OLIVER WYMAN

SUCCESS FOR IOCS IN A LOW-CARBON WORLD

The path to decarbonization

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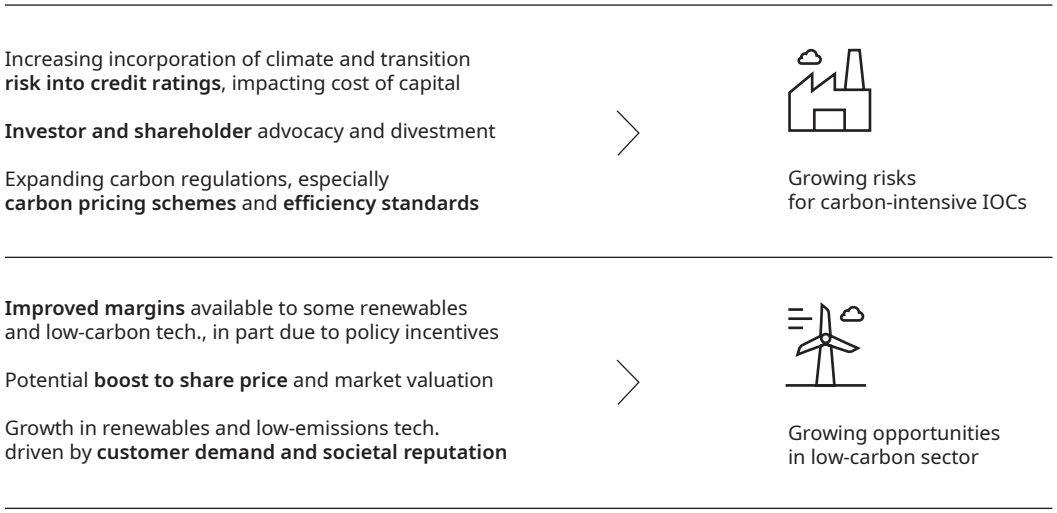
As businesses across industries continue to decarbonize, integrated oil and gas companies — commonly known as International Oil Companies, or IOCs — are under increased pressure to reduce the carbon intensity of their operations and products and face pivotal decisions on how to redefine their businesses in the coming years. Decarbonizing sooner will reduce the risk of value erosion for IOCs, and if thoughtful, can position them better than their peers to thrive in the new low-carbon normal. The double-shock of declining demand driven by COVID-19 and tumbling oil prices presents IOCs with a unique opportunity to decarbonize during a time of low opportunity cost in transitioning. With that said, they will need to act quickly to get ahead.

Exhibit 1. Risks And Opportunities Driving Decarbonization For IOCs



Source: Oliver Wyman analysis

INCREASED RISK FOR CARBON-INTENSIVE IOCS

As the financial sector increasingly incorporates climate and transition risks into credit assessments, the cost of capital for high-emission companies is impacted. A study by CDP found that companies not prioritizing decarbonization receive higher coupon rates, especially on medium- and long-term bonds.

Large investors and asset managers now include environmental, social, and governance considerations in their decisions to invest. Some banks and insurers have divested or excluded certain types of oil production in areas such as the Arctic and Alberta, Canada. With Moody's designating over 700 billion US dollars in IOC debt at high risk from carbon regulations in 2018, financial pressure has empowered shareholder advocacy groups to introduce resolutions that push IOCs to decarbonize. Similarly, regulations restricting or taxing continued emissions are becoming more common worldwide.

