

The war in Ukraine

A moment of reckoning for the oil and gas industry

accenture

In this report, we survey some of the consequences of the war in Ukraine on the oil and gas industry to date. We also frame the critical uncertainties that will shape scenarios about the war's economic and business impact.

We close with actions that energy companies may consider to strengthen their outlook, regardless of the scenario that ultimately unfolds.

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Introduction

Russia's invasion of Ukraine has had rippling humanitarian and economic impacts across the globe. These include loss of life, destruction of infrastructure and impairment of normal activity. The consequences of Russia's actions are far-reaching. People worldwide (especially in Europe), national economies and entire industries are all affected.

The energy industry is particularly vulnerable. The invasion has made a tenuous situation much worse for energy markets, particularly in Europe. The imperative for oil and gas companies, working in concert with governments, is to mitigate the potential disruption of oil and gas supplies from Russia. Over the longer term, the industry needs to strengthen its resilience and relevance in a fast-changing energy world. We believe six priority actions will help oil and gas companies—and, by extension, the governments and industries they serve—become stronger, more agile, and more responsive to global circumstances.

Russia's invasion of Ukraine has made a tenuous situation much worse for energy markets, particularly in Europe.



An industry's vulnerability exposed

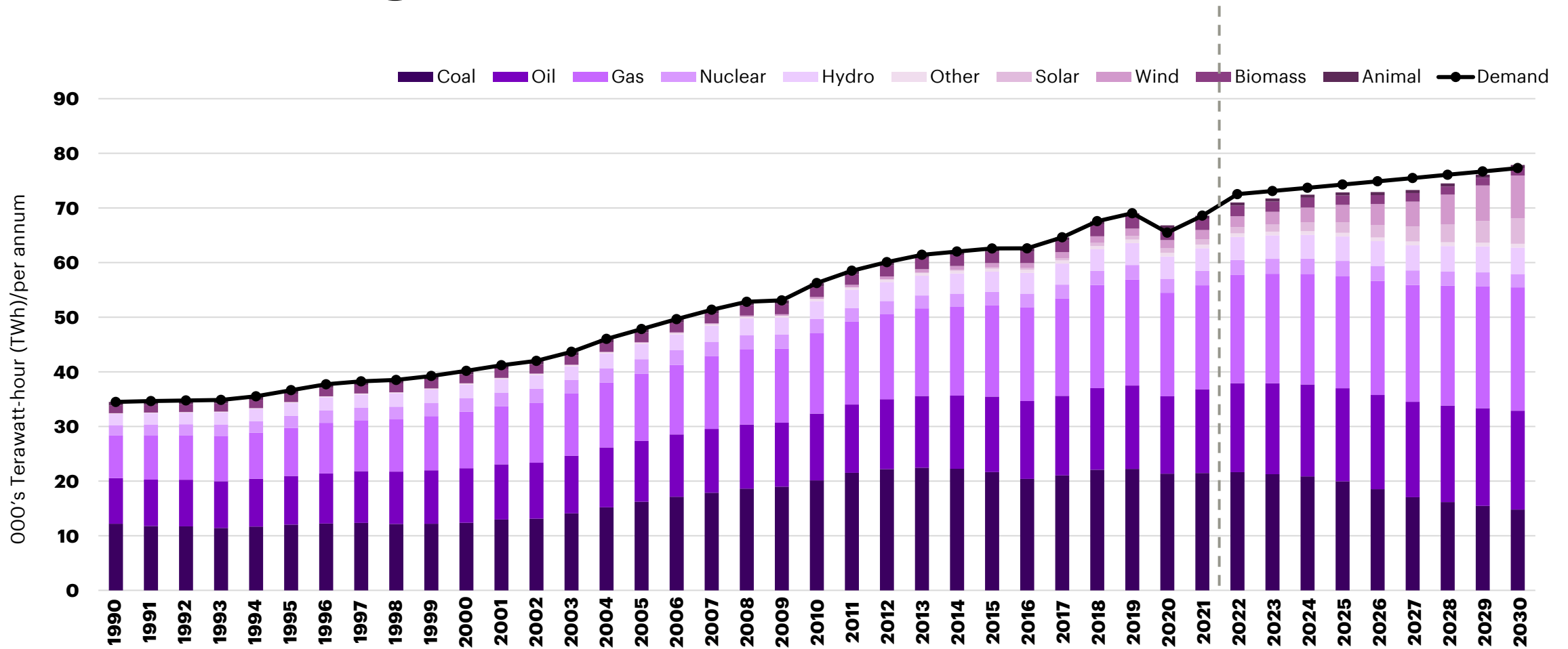
For the oil and gas industry,
pre-war does not mean pre-crisis.

For the oil and gas industry, pre-war does not mean pre-crisis. Energy markets, particularly in Europe, were already in a precarious situation. Before the invasion, global energy demand was starting to outstrip supply. With the recovery of demand following the COVID-19 pandemic, the imbalance between supply and demand was expected to grow to 2% in 2022. That may not sound like much, but it equates to roughly two million barrels of oil per day—equaling the volume of supplies from the Middle East/North Africa (MENA) that remained offline for more than five years as a direct result of the Arab Spring.¹

The supply shortfall the world is now experiencing is historic. And it can't be quickly remedied. In fact, even before Russia invaded Ukraine, the energy supply/demand gap was not expected to be fully closed before 2030.² The world was bracing itself for sustained upward pressure on energy prices.

There are several reasons for the lack of immediate practical solutions to close the gap. They include the time it will take to increase the capacity of alternative energy sources, such as renewables, nuclear energy and natural gas (particularly liquified natural gas); OPEC's spare oil capacity, which is already stretched thin; and while coal could be used to meet some energy needs, it would jeopardize the industry's—and the world's—commitment to decarbonization.

Global energy use

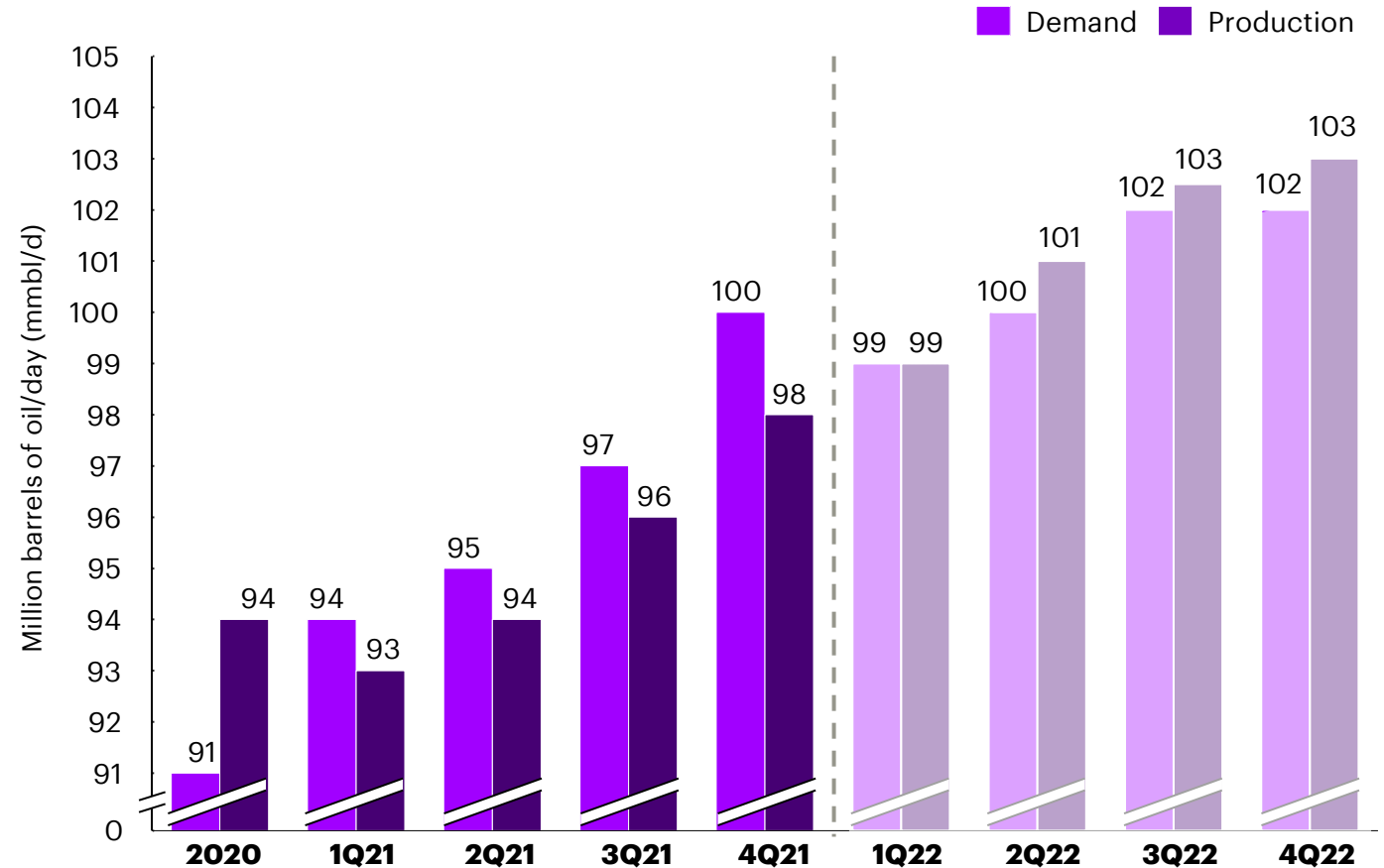


Sources: Thunder Said Energy 2022 (supply, used with permission); Accenture analysis (demand).
 Note: Assumes 0.8% demand increase per year post-2022.

The reliance on oil and gas

The challenge of closing the global supply/demand gap is compounded by the world's reliance on oil and gas. Together, oil and gas will make up more than 50% of the total energy supply in 2022.³

Liquids demand vs. supply (as of mid-Feb 2022)



Note: Forecasted estimates. More recent updates include the unplanned supply disruption in Libya (resulting in approximately 400,000 barrels of oil equivalent (boe)/d).

Sources: Accenture analysis with data from IEA; IEA Oil Market Report Feb2022 Outlook for 2022 reported in "Russian supply blow shakes global oil output picture - IEA," Reuters, March 16, 2022, factiva.com and "Tighter oil market confirmed by IEA demand revision", Reuters, February 15, 2022, factiva.com.

The transportation sector is particularly dependent on liquid fossil fuels. Per our analysis, these fuels make-up 94% of the sector's energy demand. Heavy industry, residential and commercial buildings, and electric power providers are other end users with significant demand for liquid fuels.

From a geographic perspective, developing economies are expected to be the main drivers of global oil demand moving forward. Their growing populations and transportation sectors, coupled with lower investment in clean energy, means that there are few alternatives to oil.

Since 2021, daily oil demand has exceeded supply by more than one million barrels. By 4Q21, the excess demand peaked at 2 million barrels/day. That deficit was expected to close by 2Q22, mainly driven by non-OPEC+ producers.⁴

However, several factors have made those assumptions obsolete. Russia's invasion of Ukraine raises concerns that Russian supplies may be curtailed. The recent unplanned supply disruption in Libya (resulting in almost 550,000 boe/d being taken out of the supply mix⁵) adds to the concern. As does the steady depletion of existing inventory (a 19% decline for OECD countries between August 2020 and March 2022⁶). Together, these factors will ensure that oil prices remain high and markets tight—despite the recent 260,000 boe/day drop in estimated oil demand in 2022, especially from China.⁷

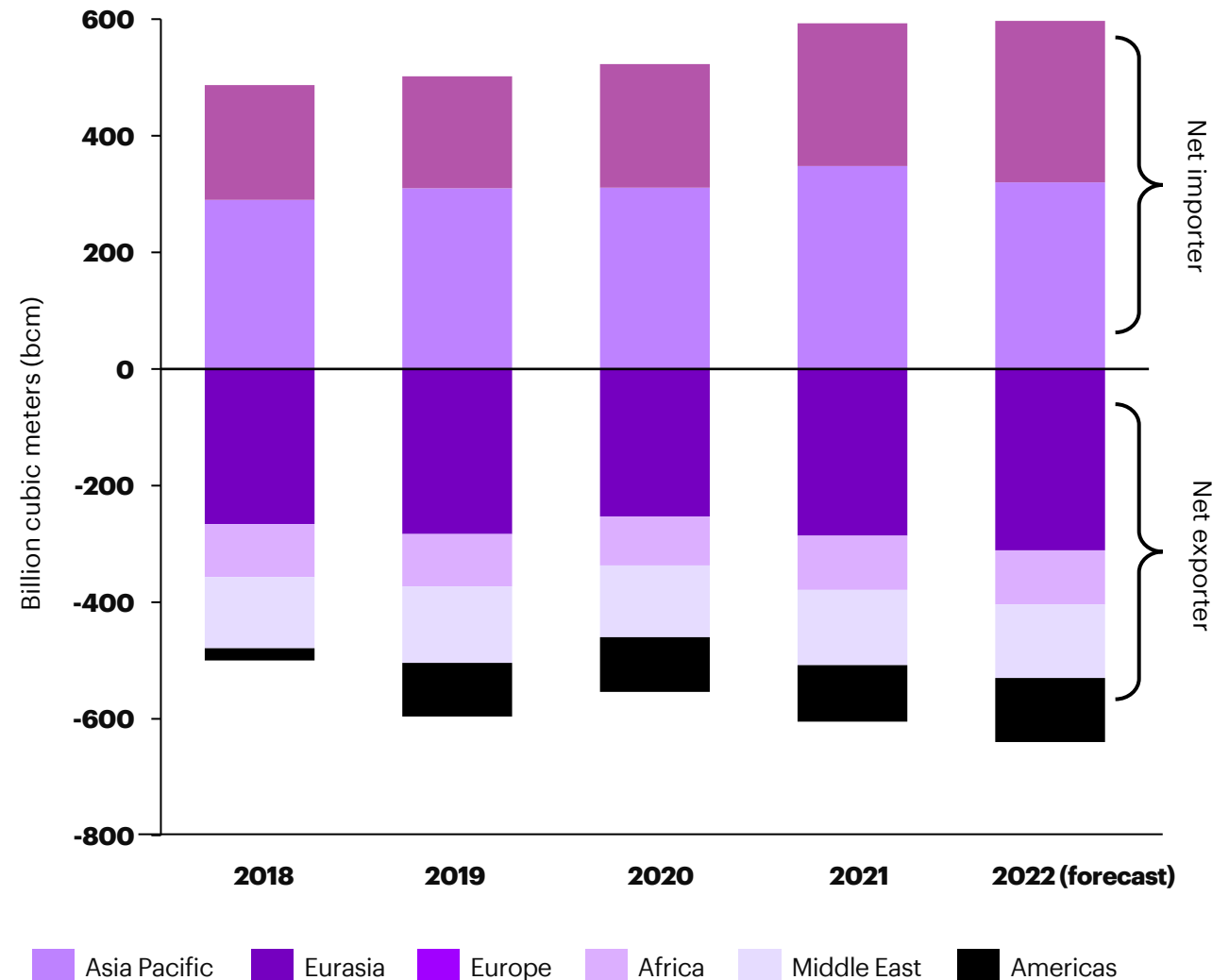
One of the reasons we believe oil companies aren't able to rapidly increase their supplies in the short term is their underinvestment in existing and new fields. Investments in new production were cut during the pandemic. This is evident in the below-quota production by OPEC+ (up to approximately 1mmb/d). It's also evident among US producers; half of the supply gap attributable to them is not expected to return.⁸ This is due to several reasons, including oil companies' focus in recent years on responding to investors' demand for consistent returns instead of increasing production (that expectation has not changed even with the current market dislocation).



A similarly complex story has unfolded in the gas sector, particularly for liquefied natural gas (LNG) in importing countries in Europe and the Asia-Pacific region.

