

THE KEY ROLE OF NO-CARBON NATIONAL OIL COMPANIES IN GLOBAL CLIMATE ACTION: LEVERAGING THE G20 FORUM TO ACCELERATE ENERGY TRANSITION

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The energy sector is the world's largest producer of CO₂ emissions, with about 90 per cent of the total derived from burning fossil fuels. Even under the International Energy Agency's (IEA) sustainable development scenario, the world will experience a long-term average temperature rise of 1.65oC. Central in the ongoing global energy transition are international oil companies (IOCs), and although many of them have announced investments in low- or zero-carbon activities, few state-owned national oil companies (NOCs) have followed suit. This is a major oversight, as the combined greenhouse gas emissions from the top 50 state-owned energy companies rank them third in the world behind only China and the U.S. NOCs must reduce their carbon emissions and set net-zero targets to reach the Paris Agreement's climate change goals.

Conceived as national champions, NOCs wield enormous influence over state economies and global energy supply chains. With a few exceptions, their low-carbon actions have been focused on Scope 1 and 2 emissions, leaving Scope 3 emissions generated by end users of their products largely untouched. National governments must transform NOCs to meet international climate agreements and to create sustained value for the societies they lead. Failing to reduce emissions will make it difficult for NOCs to attract investment and sell their products in global markets.

National governments have tremendous potential to achieve multiple policy goals in sustainable development and should give NOCs clear mandates to shift to low- or no-carbon operations and transform themselves into no-carbon NOCs (no-C NOCs). Achieving ambitious results requires governments to co-ordinate on an

international scale, since this effort involves technology, economics, research and politics that extend far beyond national boundaries.

The G20, which accounts for 62 per cent of the world's population, 82 per cent of GDP and 77 per cent of global CO₂ emissions, should take the lead.

The G20 should establish a no-carbon NOC fund to finance the development of clean technologies and retrain NOC workers. Member states should mandate sustainability for NOCs as part of nations' commitments to climate goals. They should also create NOCs4Climate, an international platform to enable NOCs to share best practices on sustainability, co-operate on projects of common interest and promote technology sharing and innovation.

The future of humanity is at stake over the issue of greenhouse gas emissions and climate change. So are the competitiveness of NOCs and the economic and social stability of countries that rely on them for a large portion of public revenues. With so much to gain and so much to lose, the time to switch NOCs to no-carbon NOCs is now.

ABSTRACT

The energy sector is the single largest source of CO₂ emissions and reducing its carbon intensity is critical to effectively tackling climate change. A great and yet largely untapped potential to reduce its emissions lies with oil and gas companies. Cognizant of this potential, in recent years several international oil companies (IOCs), publicly traded organizations with large capital access and wide geographical reach, have looked to effectively reduce their carbon intensity by shifting their operations to non-core low-carbon energy development.

In addition to bringing about positive climate-driven outcomes, the IOCs that have embraced this energy transition strive to leverage business opportunities presented by political and social environments which are progressively more aware of the energy sector's contributions to climate change. As much as this paradigm shift has sparked great interest by an increasing number of stakeholders in the energy sector, most national oil companies (NOCs) are notoriously absent.

In comparison to IOCs, not only do NOCs dominate the global oil and gas industry, but they typically enjoy more favourable industry conditions, as they benefit from improved capital access and governmental support. This is because their overall value proposition, business strategies and budgets are interlinked with, or heavily influenced by, government policies.

Under a mutable business environment which favours the development of energy resources with low- or zero-carbon content, it is reasonable to anticipate that national governments will become more determined to join the energy transition through their NOCs for two main reasons: meeting their national targets under global emissions reductions commitments while sustaining shareholder value. Moreover, given the complex efforts and resources in carrying out decarbonization at a pace and scale that effectively helps mitigate climate change, it is more likely that the world will enter a stronger decarbonization pathway if the largest economies and their NOCs fully embrace such an initiative.

The implementation of this initiative at a truly deep scale would eventually allow NOCs in these economies to transform themselves into no-carbon NOCs (No-C NOCs) that would strive for socially accountable sustainable growth, higher economic value and meaningful contributions in the global fight against climate change. This paper analyzes these issues and advances a proposal for the G20, which combines some of the largest oil and gas producer and consumer economies.

1. INTRODUCTION

The energy sector stands as the largest emitter of CO₂ emissions worldwide. By the end of 2019, approximately 90 per cent of CO₂ emissions produced from human activities came from the burning of fossil fuels alone; namely, from coal, oil and gas, in decreasing order (Global Carbon Atlas 2019). This lion's share of CO₂ emissions in a world increasingly constrained by the effects of climate change calls for less carbon-intensive processes and more sustainable patterns of energy production and use, all of which are framed under the global energy transition.

This transition recognizes the key role that the deep decarbonization of the energy sector plays to help the world stay safe within the temperature limits set by the United Framework Convention on Climate Change Paris Agreement. According to the most recent energy outlook released by the International Energy Agency (IEA) (2020b), even under a more favourable scenario than business-as-usual, known as the sustainable development scenario, worldwide CO₂ emissions from the operation of energy infrastructure would result in a long-term average temperature rise of 1.65°C. This would be well below the 2°C limit the international community pledged in the Paris Agreement but likely not below 1.5°C, unless more profound net-zero measures are taken. Achieving the sustainable development scenario would pose substantial challenges and investments, as it requires overhauling the energy sector by 2030, to double solar-based and wind-based power generation, in addition to halving coal-based generation over 2019 levels.

Against this background of increasingly stringent pressures to develop more sustainable business models in the energy sector, several international oil (and gas) companies (IOCs) — publicly traded organizations with the widest geographical reach, largest capital access and greatest integrated technological capabilities to find and produce fossil fuels — have started assessing in recent years how to reorient their strategic activities. Their goal is to keep sustaining value for their shareholders by increasingly exploring more low- or zero-carbon operations in their portfolios, even including renewable-based electricity generation. So far, however, the majority of these activities have addressed only Scope 1 and 2 emissions, while the game-changer for oil and gas operations lies in tackling their Scope 3 emissions.¹

Even though there is mounting pressure on oil and gas companies, whether state- or publicly owned, to decarbonize their operations considerably, it is mostly IOCs that have implemented comprehensive clean energy actions and announced ambitious pledges

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Full life-cycle emissions in the oil and gas industry are classified as direct or indirect and broken down into three resulting layers or scopes. Scope 1 is direct emissions coming from sources controlled by a company, such as its operations and facilities in activities that include venting, flaring and leaking; Scope 2 refers to indirect emissions that come from the power and heat purchased and are generally negligible; and Scope 3 refers to indirect emissions produced by end users and sectors from fuel combustion, most distinctively in the transport sector. On average, Scope 3 emissions represent as much as 80 per cent and 75 per cent of the full-cycle emissions for oil and gas, respectively, for which they represent a great opportunity for oil and gas companies to drastically reduce their emissions. Due to their nature though, the reduction of Scope 3 emissions is more elusive and complex, as it may entail curtailments in the company's marketed output of fossil fuels as well as offsetting and capturing emissions from end users. (IEA 2020a; Viscidi et al. 2020).

to reduce their carbon intensity.² So far, very few state-owned oil and gas companies, known as national oil companies (NOCs), have undertaken or plan to follow similar low-carbon pathways.

Despite the NOCs' generally scarce climate-driven efforts, which have been predominantly limited to targeted investments to implement certain decarbonization technologies, these companies have a great potential to reduce their operations' carbon intensity. The combined amount of greenhouse gas (GHG) emissions from the top 50 global energy-related, state-owned enterprises³ would rank third on a country basis, only after China and the United States (IEA 2016). Just in the oil and gas industry, out of the 15 NOCs with crude oil production levels over one million barrels of oil equivalent in 2018, the joint volume of GHG emitted by only seven of them amounted to 537 million tonnes of CO₂ equivalent,⁴ an amount similar to Canada's total emission during that same year, equivalent to 568 million tonnes of CO₂ (Global Carbon Atlas 2020).

Consequently, despite their dominance and strategic importance, NOCs fall behind in setting ambitious climate targets and investing in low-carbon projects in comparison to IOCs. Given the volume of emissions that could be avoided and the political influence of national governments in the strategic management, there is an ample opportunity to transform the NOCs' vision and mandate to considerably reduce their carbon emissions and set a net-zero target in line with the Paris Agreement's goals. Engaging in such a way to reach their Scope 3 emissions would allow NOCs to transcend their traditional oil and gas core activities, not only to venture into new markets and more sustainable operations but also to replace the conventional fuels that are marketed to final consumers with zero-carbon options. This in turn would pave the way for their ultimate evolution as no-carbon NOCs (No-C NOCs), companies fully dedicated to deploying low-carbon energy systems, products and services — reminiscent of the emerging business models several IOCs are currently pursuing in the oil and gas industry.

