



# managing climate change risks

a perspective for investors

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human energy®

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### forward-looking statements warning

CAUTIONARY STATEMENT RELEVANT TO FORWARD-LOOKING INFORMATION FOR THE PURPOSE OF "SAFE HARBOR" PROVISIONS OF THE PRIVATE SECURITIES LITIGATION REFORM ACT OF 1995

This report contains forward-looking statements relating to Chevron's operations that are based on management's current expectations, estimates and projections about the petroleum, chemicals and other energy related industries. Words or phrases such as "anticipates," "expects," "intends," "plans," "targets," "forecasts," "projects," "believes," "seeks," "schedules," "estimates," "positions," "pursues," "may," "could," "should," "budgets," "outlook," "focus," "on schedule," "on track," "goals," "objectives," "strategies" and similar expressions are intended to identify such forward-looking statements. These statements are not guarantees of future performance and are subject to certain risks, uncertainties and other factors, many of which are beyond the company's control and are difficult to predict. Therefore, actual outcomes and results may differ materially from what is expressed or forecasted in such forward-looking statements. The reader should not place undue reliance on these forward-looking statements, which speak only as of the date of this report. Unless legally required, Chevron undertakes no obligation to update publicly any forward-looking statements, whether as a result of new information, future events or otherwise.

Among the important factors that could cause actual results to differ materially from those in the forward-looking statements are: changing crude oil and natural gas prices; changing refining, marketing and chemicals margins; the company's ability to realize anticipated cost savings and expenditure reductions; actions of competitors or regulators; timing of exploration expenses; timing of crude oil liftings; the competitiveness of alternate-energy sources or product substitutes; technological developments; the results of operations and financial condition of the company's suppliers, vendors, partners and equity affiliates, particularly during extended periods of low prices for crude oil and natural gas; the inability or failure of the company's joint-venture partners to fund their share of operations and development activities; the potential failure to achieve expected net production from existing and future crude oil and natural gas development projects; potential delays in the development, construction or start-up of planned projects; the potential disruption or interruption of the company's operations due to war, accidents, political events, civil unrest, severe weather, cyber threats and terrorist acts, crude oil production quotas or other actions that might be imposed by the Organization of Petroleum Exporting Countries, or other natural or human causes beyond its control; changing economic, regulatory and political environments in the various countries in which the company operates; general domestic and international economic and political conditions; the potential liability for remedial actions or assessments under existing or future environmental regulations and litigation; significant operational, investment or product changes required by existing or future environmental statutes and regulations, including international agreements and national or regional legislation and regulatory measures to limit or reduce greenhouse gas emissions; the potential liability resulting from other pending or future litigation; the company's future acquisition or disposition of assets or the delay or failure of such transactions to close based on required closing conditions set forth in the applicable transaction agreements; the potential for gains and losses from asset dispositions or impairments; government-mandated sales, divestitures, recapitalizations, industry-specific taxes, changes in fiscal terms or restrictions on scope of company operations; foreign currency movements compared with the U.S. dollar; material reductions in corporate liquidity and access to debt markets; the effects of changed accounting rules under generally accepted accounting principles promulgated by rule-setting bodies; the company's ability to identify and mitigate the risks and hazards inherent in operating in the global energy industry; and the factors set forth under the heading "Risk Factors" on pages 20 through 22 of the company's 2016 Annual Report on Form 10-K. Other unpredictable or unknown factors not discussed in this report could also have material adverse effects on forward-looking statements.

# Letter from the Chairman and CEO



**John S. Watson**  
Chairman and CEO

Recently, some of our shareholders have expressed interest in gaining greater insight into how Chevron manages climate change risks. This report is meant to address this topic by providing the Company's views on long-term fundamentals of the energy industry, the processes by which we manage risks—including climate change risks—and the significant steps we have taken to manage greenhouse gases (GHGs).

Chevron shares the concerns of governments and the public about climate change risks and recognizes that the use of fossil fuels to meet the world's energy needs contributes to the rising concentration of greenhouse gases in Earth's atmosphere. GHGs contribute to increases in global temperatures. The Company also shares the view of many industry analysts that oil and natural gas will remain a major portion of energy supply for the foreseeable future. The accessibility and reliability of energy offered by oil and natural gas are important contributors to improving standards of living worldwide and growing economic prosperity.

Chevron operates in a highly competitive and constantly changing marketplace. We regularly reassess our views of existing and future energy markets as well as policy scenarios under which we expect to operate. To manage the wide array of potential risks inherent to its business, Chevron has in place mature processes for risk management, including risks that may be associated with climate change. Executive management and ultimately the Board

of Directors are involved in these processes. Examples of our risk management processes include Enterprise Risk Management, investment decision making, and strategic and business planning. As to climate change risks, our assessments have included an examination of potential carbon-constrained scenarios, including pricing scenarios and the relative competitiveness of asset types.