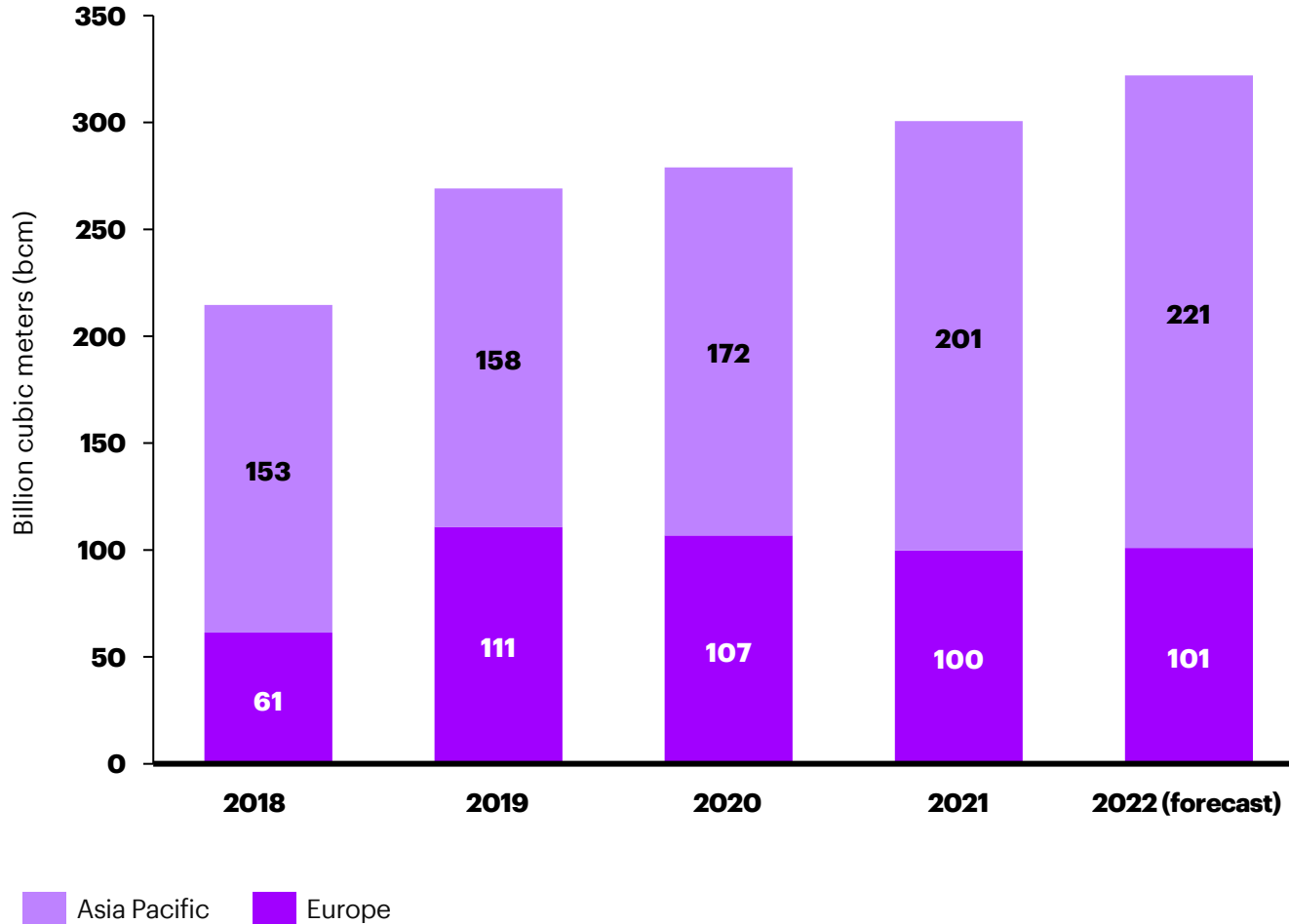
Global demand for natural gas—which is widely seen as a cleaner and cheaper option to hydrocarbon-sourced energy—was growing steadily to meet the needs of power generators and other sectors. The COVID-19 pandemic dampened demand growth in Europe. Gas inventories in Europe reached 10-year lows.⁹

Natural gas production-consumption gaps (as of Jan 2022)



Source: IEA [Gas Market Report Q1-2022](#) (2022), All Rights Reserved, as modified by Accenture.

LNG net imports for Asia and Europe (as of Jan 2022)



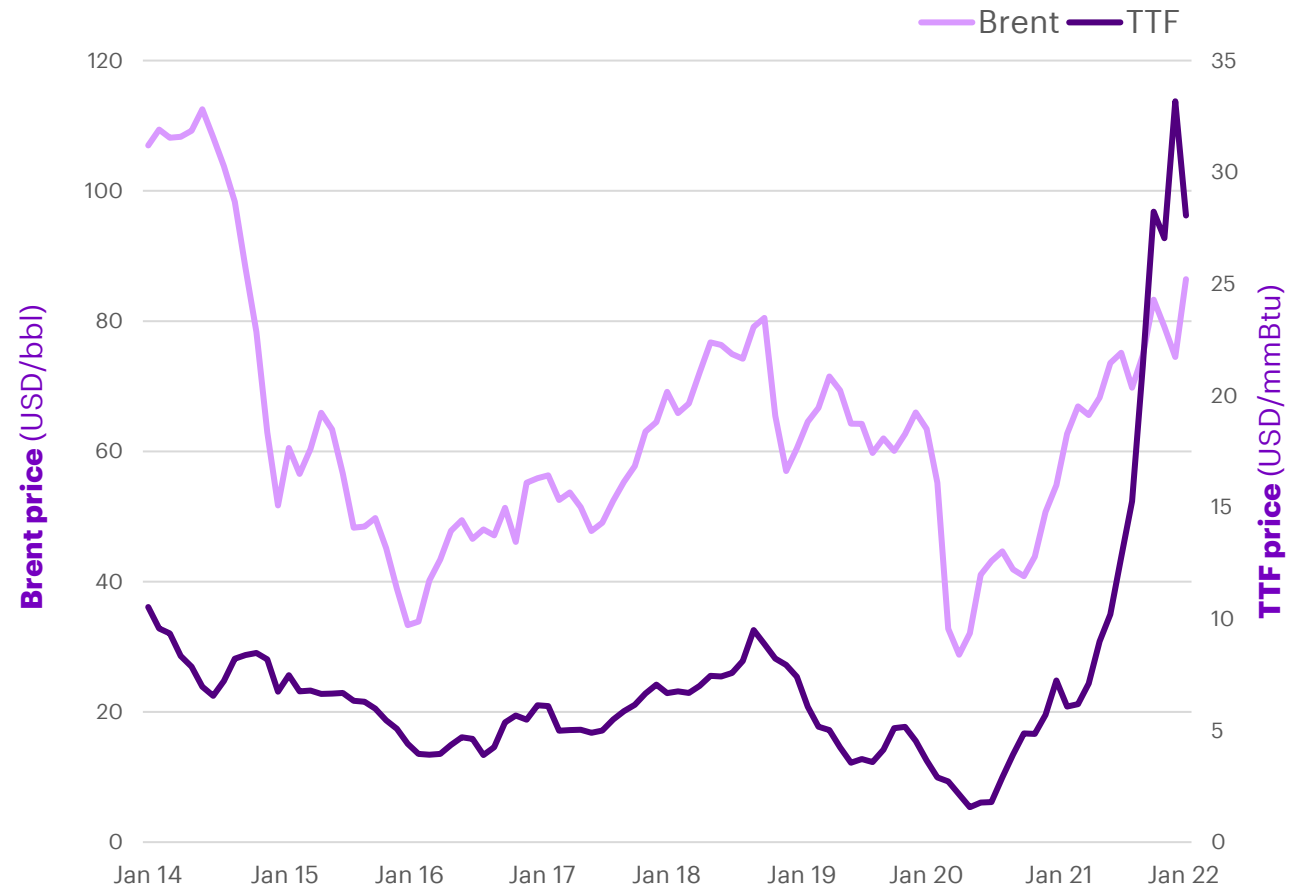
Source: Accenture analysis based on data source Refinitiv.

But demand for LNG continued climbing in Asia, with forecast demand growth of 10% expected in 2022. In the resulting tight market, regional supply deficits became more common and competition for LNG to fulfill supply gaps grew even more fierce.

Given all these factors, supply tightness was expected to persist through 2022, even before the invasion.

That meant the upward pressure on energy prices (e.g., TTF ~ 30 \$/MMbtu in late 2021) was also expected to persist.

Brent crude oil¹ and TTF natural gas² closing price

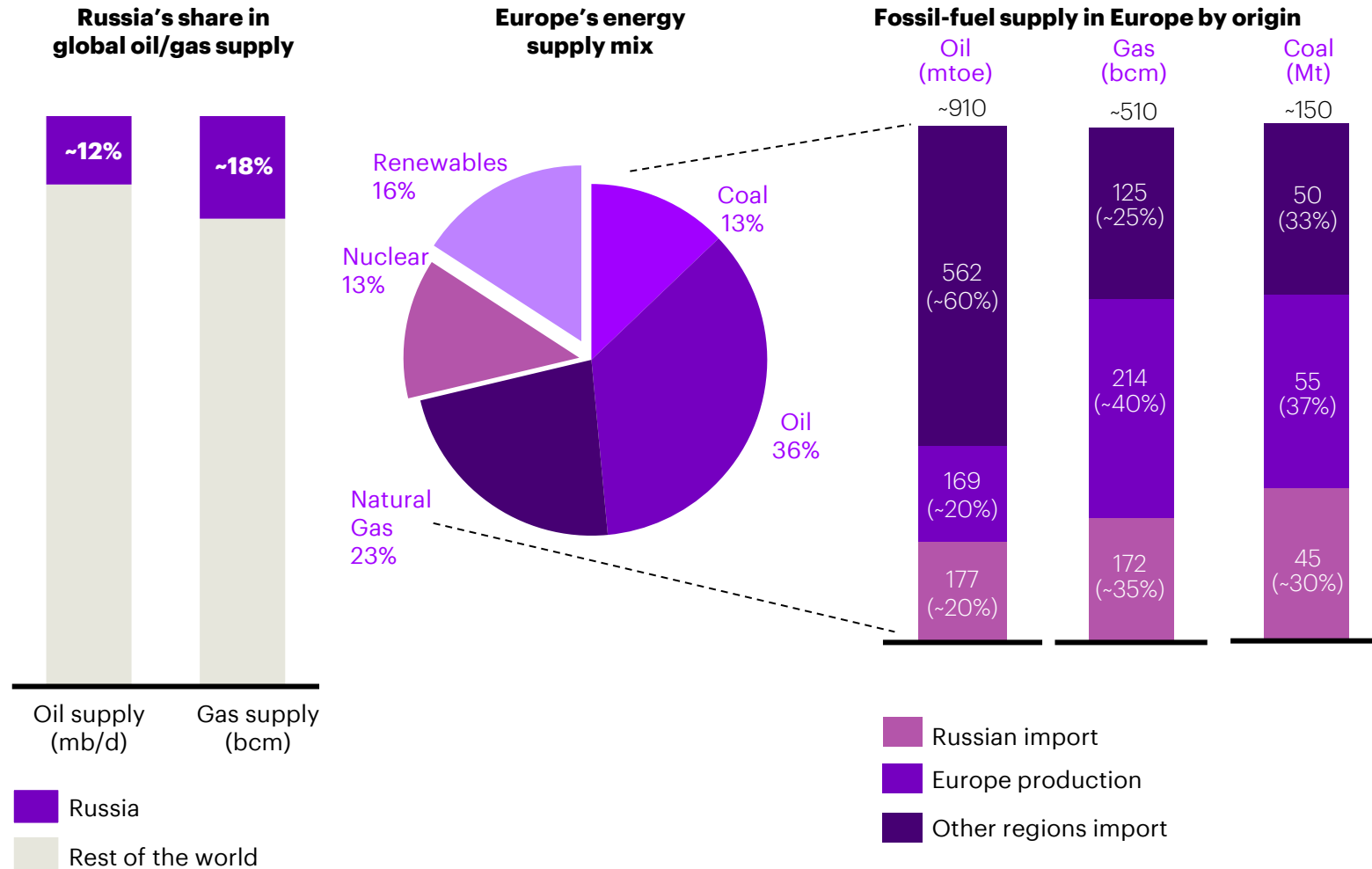


Source: Accenture price forecasting using Capital IQ base data, based on elasticity analysis incorporating potential global supply/demand gaps from e.g., 25% or 50% European gas supply disruption as detailed under our selected scenarios.

The reliance on Russian oil and gas

As the world's third-largest oil producer (and second largest exporter of crude oil) and second-largest natural gas producer (and largest exporter), Russia supplies nearly a sixth of the global oil and gas supply. Its dominance is particularly evident in Europe, where it supplies more than 20% of the continent's oil and more than 30% of its gas. A number of countries in Europe, including Germany, Austria, Finland, Poland, Slovakia and Hungary, are dependent on Russia for 50% to 100% of their oil and gas imports.

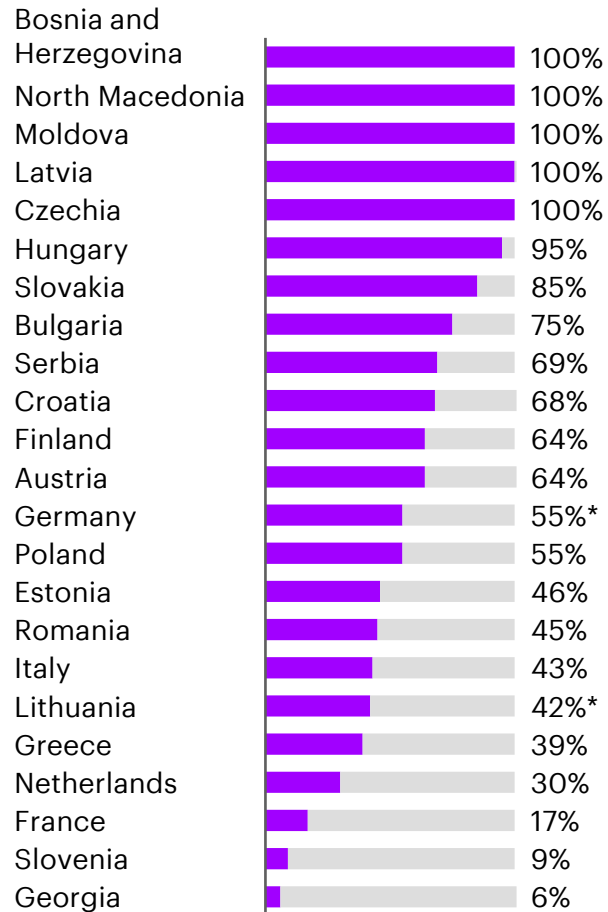
Russia is a major supplier of Europe's oil and gas



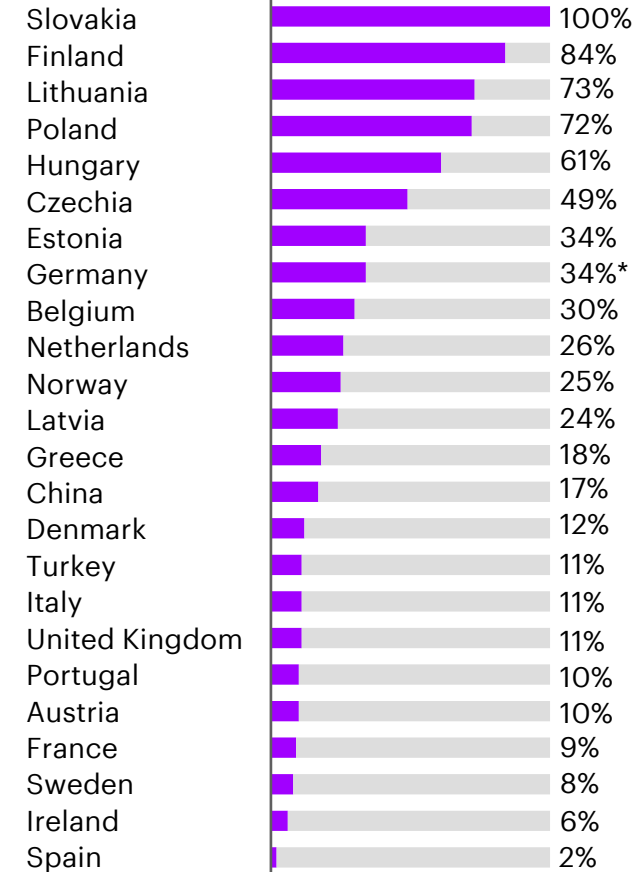
Source: Accenture analysis based on data from IEA [Oil Market and Russian Supply 2022](#); IEA [Oil Market Report Feb 2022](#), IEA [Gas Market Report Q2-2022](#) (Russia share in global oil/gas market); [Rystad](#) (Russia gas supply to Europe) and Eurostat.
 mtoe = Million tons of oil equivalent | bcm = Billion cubic meters | mt = Million tons

Percentage of total crude oil and gas imports sourced from Russia (by country)

Gas supply



Crude oil supply



Notes: *Germany reported to have dropped to 35% for gas and 12% for oil by May 2022 and Lithuania to 0% for gas by May 2022.

Source: Accenture analysis based on Eurostat 2020 or latest available full year, "[Imports of oil and petroleum products by partner country](#)", [Imports of natural gas by partner country](#).

Russia's dominance is particularly evident in Europe, where it supplies more than 20% of the continent's oil and more than 30% of its gas. Several countries in Europe, including Austria, Finland, Poland, Slovakia and Hungary are dependent on Russia for 50% to 100% of their oil and gas imports.



With the recent invasion of Ukraine, Europe's dependence on Russian oil and gas presents a potential existential crisis. Sanctions to limit oil and gas imports have not yet been enacted.¹⁰ But there are myriad other threats. We've already seen Russia take actions to halt gas supplies to Poland and Bulgaria.¹¹ Additionally, Russian pipelines to the EU may be at risk of supply disruption—either through unilateral decisions to limit gas imports or infrastructure damage. Given that Ukraine's transit pipelines can carry more than a third of Russian exports to Europe,¹² the latter risk is concerning.

In the face of a sudden shortfall of gas supply, Europe would be hard pressed to find alternatives. LNG imports may be considered as part of a longer-term solution. But Europe's liquefaction and terminal capacities are quite limited. The earliest they could be ramped up is estimated to be at the end of 2023.¹³ And even the additional capacity (that is ramped up) can only fulfill a portion of the supply shortfall that may result from a significant disruption of Russian supply.

Finally, even if gas can be imported into Europe, moving it across various countries will be constrained by a limited interconnector network.