In addition to supporting the transformation of no-carbon NOCs for climate-driven purposes, there is a stronger case for national governments to adopt this proposal if it can also become a tool that provides economic recovery in the aftermath of the COVID-19 pandemic. In addition to certain trends already identified to shape the energy sector in the next few years,⁵ the pandemic's immediate and long-term effects are now considered additional major drivers that will make more complex the economic, social and technical considerations embedded in the energy sector (WEC 2020; WEF 2020).

Much of the IOCs' recent strategic business shift has been extensively covered by news outlets (The Economist 2020; Mufson 2020), financial and consulting firms (Goldman

² During 2020, major IOCs BP (2020a) and Shell (2020) announced their respective goals to become net-zero energy companies by 2050 or sooner.

³ Analyzed companies were involved in both fossil fuels and power generation industries.

⁴ This list includes Saudi Aramco (Saudi Arabia), Rosneft (Russia), Gazprom (Russia), Petrobras (Brazil), PEMEX (Mexico), Petronas (Malaysia) and Equinor (formerly Statoil, from Norway).

⁵ These usually refer to the increasing decarbonization, decentralization (of energy sources) and digitalization. Implicit among these trends is a growing electrification of end-use sectors, particularly in transport (WEC 2020).

Sachs 2018; Wood Mackenzie 2020), institutional sources (IEA 2020a) and academic literature (Shuen, Feiler and Teece 2014; Stevens 2016; Zhong and Bazilian 2018; Pickl 2019). However, there is still very little attention given to the crucial impact that NOCs may play in the fight against climate change whenever they decide to pursue similar decarbonization strategies. Moreover, while several authors (IEA 2016; Prag, Röttgers and Scherrer 2018; Benoit 2019; Beltrán 2020) have addressed the relevance of engaging NOCs in climate policies, there is a lack of deeper research to continue shedding light on the benefits of translating these arguments into policy action. The time is ripe to call for bolder climate action in the energy sector, because of the expected sustained growth of renewable energy generation during the coming decades (IEA 2020b).

Tackling climate change requires international collaboration to move the needle faster and in the right direction. Governments have historically joined international energy initiatives to support the exchange of best practices and collaborative efforts to fight climate change. Consequently, these issues must be capitalized upon within the context of a high-level international platform. The proposal in this paper would be more influential on a global scale if fully adopted by the world's largest economies; namely, within the scope of the G20 forum.

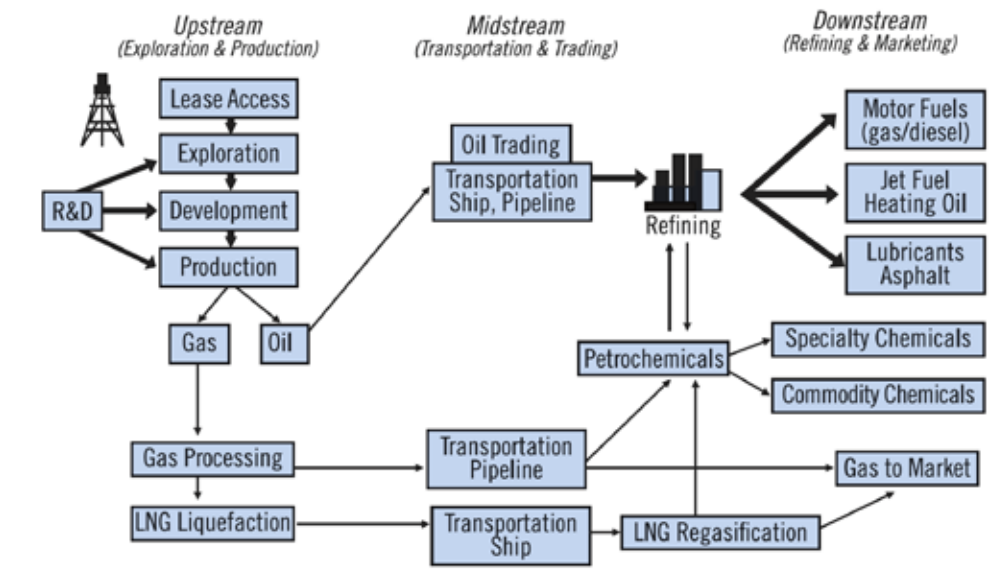
Not only is the G20 likely the most influential international political forum, but since 2009 its member countries have agreed to phase out fossil fuel subsidies. They have become aware of the interdependence between economic growth, climate change and energy sustainability. As the need for climate action grows more critical, the G20 members may want to increase their political influence by supporting a co-ordinated decarbonization pathway through their own NOCs. The implementation of this initiative would also allow these companies to become no-carbon NOCs that would yield economic, social and environmental benefits by providing sustainable growth, bringing higher economic value to their stakeholders and helping offset carbon emissions that worsen global climate change.

To elaborate on these ideas, this paper is structured as follows. Section 2 examines, from different perspectives, the energy transition underway, including its effects on oil and gas companies and the low-carbon strategies implemented by IOCs to become new energy firms. Section 3 reviews the NOCs' role and analyzes their possible evolution into no-carbon NOCs. Section 4 explores the influence, scope and strategic alignment of the G20 forum to adopt this initiative. Section 5 summarizes this paper's findings and puts forward some policy recommendations.

2. AN EMERGING PARADIGM IN THE OIL AND GAS INDUSTRY

In general, the emissions-intensive value chain in the global oil and gas industry shown in Figure 1 consists of two main types of players. IOCs, publicly traded firms, are usually the largest and with vertically integrated operations, which compete for the exploration and development of resources across the world; and NOCs, companies wholly or largely controlled by national governments, established with the main objective of managing domestic oil and gas resources in their respective home countries.

FIGURE 1: VALUE CHAIN IN THE GLOBAL OIL AND GAS INDUSTRY



Source: (Inkpen and Moffett 2011, 21)

2.1 RATIONALE UNDERLYING THE IOCS' TILT FOR SUSTAINABILITY

Strategic readjustments are not uncommon among IOCs. Historically, the oil and gas industry has entered different periods of business turbulence that have eroded the IOCs' competitive premises and triggered their strategic responses to help them stay in the business and sustain value creation for their shareholders (Grant 2003). As publicly traded companies with increased market visibility for a wider range of stakeholders, IOCs have reflected growing concerns over the environmental, social and governance (ESG) effects of their activities, which has helped them mitigate reputational, financial and operational risks to facilitate their attraction of capital and social licence to operate.

In recent years, several IOCs have acted to transform their overall operations by integrating stronger sustainability approaches and commitments. These shifts can be largely regarded as oriented to renovating their competitive advantages under rapidly changing economic, financial, social and political environments worldwide. These various environments have converged in urgently placing value on energy systems with lower or zero-carbon content.

In embracing this new business model, IOCs can pave the way for their ultimate evolution into integrated energy companies (IECs), firms characterized by an aspiration of “broadening into electric power, energy services, and new technologies [...] with the energy transition in mind” (Yergin 2020, 904). In practice though, the efforts several of these companies have undertaken have mainly lowered the carbon footprint of the activities pertaining their Scope 1 and 2 emissions. This opens a window of opportunities for implementing more ambitious actions that target their Scope 3 emissions as well.

From a strategic management perspective, these moves can be explained under the dynamic capabilities approach, whereby firms “integrate, build and reconfigure internal and external competences to address rapidly changing environments” (Teece, Pisano and Shuen 1997, 516). However, the scope of these dynamic capabilities has become rapidly ineffective, in line with shorter life cycles in traditional oil and gas business models. Certain industry drivers that built up for decades resulted in the IOCs’ continual adjustment of their dynamic capabilities to expand oil and gas production through frontier resources⁶ and to operate under more complex business interactions with NOCs and national governments. However, no driver ever had such a game-changing effect in the industry as the mainstream call to decarbonize oil and gas activities (Shuen, Feiler and Teece 2014).⁷ Essentially, this call for decarbonization is disruptive, because it puts forward the unprecedented notion that to effectively fight climate change, oil demand must start dwindling. This is contrary to the industry’s cornerstone of finding and producing more fossil resources to match expanding demand.