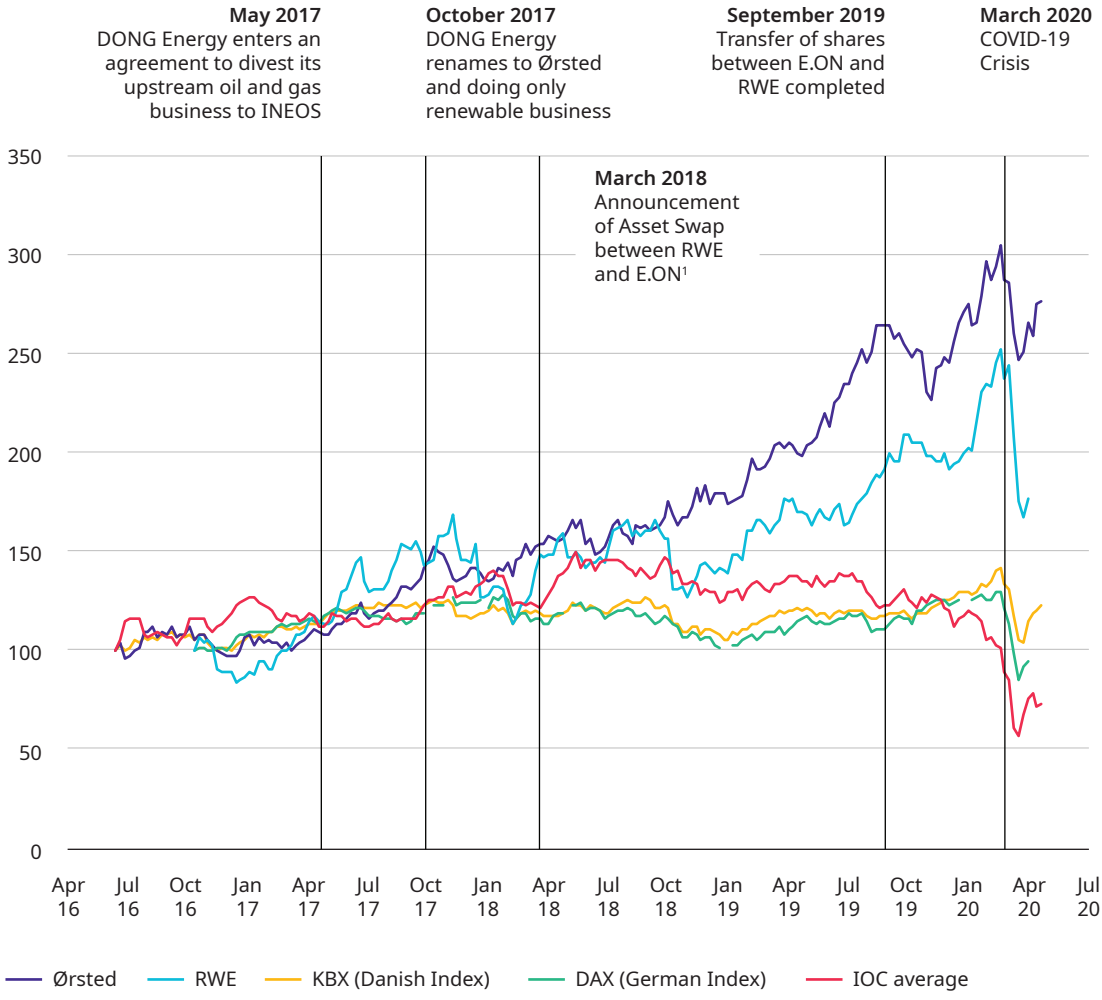
While investors previously tolerated higher economic risk in fossil hydrocarbons given their higher returns, they are less likely to accept higher risk now that returns have approached those of renewable power. IOCs can also demonstrate a lower opportunity cost to invest in low-carbon renewables now while oil prices are low.

THE LOW-CARBON SECTOR IS LOOKING UP

While economic and reputational risks facing carbon-intensive industries have increased, policy incentives and improved margins for some low-carbon products present opportunities for low-carbon companies. RWE and Ørsted demonstrate that markets tend to reward decarbonization with higher share prices, having substantially outperformed their markets after moving toward becoming renewable energy companies. Between 2018 and 2020, RWE shares increased by one-third after acquiring renewable energy assets from German utility E.ON, and Ørsted's market capitalization went up nearly 70 percent after becoming a renewables-only company in late 2017.

Exhibit 2. RWE And Ørsted Share Price Evolution (Rebased To 100)