Some refineries—especially in Germany and central and eastern Europe—are dependent on Russian crude oil. Historically, refinery capacity has been outstripping demand. This means facilities have

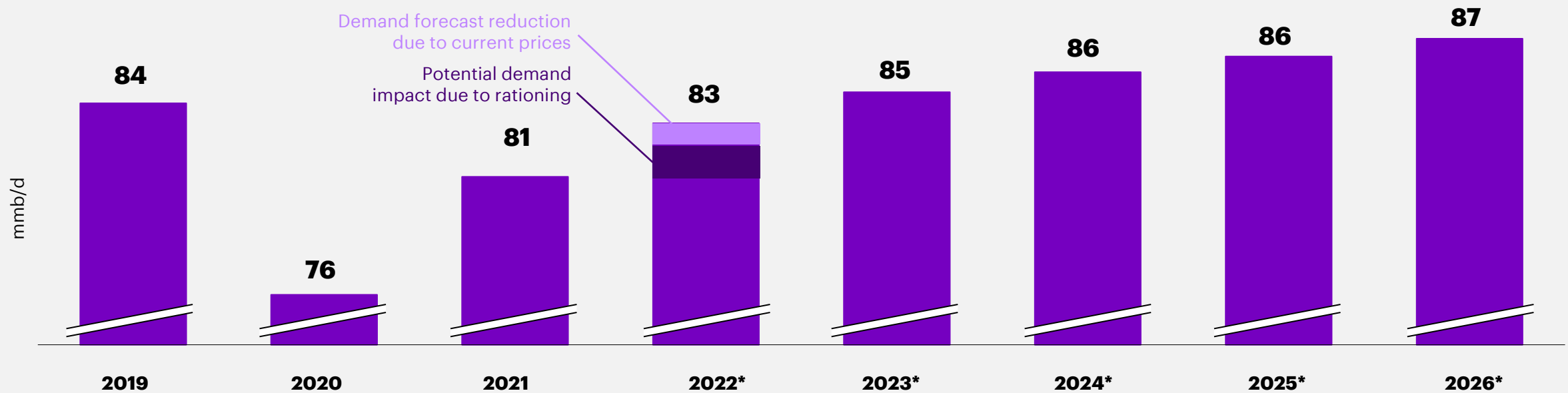
been underutilized and refiners have faced increasing margin pressures. A persistent high oil price environment coupled with inflation may continue to erode fuels demand. If crude oil supplies from Russia are curtailed, the margin impact could be more significant as some refiners are not able to easily replace Russian crude oil.

Pre-invasion oil product demand forecasts of 83 million barrels (mmb)/d may fall to 79 mmb/d or lower this year. However, demand is expected to grow over the next several years. And if oil (crude and product) supplies from Russia are disrupted, refiners will likely be challenged to secure feedstocks to replace them. Diesel prices have already started to reach near record levels.¹⁴

Growth in refinery product demand 2020 – 2026 (as of Jan 2022)

The war in Ukraine is eroding demand. The initial 83 mmb/d pre-war forecasted 2020 demand might erode to lower than 77 mmb/d for 2022. Key drivers for reduced demand would be higher prices and policy responses to limited regional supplies, due to oil feedstock supply constraints and low inventories.

Refining capacity >100 mmb/d and net increasing to 107 mmb/d by 2026



*Forecast

Source: Accenture analysis on impact rationing built on baseline data from IEA Oil 2021 (2021), All Rights Reserved, as modified by Accenture.



Securing an affordable energy supply

Any supply shocks caused by the invasion in Ukraine will likely affect Europe significantly and, to a lesser extent, the rest of the world. Commodity prices could be pushed to all-time highs. A curtailment of Russian oil and (especially) gas to Europe would likely require policy responses and could lead to the rationing of energy across energy-dependent sectors.

Countries are already preparing for possible supply disruptions. The European Union has announced a plan to transition away from Russian oil and gas.¹⁵ Germany has made plans to end Russian oil imports by the end of 2022.¹⁶ The United Kingdom and United States have implemented embargoes.¹⁷ And global seaborne markets are currently hesitant to absorb Russian cargoes. In early March, 70% of Russia's seaborne oil exports were in an indeterminate state, struggling to find buyers.¹⁸

Russia's invasion of Ukraine has demonstrated just how vulnerable energy markets are. Reducing reliance on Russian oil and gas could be a key step to shoring up energy security. But downscaling dependence won't be easy. Countries will be required to find or develop alternative sources, which requires technical, financial and geopolitical expertise, investment and collaboration. Nations will also need to work with oil and gas companies to reimagine the energy system of the future and how consumers and industries use energy.

Possible implications of the war in Ukraine

On countries,
industries and consumers

On countries, industries and consumers

The impact the Russian invasion of Ukraine will have on Europe and its consumers, the oil and gas industry and other energy-intensive industries will depend on several factors, including:

- The war's duration
- The severity of Russian supply shocks and the level of oil and gas shortfalls in Europe
- The intensity and focus of sanctions against Russia
- Energy prices
- The level of destruction (if any) to the oil and gas infrastructure in Ukraine or elsewhere
- Government policies to support industries and consumers during supply shortfalls
- The energy industry's actions to replace Russian oil and gas supplies, and to build capacity in alternative fuel sources

At present, these factors are unknowable. Our analyses of European countries' economic conditions and their reliance on different energy sources provide a view into the potential near-term impact of the war. We also look at actions energy companies might consider to help mitigate the negative effects.



Three potential scenarios

Based on our analysis, we have considered the impact of three different scenarios.

- We have moved into the third month of the invasion. Roughly a quarter of Russian energy has been disrupted largely due to self-sanctioning by European buyers or government-enforced sanctions in North America. There has been some redirection of Russian supplies, but it's been limited so far. In this current scenario, energy shortfalls in Europe should be manageable, although the chemicals, basic materials and manufacturing sectors might experience disruptions. Commodity prices would remain elevated—up to \$150 per barrel for oil (bbl) and up to \$50 per million British thermal units (MMBtu) for gas.
- An expanded scenario based on an escalation of the war in Ukraine could bring about a 50% reduction of Russian gas flows into Europe and potential for embargoes to pull large volumes of Russian crude oil products from the European market by the end of 2022. In this scenario, oil prices could rise to \$150-\$200 per barrel. Gas prices could approach \$100 per MMBtu. All industries in Europe would likely be affected and some industrial sites may be forced to temporarily cease/stall operations.
- An extended scenario based on a complete embargo on Russian energy supplies. In this scenario, oil prices could exceed \$200 per barrel over a sustained period of time and gas prices climb to \$100 (or more) per MMBtu over several months. Rationing of oil and gas in Europe would be more likely. All industries in Europe would be affected.

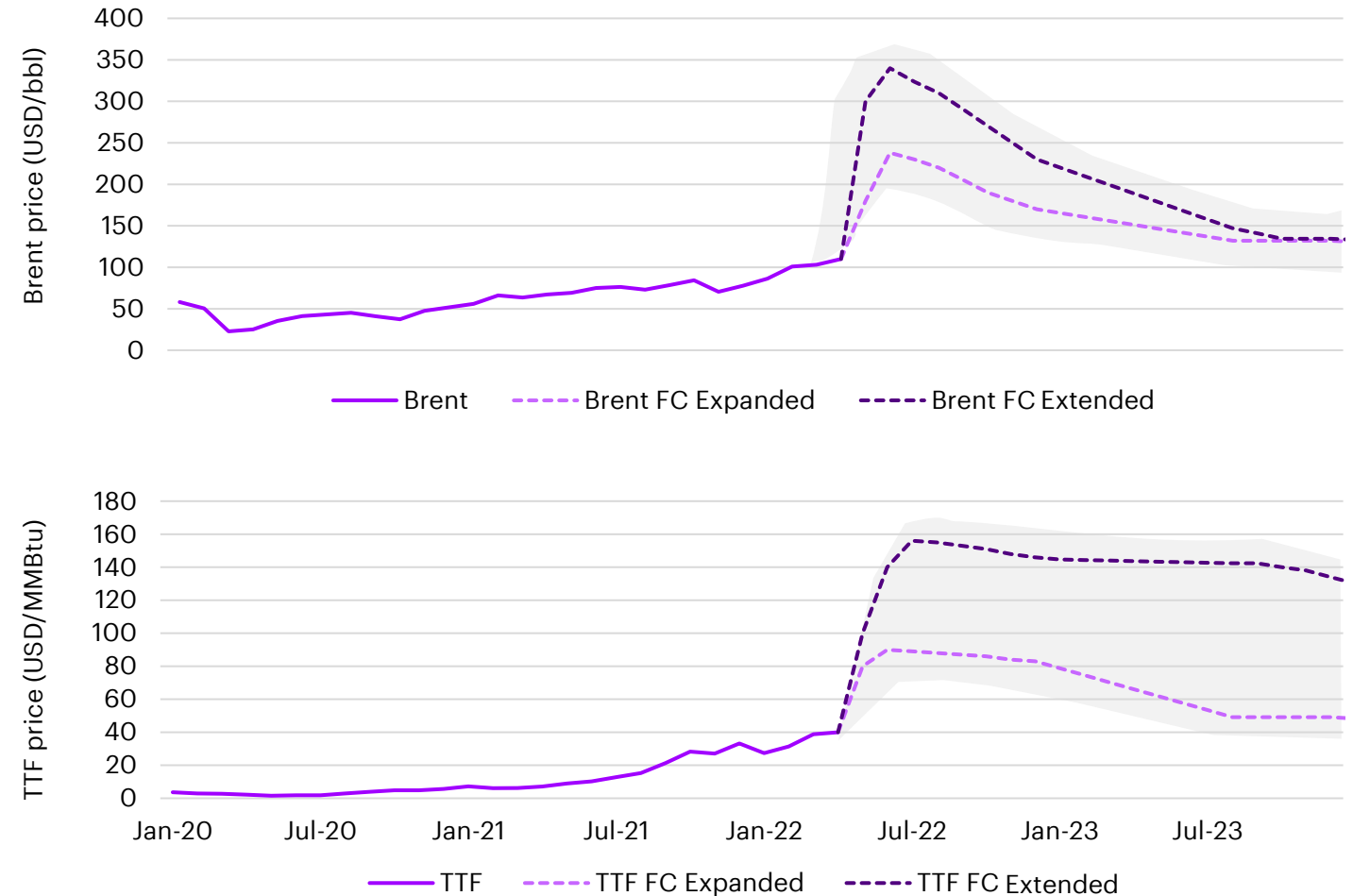
Potential energy scenarios

		Current	Expanded	Extended
Energy market + supply		Oil \$100-150/bbl TTF gas <\$50/MMbtu 25% curtailment of Russian gas Partial ban on Russian crude	Oil \$150-200/bbl TTF gas - \$50-100/MMbtu 50% curtailment of Russian gas Russian crude to Europe phased out by '22	Oil - >\$200/bbl TTF gas >\$100/MMbtu Complete stop of Russian gas and crude oil deliveries to Europe
European industries	Gas use reduction	Non-LNG geographies (market-based)	Non-LNG geos (rationing)	Rationing across Europe, solidarity
	Impacted	Chemicals, basic materials, manufacturing	Across industries	Across industries
	Shutdowns	No major disruptions	Non-critical industrial sites	Non-critical industrial sites
European B2C		No major disruptions	No major disruptions	Potential restrictions in heating/mobility
Rest of the world (including North America)		Some LNG shortages No major disruptions	Gas markets tighter, higher prices Oil prices weigh on import heavy geos Some disruptions - industries	Energy-led sovereign debt defaults Rolling blackouts in energy poor geos

Note: Rest of the world potential debt defaults focused on emerging economies. | TTF: Title transfer facility | Source: Accenture analysis on data from Factiva.¹⁹

Based on our analysis, oil and gas prices in the expanded and extended scenarios would likely peak in mid-2022 and remain elevated for at least a year. Over the longer term, oil prices in both scenarios could converge as the supply /demand gap closes.

Brent crude oil¹ and TTF natural gas² closing price



Note: ¹ICE Brent daily future, ²ICE TTF daily future.
 Source: Accenture analysis with CapitalIQ data.



In any scenario, energy price increases—already driven higher by increased demand as post-pandemic economies re-opened and now exacerbated by the crisis in Ukraine—will impact consumer prices. Based on our analysis of OECD data, the dual shocks brought about by the pandemic and the war are expected to drive the largest consumer price increases in 20 years.

Inflation and energy price shocks in Europe*

	Energy price increase	Change in consumer prices			Change in labor costs		
		1 year before	1 year after	Difference	1 year before	1 year after	Difference
Ukraine invasion (2022)	70%-200%	2.6%	4.6%-8% E	+2pp/ +5.4pp E			
Oil price shock (1973)	470%	7.9%	12.2%	+4.3pp	7.0%	13.8%	+6.8pp
Iran-Iraq war (1979)	150%	10.3%	11.7%	+1.4pp	7.6%	13.8%	+6.2pp
Gulf war (1991)	11%	4.4%	4.7%	+0.3pp	3.8%	5.1%	+1.3pp
Arab spring (2010)	12%	1.7%	2.8%	+1.1pp	5.6%	1.0%	-4.6pp

Note: *Considers the average of the UK, Germany and France.

E = expected | PP = Percentage point.

Source: Accenture Research analysis of [OECD Unit labour costs and labour productivity](#), [OECD Inflation/CPI Statistics](#), Oxford Economics Global Economics Databank.



The country-level economic impact

The current high energy prices and inflationary pressures are already having a significant impact on European economies in terms of an expected decline in GDP growth.²⁰ The war and its impact on energy supplies are expected to exacerbate and accelerate European countries' inflation growth and GDP shrinkage through the end of 2022.²¹

When it comes to potential shortfalls in gas supplies across Europe, we have simulated potential outcomes of our "expanded" and "extended" scenarios, analyzing the impact potential by-country gas supply disruptions considering the current restrictions of the local gas infrastructure.²² Each case assumes European LNG regasification, European pipeline flow and other technical limitations. The impact of either scenario could possibly lead to gas rationing.

Up to 50% reduction in Russian gas imports

Over the next 12 months would likely result in supply shortfalls in 18 countries (relative to those countries' energy demands). The greatest impact would occur in Central and Southeastern Europe:

Germany ~ up to

9%

Baltics ~up to

20%

Central – Eastern Europe ~ up to

15-30%

Southwestern Europe would be largely spared energy disruption, given that those countries' high LNG imports would likely offset any gas exposure from Russia.

Up to 100% reduction in Russian gas imports over the next 12 months would likely bring supply shortfalls to 22 countries.²³

The industry-level impact (by country)

Many industries in Europe depend on natural gas. Several, in fact, rely on gas to meet a third or more of their energy demands.

Percentage of sectoral energy demand addressed with natural gas

	Germany	France	Italy	UK	Spain	Belgium	Poland	Sweden
Power generation	19%	6%	47%	29%	25%	24%	9%	0%
Iron/steel	18%	26%	29%	14%	18%	21%	27%	5%
Chemical/petrochem including feedstocks	26%	22%	18%	23%	41%	21%	35%	18%
Non-ferrous metals (e.g., aluminium)	37%	29%	57%	39%	33%	42%	37%	2%
Non-metallic minerals including cement	37%	47%	47%	46%	46%	37%	33%	13%
Machinery/transport equipment	33%	35%	35%	48%	37%	40%	29%	3%
Paper/pulp/printing	34%	39%	30%	20%	34%	19%	12%	1%
Wood/wood products	7%	10%	6%	54%	14%	8%	4%	0%
Textile/leather	52%	49%	51%	42%	46%	48%	35%	5%
Food and tobacco	55%	46%	40%	56%	41%	57%	39%	20%

Sources: Accenture analysis with data on consumption from Eurostat data [Imports of natural gas by partner country](#) and [Simplified energy balances](#), and data on non-energy use/feedstock from [IEA WEO](#) 2020 and 2021.

These and other industries are impacted to some degree by higher gas prices across countries. Shortages of natural gas supplies from Russia would compound the problem. Industries in Italy and Germany—especially manufacturing, cement and construction, steel and non-ferrous metals, and consumer goods sectors—may be particularly hard hit. Conversely, the share of Russian gas imports used to meet industry energy demand in the United Kingdom and France is low. In those countries, domestic supplies or alternative export routes could lessen the effects compared to more gas-dependent industries.

Percentage of sectoral energy demand addressed with natural gas from Russia

	Germany	France	Italy	UK	Spain	Belgium	Poland	Sweden
Power generation	4%	0%	11%	0%	1%	1%	1%	0%
Iron/steel	4%	1%	7%	0%	1%	1%	4%	0%
Chemical/petrochem including feedstocks	6%	1%	4%	0%	1%	1%	5%	0%
Non-ferrous metals (e.g., aluminium)	8%	1%	13%	1%	1%	1%	6%	0%
Non-metallic minerals including cement	8%	2%	11%	1%	2%	1%	5%	0%
Machinery/transport equipment (estimate)	7%	2%	8%	1%	1%	1%	5%	0%
Paper/pulp/printing	7%	2%	7%	0%	1%	1%	2%	0%
Wood/wood products	1%	0%	1%	1%	0%	0%	1%	0%
Textile/leather	11%	2%	12%	1%	2%	1%	6%	0%
Food and tobacco	12%	2%	9%	1%	1%	2%	6%	0%

Note: Share of imports based on share of Russia in total national imports of the commodity, applied to percentage of the commodity in the industry-specific energy mix, assuming imported gas is distributed equally across industries.