The permanence of low oil prices associated with a long-term outlook of shrinking oil demand and the falling costs of renewable technologies — which have brought down solar photovoltaic electricity generation to equal or lower costs than those of coal- and gas-fired power plants (Weijermars, Clint and Pyle 2014; IEA 2020b) — provides additional economic incentives for IOCs to act in gradually leaving oil and gas operations for the integration of low-carbon and renewable-based assets in their portfolios. In addition, the unprecedented economic effects of the COVID-19 pandemic during 2020 have given the international community an opportunity to reconsider the configuration of our current energy systems. So far, there are an increasing number of political,

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The development of those oil and gas resources involving more complex technologies and processes than those conventionally employed by the industry, which typically result in higher costs and environmental risks. Example of frontier resources include those coming from deepwater and ultra-deepwater reservoirs, unconventional formations (including low-permeability shales) and Arctic territories as well as extra-heavy oil in the form of oilsands and oil shales.

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BP, the U.K.-based IOC, attempted to enter the renewable energy market as early as 2005 by establishing its Alternative and Renewable Energy venture, but after billionaire expenditures and little success, it aimed to exit the market and tried to sell its non-fossil fuels assets in 2011 and 2013 (Pickl 2019). This case is useful for stressing the convergence of external forces in supporting a strategic decision.

technological and economic signals that suggest they will phase out fossil fuels more rapidly to foster a sustainable energy transition at full throttle.⁸

From a political economy perspective, insights also match strategic management and economic considerations. Stevens (2016) notes that while IOCs were the dominant industry players for most of the 20th century, their strategies had to be reformulated once the energy shocks and the emergence of strong national governments took place in the global oil and gas arena in the 1970s, indelibly changing the rules of the game in favour of NOCs. Consequently, in the early 1990s, the IOCs were driven to create shareholder value by finding and booking more cost-competitive oil and gas reserves, even at the expense of increased technological complexity and typically higher development costs. Nevertheless, this strategy fell short recently, not exactly because of operational or economic inefficiencies but because of external environmental forces. This involved a progressively changing public mindset to leave oil and gas resources in the ground (i.e., unburnable carbon) to avoid their combustion, thus limiting the continuous rise in average world temperatures to reduce the perilous effects of climate change.

2.2 CLIMATE CHANGE IN THE EVOLUTION OF IOCS INTO IECS

Climate change stands as one of the most serious global challenges ever, given its devastating effects for every country. These effects are only set to grow in line with the steady rise in average world temperatures. The energy sector, and in particular the combustion of fossil fuels, represents the single largest source of emissions that bring about climate change. The policies and actions leading to a large and rapid decrease in the carbon intensity of oil and gas operations are now considered fundamental to achieving emissions reductions linked to the commitments to curb climate change pledged by the international community.

The annual gathering of the international community to assess progress in the fight against climate change — Conference of the Parties (COP) under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC) — has placed global attention on this issue. The 2015 launch of the UN's Sustainable Development Goals, a set of 17 ambitious objectives to be achieved by 2030,⁹ has stressed the need for academia, government, industry and society stakeholders to develop more sustainable energy systems, shifting away as much as possible from fossil fuels and strongly promoting low- or zero-carbon solutions using renewable energy sources. Public

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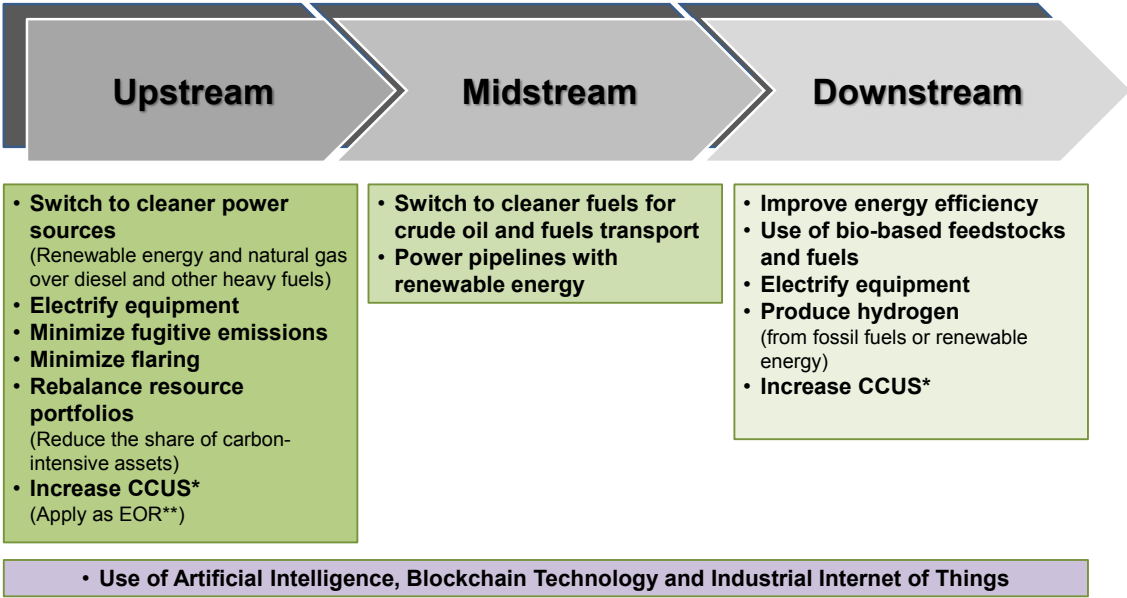
These signals include a weaker long-term demand outlook for oil-based fuels, which would be partially influenced by an economic downturn expected in the transport sector's energy demand resulting from the COVID-19 pandemic and by a higher penetration of electricity in its sectoral energy mix (IEA 2020b). This electrification would be brought about not only by more sustainable public policies, but also by larger electric vehicles sales and by the possible displacement of conventional oil-based jet fuel in the aviation industry in favour of alternative fuels. In September 2020, European aerospace manufacturer Airbus (2020) announced its plans to develop a zero-emissions, hydrogen-fuelled commercial aircraft that could enter into service as soon as 2035.

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These goals are part of the 2030 Agenda for Sustainable Development and represent a call for collective action from all countries in a shared task of achieving greater prosperity and reducing inequality while tackling climate change and preserving the natural environment. Of the 17 Sustainable Development Goals (SDG), one of them is directly related to the sustainable use of energy: Ensuring universal, affordable and sustainable energy access (SDG 7). Taking urgent action to fight climate change and its impacts (SDG 13) is also closely related to the energy sector (UNSD 2020).

policies and progressively lower costs resulting from economies of scale and continuous technological improvements have also favoured renewable energy development (IEA 2020b). Climate-driven changes in the IOCs’ business models have been primarily concerned with reducing the GHG intensity of their direct oil and gas operations, but the bulk of their full life-cycle emissions comes from indirect sources. Consequently, to reduce emissions on a larger scale, IOCs require the implementation of more complex methods across their upstream, midstream and downstream activities, which, as shown in Figure 2, involve reducing their respective to-market output of fossil fuels as well as offsetting and capturing emissions. Furthermore, the IEA (2020a) has estimated that in order to meet international emissions commitments, 50 to 59 per cent and 52 to 58 per cent of the global proven reserves of crude oil and natural gas, respectively, must be left in the ground.

FIGURE 2: MAJOR DECARBONIZATION METHODS ACROSS THE OIL AND GAS VALUE CHAIN



Note: *CCUS: carbon capture, utilization and storage; **EOR: enhanced oil recovery.

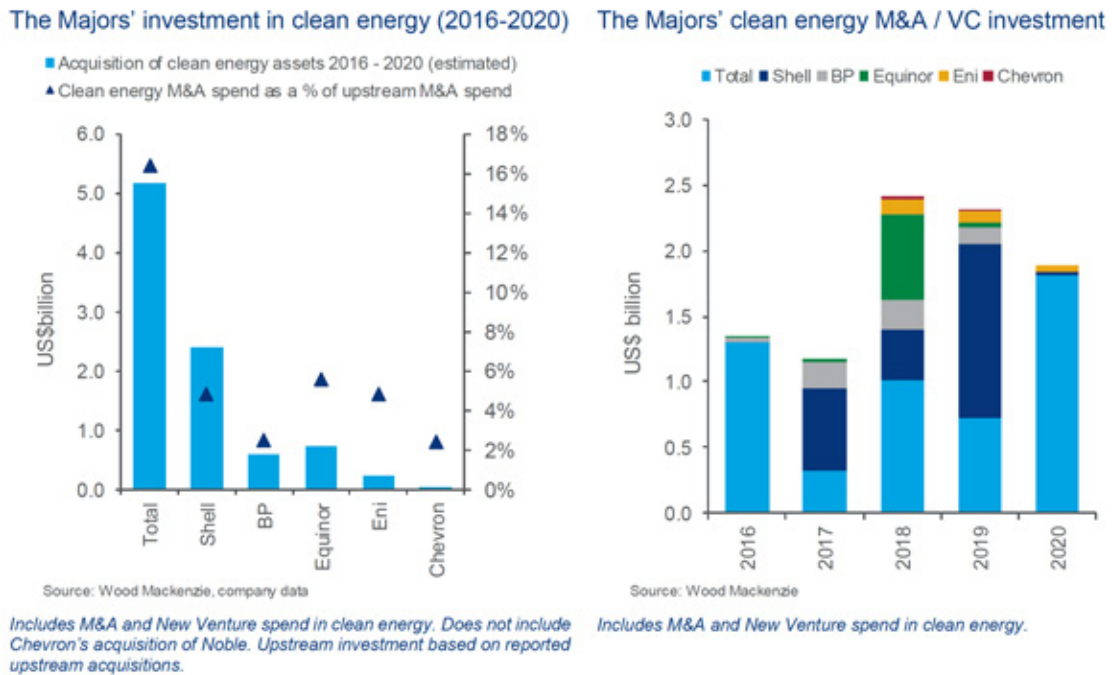
Source: Authors’ based on Beck et al. (2020); Viscidi et al. (2020) and Lu, Guo and Zhang (2019).