In Euros, rebased to 100
2016-2020



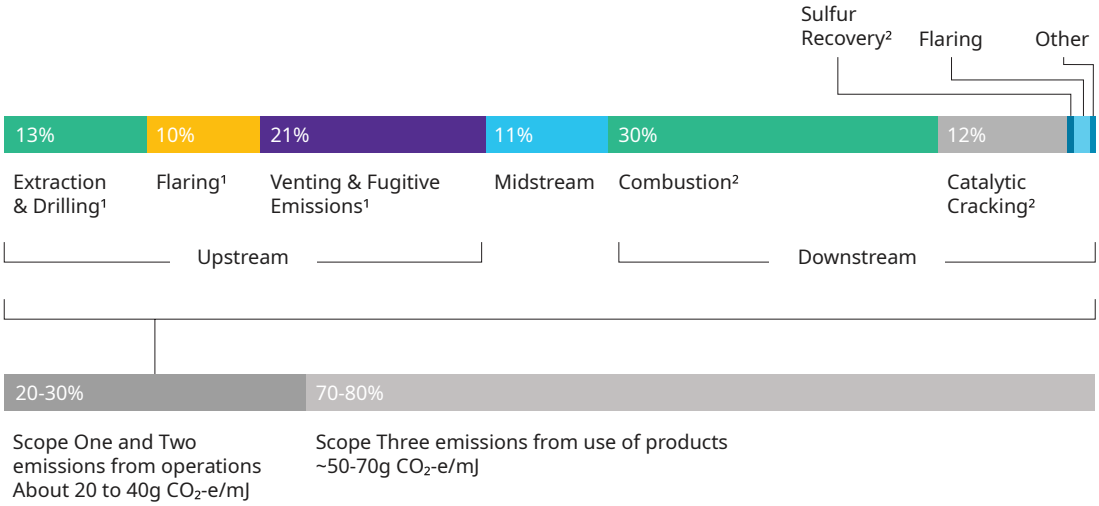
Source: Datastream, Oliver Wyman analysis

At the same time, customers and society reward decarbonization efforts. Young professionals increasingly seek out employers with strong environmental agendas, while consumers tend to show a higher willingness to pay for cleaner energy products. In addition, corporations and governments have set ambitious sustainability and renewable energy targets, offering potential benefits to IOCs that seek to achieve such targets.

THE OIL AND GAS VALUE CHAIN IS PARTICULARLY CARBON INTENSIVE

Given the carbon intensity of its operations and products, the oil and gas sector has a particularly important role to play as society decarbonizes. In total, consumption of oil and gas across industries accounts for over 55 percent of global annual emissions, and these emissions exist across the value chain of each megajoule produced and consumed (see Exhibit 3 for the breakdown).

Exhibit 3. Oil And Gas Value Chain Emissions



1. Emissions from extraction could increase as much as 17 to 40 percent for heavier oils. The risk of emissions from flaring, venting and fugitive emissions can decrease as much as six percent with heavy oils.

2. Emissions from combustion, cracking and sulfur recovery can increase 17 to 40 percent if the oil is heavier.

Note: Unit is a percent of total g CO_2-e/MJ, derived from average carbon intensity across the industry. The 20 to 30 percent of emissions from oil and gas company operations breaks down across upstream, midstream, and downstream, as shown in the bottom half of the chart.

Source: Oliver Wyman analysis, Profiling Emissions in the Supply Chain (Carnegie Endowment Oil-Climate Index), Global Carbon Intensity of Crude Oil Production (Science Vol 361, 2018), Petroleum Refineries Sector (EPA, 2013 GHGRP Industrial Profiles

Nearly 20 percent of emissions, called Scope One and Two, stem from the production, transport, and refining processes themselves, with the rest falling into Scope Three, from final combustion and the carbon content in oil and gas products. For IOCs, the proportion of emissions stemming from the end-user is often higher, given that they do not handle the same volume of oil at each operational stage. Many IOCs report that their own Scope One and Two emissions comprise just five to 15 percent of what they report. IOCs should actively work to decarbonize across the value chain to buffer their business models against transition risk and to capture more of the low-carbon opportunity.

PATHWAYS FOR IOC DECARBONIZATION

The Oliver Wyman Decarbonization Maturity Framework presents a pathway for IOCs to decarbonize. It encompasses four key stages of maturity: Small Steps, Shifting Gears, Low-Carbon Champion, and Carbon Neutrality. An IOC can use the framework as a guide to determine which actions to take, what results to expect at each stage, and what will be involved in transitioning to its end goal. In general, decarbonization in early stages focuses more strongly on the first two action categories in Exhibit 5, while later stages require larger shifts in an IOC's portfolio and business model.