Sources: Accenture analysis with data on consumption from Eurostat data [Imports of natural gas by partner country](#) and [Simplified energy balances](#) 2020 or latest year, and data on non-energy use / feedstock from [IEA WEO](#) 2020 and 2021.

A prolonged period of higher energy prices—not just for natural gas, but also oil—would impact industries whose material inputs are influenced by energy prices. Material costs for the chemicals industry, for example, are tied mainly to the cost of petroleum. Similarly, industrial and high-tech sectors rely on energy-intensive material inputs. High energy prices in these sectors would likely drive price inflation down the value chain and could weigh on margins. While our analyses suggest that elevated energy prices can negatively impact corporate margins, there is less evidence to suggest that higher prices will depress equity returns.

Energy cost by sector (Europe and US)

Rough estimates of main impact

Key: High  Low

Industry	Energy % of inputs ¹	Raw material % of inputs ²	Wages % of revenues ³	Main Impact	Key drivers
Aerospace/defence	1%	8-10%	17-25%	2 nd round	Original equipment manufacturer (OEM) material costs; e.g., aluminum, rubber
Automotive	1%	11-13%	11-15%	2 nd round	OEM material costs; e.g., steel, glass, aluminum, rubber, other metals
Banking	1-3%	0%	29-32%	3 rd round	Sanctions, increased interest rates with potentially positive impact
Capital markets	0-1%	0%	26-34%	3 rd round	Weak equity markets, risk premia, low primary issuance, reduced M&A
Chemicals	8-10%	44-55%	14-18%	1 st round	Oil and gas dependence as energy and feedstock (e.g., for fertilizers and potash)
Communications and media	1-3%	1-2%	21%	3 rd round	Inflation (other key factor: cybersecurity risks)
Consumer goods and services	3%	28-39%	15-16%	2 nd round	Energy/material costs (other: wheat/corn shortages, Russia market, demand impact)
Health	2-4%	3%	50%	3 rd round	Minor impact
High tech	1-2%	7-10%	27-43%	2 nd round	Minor impact, potential for inflation in materials incl rare earth metals
Industrial ⁴	2-5%	15-29%	25-33%	2 nd round	Energy and material costs (other key factors: material shortages, Russia as key region)
Insurance	0-1%	0%	12-20%	3 rd round	Stock market volatility, interest rates
Life sciences	1-2%	8-19%	17%	2 nd round	Minor impact
Natural resources	8-32%	32-34%	15-16%	1 st round	Energy costs; e.g., steel/cement (other: raw material shortages in mining and metals)
Public services	5-10%	2-4%	50-53%	3 rd round	Government/public spending
Retail	4-5%	1-2%	32-34%	2 nd round	Energy costs, broader consumer sentiment
Software and platforms	1%	0-2%	38-41%	3 rd round	Minor impact
Travel/freight	11-13%	2%	27-34%	1 st round	Fuel prices, inflation, economical/political instability
Utilities ⁵	50-52%	2-3%	9-15%	1 st round	Supply security, gas prices, re-prioritization of clean energy efforts in short-term

¹Energy inputs — percentage share of energy inputs for total intermediate inputs for respective industry, range min/max for Europe/US — with varying region for minimum value. ²Raw material inputs — Maximum percentage share of raw materials inputs for total inputs for respective industry based on latest available pre-COVID data from OECD. ³Wages as % of revenues — Maximum percentage share of materials inputs for total outputs for respective industry based on latest available pre-COVID data from OECD. Not visualizing SG&A and margins. ⁴ Excludes logistics/freight ⁵ Supply of electricity/gas/heat excluding water/waste.

Sources: Accenture Research analysis with data from OECD [input/output tables](#) and [supply/output tables](#). Europe is represented by the aggregated average of France, Germany, Italy, Spain and the United Kingdom.



In addition to high energy prices, reduced consumer purchasing power and lower demand for industrial products could further erode margins among energy-intensive industries in Europe. Our analysis anticipates demand reductions in the following industries:

- Mobility/freight
- Cement/construction
- Steel/non-ferrous metals
- Chemicals/petrochemicals
- Manufacturing

Utilities and consumer goods industries could also see a slight reduction in demand. But their narrow margins may be less affected because they could pass higher input costs to end consumers (albeit with a time lag).

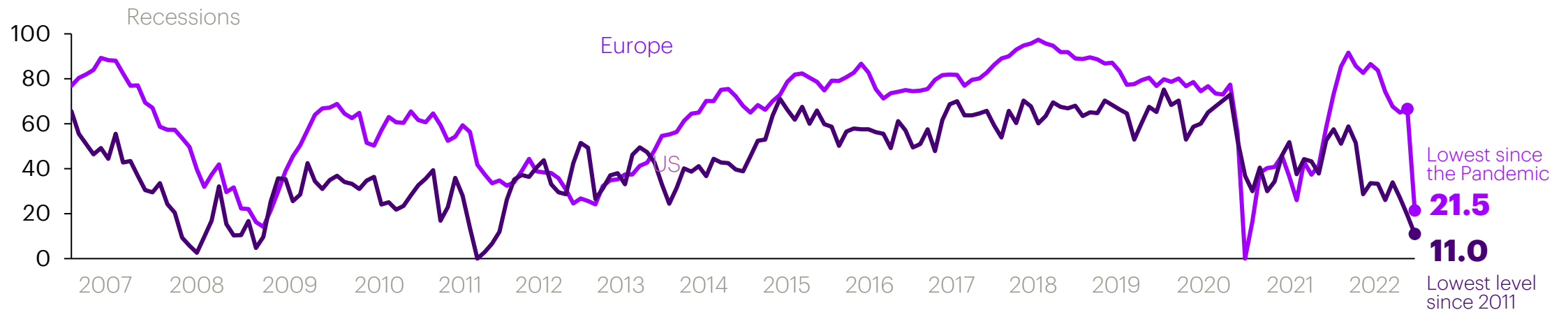
However, it is likely that high energy prices will lead to a reduction in energy demand. Utility earnings would likely be affected negatively in this price environment.

Consumer impact

Global inflation was already poised to affect consumer spending in 2022 and beyond. Overall consumer sentiment has been deteriorating for the past two years. Gasoline prices have made people rethink their mobility. Now, with the war driving sudden spikes in energy prices, it's possible that consumers could further curtail their discretionary spending.

Energy cost impacts: Consumer spending

Expected consumer sentiment: Europe and US (Jan 2007—Mar 2022 - Status as end of March 2022)



Sources: Accenture Research analysis of [European Commission Consumer Sentiment Survey for EU](#) and [University of Michigan, Survey Research Center, Surveys of Consumers](#). US survey re-baselined from 100 to 0.

Energy price rises could have a material effect on people's real incomes around the world.

For example, our analysis shows a **20%** increase in household electricity bills due to higher energy costs would pull **\$90 billion** from the pocketbooks of households in G7 countries.

A **30%** or **50%** increase would burden households with **\$130 billion** or **\$220 billion** in increased costs in total, respectively.

Despite the threat that higher energy prices pose, consumer spending fundamentals remain positive. Household savings rates are higher than they were before the pandemic.²⁴ Nominal wage growth continues to rise.²⁵ And equity market and house price appreciation in the past two years have boosted household wealth.²⁶

It is too early to understand how consumer spending might ultimately be affected. But oil and gas companies should be mindful of the potential reduction in consumer demand that lies ahead.

The path forward

Building long-term resilience and agility in the energy system of the future is now more important than ever.

The 2020s kicked off as the make-or-break decade for the oil and gas industry. Structural shifts in the industry, the mounting pace of the energy transition, competition from new energy sources, and demand for environmental accountability had already pushed many energy companies to plan their reinventions. The COVID-19 pandemic, which decimated short-term hydrocarbon demand only accelerated the need for change.

Now, just two years later, energy demand has surged back. Supplies have yet to catch up. Commodity prices have reached record highs. On top of all this, Russia invaded Ukraine—further roiling energy markets and making a highly volatile energy system even more so. Building long-term resilience and agility in the energy system of the future is now more important than ever. But, as the war in Ukraine has made abundantly clear, so is the industry's efforts to strengthen energy availability and security.

Potential impact of the Ukraine invasion on the energy system

Energy security



Significant investments in fossil fuels production and transportation (alternatives for Russian supply) ¹

Energy sustainability



Shift in energy importers toward securing supply (fossil or clean)²

Commodity	Potential demand-side response	Potential supply-side response
Oil	Russian crude flows East; Other crude flows West ³	OPEC major beneficiary (followed by North America) ³
Natural gas	Gas growth slows; Europe inbound infrastructure expands ³	US becomes largest LNG player ³
Coal	Coal demand increases (in Europe and Asia)	Africa, Australia and LATAM supplies increase
Wind + solar	Stronger push/demand in Europe and developing nations	Mixed – appetite to invest conflicts with available investment
Nuclear	Countries re-consider nuclear, progress limited by lead time	Smaller/modular facilities, but scale only post '25

Country	Exposure ⁴	Potential Response ⁴
US	Low	Export +
Canada	Low	Export +
Germany	High	Import + , Diversify
France	Medium	Diversify
United Kingdom	Low/Medium	Diversify
Japan	Medium	Diversify
China	Low/Medium	Import +
India	Medium	Import +
Saudi Arabia + Middle East	Low	Export +

¹Based on the analyses in this report, "Alternatives to Russian crude supplies" and "Alternatives to Russian natural gas supplies."

²Based on previously mentioned sources and REPowerEU

³Based on alternatives for supply analysis and European Incremental European pipeline vs. LNG regasification capacities details

⁴Based on import/export volumes for oil, natural gas (including dependency on Russia, access to LNG) and Umlaut/EWI analysis for Accenture

Source: Accenture analysis.



The oil and gas industry is now at a crossroads, with important decisions to make. Companies seem to be leaning towards ramping up traditional (brownier) supplies to help countries that currently depend on Russian oil and gas maintain energy security. However, with this crisis comes the opportunity to accelerate the transition to a greener, more efficient energy system. And while today the focus is on both fossil fuel and renewable energy sources, how these competing forces will balance in the next few years remains to be seen.

The growth of both oil and gas production is expected to continue. Investments in new infrastructure in the United States (i.e., to increase production and LNG export capacities) is expected to accelerate as Russian exports traditionally bound for Europe flow east.²⁷ In Europe, investments in LNG imports and natural gas infrastructure have also been announced²⁸. But those investments are also coupled with demand reduction measures (e.g., energy-efficiency programs) and an ambition to accelerate the transition to renewable energies (e.g., the Europe REPowerEU plan looks to increase solar deployments by 20%).²⁹ Nuclear is increasingly coming back on the energy agenda. Coal may be as well. Countries that pursue coal as an alternative to natural gas would deal a significant blow to advocates of an urgent energy transition.

Closing the oil and gas supply gap

Today's high commodity prices are giving oil and gas companies a significant financial boost. But the challenges facing the industry and the fundamental elements of the required reinvention have not changed.

These challenges must be considered in light of the immediate imperative: bridging the energy gap that might be caused by curtailment of Russia's oil and gas supplies.

The industry will need to play a leading role in lessening the world's (and primarily Europe's) dependence on Russian oil and gas by quickly developing a diversified set of alternative energy sources and capabilities.

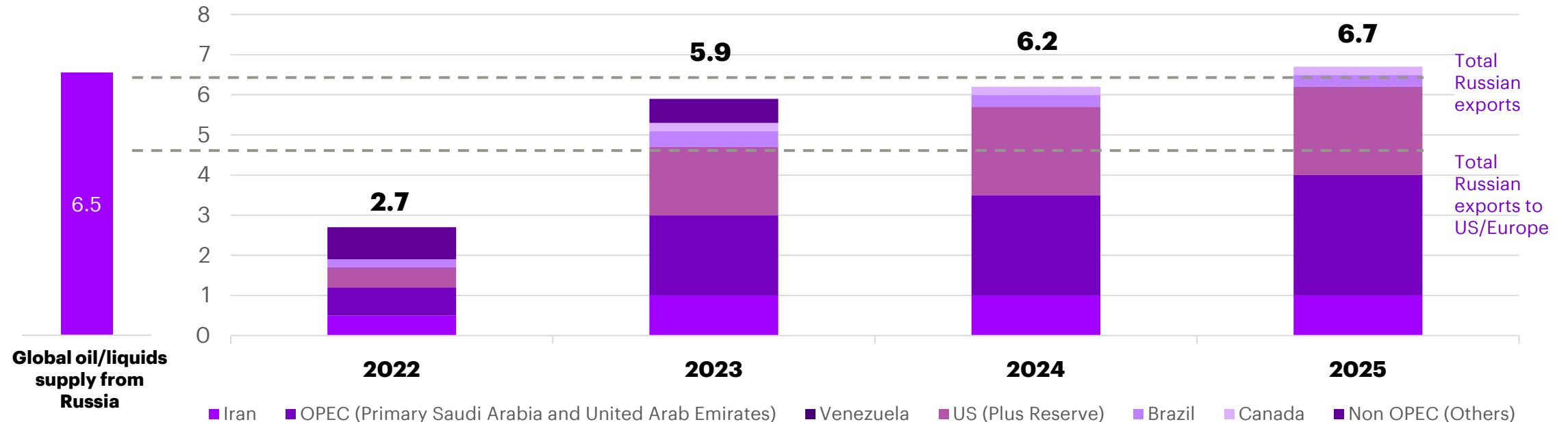
Alternatives to Russian crude supplies

Several crude supply alternatives are possible:

- Growth in US supply of 1.5-2 mmb/d is expected through 2023, with an additional 0.5 mmb/d by 2025. In the immediate term, the United States could also partially offset approximately 0.2 mmb/d of Russian oil volumes through releases from its Strategic Petroleum Reserve.³⁰
- OPEC—which can feasibly continue increasing its supplies by 0.4 mmb/d per month through October 2022—is expected to increase supplies by a cumulative 3 mmb/d by 2025.³¹ Venezuela is not expected to contribute to this increase since it is already producing at capacity.³²
- Iran could add an incremental 1 mmb/d by 2023 as an alternative to the Russian supply, but that contribution is contingent on overcoming the political barriers related to the nuclear deal.
- Other non-OPEC producers could add 0.5 mmb/d of incremental supply between 2021 to 2025.³³

Potential alternatives to Russian crude supply (mmb/d)

Oil companies won't just have to offset Russian crude but also meet new demand for oil, which is expected to increase by 4-7 mmb/d by 2025.³⁴ Securing additional production to meet demand in the short term, especially in the US and Venezuela, would be quite challenging, given the drilling lead times, capital investments and talent needed to accelerate production.



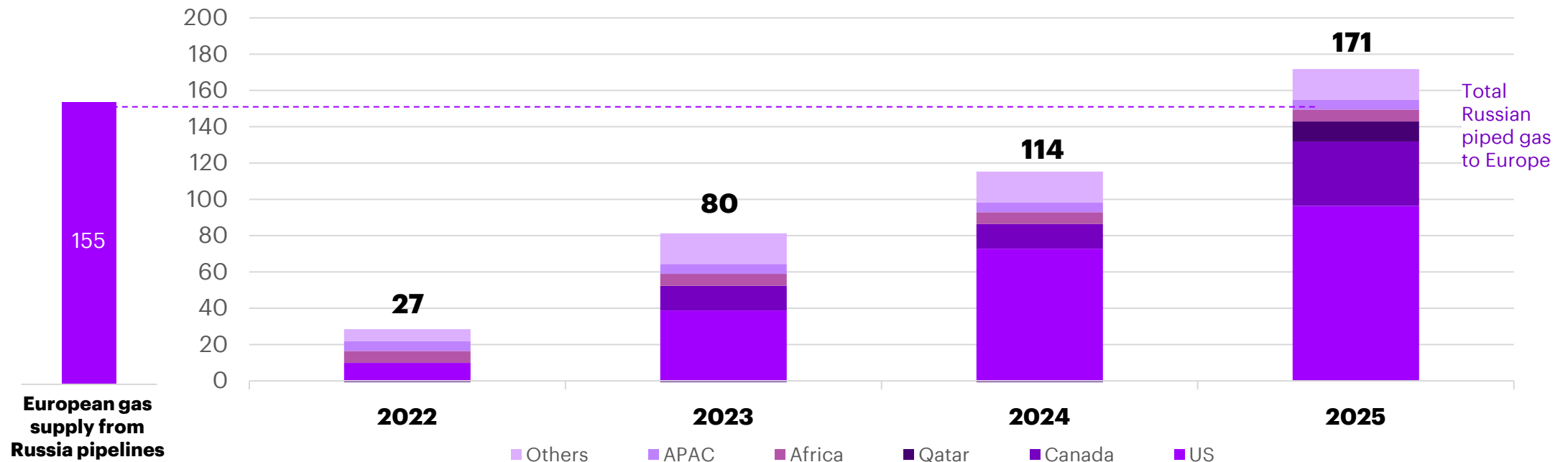
Sources: Accenture analysis with data from Rystad, Factiva.com.³⁵

Alternatives to Russian natural gas supplies

- Increasing the systemwide gas capacity to address any Russia-led supply gap will depend, primarily, on the global liquefied natural gas (LNG) supply. The ramp-up of LNG will likely be primarily by the United States, which is the biggest LNG exporter, with ~125 billion cubic meters (bcm) of export capacity this year. The US has already made plans to deliver 15 bcm additional LNG exports to Europe in 2022. By 2030, the goal is to deliver an additional 50 bcm/year, up from 22 bcm in 2021.^{36, 37}
- More than 200 bcm of LNG export capacity is approved in North America for delivery by 2025 (although delays in delivery are possible).³⁸ At least four LNG facilities could be operational within the next two years.³⁹ Two Canadian LNG terminals in British Columbia are also expected to come online in the next couple of years⁴⁰ and could help make up for the Russia-led supply gap.