These methods also incur higher costs and demand more sophisticated technologies that jointly affect the companies’ profitability. Some IOCs have announced more ambitious capital investments to amplify and diversify their portfolios into low-carbon areas.¹⁰ This may encompass the development of renewable energy and other clean energy sources which may not be already commercial, but bear promising potential, such as massive hydrogen use. Despite these milestones, as shown in Figure 3, the IOCs’ capital investments outside their core operations — mergers, acquisitions and venture capital

¹⁰ Shell is expected to increase its capital investments in new energy ventures during 2021 and 2022 to US\$2-3 billion, while BP’s budget in new energy ventures could grow to US\$5 billion by 2030. Eni and Repsol are expected to announce similar measures (Wood Mackenzie 2020).

activities — have been marginal and represented less than one per cent of their total expenditure (IEA 2020a).

FIGURE 3: CLEAN ENERGY INVESTMENTS BY IOCS, 2016-2020



Note: In the oil and gas industry, the term “majors” is often interchangeably used with “IOC”; M&A: mergers and acquisitions; VC: venture capital.

Source: Wood Mackenzie (2020)

The low-carbon strategies several IOCs have implemented differ in their breadth and depth, but in general, as seen in Figure 4, they have striven to mitigate emissions in their conventional operations with fossil fuels while making some progress into more complex non-core activities that aim to reduce their overall carbon intensity and diversify their business lines. In the first stage, non-core activities may relate to the use of technologies to capture, use and offset carbon emissions (CCUS). This may include enhanced oil recovery technologies through the injection of captured CO₂ to wells, but may later advance into the supply of low-carbon gases and biofuels up to the development of renewable-based electricity and even into electricity distribution and retail.

This scope of activities shows how far IOCs are venturing in their quest for sustainability and diversification, undertaking projects and business very different from their traditional expertise — in which other type of low-carbon energy and power companies have already attained competitive advantages — but in which their transferable skills and technologies may give them a competitive edge. The shift into renewable energy and power transmission activities, for example, is more noticeable in the strategies carried out by European-based IOCs (BP, Eni, Shell, Total and Repsol), likely because of the different political stances and corporate weight respectively given in Europe and the

U.S. to climate change over financial and economic criteria.¹¹ Although it may seem unrelated, the diversification in operations of IOCs to power-related activities is a rational consequence, because just as in the case of fossil fuels, the expansion of renewable-based generation largely rests on its transmission and distribution to end users as electricity.

FIGURE 4: SUSTAINABILITY STRATEGIES FROM SELECTED IOCS

Company	Enhancing traditional oil and gas operations			Deploying carbon capture, utilization and storage		Supplying liquids and gases for energy transitions		Transitioning from International Oil Companies to International Energy Companies			
	Reducing methane emissions	Reducing CO ₂ emissions	Generating renewable power	For centralized emissions	For EOR	Low-carbon gases	Advanced biofuels	Solar PV and wind-based generation	Other power generation	Electricity distribution and retail	Electrified services and efficiency
BP	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
Chevron	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
Eni	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
ExxonMobil	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
Shell	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
Total	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped
Repsol	Green	Green	Green	Yellow-striped	Yellow-striped	Green	Green	Green	White-striped	White-striped	White-striped

Notes: Green-shaded cells refer to a growth area supported by observed strategic investments and/or capital/operational expenditures in commercial-scale activities. Yellow-striped cells refer to announced strategy and/or minor investments, venture capital and/or research and development spending. White-striped cells refer to a limited evidence of investment activity.

For methane and CO₂ emissions, which are not based on project and spending data, assessments reflect the presence and strength of methane reduction and emissions intensity targets, as well as evidence of their implementation, the emissions intensity trend of new investment, transparent reporting of absolute emissions and sources, and linking of executive and staff compensation to achieving goals. Power generation and efficiency investments in the Transitioning category pertain to projects destined for commercial sales (not own use). Electrified services include battery storage and electric vehicle (EV) charging. Low-carbon gases include low-carbon hydrogen and biomethane.

Source: Adapted from IEA (2020a).

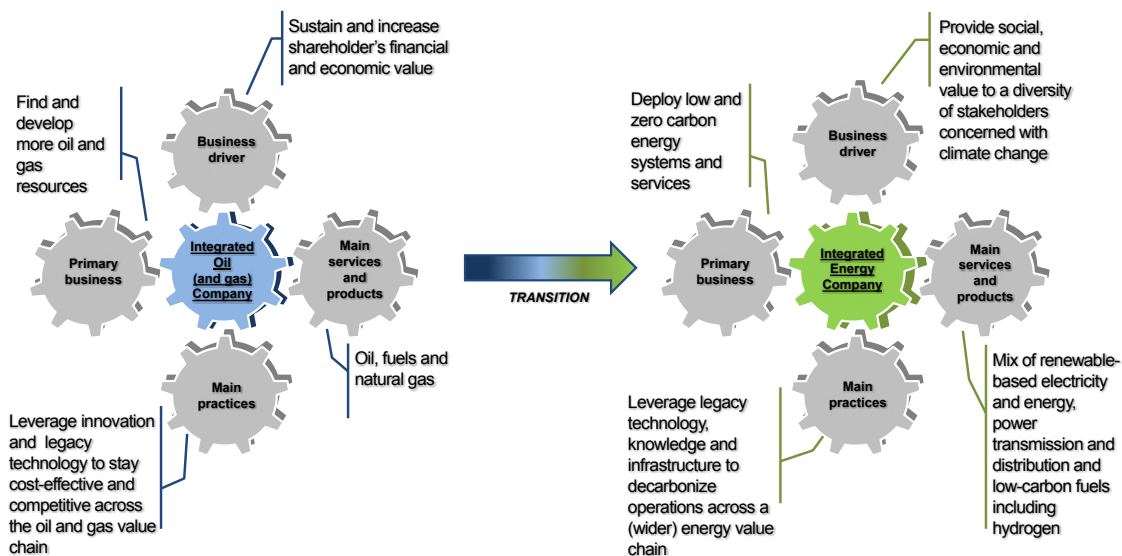
Different voices from civil society, national and subnational governments, institutional investors and shareholders, multilateral financial institutions and energy developers¹² are calling for more restrictive policies and financial measures to drive IOCs toward low-carbon energy. Their voices have been by far the most powerful force in the oil and gas industry’s transformation. These pressures have pushed IOCs to reduce their environmental footprint and enhance their operations’ sustainability. However, in the face of an urgent call for more substantial climate action, these can actually become — if bolder, better harmonized and more widely distributed — the major catalysts in the evolution of IOCs into IECs.

¹¹ This issue may be well reflected by the differing views on the Paris Climate Change Agreement by governments in Europe and the European Union on one hand, and the U.S. under the Trump administration on the other. However, as of 2021, the situation in the U.S. has changed with the Biden administration, whose plans are to put climate change and low-carbon energy development at the forefront of its economic and foreign affairs agendas.

¹² Although IOCs do not hold the majority of oil and gas reserves or production, their survival is critical to wealth creation. As of 2015, pension funds and individuals held 47 per cent of the shares in United States’ oil and gas companies in the Standard and Poor’s 500 Index (Stevens 2016).

Ultimately, this transformation will be brought about by measures that not only are intended to limit the production of end-use oil-based products but also to facilitate their replacement with energy options with much lower or zero emissions. Parallel shifts on an international scale to both the production and demand of oil-based fuels will effectively force international, vertically integrated oil and gas companies to operate more aggressively across the low-carbon energy value chain. To remain competitive in a more sustainable energy landscape constrained by the business drivers shown in Figure 5, IOCs will have to deliver new products and services, which will involve the integration of drastically different asset portfolios.