Exhibit 4. Stages In The Oliver Wyman Decarbonization Maturity Framework

	Small steps	Shifting gears	Low-carbon champion	Carbon neutrality
Description	• Small operational and process improvements • Evaluation of emissions and goals to reduce	• Modification of operations to cut carbon • Partial portfolio shift towards non hydrocarbon products • Beginning to integrate decarbonization into portfolio decision-making and investment • Some divestment from high-carbon assets	• New technologies and processes to cut carbon • Decarbonization fully integrated into financial and portfolio decisions • Strong investment into low-carbon innovation and R&D	• Near zero emissions from operations • Vast majority of investment toward carbon mitigation and low-carbon • Focus shifts externally to facilitate societal decarbonization
	Severity of the actions and weight on overall portfolio →			

Exhibit 5. The Framework Includes Decarbonization Actions Across Four Categories

Categories of actions	In-scope	
 **Vision and policies**	• Company targets and reporting • Internal policies, structures, and financials • Company decision-making and metrics considered	• Programs for employee engagement and compensation • Programs on external engagement and advocacy
 **Operations and processes**	• Upstream production and operations • Field development logistics • Power generation for captive consumption	• Downstream refining and chemicals production • Transport of products and fuels • Other manufacturing/process business activity
 **Asset and product portfolio**	• Shifting to lower CI hydrocarbon reservoirs • Shifting refinery capacity and output to new products	• Power generation intended for resale to customers • Expanding low-carbon energy offerings at retail stations
 **New business models**	• All businesses not related to the production of energy and distribution via standard channels • Offering carbon mitigation and offset products	• Venture capital outside of the traditional O&G value chain; non-traditional acquisitions • Subscription energy services

The results of decarbonization actions are measured by the indicators in Exhibit 6, summarized by the average physical carbon intensity (CI), measured in grams of CO_2-equivalent per megajoule produced, of the IOC's energy products.

Exhibit 6. How Much IOCs Are Achieving By Decarbonization Actions

Stages of decarbonization					
Operations and processes	**Upstream and midstream carbon intensity[1]**	7-10 g CO_2e/MJ	4-7 g CO_2e/MJ	2-4 g CO_2e/MJ	< 2 g CO_2e/MJ
	Upstream methane intensity	<0.5%	<0.35%	<0.2%	~0%
	Upstream flaring intensity[2]		<0.10	<0.05	~0.00
	Electrification (% of processes electrified)	<25%	25-50%	50-75%	75-100% of processes electrified with renewables
Asset, product portfolio	**Investment in low-carbon or carbon mitigation**	5-15% of total capex	15-35% of total capex	35-60% of total capex	>60% of total capex
Summary	**Physical carbon intensity (all emission scopes and all energy products)**	>60 g CO_2e/MJ	40-60 g CO_2e/MJ	10-40 g CO_2e/MJ	<10 g CO_2e/MJ

1. Upstream and midstream carbon intensity range per MJ refers to estimate of well-to-refinery GHG emissions, including exploration, drilling and development, production and extraction, surface processing, and transport to the refinery

2. Flaring intensity derived as flared gas (Mcf/d) divided by oil produced (bbl/d) – world average was ~0.14 in 2018 according to Energy In Depth