Global LNG and pipeline export ramp-up (bcm)

Beyond North America, countries like Qatar, Australia and Mozambique could help close the gap if their supply capacities allow. But the majority of any new capacity they could deliver is expected to be available only after 2025. Qatar's North Field Expansion project is expected to add ~45 bcm of incremental capacity by 4Q25. By 2027, Qatar's liquefaction capacity is expected to increase by 64% relative to today's ~105 bcm.^{41, 42}



Source: Accenture analysis based on information available at EIA, IEA, FERC, Gas Infrastructure Europe LNG Database, press releases.

Complicating matters is the fact that Western and Central Europe are not currently equipped to meet their natural gas demand by simply accepting additional LNG cargoes. They have neither the regasification capacity they need, nor a robust inland network for distribution. This infrastructure will need to be developed.

European countries could, however, increase the utilization rates of current LNG terminals, which stood at approximately 50% (excluding Iberia) in 2021. The planned increase in utilization to 80% in 2022 would introduce an incremental capacity gain of approximately 60 bcm. A further 14 bcm of new liquefaction capacity can be delivered by 2025.⁴³

That could help offset the curtailment of Russian gas supplies but would not be nearly enough to meet demand. As a result, there will likely be the need for initiatives aimed at reducing energy demand, switching to new fuel sources and accelerating renewables projects. In both our expanded and extended scenarios, natural gas rationing could be a possibility.

The golden age of gas?

Natural gas is often considered a transition fuel in the energy transition because it's less damaging to the environment than other fossil fuels and, in some cases, more economically viable than clean energy sources. Over time, renewable technologies are expected to become cheaper than fossil fuels in every region globally and will diminish demand growth for gas. In the short to medium term, however, gas will become a more dominant player in the energy system and its markets will continue to grow and mature:

- Gas markets are still regional in nature but the price spreads between regional benchmarks (HH, TTF and JKM) are expected to gradually decline in the coming years. Currently, with Russian supply risks, the price spreads place TTF levels higher than JKM.⁴⁴
- Europe is increasing its dependency on LNG markets. This is translating into a higher utilization of current assets and new investments to enable the transition away from Russian gas within the next 10 years.⁴⁵
- Henry Hub (HH), which serves as the clearing house for futures contracts, will likely show a higher level of convergence as the United States increases its percentage of natural gas exports to the global markets. There are, however, limits to how much gas the US can export, which means significant arbitrage opportunities could still exist.
- Key gas markets in Asia have been transitioning from purely domestic markets to incorporate supplies from the global LNG market.
- The LNG market is growing and becoming more mature.
- Pending regulatory changes to gas storage activities are expected to improve the transparency and openness of the gas storage market.
- Flexible contract terms and larger spot markets are driving LNG price competition. There is the possibility that global gas prices and oil prices will be decoupled in the future.
- The derivative market in Asia is expected to grow. Liquidity within the JKM index is expected to increase and trading hubs in Asia-Pacific such as Singapore will become more important in the overall global LNG trade.

Building resilience

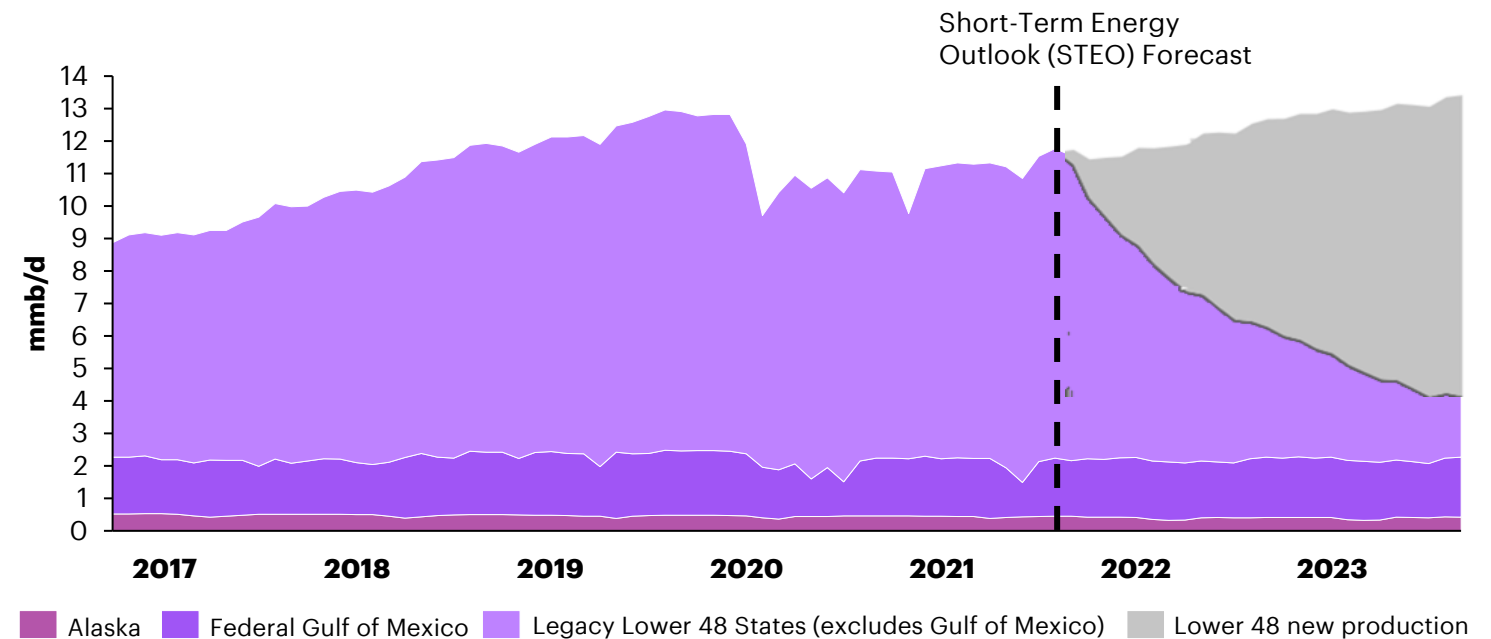
Quickly replacing Russia's contribution of supplies to the global energy system is a top priority for the oil and gas industry. But so is the creation of an agile, resilient, secure and reliable energy system that can withstand future disruptions. We believe six strategic plays could position oil and gas companies to achieve their short-term and longer-term ambitions.

Strategic play #1

Build brownfield capacity and operational excellence

Even before the start of the war in Ukraine, oil and gas companies were poised to ramp up production to record-high levels to meet surging post-pandemic demand for energy. At the time, the US Energy Information Agency forecast that 2022 crude oil volumes in the United States would increase by 760,000 b/d in 2022 and another 630,000 b/d in 2023.⁴⁶ The curtailment of Russian oil has accelerated and amplified the need for more production capacity in the short term.

US crude oil production forecast



Source: EIA STEO, March 8, 2022, with an estimated share of Lower 48 new production from EIA shown in STEO 18 Feb 2022.

One possible (and relatively quick) way to boost crude oil supplies involves increasing production from existing brownfield sites.

Production from legacy wells declines relatively quickly in tight oil formations, leading to the development of new wells within existing fields such as the Permian region. But existing wells still contain plenty of oil. In fact, it is estimated that reservoirs hold two-thirds of the original crude after primary and secondary recovery efforts.⁴⁷

To accelerate recovery, exploration and production (E&P) companies may be required to do four things:

- 1. Adopt a production system view of their operations.** That will help them to achieve visibility into "trapped" barrels. Develop capabilities and implement technologies that will facilitate them to respond faster to production setbacks.
- 2. Develop analytical capabilities** and implement technologies that will facilitate them to respond faster to production setbacks.
- 3. Upskill their workforce from generalists to specialized roles.**
- 4. Improve their planning capability for well restoration**—primarily through better predictions of subsurface and surface equipment failures.

Making such moves is not a simple undertaking. For a field with several thousand legacy wells, it would require the extensive development of field site automation. It would also call for an enhanced digital infrastructure capable of ingesting high-frequency data into analytical models to enable decisions that drive up the production efficiency of brownfield operations.

There are, however, a few improvements that can be made quickly for immediate impact. For example, completing the Drill Uncompleted (DUC) inventory (currently totaling 4,273 DUC in the lower 48 states), stimulating base production wells through refracs and acidizing jobs, and unchoking uneconomic wells in a low-price environment can generate significant value. We estimate that up to \$70 billion per year can be tapped by optimizing production via operational efficiencies, reducing planned/unplanned downtime and reducing inventory surpluses.⁴⁸

Such efforts could release currently trapped oil and gas reserves and potentially generate greater (and faster) returns than investments in the development of greenfield sites.

What to do now

- Continue to invest in wellsite and facility automation. This may include installing video surveillance to focus the field force on production-optimization opportunities rather than searching for leaks and repairs.
- Invest in data ingestion, contextualization and analytical models to create digital twins of assets. This will enable teams to run various "what-if" scenarios for production maximization under various constraints of water, gas and infrastructure capacities.
- Increase communication across disciplines at a given site to enable better, faster, insight-driven decisions to optimize production and achieve full capacity operations.
- Train and upskill employees for production optimization.

What to do six months from now

Identify methods of optimizing production to the last feasible barrel. Gas injection activities or artificial lift methods are possibilities but may require facility upgrades, costly investments and time.

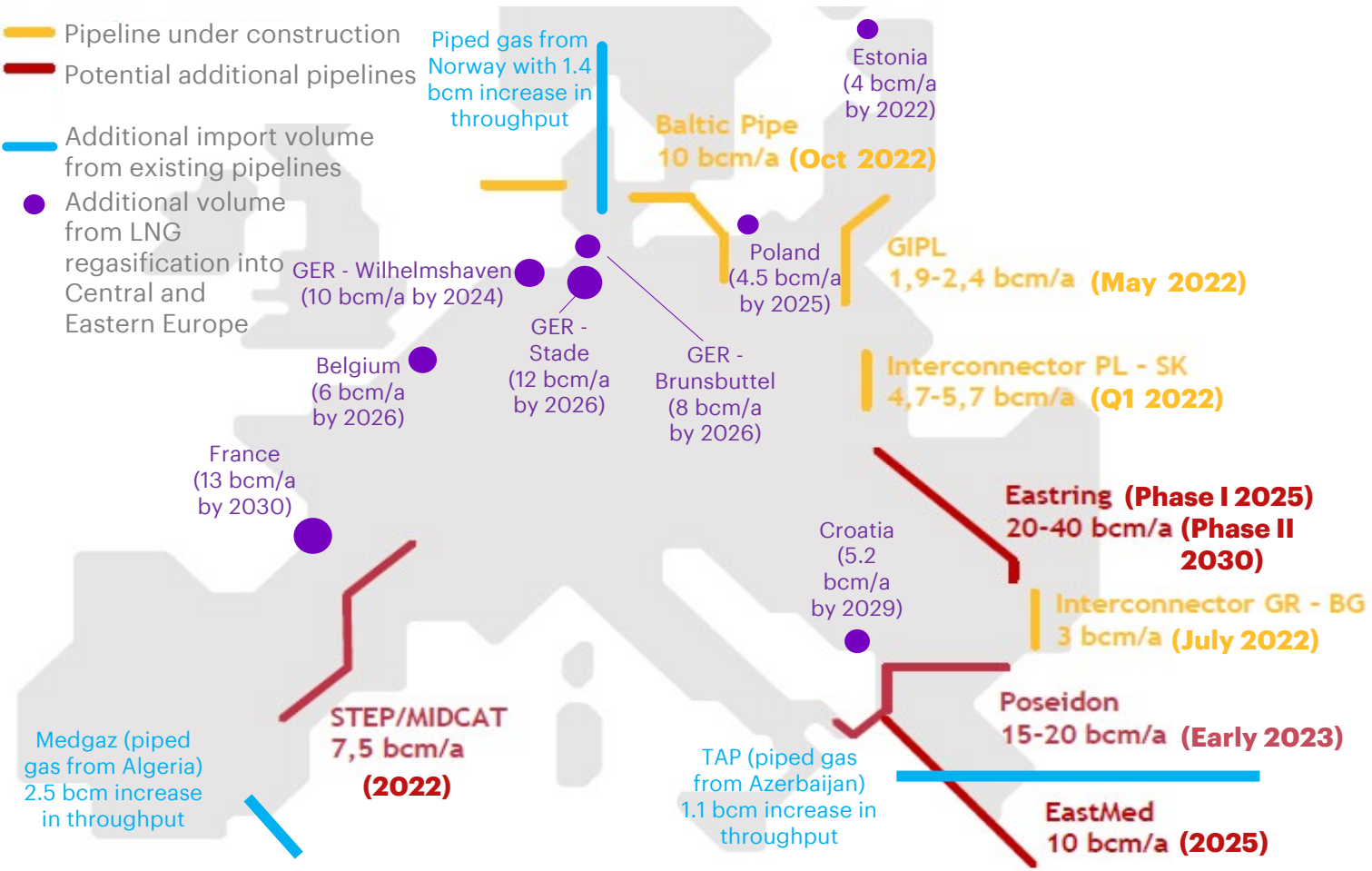
Strategic play #2

Maximize greenfield investments

Just a couple years ago, the oil and gas industry was dramatically slowing or canceling investments in greenfield projects. The pullback was due to the commodity price crash, which was driven by the supply shock and COVID-19 pandemic. But starting in 2021, this trend reversed and has now accelerated. Even before the invasion, global capital expenditure (CAPEX) investments were forecast to grow in 2022 by 7% in oil and 14% in gas/LNG and up to 18% within the shale E&P segment.⁴⁹ Upstream capital expenditures in North America were expected to grow by at least 20%.⁵⁰

At the same time, global energy transition commitments have shifted capital investment portfolios to include greener asset alternatives such as offshore wind, solar, hydrogen and biofuels.

Incremental European pipeline vs. LNG regasification capacity additions



bcm/d = Billion cubic meters/day

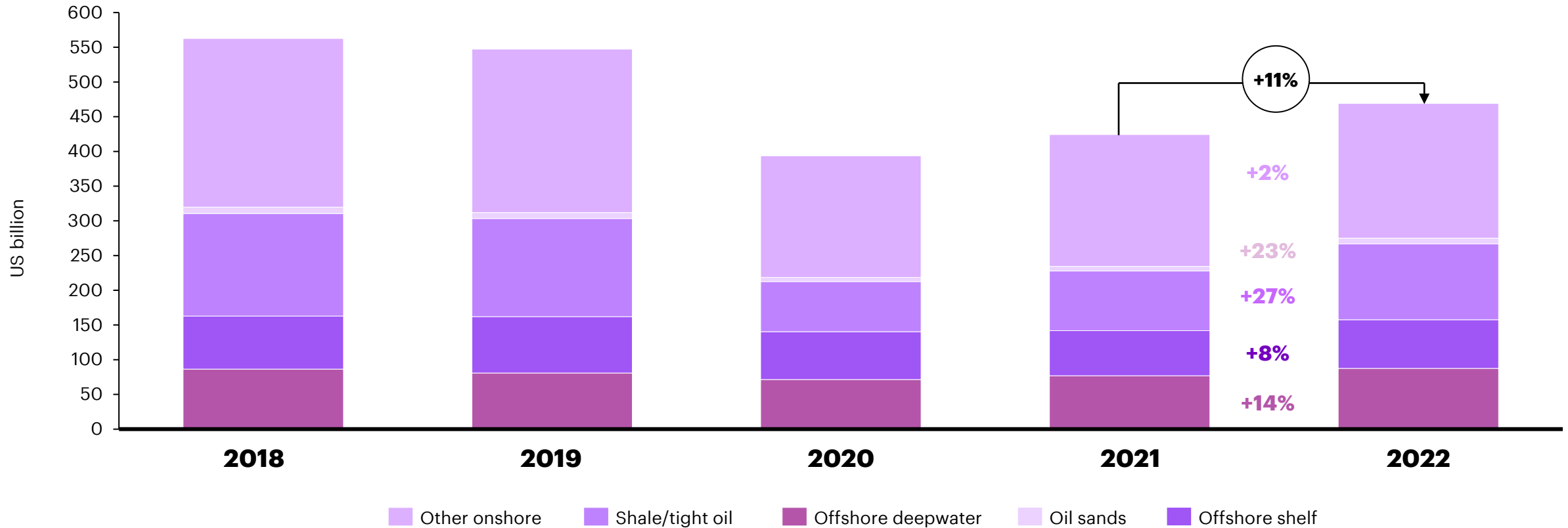
Sources: Umlaut/EWI analysis for Accenture (interconnector capacity excl completion years); Accenture analysis based on information available at EIA, IEA, FERC, Gas Infra Europe LNG Database, press releases (LNG terminals and interconnection completion years). Not showing the Trans-Mediterranean pipeline with about 32 bcm/a capacity from Algeria to Italy.⁵²

Achieving adequate returns on investments in traditional oil and gas assets and greener alternatives is key to building a more diverse and resilient future energy system.