FIGURE 5: MAIN FEATURES OF THE IOCS' BUSINESS TRANSITION TO IECS



Source: Authors', based on Zhong and Bazilian (2018), Lu, Guo and Zhang (2019) and Wood Mackenzie (2020).

3. THE ROLE OF NOCS IN A CLIMATE-DRIVEN ENERGY INDUSTRY

NOCs hold the majority of assets and emissions in the global energy sector. They are the dominant industry players. In 2010, these companies concentrated 90 per cent of global oil and gas proven reserves and 75 per cent of production, in addition to holding most undiscovered resources to be developed (Tordo 2011). Their national governments created them to become a key fiscal source from the economic rents obtained from the extraction of natural resources, as well as a vehicle of massive economic development and positive spillovers that include job creation, technology transfer and development and increased productivity.

There has always been a close link between the NOCs' organizational value propositions and corporate strategies with specific national or subnational public policies that interweave fiscal, economic and environmental priorities. In their home countries, NOCs typically hold a privileged status and become economy champions, insofar as they

frequently enjoy a legal monopoly, preferential or exclusive access to natural resources that facilitate their dominant industry position. They also have enhanced access to government funding and resources in comparison to privately owned companies. In fact, many NOCs may even operate under non-financial mandates (Benoit 2019) to favour other types of goals or visions. Because of their NOCs' power, national governments exert a strong influence on the global oil industry and on the potential for decarbonization across the supply chain.

3.1 COLLECTIVE CLIMATE ACTION INVOLVING NOCS

The NOCs' climate-driven efforts lag those of IOCs. Low-carbon actions from NOCs have been generally scarce or not profound enough to target their Scope 3 emissions and have been predominantly limited to some targeted investments on the application of certain decarbonization technologies. Except for the notable low-carbon corporate strategies from Denmark's Ørsted and Norway's Equinor,¹³ NOCs' experiences in this subject have been focused at best on reducing the environmental footprint and carbon intensity of the Scope 1 and 2 emissions from their regular operations. These examples include carbon capture, utilization and storage (CCUS) projects and low-carbon applications for upstream and downstream operations in Saudi Arabia's NOC, Saudi Aramco (2019). They also include the enforcement of stricter environmental standards and improvements in flaring and venting to reduce fugitive methane and greenhouse gas emissions by 70 per cent in the operations of Russia's NOC, Rosneft (2019).

Nevertheless,¹⁴ a previous attempt at a collective deal was forged between private companies and NOCs in response to the Paris Agreement. In 2014, 11 oil and gas companies, IOCs and NOCs alike, partnered to reduce their methane emissions and implement low-carbon technologies in what became the Oil and Gas Climate Initiative (OGCI). The OGCI partnership is very active and despite a few changes in its membership composition,¹⁵ from July 2017 to November 2020 invested over US\$1 billion in 19 advanced low-carbon and other emission-offsetting projects. These included the reduction of methane and CO₂ emissions and the application of CCUS technologies (Oil and Gas Climate Initiative 2020).

¹³ Ørsted embraces a very ambitious "green transformation" strategy among NOCs, as it aims to achieve carbon neutrality in its full life cycle of emissions (Scope 1 to 3) by 2040. Actions include sourcing, producing and selling green energy through an asset portfolio made up of onshore and offshore renewable energy and storage. While Equinor is not deliberately targeting and reducing its Scope 3 emissions, it strives to become carbon-neutral in its oil and gas operations by 2030. Equinor aims to reduce its reliance on oil and gas assets while developing a robust renewable business portfolio. Its most significant change came with its corporate rebranding in 2018 from Statoil to Equinor, to strongly signal to energy markets its departure from its core fossil fuels operations. As remarkable as both these decarbonization experiences are, they still represent isolated cases among NOCs worldwide.

¹⁴ Public-private partnerships are common practice in the energy sector, especially in the oil and gas industry, where most IOCs compete across borders and team up with NOCs, which seldom operate beyond their home countries.

¹⁵ As of 2020, OGCI had the following 12 members: eight IOCs (BP, Chevron, Eni, ExxonMobil, Occidental, Repsol, Shell and Total) and four NOCs (China's CNPC, Norway's Equinor, Brazil's Petrobras and Saudi Arabia's Saudi Aramco).

NOCs in the energy sector could follow many IOCs in diversifying their activities to encompass non-core operations in low-carbon technologies, such as clean energy generated from wind and solar technologies. The intrinsic technical complexity and high economic costs in the energy industry compel incumbent companies to pool resources, combine complementary capabilities and spread their risk to foster innovation, improve cost efficiency and increase profitability.

Under this rationale, national governments are expected to explore the transition of their NOCs more eagerly to decarbonize their portfolios for two main reasons: to fulfil more effectively their pledges before the international community about global emissions and to create sustained value, not only for their shareholders but also for society.¹⁶ By targeting a wider range of stakeholders beyond the company's own shareholders and investors, NOCs may provide increased prosperity and sustainability for a growing number of people, including workers, suppliers, customers and communities, in a mutable business environment that increasingly prices the development of energy assets with improved sustainability and merit in the fight against climate change.

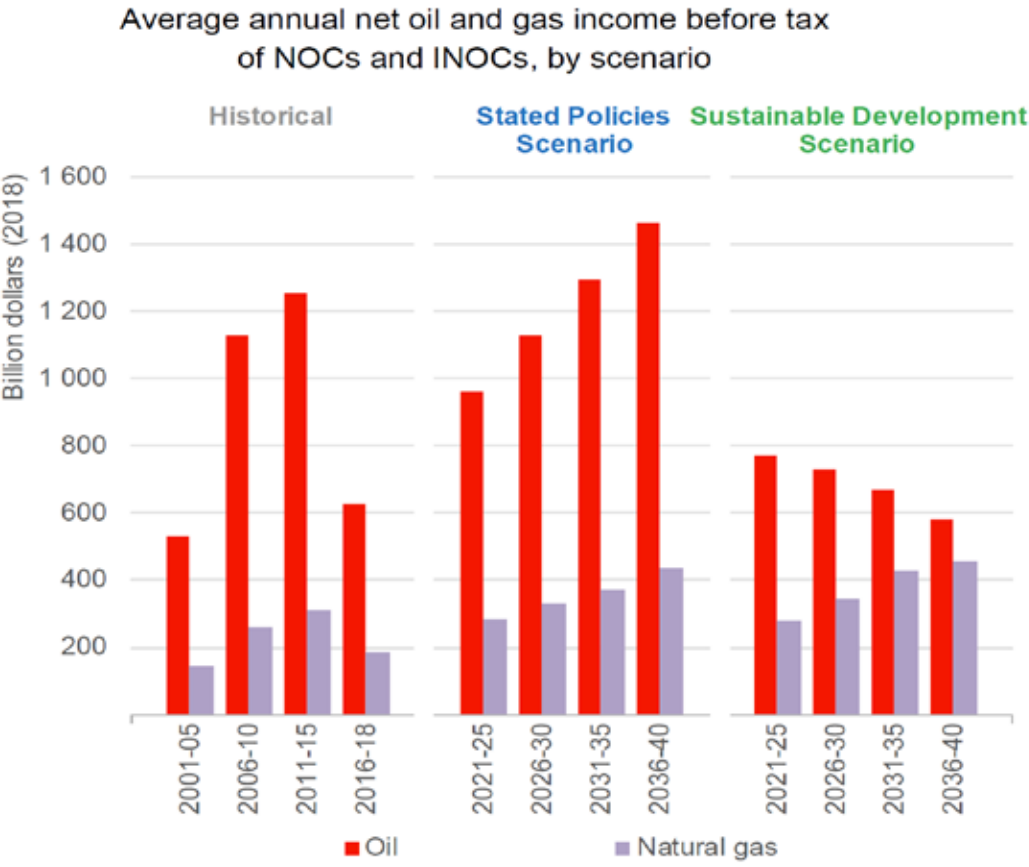
Driving the NOCs toward a low-carbon energy path would also help them avoid further fiscal and geopolitical risks. As Figure 6 shows, the revenues from NOCs are expected to drop considerably. Inaction from home countries in seizing upon these new market trends will only erode the competitiveness of these organizations.

In an international business environment poised to become more cognizant of the negative consequences of fossil fuel production and use, NOCs will certainly face more severe difficulties monetizing their natural resources in international energy markets. This will jeopardize their stability as critical sources of revenue for their economies. Furthermore, attracting capital for the development of carbon-intensive infrastructure might be more complex, as the use of oil-based fuels will be increasingly at a disadvantage over other energy options with lower or zero emissions, thus posing a much higher long-term risk of becoming stranded assets and liabilities (Goldman Sachs 2018; IEA 2020a).