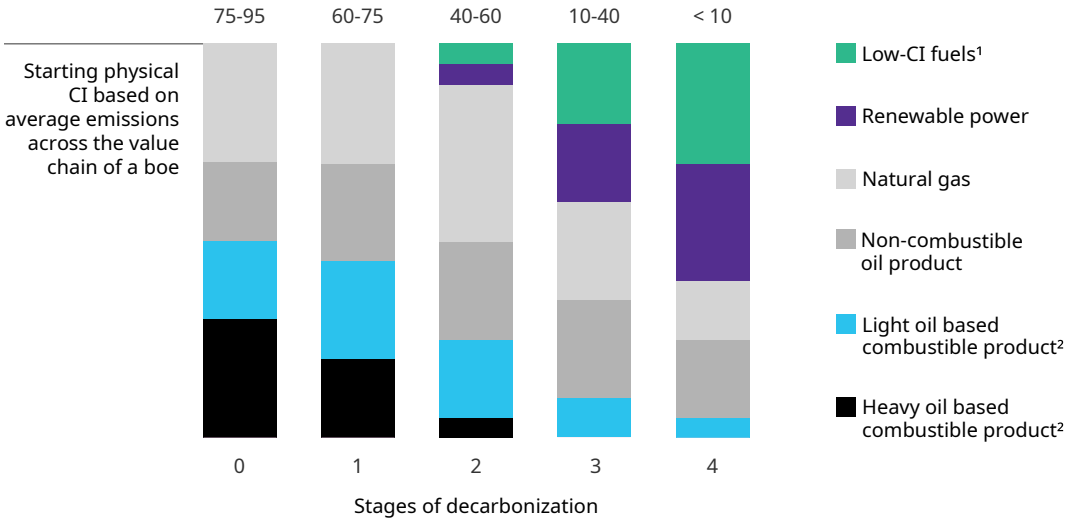
Source: Oliver Wyman analysis

The framework is not intended to be prescriptive or entirely linear, as some IOCs may be more mature in one category than in another. Stages Three and Four are ambitious by design — their associated results are industry cutting-edge, presenting a radical shift for IOCs towards low- or no-carbon ways of operating and generating returns, and culminating in a near-zero physical carbon intensity through investment in lower-CI products and divestment from higher-CI products.

JOURNEY OF AN IOC ACROSS THE DECARBONIZATION MATURITY STAGES

From status quo to Stages Three and Four, an IOC must actively transform its portfolio. The end target is a much higher share of low-carbon energy products and services, and IOCs can arrive at the target in a variety of ways. In the sample path (Exhibit 7), the IOC takes a relatively linear path for simplicity: first, away from heavy oils to natural gas and petrochemicals, which have much lower Scope 3 emissions from consumption than do combustible oil-based fuels, and then on to low-carbon intensity energies — which include biofuels, low-carbon hydrogen, electric vehicle charging infrastructure, and renewable power sources.

Exhibit 7. Product And Asset Portfolio Sample Changes Across Stages

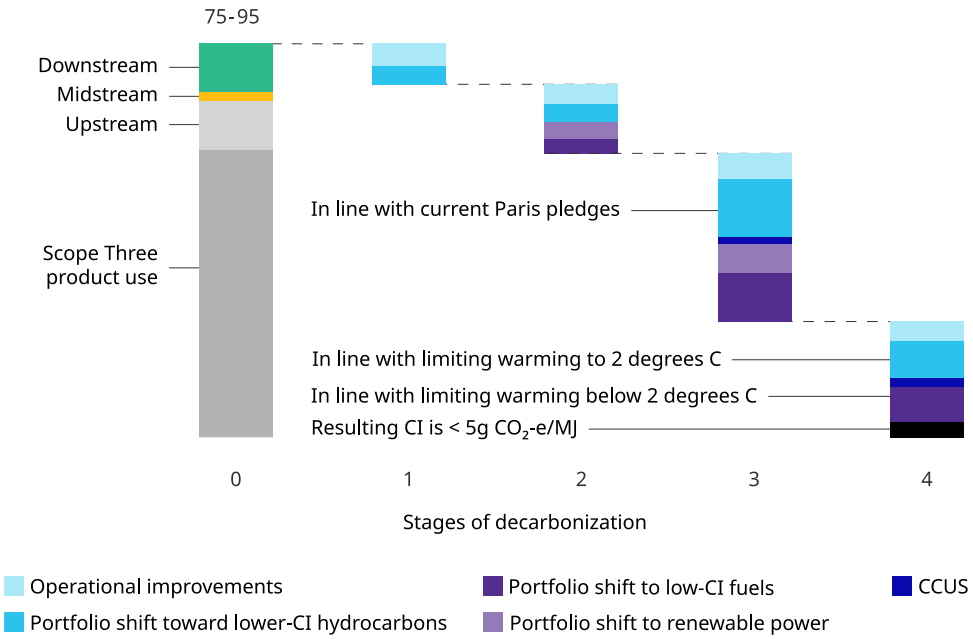


1. Includes low-carbon intensive biofuels, green or blue hydrogen, and electric vehicle charging, among others
2. American Petroleum Institute gravity is less than 35 for Heavy and more than 35 for Light in this example

Source: Oliver Wyman analysis

While transitioning through stages, the remaining fossil hydrocarbon activity can become less carbon-intensive through investments in operational and process emissions mitigation. In later stages, an IOC may invest in carbon capture, utilization, and storage (CCUS) for some of its downstream operations. The result of these combined efforts is a physical carbon intensity of near-zero, below the carbon intensity estimated to be needed for a below two-degree Celsius warming scenario (see Exhibit 8 for the step-wise reduction in carbon intensity). This indicates that the IOC has decarbonized as much as it can without outright divesting from hydrocarbon assets or investing in Direct Air Carbon Capture, the technology for which remains quite nascent.