Accelerating the development of traditional assets involves investing in upstream oil and gas fields and liquefaction capacity, regasification facilities and terminals for storage. There is a particular opportunity to build out the gas distribution network in Europe. Specifically, bringing German regasification plants online quickly could loosen current system constraints and help increase Central/Eastern Europe LNG capacity totals by approximately 70 bcm in this decade. New interconnecting and import pipelines in Europe could provide an additional flow of about 65 bcm. Throughput expansion from existing pipelines could also provide an additional flow of about 15 bcm.⁵¹



Global exploration and production investment outlook (\$US billion)



Source: Rystad Energy Ucube, data from March 31, 2022 Base case, used with permission.

Overcoming greenfield hurdles

Achieving near-term resilience and predictability in capital project delivery is critical to addressing the shortfall of Russian oil and gas. However, achieving resilience (just-in-case capabilities) in project delivery typically means forgoing just-in-time efficiencies by stockpiling materials or reserving equipment in advance, for example. The importance of deciding between greenfield or brownfield projects, engineering locations and levels of pre-fabrication is further amplified in today's inflationary environment, characterized by material and labor shortages.

Two major hurdles arising from the Russian invasion of Ukraine further exacerbate an already constrained supply market for greenfield capital projects:

- **Shortages of commodities, raw materials and components.**

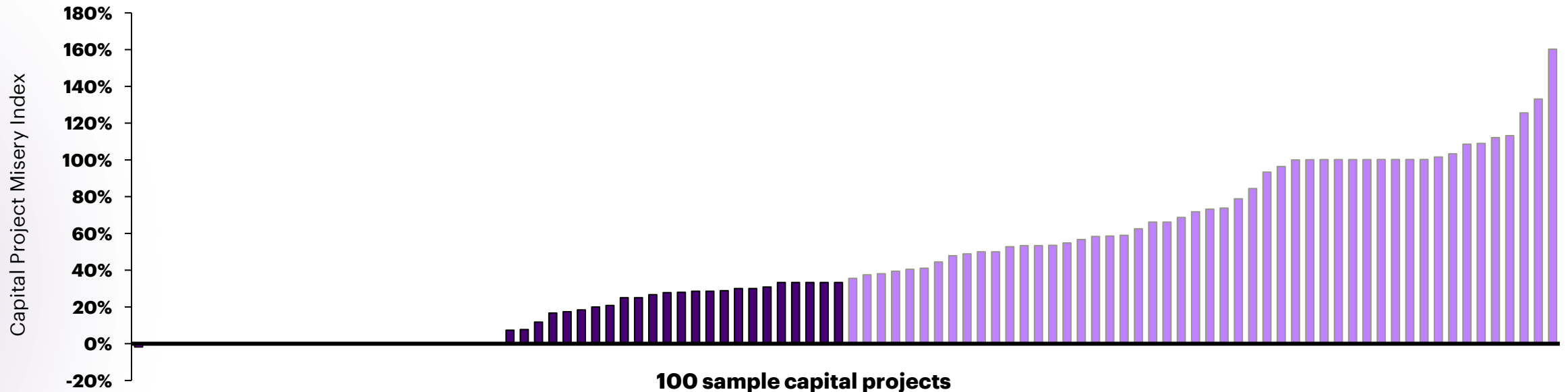
The combined production of mining commodities such as steel, aluminum and nickel from Russia, Ukraine and Belarus constitutes more than 5%, 6% and 18% of the world's production share,⁵³ respectively. The impact of sanctions has compounded inflationary pressure to drive year-over-year price increases for these commodities from 20% to 100% in 2022.⁵⁴

- **Lack of people to deliver capital projects.**

Workforce reductions and talent pool shrinkage, driven by the 2020 supply shock and pandemic, resulted in a 10-20% wage cost increase across the construction, engineering and installation sectors.⁵⁵ This has created an operating environment where constrained resources are being asked to do more with less. This is hampering growth forecasts, with segments already sold out for the year. Companies are re-evaluating their labor supply sources to move beyond labor arbitrage opportunities.

These more recent challenges have exacerbated greenfield obstacles that have persisted for years. Accenture analysis—depicted in the Capital Project Misery Index—has found that only 25% of oil and gas companies' CAPEX projects have been delivered on time and on budget.⁵⁶ One-third (33%) experience a one-year delay. A fifth (21%) suffer a two-year delay. And the remaining 19% of projects are delayed by three years or more. In our 100 major capital projects analysis, cost overruns totaled \$161 billion. The combination of cost and time overruns can take a significant toll.

Capital Project Misery Index



First quartile

- On-time and on-budget

Third and fourth quartiles

- On average **24%** over budget
- On average **52%** over time

Notes: Performance metric used is the percentage cost overrun plus percentage of time overrun. The 25% best performing projects were those where this score was lowest.
Source: Accenture analysis on 100 capital projects.⁵⁷

There are several reasons why greenfield projects have been prone to failure. Root causes tend to fall into three categories:

- a lack of pre-deal forethought;
- a lack of visibility; and
- a lack of analytics agility.

The biggest issues have resulted from not adequately considering regulatory requirements and experiencing a change in project scope.

Project delivery failure root causes

Bottom 50% of projects under Capital Project Misery Index analysed

Lack of analytics agility

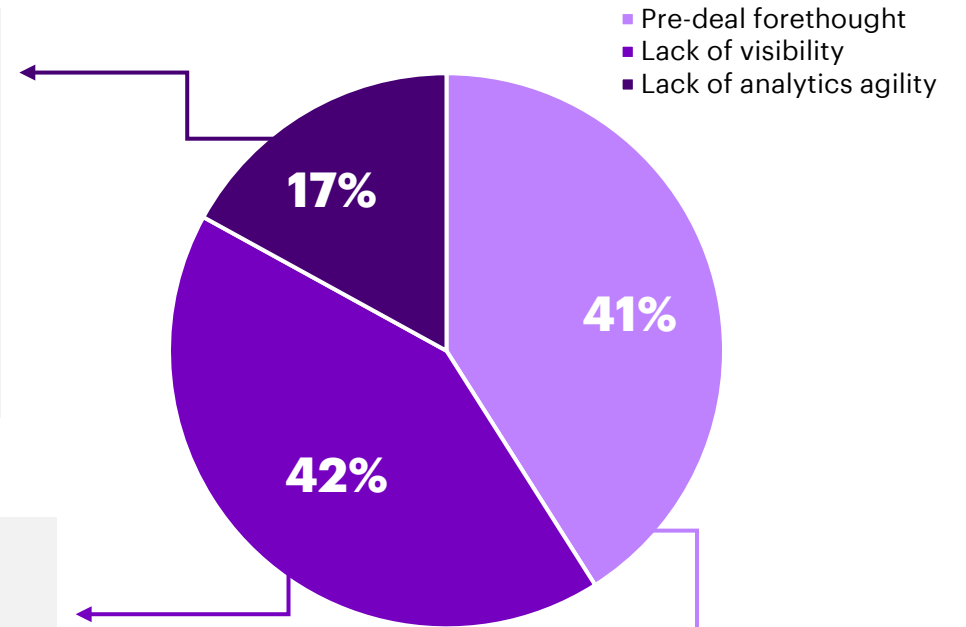
- 6%** Availability of resources and talent
- 6%** Changes in budget
- 5%** Poor productivity
- 0%** Changes in scope due to new tech

Lack of visibility

- 21%** Changes in asset scoping/new areas
- 15%** New regulatory requirements²
- 6%** Unforeseen contractor and supplier constraints
- 0%** Poor controlling/management

Notes: Performance metric used is percentage cost overrun plus percentage time overrun; The 25% of best-performing projects were those where this score was lowest.

Source: Accenture analysis on 100 capital projects⁵⁸



Pre-deal forethought

- 25%** Unconsidered regulatory requirements¹
- 11%** Original assumptions incorrect or incomplete
- 4%** Insufficient detail during planning



There's no reason for such historical failures to occur in capital projects moving forward. Even though banks' endorsement of net-zero initiatives often leads to higher upstream capital costs, recent advances in digital technologies and data management have introduced new critical project control oversight capabilities. These include portfolio and risk management, project management and assurance, engineering and project delivery and support.

When executing capital projects, analytics play a particularly important role. Accenture research⁵⁹ has found that approximately half of oil and gas companies have already implemented digital capabilities: predictive project analytics (50%), prescriptive project analytics (50%), opportunity and portfolio management analytics (48%) and smart contracts (50%). Nearly three-quarters (73%) have started deploying digital project planning solutions. And 58% have adopted intelligent estimating tools and analytics. While companies have not yet scaled such capabilities across the capital project portfolio, they are headed in that direction. Advanced data analytics is the top technology investment area for oil and gas companies between 2020 and 2024. And 100% of the 62 energy companies we surveyed indicated plans to invest at least \$10 million in their data lakes over that same period.

These new capabilities, tools and methods, coupled with the fiscal discipline and rigor investors now demand, will likely usher in a very different approach to capital project execution.

Also, oil and gas companies now know what has caused overruns in the past, which means they can mitigate the likelihood of their recurrence. Leaders in project delivery provide valuable insights into what works. We believe oil and gas companies can deliver capital projects on time and within budget by better managing their pre-deal and project delivery activities.

Learning from other industries

Like the energy industry, the engineering and construction sectors are committed to optimizing their capital projects. They have made significant digital investments to boost transparency and agility through their value chains. Yet, our research found that nearly two-thirds do not realize the benefits they expected around key performance indicators linked to cost, delivery, risk, talent and financial management.

The problem has less to do with the efficacy of their digital transformations and more with their failure to institutionalize data ownership and operationalize data for better decision-making. Specific issues for engineering and construction firms include the prevalence of siloed teams and the lack of a collective strategy for leveraging data and data-driven processes. We see these same barriers in the oil and gas industry.

Our research shows that integrating elements of the CAPSTONE framework can deliver an incremental 6.6% return on capital investments—and boost operating margins by up to 5.8%.⁶⁰

To help engineering and construction companies overcome these hurdles, Accenture developed a CAPSTONE (Capital Projects Strategic and Operating Network) framework to create a highly collaborative environment for sharing and using data. The framework comprises four key elements:

- **A data-committed C-suite.** Transformation leaders must be passionate about creating a culture of data ownership, data-sharing and data-driven decision-making.
- **A data-sharing infrastructure and capabilities.** Shared information systems and shared digital twins of capital projects enable teams to detect and fix problems early.
- **Data-centric talent.** 65% of outperforming engineering and construction companies can access digitally skilled labor. Data stewards and data coaches can help build the talent that is needed.
- **Incentive-based contracts.** Contracts tied to financial goals can incentivize all stakeholders—operators, suppliers and contractors alike—to make collaborative use of data-based insights.

Oil and gas companies might want to consider adopting a similar data-centric approach to maximizing the potential of their greenfield projects.

What to do now

Accelerate final investment decision (FID) on key LNG capital investments (expansions and greenfield developments).

- Set up a dynamic pre-deal underwriting methodology to address risk-adjusted assumptions and financials, deal terms, viability and structure.
- Incorporate sensitivity measures and impacts of cost shifts and supply availability, including for critical commodities, equipment and labor across scenarios and time horizons.
- Prioritize projects based on cost and time risk profiles to evaluate brownfield vs. greenfield opportunities, including concurrent de-risking of energy projects.
- Evaluate opportunities and optimize capital allocations based on intrinsic and extrinsic value (e.g., trading value). Bring trading into the deal shaping process early to capture the potential extrinsic value.

Activate near-term actions to bolster the ability to react to dynamic market conditions and identify strategic operating model enablers.

- Prioritize optimizing engineering and project standards for the current project portfolio.
- Increase third-party leverage to mitigate resource constraints.
- Continue adopting and refining agile concepts in project governance, organization and processes.
- Optimize capabilities in early planning stages, including concept development, design and execution planning.
- Refresh the digital strategy and establish consistent and common toolsets (integrated with a common data platform) across the project control application suite.

What to do six months from now

Strengthen capital project management visibility.

- Adopt predictive and prescriptive analytics to better manage project schedules and cost variability.
- Leverage consistent single-source data and common toolsets across the project control application suite to determine whether a project is on track and identify potential next best actions.
- Deploy methods and tools for portfolio and risk management to improve capital efficiency and resilience against strategic, operational, ESG, credit and market risks.

Expand implementation of agile operating model techniques.

- Establish agile project governance to re-evaluate the production system trade-offs across the project lifecycle.
- Leverage global scale to mitigate the impact of material and labor shortages by re-drawing supply sources and logistics routes based on resilience scorecard metrics.

Continue the digital transformation.

- Automate processes to increase workforce tool-time and productivity.
- Integrate planning, design and execution solutions to enable standards-based data sharing and a shared data environment for projects.
- Align contracts with procedures to drive more incremental data exchanges with contractors, leveraging industry standards such as CFIHOS.

Create a data-driven culture.

- Ensure the involvement of a data-committed C-suite.
- Strengthen the data-sharing infrastructure and capabilities.
- Build a pool of data-centric talent.
- Establish contracts to incentivize data-sharing.

Strategic play #3

Achieve supply chain resilience

The energy industry has long faced supply chain challenges, and the pandemic made them worse. Regional quarantines either created shortages of vital raw materials such as steel or brought ground production of necessary equipment to a halt. Even when materials and parts were available, logistical issues ranging from port congestions to the lack of last-mile drivers made it difficult to transport them to their final destinations.

Supply chain problems in the oil and gas industry put >20% of capital plans at risk.⁶¹

Now, Russia's invasion of Ukraine may create additional shortages in iron ore, nickel and other materials used in oilfield equipment. On top of this, countries and energy-intensive industries are looking to quickly replace their Russian oil and gas supplies. With supply chain problems holding up brownfield and greenfield projects, the challenge to meet the world's short-term energy needs has grown exponentially.

Finally, inflationary pressures can't be ignored. Inflation has made products that are available much more expensive. The capital spending set aside to meet demand and offset Russian oil and gas will actually buy less than it used to. Accenture estimates that current supply chain problems in the oil and gas industry put more than 20% of capital plans at risk.⁶²

A problem years in the making

Many of today's supply chain challenges are out of the industry's control. But some supply chain problems are attributable to energy players' actions over a long time. For example, oilfield equipment and services (OFES) companies have been downsizing for years to boost their cash flows and profitability. Now that demand for oil and gas is surging again, they are struggling to ramp up their inventories and production capacities. The same is true of their talent. The people they need to answer the industry's call for support just aren't there in sufficient numbers.

Operators are in a similar situation. They've responded to investors' demand for sustainable returns by cutting costs. Less attention—and money—was allocated to bolster a more resilient energy system. That means they haven't focused on building visibility across their supply chains. In fact, many still lack digital operations platforms that match materials and work crews, resulting in inefficiencies and longer wait times. On top of all that, many operators rely on spot purchasing or single-source supplier contracts for logistics or field support services. These contracts lock them into relationships with service providers that can no longer guarantee delivery.

Together, these value chain challenges add at least \$10 to \$15 per barrel to the breakeven cost of a new well.⁶³

Root causes of supply chain vulnerability

As the pandemic and the war in Ukraine suggest, crises that have the potential to disrupt oil and gas companies' operations are unavoidable. But the problems—and costs—associated with supply chain troubles needn't be as cumbersome as they have been in the past. Why? Because we now understand the underlying issues that have made the industry—particularly exploration and production companies—more susceptible to supply chain disruption. Addressing those issues today is critical for building supply chain resilience.

- **Lack of demand and resource pooling across operators.**

Without integrated planning, demand pooling and shared infrastructures among operators and oilfield and equipment services (OFES) companies, the industry is unable to optimize utilization of logistics networks, service crews or material inventory. As a result, operators can't effectively mobilize capacity to meet demand and their growth objectives.

- **Arms-length relationships with OFES companies.**

Rather than establishing long-term contracts with OFES providers, operators tend to rely on spot purchasing. Without long-term commitments and robust relationships with operators, OFES companies aren't incented to invest in the equipment and capabilities needed to address market demand swings. Thin margins further discourage the OFES investments that could boost supply flexibility. Additionally, because relationships between operators and OFES companies are transactional rather than strategic, it's difficult for them to work together to proactively identify supply risks and develop mitigation strategies.

- **Low visibility/high inefficiencies.**

Operators tend to have little visibility into their end-to-end supply chains, which means it takes them longer to respond to disruptions. They also typically lack an operations platform that matches materials with work crews, resulting in system inefficiencies and longer wait times, which affect efficiency and free cash flow.

A re-imagined supply chain

Recognizing the issues that make existing supply chains so susceptible to disruption is the first step toward overcoming them. While energy supply chains can usually withstand short-term disruptions, their standard risk models and supply chain capabilities fall short when dealing with longer-term, high-impact events. Building supply chain resilience will require operators and OFES companies to ask hard questions—and then gear their organizations for an integrated and efficient approach to reducing their collective risks.