¹⁶

This matches the redefinition of a corporation purpose put forward in the U.S. in August 2019, which moves away from an exclusive focus on shareholders (Business Roundtable 2019).

FIGURE 6: AVERAGE ANNUAL NET OIL AND GAS INCOME OF NOCS* BEFORE TAX, BY SCENARIO



*Data include those NOCs which operate in their home countries and those which do so internationally. Note: Scenarios refer to the International Energy Agency’s World Energy Outlook. Net income before tax: revenue minus finding and development costs and operating costs.

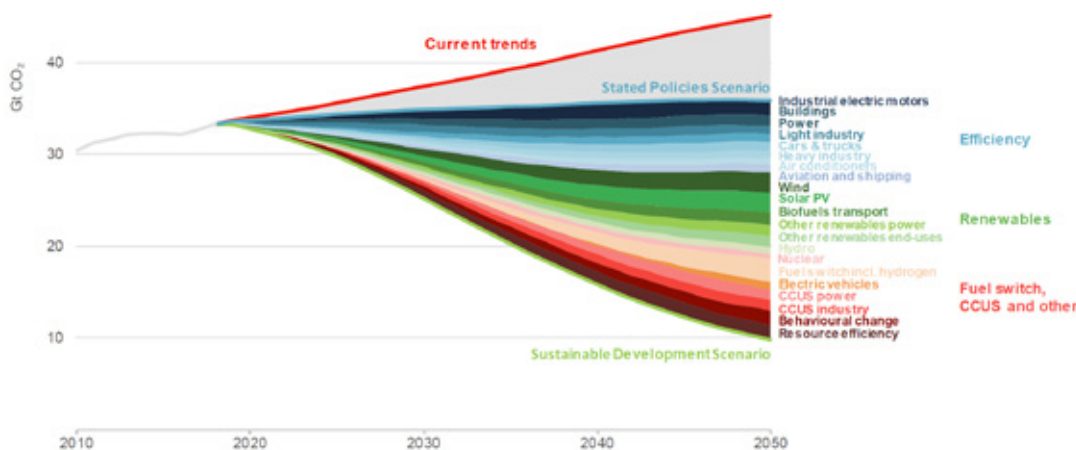
Source: IEA (2020a, 106)

The gradual shift toward the development of renewable resources and other new low-carbon energy products and services is also likely to impact the power and geopolitical relationships among energy producers and consumers, especially as physical dependency on the naturally asymmetrical endowments of fossil resources becomes less relevant (O’Sullivan, Overland and Sandalow 2017). First movers are likely to create new competitive advantages and economic opportunities under the challenges created by the array of stakeholders and relations in a renovated industry landscape.

3.2 GOING ONE STEP FURTHER, FROM NOCS TO NO-CARBON NOCS

Most NOCs have lagged the IOCs in setting more ambitious climate-driven paths, and yet their direction, performance and operations can be leveraged to help them transform the energy sector’s entire value chain. As Figure 7 shows, there is an ample range of approaches to decarbonize energy activities, which involve fuel switching, increased efficiency, widespread renewable energy use and carbon emissions capture.

FIGURE 7: ENERGY-RELATED CO₂ EMISSIONS AND CO₂ EMISSIONS REDUCTIONS BY MEASURE IN THE SDS



Note: SDS: World Energy Outlook’s Sustainable Development Scenario.

Source: IEA (2020a, 50)

Those national governments owning NOCs can benefit from the pivotal role these organizations play to develop more sustainable operations and to reduce their GHG emissions.¹⁷ Reminiscent of the aspirational goal of IOCs to transform into IECs, fostering the transition of NOCs into no-carbon NOCs, companies spanning the widest range of low- to zero-carbon energy activities would greatly accelerate the pace to a more sustainable energy future.

If fully engaged in energy transition and climate action programs, no-carbon NOCs bear a tremendous potential to facilitate the harmonization of policy goals that foster long-term sustainable development: provision of energy services with lower carbon intensity, mitigation of worsening environmental conditions and effective contribution to economic growth. NOCs can be given a clear mandate to develop specific assets with explicit deliverables by which they can measure their accountability and operational success. They may also underpin public policies by allowing the pool of resources (public and private, domestic and international, technological or operational) to increase their

¹⁷ According to the Natural Resource Governance Institute (2019), out of 61 countries owning NOCs in 2019, at least 25 of them were NOC-dependent, meaning that the revenues collected from their extractive activities made up more than 20 per cent of the government’s total revenues.

effectiveness and performance. For these reasons, the no-carbon NOCs have competitive advantages in supporting actions to achieve net-zero emissions goals in their countries.

The NOCs' ability to modify their investment criteria hinges on their institutional mandates. Although NOCs have increased their investments in renewables, either through direct investment or through mergers and acquisitions, they have also increased their investments in fossil fuel-based power plants (Prag, Röttgers and Scherrer 2018). As renewable-based energy integration will require expanded, modern transmission infrastructure, the impacts of the NOCs' actions could pave the way for global decarbonization while reviving economic activity after COVID-19.

To achieve these ambitious results, governments must co-ordinate their actions internationally, given that energy projects are not exclusively technical or economical endeavours. Rather, they are interrelated, multidimensional constructs that reflect political positions affecting the benefits of all stakeholders and their perceptions, and which call for appropriate governance mechanisms (Lozano-Maya 2016). Successfully implementing a climate change initiative involves effective international co-ordination and collaboration. Governments have already collaborated in successful international initiatives in the energy sector to share best practices and fight climate change. Twenty-five countries have been working since 2015 in Mission Innovation (2020) to double their clean energy research and development expenditures, from US\$15 billion to US\$30 billion over five years.

This proposal also creates the possibility of aligning the current programs and policies of no-carbon NOCs with their governments' contributions-compliant emissions trajectory. This would positively affect national climate goals and make a stronger case for co-ordinated action among countries owning no-carbon NOCs and those which are major consumers of their products. This co-ordination can align investment behaviours that facilitate financial resources oriented to climate action for those no-carbon NOCs' host governments.

A CALL FOR BOLDER CLIMATE ACTION IN THE G20

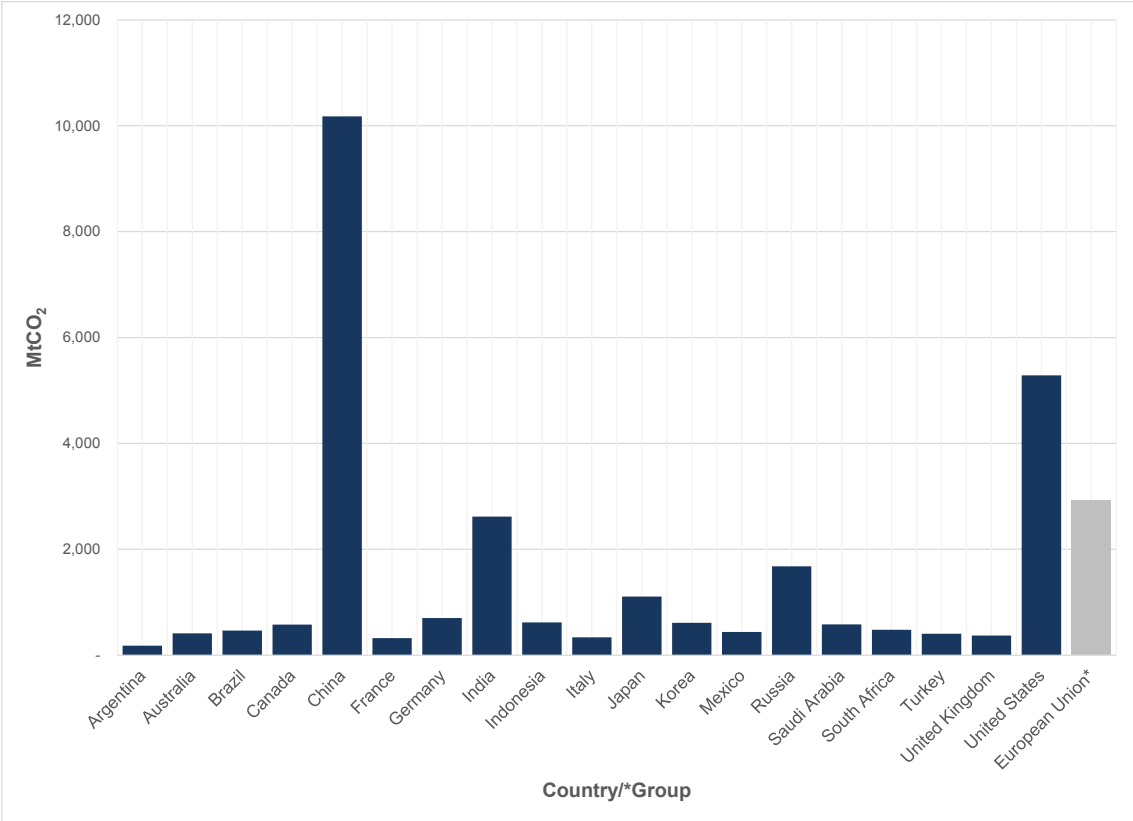
The G20 was created in 1999 by seven of the most developed economies to discuss international economic issues.¹⁸ Over the years, however, the G20 has expanded its membership to cover a wider geographical reach with a presence on every continent. The G20 is formed by 19 countries plus the European Union, which is represented by the European Commission.¹⁹ Due to its membership profiles, which combine the most developed and the largest economies worldwide, by the end of 2019 the G20 accounted for 62 per cent of the global population, 82 per cent of global GDP (World Bank 2020) and 75 per cent of global trade (G20 2020a).

