consumer across all sectors, and therefore the scope 2 (indirect energy i.e., electricity and team imports) emissions are very important to address. Solar power is an example of a renewable energy source which is very applicable to the Middle East.

Although there are transition risks for businesses to invest in sustainable practices, the risk of no action can be higher. According to the World Economic Forum (WEF), Failure of climate change mitigation and adaptation has the highest risk by impact and second highest by likelihood over the next 110 years.[105] The transition towards sustainability for the chemicals sector has both financial and environmental benefits, as demonstrated by the track-record of leading companies in the industry.

Other Stakeholders

The transition to a sustainable chemicals sector also depends on other stakeholders. As more and more companies make Net Zero commitments, **investors** can consider this as an opportunity not only for protecting the environment, but also for financial returns. With the help of financial instruments and investment options, investors can advance the transition even more. Moreover, investors can also increase the pressure on chemical companies to take necessary action. For instance, Climate Action 100+ is an investor initiative to ensure the world's largest corporate GHG emitters take necessary action on climate change. The initiative calls on 46 focus companies in the oil and gas and chemical industries to create long-term energy transition plans with aligned short-and medium-term targets.[106]

Stock exchanges can also contribute towards sustainability Currently, major stock exchange markets such as New York Stock Exchange and London Stock Exchange are raising the demand for Environmental, Social and Governance (ESG) disclosures for listed companies. ESG disclosures help in identifying new business opportunities to improve sustainability performance. Disclosing on ESG related topics can also help in managing long-term risks, including risks associated with climate change. The UN led Sustainable Stock Exchanges initiative has built momentum across many stock exchanges, including the ones in the Middle East. The Dubai Financial Market (DFM), for example, has already published guidelines on ESG reporting, though they remain voluntary.[107] In addition, The Saudi Stock Exchange (Tadawul) has also committed to publishing ESG guidance for its listed companies.[108] **Financial regulatory authorities** can add ESG disclosures as a requirement for listing, creating another driver for large chemical companies in the region to make the transition.

Trade associations, such as GPCA, can play an important role in guiding decision-making for stakeholders, such as governments, investors, customers and even chemical companies themselves. The GPCA is a leading voice of the chemical industry, and the biggest communication platform for petrochemical companies in the region. The GPCA can use this platform to guide the companies in improving their non-financial reporting in order to have better understanding of the market, thus better decision-making for other stakeholders.

Other organisations can also help the chemical industry stakeholders in their decision-making. One example is ChemSec - an environmental **non-government organisation (NGO)** that has recently developed a tool to measure the chemical footprint of 35 of the world's largest chemical companies. The tool provides data on how chemical companies are performing in terms of sustainability topics, based on the amount of hazardous chemicals they produce and their efforts to transition to safer, greener alternatives.

The UK leads as an example of how the private sector can go beyond current legislative and policy requirements. A "UK Plastic Pact" has been signed by 40 businesses, including major international consumer goods retailers and manufacturers.[109] The pact has four targets to be achieved by 2025: 100% plastic packaging must be recyclable, reusable or compostable; 70% must be composted or recycled effectively; 30% average recycled content must be reached; and unnecessary single-use plastic packaging to be eliminated. Recommendations include similar corporate and governmental initiatives, in which countries or companies surpass the minimum legal requirements.

6. Conclusions

Chemicals and petrochemicals play a critical role in the economy of the Middle East and therefore it is vital to be prioritized in the national agendas. There are many challenges that accompany the benefits of the chemical industry, and to mitigate these challenges stakeholders across the chemical value chain need to rethink their contributions towards the sector.

Governments of Oman, Saudi Arabia and the UAE have already started adjusting their vision to address the multiple risks to the petrochemicals industry, and major companies in the industry have also started shifting their strategies to adopt more sustainable practices in their businesses and operations. However, adopting positions towards sustainability is driven differently for businesses in the chemical industry, depending on stakeholder pressure, portfolio flexibility and organisational capabilities for each company. Although governments have responded to various risks from the industry, current policies and legislations can be further improved to promote sustainability practices and meet the global sustainability agenda.

The Middle East relies heavily on fossil fuels. Although the region is smaller in geographical area, the chemical industry's total CO_2 emissions are in the same level of Europe and North America. The Middle East also suffers from water scarcity, resulting in higher CO_2 emissions from extensive water desalination, resulting in more energy-intensive operations. Therefore, implementing schemes like carbon taxes and emission trading system can have an underestimated contribution.

From a financial perspective, the recent economic disruptions caused by the COVID-19 pandemic introduced immense pressure on companies in the chemicals sector. Financial institutions will now have an important role to aid economic recovery. Common sustainable financing mechanisms such as green bonds and loans have had some limitations for the chemicals sector, but new instruments such as transition bonds and sustainability-linked financing can help address this. Investors, on the other hand, have been hesitant to invest in sustainable projects in the Middle East. This could be mainly linked to the limited available data on the sector's performance in sustainability which prevents investors from exploring new markets. Various stakeholders can support the industry to disclose their information, facilitating the path for investors' contribution.

At the business level, leaders in the chemical industry have already started adopting new business models to meet their Net Zero commitments, something that needs to be considered for local companies as well. This requires a shift in business models and operational capabilities, which could be seen as a significant investment to companies. Although some global companies have demonstrated the feasibility of implementing energy efficiency projects to reduce GHG emissions, this has not been widely considered in the Middle East given the lower costs of energy that is generated from the existing oil and gas. Nevertheless, this investment should not be seen as a high price, especially when compared to the risks of no action.

As the report shows, there is no unique path to make the transition towards a sustainable chemicals sector. Nevertheless, each stakeholder in the sector can make a contribution that drives others to make further contributions. For example, governments can introduce new or revise existing policies and legislation to promote sustainability, incentivise operational efficiencies (i.e., removing energy subsidies), and incentivise circular economy practices by the sector. Moreover, the financial institutions can provide the required financial mechanisms for businesses in the industry, facilitating their journey towards a sustainable chemicals sector.

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