What to do now

Anchor a mitigation plan in a clear understanding of what is possible and required when supply chains are threatened.

- What is needed to quickly mobilize the organization?
- How do we recognize the most critical impacts the disruption may have on our customers, people and business?
- What data and analytics are needed to inform our action plan?
- How does our action plan account for the idiosyncrasies of our supply chain?
- What operational changes are needed to ensure ongoing agility and resilience?

Consider ways to potentially reduce supply risks, such as:

- Conducting supply chain stress tests, leveraging digital twins to identify supply risks across the supply base.
- Confirming supply to ensure the feasibility of CAPEX and operational plans.
- Implementing shared procurement operations to optimize sourcing across basins and leverage a greater scale of purchases.

What to do six months from now

Pool demand and resources with other operators to reduce buffers for improved availability and efficiency; provide OFES companies visibility into this unified view of demand.

Develop new contract structures that incentivize OFES companies to improve supply resilience.

Strengthen relationships with OFES companies to understand supply shortages in real-time and work together on mitigation strategies.

Establish a basin-wide supply chain control tower to improve end-to-end supply chain visibility and resource utilization and optimize the execution of daily drilling, completions and production, and Scope 3 emissions-tracking activities.

Strategic play #4

Strengthen commercial and trading capabilities

As countries look to reduce their dependency on Russian oil and gas, the time is right for players in the energy industry to strengthen their commercial and trading capabilities and use them as levers to navigate today's highly volatile environment.

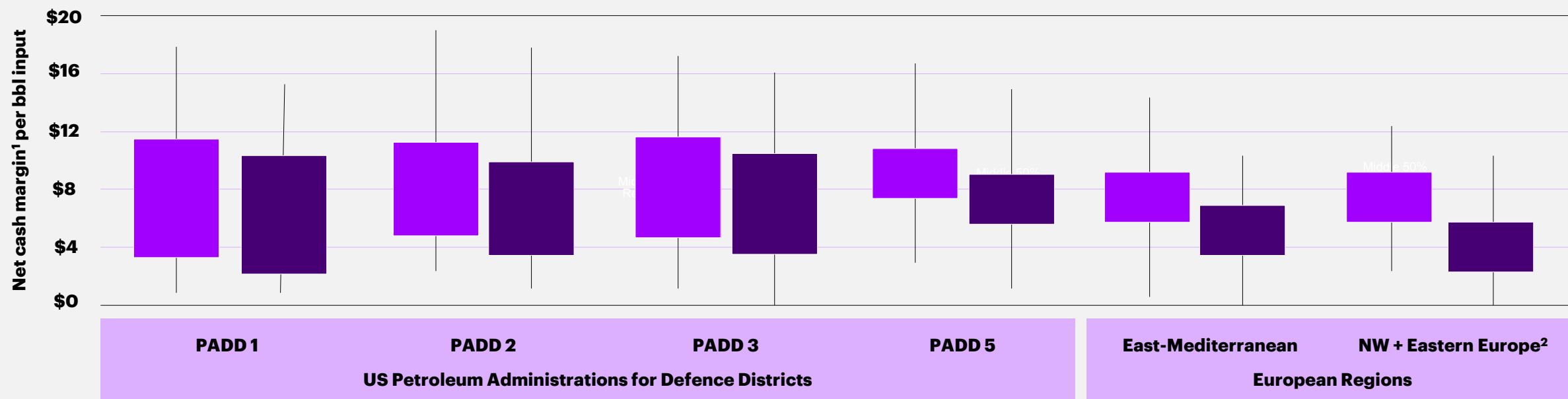
The current energy crisis is already affecting the refining sector. The impact is felt mainly in the United States and Europe and may potentially affect all regions due to the global nature of the crude oil market. **Going forward, a persistent high oil price environment coupled with inflation may erode fuels demand.** If the crisis persists or deepens, the ability to source crude oil and products might also be affected. This challenge would be more pronounced in Europe.

Refinery margin impact

■ Q4 '21

■ Supply constraint at \$125/bbl Brent

Based on maximum cash margin, middle 50%, minimum cash margin



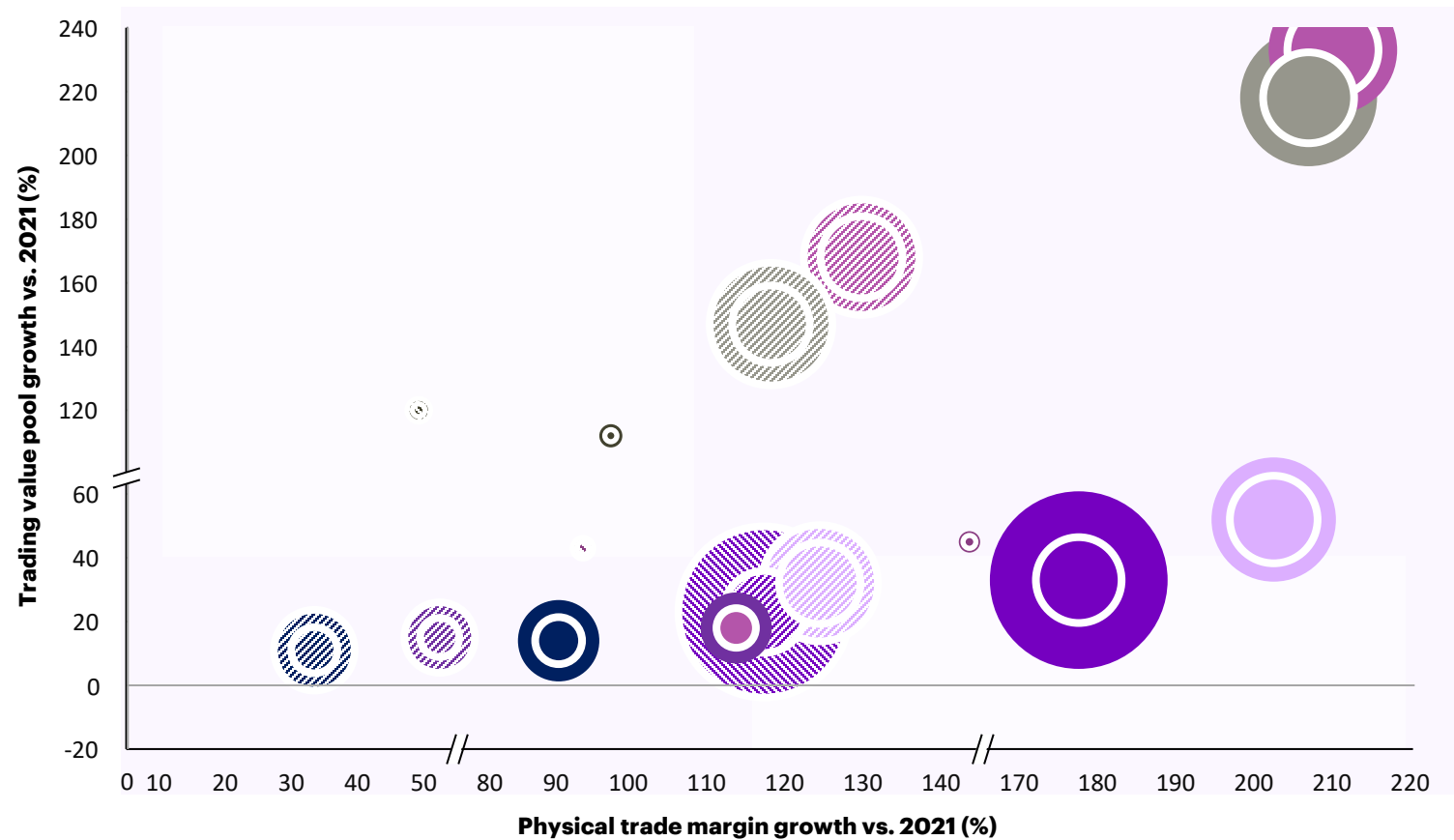
Notes: ¹Net cash margin ranges estimates are based on loss of profit (LOP) revenue minus crude and other fixed stock costs, refinery variable and fixed costs plus non-LOP revenue. Assumes reduction in demand 0.8-1 million barrels per day (mmb/d) versus pre-war estimates; ²Cash margin drop includes impact of supply constraints in Eastern Europe.

Source: Accenture analysis based on company data.



For the energy industry as a whole, however, volatility also brings opportunity. In trading markets, the high commodity prices and increased volatility seen in 2022 are likely to reach equilibrium in 2024 or 2025. In the interim, new arbitrage opportunities might emerge to increase the overall trading value pools across various commodities.

Trading value pools (Million USD) - Global



Scenarios

■ 2022 Value
▨ 2024 Value

Commodities

■ Crude Oil
■ Gasoline
■ Diesel
■ Naphtha
■ Natural Gas
■ LNG
■ Electricity
■ Petrochemicals

Global profit pool (Million USD)

○ 100,000
○ 50,000
○ 25,000
○ 10,000
○ High estimate
○ Low estimate

Note: Electricity figures include Europe, North America and selected Asia Pacific countries.

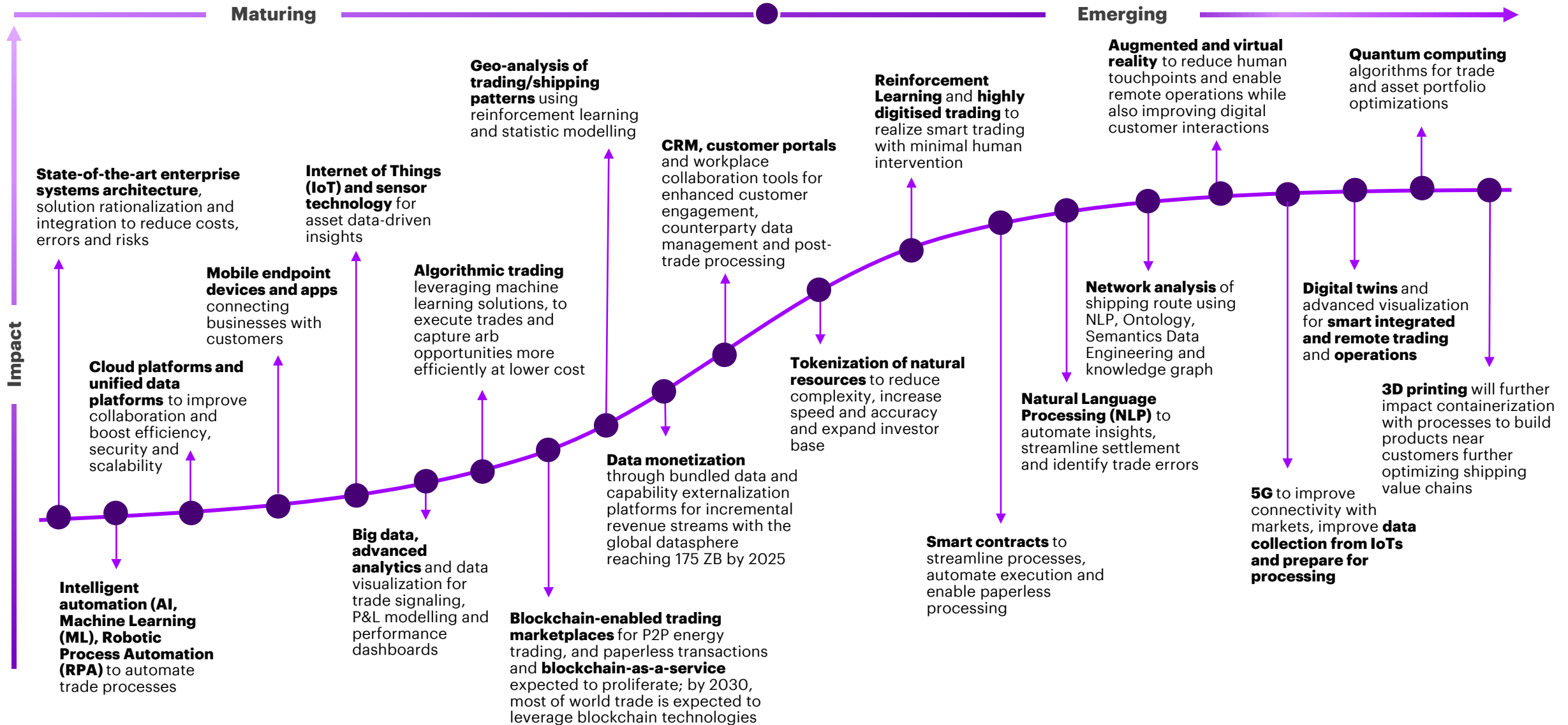
Source: Accenture analysis based on impact of trading margins and commodity demand on global trade value pools under selected scenarios.



The role of digital technologies in trading

As their trading capabilities mature, leading energy companies increasingly digitize their operations to drive greater efficiencies and better manage and optimize the daily change to their profit and loss. They are shifting to cloud-based ecosystems, unifying data sources, building mobile capabilities, automating operations and building customer-facing platforms and marketplaces. Importantly, they also take advantage of new technologies to generate insights and make better, faster decisions. Others in the industry should follow their lead.

Digital technologies are changing the end-to-end trading landscape



Re-imagining the trading function

Navigating the economic impact—positive or negative—of the war in Ukraine and the subsequent energy crisis requires oil and gas companies to fortify their commercial and trading capabilities. To build a more resilient trading function, energy companies should consider the following steps.

What to do now

- Understand the available risk capital within the organization and allocate more of it to trading.
- Make the necessary tactical operating model changes to optimize margins across the integrated value chain.
- Start investing in value chain optimization technologies and other digital technologies (artificial intelligence (AI) and machine learning) to improve the accuracy and efficiency of key processes across the trade life cycle.
- Review the trading strategy with an eye toward new trading flows, expected arbitrage opportunities (global and regional) and new trade flow access requirements (e.g., terminals, depots, storage, etc.).
- Strengthen cybersecurity protections across the organization to protect commercially sensitive data.

What to do six months from now

- Implement necessary portfolio changes to support the new trading strategy. This may include, for example, gas businesses, low-carbon products or network nodes such as storage facilities and depots.
- Rebalance term/spot business composition to ensure supplies match market opportunities.
- Overhaul the operating model; clearly defined roles, responsibilities, accountabilities and risk ownership can help maximize margins and support new investment decisions.
- Expand the scope and scale of the risk management function to cover all types of risk and embed a risk/return mindset for commercial decision-making across the organization.

Strategic play #5

Accelerate clean energy investments, demand-side efficiency and decarbonization of industries

The short-term and longer-term reduction in reliance on Russian energy can be a catalyst to bring forward the energy transition. It could also enhance the investment case for clean energy and drive the transformation of the industries and sectors that are the consumers of fossil fuels from Russia.

Oil and gas players are making their moves. But there are still plenty of opportunities to seize.

Take renewables. Global projects aimed at boosting renewable energy capacity hit a record in 2021; 257 gigawatts (GW) of new wind and solar capacity were added worldwide.⁶⁴ This figure may sound impressive, but it is well below the 960 GW needed annually by 2030 to meet the 2050 net-zero target.⁶⁵

Additionally, supply-side interventions will need to be augmented with demand-side energy efficiency gains from businesses and end consumers to achieve climate goals in the required timeframe. The IEA indicates that energy efficiency improvements can drive more than 40% of the reduction of greenhouse gas (GHG) emissions over the next 20 years.⁶⁶

Furthermore, the decarbonization of extractive and manufacturing industries, representing over a fourth of total anthropogenic CO₂ emissions,⁶⁷ is fundamental to the global energy transition. Just three sectors—cement and concrete, iron and steel, chemicals and petrochemicals—are collectively responsible for over 70% of direct industrial CO₂ emissions.⁶⁸

The World Economic Forum has outlined 10 choke points limiting the net-zero transformation of industries where out-of-the-box solutions are most needed

Breakthrough technologies	Infrastructure access	Demand for low-emission products	Policies and regulations enablement	Scaling capital
Most technologies used to decarbonize production processes are either yet to be demonstrated at scale or yet to be competitive with current high-emission alternatives.	Most net-zero compatible technologies for industries involve clean hydrogen, decarbonized power or carbon capture. The infrastructure to supply these energy sources and handle captured CO ₂ is still nascent.	Decarbonizing production processes require heavy investments, which lead to green premiums for consumers. Demand signals for pricier low-emission industrial products are only emerging.	Public incentives, including direct or indirect carbon pricing, subsidies or tax breaks, product use specifications or technology mandates, are still insufficient to support the business case for low-emission investments in most industries.	Both brownfield and greenfield low-emission industrial projects can require significant capital expenditure. Mechanisms to attract direct capital towards such projects offering less certain or immediate returns are just emerging.
Transition capability building	Carbon measurement and management	Supply chain circularity	Scope 3 abatement	Residual emissions offsetting
The net-zero transformation requires industrial firms to integrate new, often very different, capabilities. Re-skilling, up-skilling and hiring large pools of talent, workforce and management can be a bottleneck.	Measuring, monitoring or forecasting emissions of different nature and scope is complex when myriad industrial processes span very large areas. Standards and effective tools are emerging.	Secondary/recycled production typically emits a fraction of primary production emissions; however, it requires the establishment of recycling infrastructure, facilities, networks and new business models to scale up.	Scope 3 emissions are particularly hard to measure and address in most industries. Methodological challenges, as well as limited control over these emissions, make scope 3 abatement very challenging.	In some industries, known technologies are not able to fully decarbonize production. Reaching net-zero will require substantial investments in GHG removal projects to address residual emissions.