Exhibit 8. Sample Decreases In Physical Carbon Intensity



Source: Oliver Wyman analysis

Some IOCs may decide to keep the credits they generate for emissions avoided by their renewable power and low-carbon intensive fuel investments, potentially forgoing revenue in jurisdictions where such credits have value. Likewise, some may invest in carbon offsets through activities like tree planting, ensuring that the offsets are credible, verified, and additional — because not all are. Incorporating renewable credits and carbon offsets may allow an IOC to claim an accounting carbon intensity that is neutral, or potentially even negative as soon as Stage Three. IOCs that have shared details about how they intend to reach their decarbonization goals all rely on offsetting to some extent.

In order to reach Stage Four, an IOC must substantially shift away from combustible oil products to low-carbon intensive fuels and power to reach a physical carbon intensity near zero without relying on external offsets. At Stage Four, the portfolio should be primarily low- or no-carbon, and any remaining fossil operations must be comparable to the best-in-class examples today. Even then, an IOC may have absolute carbon emissions that it intends to offset or continue making efforts to mitigate.

LEVERS TO DECARBONIZE AN IOC

The path to Stages Three and Four of decarbonization is challenging and involves substantial investment in a combination of operational improvements — including CCUS, renewable power, low-carbon intensive fuels, and sometimes even in external carbon offsets, such as tree planting or other natural carbon sinks.

In the example previously outlined, required investments in CCUS and carbon offsets depend on the volume of an IOC's Scope One and Two emissions. While more affordable than renewable investments, both types of investments face challenges. CCUS does not yet exist at scale. Nature-based carbon offsets do not impact an IOC's physical carbon intensity, and the amount of land required is substantial. A company with Scope One and Two emissions of about 70 million metric tons per year would need to plant trees on land the size of Belgium just to cover its operational emissions.

Exhibit 9. Sample Investments In CCUS and Offsets Based On A Large IOC

	Assumed % of operational (Scope 1 & 2) emissions mitigated	**Required volume**	**Upfront investment**	**Effective investment per ton CO_2-e mitigated**	**Benchmarks for scale**
CCUS[1]	20%	~14 Mt CO_2-e	~$1.2 BN	$87	Total CCUS capacity worldwide currently: **~40 MT**
Trees[2]	10%	~7 Mt CO_2-e (~600MM trees on ~850K acres)	~$180 MN	$25	Acreage of Belgium: **7.6 MN**

Note: All figures are annual. Investments assume an IOC with 70 MT CO2-E Scope One and Two emissions annually, following the path to decarbonization in Exhibits 7 and 8.

1. Assumes cost of $87 / tCO_2, as described by "The Cost of CO_2 Capture and Storage," Sept. 2015

2. Assumes a tree absorbs ~11.8 kg CO_2 per year; ~700 can be planted in an acre; $0.30 per tree

Sources: The Guardian, Arbor Foundation, Global CCS Institute 2017, Oliver Wyman Analysis

Unlike CCUS and tree planting, investments in renewable power and low-carbon intensity fuels shift an IOC's product mix. The investments are larger, but these technologies provide a return often boosted by policy incentives, enhance reputation and customer demand, and shift the IOC's physical carbon intensity. Investment in these technologies must align with divestment from combustible hydrocarbon assets. The more an IOC divests from combustible hydrocarbons, the lower its required investment in low-carbon energy to meet carbon intensity targets becomes. Otherwise, the required low-carbon energy capacity for multiple IOCs to meet their carbon intensity targets is staggering, and could saturate some markets.

Even with enough demand for these new technologies, smart divestment decisions can facilitate the capital flexibility needed to expand at-scale into low-carbon energy. As a company designs its decarbonization path, it must consider the trade-offs between divesting from high-carbon assets and investing in low-carbon or carbon sequestration assets. Ambitious decarbonization will require both. It will also require moving customers away from carbon-intensive products — for example, perhaps by subsidizing the trade-in of combustion vehicles in exchange for electricity purchase contracts instead of only installing electric vehicle charging infrastructure.

THE RISKS AND OPPORTUNITIES MOTIVATING DECARBONIZATION WILL LIKELY ACCELERATE

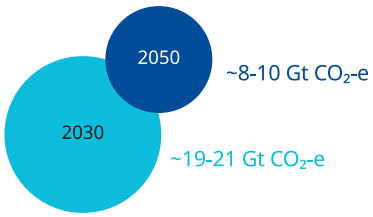
The following chart outlines two scenarios for how macroeconomic and geopolitical factors could impact the value at stake for IOCs.