¹⁸ The forum was born in response to the 1998 financial crisis and its global effects.

¹⁹ Member countries are Argentina, Australia, Brazil, Canada, China, France, Germany, Japan, India, Indonesia, Italy, Mexico, Russia, South Africa, Saudi Arabia, South Korea, Turkey, the United Kingdom, the United States and the European Union. Spain has also become a permanent guest. It is worth noting the simultaneous membership of several European countries along with the European Union.

This combination of remarkable economic and political weight grants the G20 a privileged status among other multilateral forums, as far as being regarded “the premier forum for international cooperation” (G20 Foundation 2017). While this status makes the forum particularly privileged to discuss major economic issues, it also influences other key topics and trends affecting the global policy agenda. For climate issues, the G20 represented over 77 per cent of the global volume of 36,441 MtCO₂ emitted in 2019; furthermore, due to the configuration and size of several of its member economies, as seen in Figure 8, the CO₂ emitted only by China, the United States and the European Union accounted for more than half of that global amount (Global Carbon Atlas 2020).

FIGURE 8: INDIVIDUAL CO₂ EMISSIONS IN THE G20 FORUM



Note: Data refer to individual countries with the exception of *the European Union, which is formed by 27 countries.

Source: Global Carbon Atlas (2020).

To capitalize on the G20’s relative weight on global emissions, its member countries could benefit from more effective energy sustainability policies. Both the Transition Readiness Index (WEF 2020) and the Trilemma Energy Index (WEC 2020) are influential composite scores that assess country-wide energy transition aptness. The scores are contingent on several elements, including the energy system’s performance and transition readiness, as well as energy affordability and universal access in contexts of reliable carbon-neutral supply that is progressively diversified. According to the data shown in Table 1, while most G20 members looked forward to strengthening a transition of their energy systems,

all but a few European countries still fell short in 2020 of becoming exemplary models of sustainability and decarbonization. This leaves the door open for better policies and co-ordinated action to increase their impacts.

TABLE 1: POSITIONS OF G20 MEMBER COUNTRIES IN ENERGY TRANSITION-RELATED INTERNATIONAL RANKINGS

#	Country	WEF Transition Readiness Index, 2020		WEC Energy Transition Index, 2020	
		Ranking*	Score	Ranking**	Score
1	Argentina	56	55.8	30	73.6
2	Australia	36	59.7	25	75.4
3	Brazil	47	57.9	28	74.9
4	Canada	28	61.7	6	81.5
5	China	78	50.9	55	67.0
6	France	8	68.7	5	81.7
7	Germany	20	63.9	7	80.9
8	India	74	51.5	86	56.2
9	Indonesia	70	52.4	56	66.8
10	Italy	26	62.0	11	78.9
11	Japan	22	63.2	24	75.7
12	Korea	48	57.7	31	73.4
13	Mexico	50	56.5	45	69.6
14	Russia	80	50.5	29	73.8
15	Saudi Arabia	86	48.7	55	67.0
16	South Africa	106	42.7	74	62.1
17	Turkey	67	53.1	58	66.6
18	United Kingdom	7	69.9	5	81.7
19	United States	32	60.7	9	79.8
20	European Union	NA	NA	NA	NA

Notes: WEF: World Economic Forum; WEC: World Energy Council. NA: Not available. * Out of 115 countries. ** Out of 108 countries.

Source: World Economic Forum (2020) and World Energy Council (2020).

4.1 THE G20'S STRATEGIC ALIGNMENT WITH ENERGY SUSTAINABILITY AND ENGAGEMENT OF NOCS

Unlike other international forums, the G20 lacks a permanent secretariat. Instead, its management and agenda are carried out by rotating presidencies, whereby the predecessor and successor countries work with the current presidency to ensure continuity in the forum's work.

From December 2019 to November 2020, Saudi Arabia held the G20 presidency and published its Vision 2030, a strategic planning document that contained a set of long-term goals and expectations for the country's own economic and social configuration but that resonated as well across the G20. The long-term plan offered two features related to shaping a more sustainable energy future. First, despite having some of the largest crude oil reserves in the world,²⁰ the country aims to reduce its dependence on that energy source, while investing heavily in the development of solar-based and wind-based renewable energy. It aims to become an industry champion capitalizing on the

²⁰ According to BP (2020b), by 2020 Venezuela held the largest crude oil reserves in the world, which amounted to 303.8 billion barrels, although Saudi Arabia remained slightly behind, with a volume of 297.6 billion barrels.

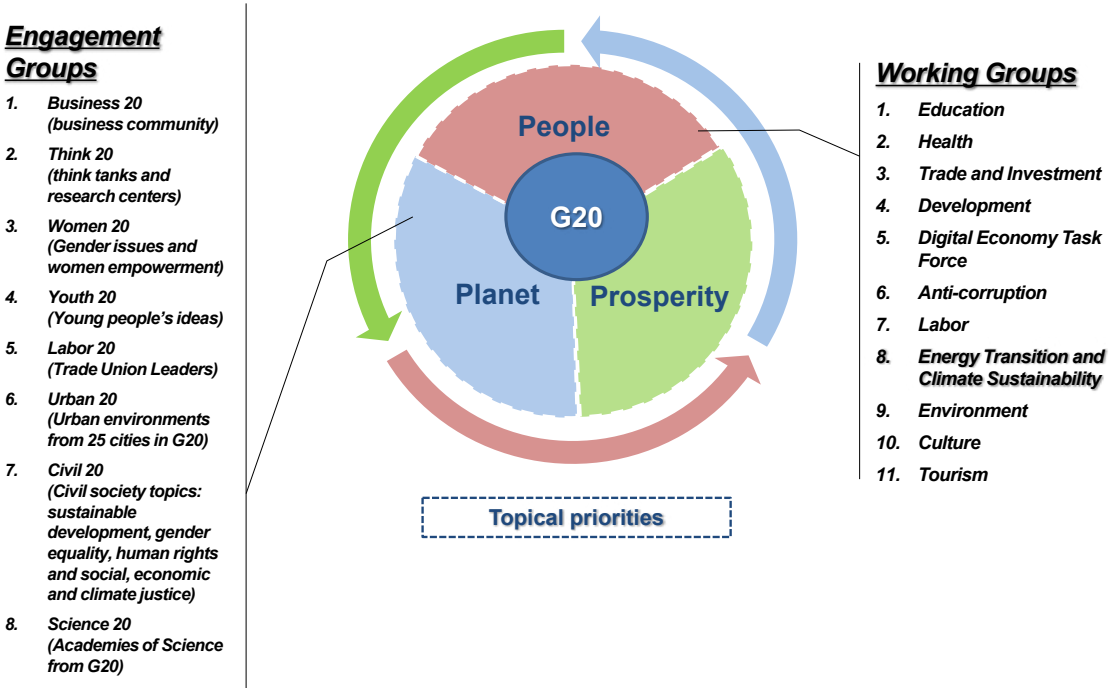
energy knowledge from its legacy oil and energy industries. Second, while Saudi Arabia's NOC, Saudi Aramco, was one of the top-producing companies of crude oil in the world in 2020 and the best valued in financial terms,²¹ Vision 2030 anticipates the company's transition from a NOC into a global industrial conglomerate, suggestive of the no-carbon NOC concept, in order to support a more diversified economy that will become less reliant on crude oil production and fiscal revenues (Kingdom of Saudi Arabia 2020). This clearly signals a paradigm shift that interweaves energy, climate change and economic considerations.