Source: "[Fostering Effective Energy Transition – 2022 Edition](#)," The World Economic Forum in collaboration with Accenture 2022.

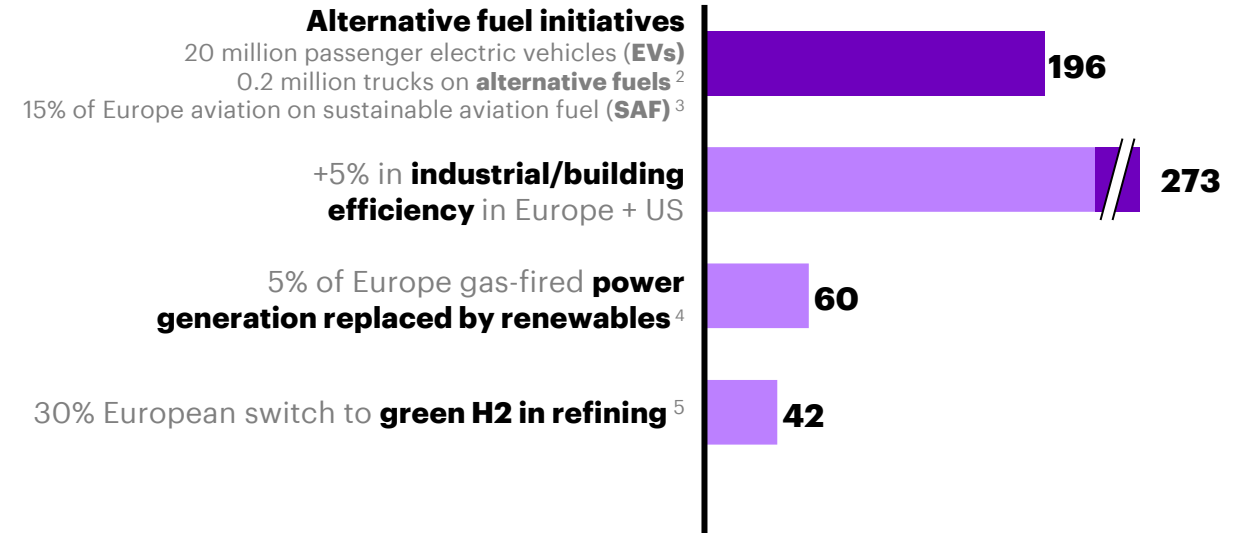
Clean energy investments, demand-side energy efficiency and industry decarbonization are three key areas of action for oil and gas companies. Each can open up new growth opportunities across multiple segments—all while leveraging profits from record-high energy prices and decades of experience collaborating with suppliers and customers, industry peers and other ecosystem stakeholders such as governments, policymakers, investors and consumers.

By doing so, oil and gas companies can help countries strike the right balance between energy affordability, security and availability, and sustainability imperatives.

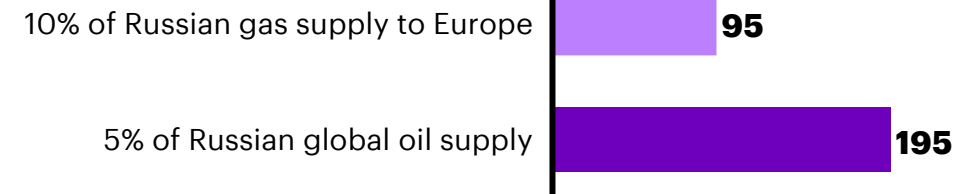
Oil and gas companies can play a further role in supporting demand management initiatives, given the greater need for energy efficiency. Commercialization of energy efficiencies (through energy services offerings) could yield significant growth opportunities for well-capitalized oil and gas companies with existing trading capabilities.

Example initiatives to avoid oil and gas demand

Oil Gas
mmboe/year



Above initiatives could address



Notes: 1) Assumes a car using 720 liters of gasoline a year with 6 l/100km and 12,000 km/yr. 2) Assumes a 40-ton truck using 33.1 L/100km for 150,000 km/year. 3) Based on European 2021 aviation fuel demand. 4) Assumes gas-fired baseload power plants replaced by flexible wind/solar/battery storage mix able to provide stable supply similar to baseload power generation. 5) Assumes 0.03 boe natural gas needed to produce 1kg steam methane reforming (SMR)-based H2 today.

Sources: Accenture analysis with data from Eurostat, European Commission and IEA.

To succeed in driving demand-side efficiencies and new energy services, oil and gas companies should consider:

Rethinking scenario planning: The current market environment and regulatory incentives have the potential to accelerate the commercial readiness of breakthrough technologies. This will reduce the need for hydrocarbons in major consuming sectors such as industries, transportation or power generation. It's critical to reassess demand for both hydrocarbon and low-emissions products in the medium term and the subsequent technology investment opportunities.

Repositioning themselves as energy suppliers: Oil and gas companies should look through the lens of being "energy suppliers," rather than hydrocarbon suppliers now that demand is structurally transitioning and accelerating toward renewable power, clean hydrogen and LNG. They also need to determine where to play in the new decarbonized energy landscape. The good news is that oil and gas companies have the necessary capital and talent to undertake and successfully deliver new energy ventures.

Channeling new returns toward the transition: Today's high commodity price environment, with its windfall profits, presents a unique opportunity for oil and gas operators to invest in the development of the infrastructure of the decarbonized economy (e.g., carbon transport and storage, hydrogen networks, grid expansion and modernization). Their participation would lower adoption barriers for other industries, while creating opportunities in new markets.

Participating in decarbonization collaborations: Solutions to the 10 industry barriers are seldom found within a single firm or even industry. New forms of multi-stakeholder collaborations are essential to accelerate the industrial transformation towards net-zero. Oil and gas companies can actively participate in such collaborations by producing clean hydrogen for industries; reutilizing captured CO₂; building hydrogen-ready LNG terminals; participating in supplier emission-performance programs; supporting customers with energy efficiency and decarbonization expertise; sharing knowledge with industry and cross-industry peers; developing shared infrastructure for industrial clusters; and participating in cross-industry funding.

Practical actions

To address the changes in customers' demand for energy and position themselves as leaders in the energy transition, oil and gas companies can take practical steps. It is essential for companies to swiftly revisit their short-, mid- and long-term investment plans and transition priorities. They should also reconfigure their portfolios and start building momentum around clean energy, energy efficiency and decarbonization offerings.

What to do now

- **Identify and initiate discussions with potential collaborators** (e.g., suppliers and customers, industry and cross-industry peers, governments and other stakeholders) on clean energy investments, demand-side efficiency in residential and commercial buildings, and industrial decarbonization.
- **Expand into adjacent areas such as blue hydrogen, biofuels and energy efficiency management services** to enrich commercial portfolio and growth prospects.
- **Review short-term economic and portfolio assumptions** considering anticipated changes in demand for oil, gas, LNG, blue/green hydrogen and decarbonized power.

What to do six months from now

Build position in long-term decarbonization of industries through technologies such as CCUs and hydrogen, systemwide energy efficiency improvements, and leading position in synthetic/renewable transportation fuels.

Develop programs and capabilities to help customers and countries diversify their **energy supply mix**.

Reshape portfolios and R&D investments by channeling new returns to meet new demand requirements.

Revisit long-range planning to incorporate countries' mid- and long-term energy mix changes (e.g., acceleration of the transition to renewables, new/modular nuclear power programs, ramp up in blue/green hydrogen, etc.).

Repositioning themselves as either integrated energy providers, decarbonized oil and gas leaders, or low carbon specialists.

Strategic play #6

Fortify cyber defenses

Energy companies have long been vulnerable to cyberattacks, but now the risk is higher than ever.

The war in Ukraine—and the sanctions placed upon Russia as a result—have triggered retaliatory cyberattacks. Accenture's Cyber Threat Intelligence and Cyber Investigation and Forensics Response teams found that Russia's invasion of Ukraine has resulted in a significant increase in cyber threats, including to critical infrastructure, by ideologically or financially motivated actors.⁶⁹

In response to the heightened cybersecurity risks posed by the war in Ukraine, Accenture's Cyber Threat Intelligence and Cyber Investigation and Forensics Response teams are continually gathering intelligence, monitoring incidents and activities, and developing countermeasures and mitigation strategies.

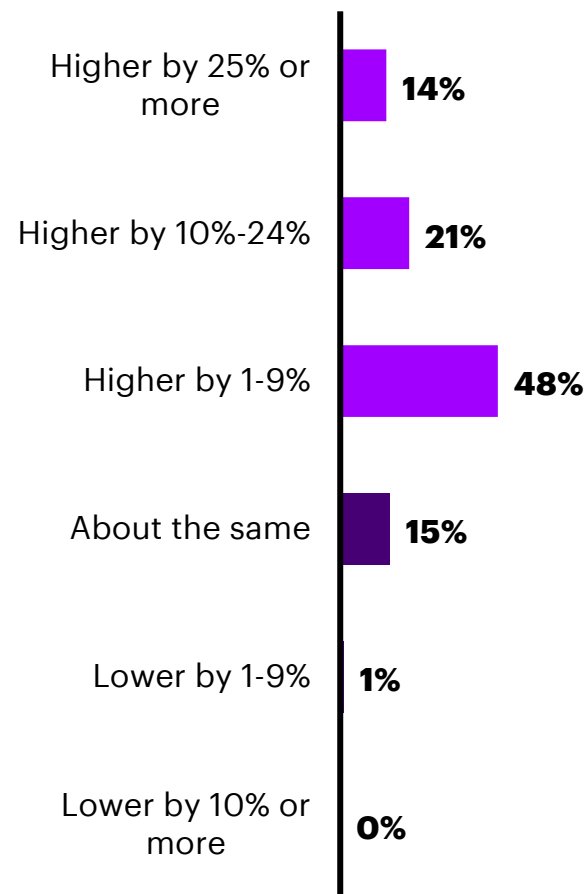
These teams regularly publish [Global Incident reports](#) with the most up-to-date and comprehensive analysis.

Potential disruptions to energy production are a significant risk. But the energy generation attack surface spans the value chain. For upstream businesses, these threats are primarily focused on production facilities, including those that generate energy from renewables such as wind. In the downstream space, potential targets include refineries, petrochemical tank farms and ports. And for mid-stream companies, pipeline infrastructure appears especially vulnerable.⁷⁰

Accenture Cyber Threat Intelligence has observed a 200% increase in scanning activities within companies that export liquified natural gas to Europe. To date, there have been no significant impact events in critical energy infrastructure.

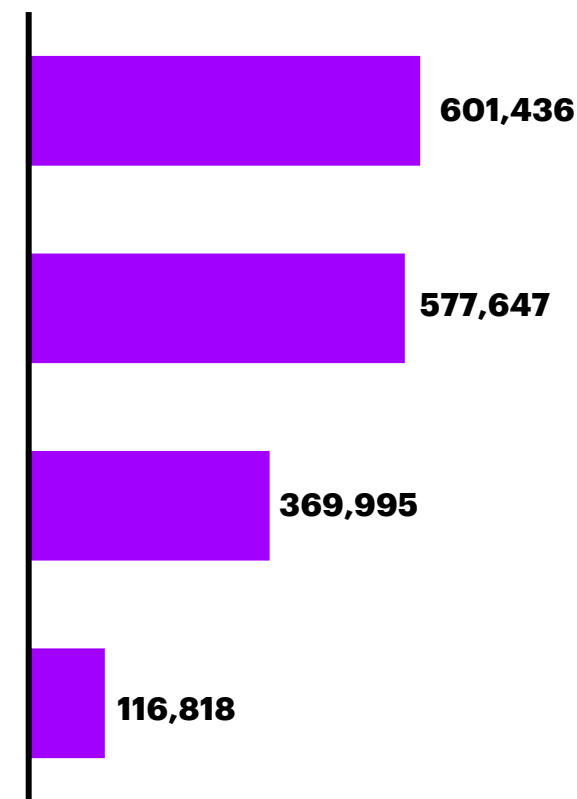
Industry leaders are quite aware of the threats they face. They have been under attack for years. From a sample of 55 Fortune 500 energy sector executives, nearly half had their corporate credentials exposed in a breach or leak since 2018. Also, over the past few years, the 20 largest global energy companies have had millions of records containing sensitive personal and employee data compromised.⁷¹ It's not surprising, then, that 83% of executives in the oil and gas industry increased their cybersecurity spending in 2021.⁷²

Increased cybersecurity spending in oil and gas in 2021



Source: Accenture State of Cybersecurity Resilience 2021 (N=4,7444; n=210 for oil and gas).

Number of exposed records of 20 largest global energy companies



Source: Constella Intelligence Energy Sector Exposure Report 2021, as reported in "Why Europe's energy industry is vulnerable to cyber-attacks", European Council on Foreign Relations (ECFR), March 7, 2022 with an estimated yearly total based on data collected through Sep 2021, of top 20 energy companies by revenues.



As the conflict in Ukraine unfolds, the humanitarian impacts are unmistakable. So are the financial and business implications for energy companies. In this environment of uncertainty, there are cyber impacts that are often overlooked.

What we've found

Accenture's Threat Intelligence, iDefense, has observed:

- An increase in reports of attacks and preparation for attacks against energy generation within the last 60 days, especially against Western and NATO-allied energy infrastructure. While disruptions to energy production constitute the main threat, upstream production and downstream services are also vulnerable to attack. Due to European reliance on Russian natural gas and Russia's interest in preserving this leverage amid widespread sanctions, LNG resources and pipelines are also at elevated risk of cyber-attacks by Russian state, cyber-criminal and hacktivist threat groups. In addition, recent targeting of the renewable energy sector, including wind, further elevates the risk to energy generation.
- An uptick in the number of ransomware victims who were publicly outed due to a lack of ransom payment. Five "energy" and one "oil and gas" organizations were listed in March and April 2022, compared to zero organizations from those industries reported between November 2021 and February 2022.
- Diverse threat groups probing and attacking energy infrastructure before and after Russia's February 2022 invasion of Ukraine. Many such groups have chosen sides based on ideological lines. Accenture has seen at least 50 pro-Ukrainian ransomware groups and at least 20 pro-Russian groups, all launching cyber-related attacks aligned with their ideology.

The war in Ukraine is an evolving situation and threats change rapidly.

It is critical that leaders review the following readiness questions with their technology and operations cybersecurity teams.

What to do now

General cybersecurity questions

- Do we have operations in the affected region?
- Are any of our critical suppliers or managed services providers based in Russia or Ukraine or have branches, businesses or service delivery centers there?
- Is our network segmented by geography, and can we quarantine exposed geographies without undermining critical business services elsewhere?
- Are services underpinning critical business services segmented from corporate networks?
- Do we have any ongoing unresolved/open breaches that could involve state-level actors?
- Have we had any breaches involving a Russian or Ukrainian threat actor over the past five years?
- What specific technical, business and organizational measures and contingency plans have we put in place to respond to the current crisis's elevated threat levels?
- Are all external and remote services fully patched, up to date, and hardened?
- Is multi-factor authentication enforced for all remote users, contractors or third-party service providers?
- Are all systems underpinning critical business services patched and up to date?
- Is access to all critical assets and resources logged and subject to active centralized and consolidated monitoring?
- Is privileged access actively restricted to minimum access rights?
- Have we actively validated the effective operation of critical protective security controls in the last six months?
- Have our detection and response capabilities been tested by multiple simulated high-capability attacks in the last six months?
- Have we tested the measures we have in place to prevent DDoS attacks in the last six months?
- Are we undertaking threat hunting for attackers already within our network (e.g., originating from a compromised supply chain or insider)?
- Does our business continuity planning include cybersecurity incident response planning? Does it extend beyond disaster recovery and backup recovery?
- Have we tested backup and recovery procedures for systems underpinning critical business services in the last six months?

What to do now

Operational technology-specific cybersecurity questions

- Do our operational technology (OT) systems have remote connections originating from impacted regions? Do we enforce multi-factor authentication for all remote access connections?
- Do we have cybersecurity visibility and OT-specific monitoring and anomaly/intrusion detection tools?
- Do we routinely conduct vulnerability assessments for both IT and OT environments?
- Are our servers and workstations regularly patched in the control system environment?
- Are safety systems on the same network as control systems? Can we ensure an attack on one will be isolated from the other?
- Have we planned to operate the OT systems manually or offline if needed?
- Do we have backup emergency communication methods for the control room and field personnel?

What to do six months from now

- Establish a crisis communications plan.
- Review third-party risks and vulnerabilities.
- Enforce encryption procedures and multi-factor authentication everywhere.
- Patch software and OT system vulnerabilities to enable mitigating controls.
- Segment safety and control systems.

Transitioning amid uncertainty

Russia's invasion of Ukraine has had a deep human, economic and business impact. It has disrupted lives and livelihoods. Supply chains, industries and economies. The energy industry, like all others, is now operating in an uncertain environment. Some may argue that the war and its impact will push oil and gas companies' strategies for reinvention to the back burner. We disagree.

Oil and gas companies have an opportunity—and an obligation—to ensure energy sustainability, security and affordability. The war has amplified, not diminished, the call to action. It has made the energy transition and the need for a reinvented, highly resilient energy system more important than ever.

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