In Scenario One, most favorable for the current IOC business model, the pace of growing risks for carbon intensive businesses does not accelerate substantially, and low-carbon business incentives slow. Simultaneously, the price of oil recovers most of its value as economies recuperate from COVID-19 lockdown measures.

In Scenario Two, the pace of external pressure accelerates rapidly over the coming years, and oil prices remain severely depressed. The result is a more rapid decrease in worldwide oil and gas emissions. Likewise, the potential for IOC value destruction is more severe in this scenario, as is the potential for value creation for companies that invest sooner in low-carbon intensive energies.

Exhibit 10. Scenarios And Explanations

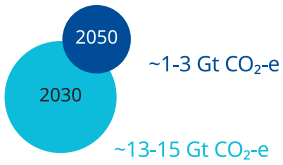
Scenario 1:
Slow societal decarbonization
Annual global emission footprint
from O&G production and consumption



Decreasing oil price

- Growing opportunities in the low-carbon sector
- Growing risks for carbon-intensive IOCs

Scenario 2:
Rapid societal decarbonization
Annual global emission footprint
from O&G production and consumption



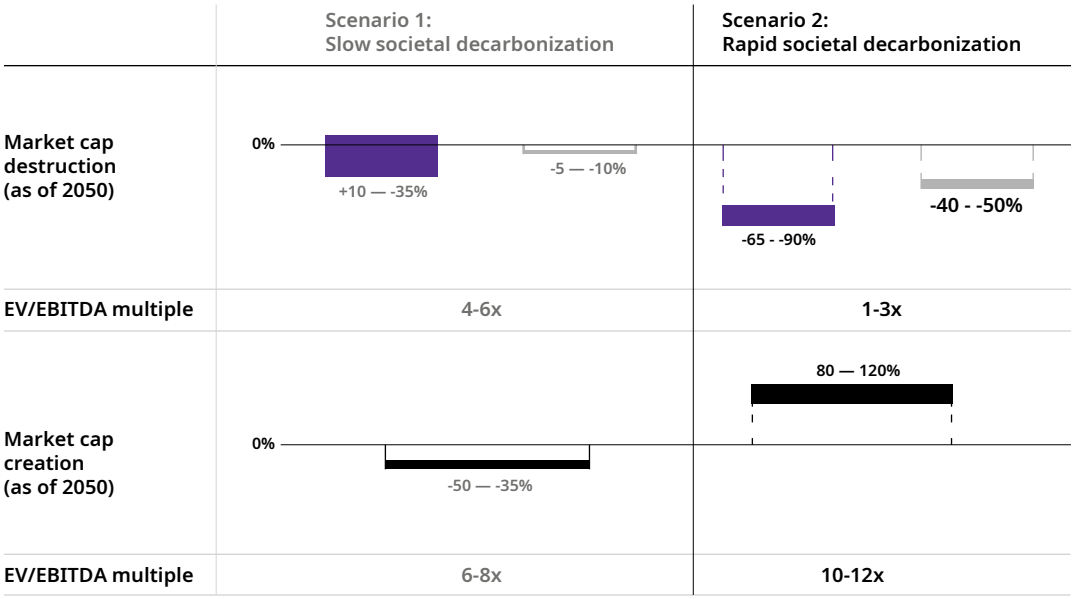
Increasing imperative for IOCs to decarbonize rapidly > An outcome further to the right appears more likely

	Scenario 1:	Scenario 2:
Oil price and macroeconomics	• Oil price recovers most value as production is lost from key markets, such as US shale • Main customers and utility demand recover, and major economies outside of Europe focus on economic recovery above all else	• Slow recovery of oil price • COVID-19 advances date of peak O&G demand • Renewables prove reliable at high penetration • Travel and commuting patterns remain permanently changed toward lower energy intensity
Opportunities in the low-carbon sector	• Low-carbon returns remain dependent on state incentives, which decrease as demand for the incentives increases rapidly • Minor expansion of regulatory ambition on carbon	• Low-carbon returns become less reliant on state incentives as markets grow and technologies improve • Still, COVID recovery strengthens incentives for low-carbon investments
Risks for carbon-intensive IOCs	• Few strong carbon requirements in recovery funds • Investors continue to fund most oil and gas reservoirs, limiting restrictions to reputational wins (Arctic, tar sands, etc.)	• COVID recovery funds require carbon mitigation • Climate impacts become more severe in coming years, prompting strong new government actions such as expanded carbon prices[1] • Investors and asset managers expand coal/tar sands restrictions to other O&G reservoirs

1. Principles for Responsible Investing from the UN describes an "Inevitable Policy Response" (IPR) to climate change in the mid-2020s, which predicts a devaluation of carbon-intensive assets of 3.1% and the fossil fuel industry being hit hardest.