In December 2020, Italy took up the G20 presidency until November 2021. Italy's G20 presidency has underscored that multilateralism is fundamental to addressing critical global issues, and the G20 must step in to use its powerful influence to fill that role. These critical issues are further defined in the form of three priorities. The first one, "People," refers to shaping a better social, sanitary and economic future after the COVID-19 pandemic. The second one, "Planet," seeks to ensure the sustainable use of our natural resources, achieving the United Nations' SDG and promoting a widespread renewable energy transition. The last priority, "Prosperity," aims to build up resiliency to foster a more prosperous and inclusive global economy; to do so, it seeks to leverage digitalization and technology, which includes the deployment of more efficient energy distribution networks and grids (G20 2020b).

The G20's current governance structure, which is shown in Figure 9, includes 11 working groups that span diverse topics, two of which particularly address energy transition and climate sustainability, as well as the environment (G20 2020c). To strengthen its decision-making process and the understanding of the different issues spread across its priorities and working groups, the G20 has reached out to a diversity of stakeholders through several engagement activities.

²¹ Information based on Platts' "Top 250 Global Energy Company Rankings" (2020), which are calculated from a set of financial variables that include asset worth, revenues, profits and return on invested capital.

FIGURE 9: GOVERNANCE STRUCTURE OF THE G20, 2020*



Note: Applicable to the G20 presidency under Italy, effective from December 2020.

Source: Authors', based on G20 (2020b, 2020c).

Engagement with these stakeholders takes place in regular meetings, which are independent from the work of member governments, but which provide recommendations and critical input to the forum's work. These outreach activities provide more legitimacy to the forum's work and amplify its power and influence in the international policy agenda, to voice collective concerns and find more effective solutions.

For all these reasons, the G20 is the most appropriate and conducive multilateral forum to undertake this initiative and promote the transition of their NOCs to no-carbon NOCs. Considering that G20 member countries agreed to phase out fossil fuel subsidies beginning in 2009, and as the need to act on climate change builds, they may want to support a common decarbonization path by getting their NOCs to use their shareholders' influence to accelerate the low-carbon transition while retaining public service obligations and financial return requirements. Therefore, G20 member governments with an urgent need to act on reducing emissions have a substantial opportunity to work together based on the policy recommendations offered in the next section.

5. POLICY RECOMMENDATIONS

In addition to the energy sector's dynamics, there are market levers that would enhance the competitiveness of no-carbon NOCs. Today, consumer preference tilts towards sustainability. Whether it is a product or a service, consumers are pushing for more organic food, alternative means of transport and clean power generation. The faster the NOCs move towards sustainability, the more competitive they will become, leading the way to a low-carbon future.

Services are also switching to accommodate these new preferences. Financial services are moving away from fossil fuel investments towards renewables. Large banks, investment firms, mutual funds and insurance companies are acting to reduce or even eliminate their exposure to fossil fuel investments. Blackrock, one of the largest investment firms worldwide, announced earlier this year that it will pull back from investments in coal. Thus, the cost of finance in the long run will have a positive effect on profitability for companies and industries that speed up their decisions to adapt to the new normal. In 2018, a survey by the Bank of America Merrill Lynch found that firms with a better record than their peers on environmental, social and governance issues produced higher three-year returns, were more likely to become high-quality stocks, were less likely to have large price declines and were also less likely to go bankrupt (Eccles and Klimenko 2019). NOCs can also take advantage of their access to capital and even complement and expand their sources of funding to galvanize the transition with a more competitive balance sheet, a larger portfolio of investors and a much better risk profile diversifying their focus and entering or creating new markets. For example, NOCs have developed a thorough skill in building and managing complex projects over the years; they could re-channel their efforts to incursion into offshore wind or ocean energy.

Governments can lead and accelerate the pace towards the energy transition by creating a no-carbon NOC fund, reorienting NOCs towards sustainability and supporting an international platform of co-operation for NOCs, in accordance with the actions proposed below.

- 1. Create a No-Carbon NOC Fund (“No-C NOC Fund”).** The OECD and the G20 put forward a landmark international collaboration initiative to end tax avoidance and announced an agreement to set a 15 per cent global minimum corporate income tax rate, which is expected to generate around US\$150 billion yearly. Although the rules are yet to be determined, one possible alternative for allocating part of these resources could be speeding up the energy transition process and ensuring that no one is left behind. With the help of the Climate Investment Fund, the G20 can create a no-carbon NOC fund, which would provide “financing for advanced and clean technologies, including CCUS/Carbon Recycling and other related technologies to abate their emissions”; and “support to provide retraining and social protection for NOC workers, thus facilitating a just and inclusive transition” (G20 2021).
- 2. Reorienting NOCs towards Sustainability.** G20 member countries can strengthen their NOCs' mandates by incorporating sustainability to drive their mission and their *raison d'être*, which can result in many benefits to their stakeholders

(Beltrán 2020). The new mandate would be consistent with national and international obligations on climate action and would certainly send a strong signal of the government's commitment to tackle climate change. This tilt towards sustainability would improve NOCs' competitiveness by aligning their mission with the new low-carbon development architecture, and by granting them access to climate finance, clean energy technology and carbon-planning tools. It will be easier for the public to hold their governments accountable, assess the value of taking climate action, and eventually, enjoy the social revenue of a low-carbon future.

- 3. Establish NOCs4Climate, an International Platform of Co-operation for Climate Action.** Governments can create an international platform within the G20 framework to share NOCs' best practices and lessons learned in their sustainability efforts, foster international co-operation on projects of common interest and facilitate technological co-operation and innovation. NOCs4Climate would bring several benefits to stakeholders. The platform would allow NOCs to access new business models and technology to improve their competitiveness and to leverage their joint market power in projects to speed up climate action across the energy sector and industry. It would help governments multiply their actions by collaborating with similar companies, and pool resources to be much more cost efficient; it would grant them access to a wealth of knowledge and experience to inform and redesign policies. It would provide the public with a framework to assess the NOCs' individual performances, and to learn and request revisions based on benchmark information. NOCs would thus drive the energy transition and help their shareholders and the planet.

While several G20 member economies do not have NOCs, the combination of some of the largest producers and consumers of oil-based products in the world in this premier group and the alignment of their incentives can jumpstart a profound change that facilitates agreements in the production and demand of oil products with rippling effects for global CO₂ emissions. By leading a sweeping effort away from the production and demand of conventional oil-based fuels in favour of options with much lower or zero-carbon content, the G20's strong political, economic and energy forces can set a landmark example that will certainly influence other economies to set in motion like-minded actions and critical climate responses.

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Mr. Beltran had a distinguished 13-year career in public service in the government of Mexico, including as the longest serving Deputy Secretary of Energy (2012-2018). In this capacity, he led the Ministry's coordination of Mexico's National Energy Strategy, policy document that served as the foundation for the energy reform of 2013. He was also on the Board of Directors of Petróleos Mexicanos (Pemex), Mexico's national oil company and the world's 10th largest oil producer and was alternate Chairman of the Board of Directors of Comisión Federal de Electricidad (CFE), Mexico's national power utility and a Global 500 company. Mr. Beltran also chaired the boards of the national laboratories of the energy sector (Mexican Petroleum Institute; National Institute of Electricity and Clean Energies; National Nuclear Research Institute), and presided the board of a billion usd R&D trust funds that created the Mexican Centers for Innovation on Energy (biofuels, CCS, geothermal, ocean, solar, and wind), the largest clean energy technology innovation networks in Latin America, and invested in the biggest talent development effort in the energy sector in the country.

Before serving as Deputy Secretary of Energy, Mr. Beltran held other leadership positions in the Ministry of Energy, including Director-General for Information and Energy Studies and Director for International Negotiations.

Mr. Beltran is currently also a member of the Advisory Board of the Just Transition Initiative (partnership between the Climate Investment Funds and the Center for Strategic and International Studies); a member of the Board of Fundación Por México (NGO focused on providing educational services to underserved communities); a member of the IPS International Association (global news agency); a member of the expert's network and the Global Futures Council of the World Economic Forum; and a mentor of the Global Women's Network for the Energy Transition. He is also consulting the Inter-American Development Bank, the Latin American Energy Organization, and the World Bank on issues surrounding the energy transition.

Mr. Beltran is a leading expert in the energy transition, he has been named several times as one of the most influential leaders in the energy sector in Mexico and personality of the year in renewable energy (including in 2018).

He holds a Master's in Public Administration in International Development from Harvard Kennedy School and a Bachelor of Science in Economics from Instituto Tecnológico Autónomo de México (ITAM).

Juan Roberto Lozano-Maya is a Senior Specialist in the design and implementation of energy cooperative projects and public policies. At Mexico's Electricity Independent System and

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