To demonstrate both cases, it is essential to look at value-at-stake (Exhibit 11). For value destruction, we looked at loss in EBITDA based on decrease in oil demand, aligning the multiple with strong and weak market performance today. We compared the potential loss in market cap in this case with loss from a low oil price — the latter is more conservative, given that oil price does not strictly follow available demand. For value creation, we modeled redirecting some Capex and devalued assets into renewable power and fuel. While Scenario Two certainly pushes for a shift toward low-carbon, Scenario One still destroys some value in strict business-as-usual. The ultimate outcome will likely fall somewhere between these two scenarios, but some acceleration of societal decarbonization appears likely.

Exhibit 11. Market Cap Analysis



Source: Oliver Wyman analysis

IOCS SHOULD ACCELERATE THEIR DECARBONIZATION TODAY

The likelihood of more rapid societal decarbonization presents IOCs with an imperative to accelerate and materialize their decarbonization efforts. This stems fundamentally from a responsibility to maintain shareholder value, which is at stake as society increasingly accelerates decarbonization. The coal industry has lost an estimated 50 percent of its value over the past decade, providing a cautionary tale for other businesses that do not adequately address their carbon.

In recent months, some IOCs have set stronger decarbonization ambitions than ever before. This increased ambition is a welcome move, even if a gap still exists to meeting the Paris Agreement's temperature goals. IOCs should consider increasing their ambition and develop a proactive plan to progress across decarbonization stages. Without outright divesting from combustible hydrocarbons, which is off the table for many IOCs, decarbonization will require a step-wise transformation of the business toward low-carbon power and fuels. However, market demand and capacity for these new technologies have a ceiling, and relatively few opportunities exist for rapid inorganic growth on the scale needed. Additionally, low-carbon regulatory support is often strongest for first movers, driven both by capacity caps on incentives and the fact that regulatory credit potential for avoided emissions decreases as carbon intensity targets become more stringent.

DECARBONIZATION WILL REQUIRE REINVENTION

Decarbonization for IOCs requires a true transformation — business as usual with incremental increases in low-carbon investment will not be enough. IOCs must meet the step-change challenge of decarbonization by transforming how they operate and allocate capital, integrating carbon considerations into every decision they make.

To pull off this kind of reinvention, IOCs will need to transform their capital allocation processes to weigh carbon, build the case to investors, adjust their business structures, and incentivize decarbonization internally as well as externally, becoming champions for societal decarbonization. IOCs have a role to play working closely with governments and regulators to build the path and incentives to shift away from high-carbon fuels. As an IOC reinvents itself, a period of business contraction could precede renewed growth as the company divests from existing assets and builds a customer base for its new low-carbon offerings. Investors, if serious about IOCs decarbonizing, should accept this potential contraction and encourage transformation regardless.

Exhibit 12. Decarbonization Requires A Reinvention Of How IOCs Operate And Allocate Capital

Weigh capital allocation against carbon goals

Align portfolio with decarbonization priorities, including through divestment

Adjust business structure around decarbonization

Inform and enforce decarbonization decisions with dedicated teams

Build the case to investors

Create a leading investment case meeting expectations on both climate and shareholder returns

Incentivize progress internally and externally

Reward decarbonization at all levels of the organization, advocate for relevant policies, and bring customers along the journey

Source: Oliver Wyman analysis

IOCs that proactively transform their business to decarbonize are more likely to thrive as the world doubles down on cutting carbon to combat climate change. A recent increase in ambition among some IOCs makes clear that these companies recognize the risk in business-as-usual, and the consequent opportunity in transforming. The challenge now is developing and executing a clear and detailed game plan for how to transition across decarbonization stages.

Oliver Wyman is a global leader in management consulting that combines deep industry knowledge with specialized expertise in strategy, operations, risk management, and organization transformation.

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