Our processes have enabled the Company to adapt to the dynamic and constantly changing nature of energy markets. As markets have evolved and changed, so have our Company's operations. The history of our operations has shown that we are consistently well prepared and able to adapt to changing conditions in the marketplace.

We hope this report will provide insight into some of the long-standing risk management processes we use and the application of these processes to the management of climate change risks. Chevron remains committed to continued shareholder engagement on this and other issues of interest. We appreciate your investment in Chevron.



March 2017

# executive summary

**Reliable and affordable energy is necessary for improving standards of living, expanding the middle class and lifting people out of poverty. Oil and natural gas will continue to fulfill a significant portion of global energy demand for decades to come—even in a carbon-constrained scenario.**



## managing risk

Chevron utilizes a number of processes to manage risk, including risks that may be associated with climate change. These include Enterprise Risk Management, Strategic and Business Planning, Portfolio Management, and assessments of commodity pricing.

- Chevron considers an internal outlook of carbon prices in the economic evaluations supporting major capital project appropriation approvals.
- Chevron uses a risk-based approach to address possible physical impacts to our critical infrastructure.
- Chevron continually refreshes our portfolio taking into account our views of future market and regulatory conditions. Chevron has the ability to adjust investment patterns, and portfolio composition will reflect the evolving nature of possible demand and regulatory changes.

In view of the continuing global demand for oil and gas, the substantial future investment required to meet that demand, and the way investment decisions to explore for and/or develop resources are phased and made with a market view in mind, the current risk exposure to the Company in a greenhouse gas (GHG)-restricted scenario is minimal.

Chevron has analyzed the impacts of supply, demand and resultant pricing levels under a reduced-demand/GHG-constrained scenario, including consideration of the International Energy Agency (IEA) 450 Scenario.

### **This analysis has shown:**

- The pricing levels modeled for the IEA 450 Scenario generally align with the low end of the price trajectory range already being used throughout Chevron's various planning processes.
- Although certain high-cost assets around the world could be impacted by a hypothetical GHG-constrained case, those high-cost assets for which a final investment decision has yet to be made would not find a place in our investment portfolio given our risk management processes. Lower-cost assets remain competitive, specifically, those assets already producing, which would continue to produce.

Chevron has undertaken a number of steps to manage GHGs, including investments in flare reduction, investments in CO<sub>2</sub> injection, improved energy efficiency and activity in biofuels.

In summary, we believe Chevron's current risk management and business planning processes are sufficient to mitigate the risks associated with climate change. These processes are appropriate to enable the Company to continue to monitor and adjust accordingly as climate policy developments unfold.

# introduction

**This report provides an explanation of the means and processes by which Chevron manages climate change risks.**

**In this document, we address:**

- The Company's views of the fundamental principles underlying the global energy industry that drive our long-term decision making, including climate change matters and their effect on energy demand, supply and pricing;
- The Company's risk management and governance processes and how they are used to effectively address climate change risks to our industry and the Company; and
- The Company's actions to manage the climate change risks to our business segments.

**most forecasts call for global energy demand to rise by approximately one-third or more by 2040 as populations grow, incomes rise and people all over the world strive for higher living standards**



# long-term fundamentals

The products Chevron develops are indispensable to the economies of the world.

Energy enables light, heat, mobility, mechanized agriculture, modern health systems and electronic devices. Energy is one of the fundamental drivers of sustained economic growth and human progress, and over the past 150 years fossil fuel energy has enabled the greatest advancements in living standards in recorded history. Fossil fuels are reliable, are energy-dense, can be stored, and require a global infrastructure of refineries, pipelines, ships and distribution systems that has taken many decades to build. As big as the global energy system is today, it will become even bigger as the world's industrial base grows, new technologies are invented and populations expand.

## energy demand

There are still 1.2 billion people in the world without electricity and more than 2.7 billion people who burn solid fuels, such as wood, crop residue and dung, to cook their food.<sup>1</sup> The delivery of affordable and reliable energy to these people is critical to global economic growth and stability. This will drive far more energy demand than can possibly be met by renewable sources using today's technology. Most forecasts call for global energy demand to rise by approximately one-third or more by 2040 as populations grow, incomes rise and people all over the world strive for higher living standards.

The IEA's New Policies Scenario, which incorporates existing energy policies around the world as well as an assessment of the likely results of announced, but not-yet-enacted policies, anticipates that oil and natural gas will meet roughly half of global energy demand by 2040. Even in its 450 Scenario, which models a much higher level of emissions reductions,<sup>2</sup> oil and natural gas will meet 44 percent of global demand in this same time frame, with coal providing an additional 16 percent. By comparison, wind and solar generation are expected to increase, meeting about 3 percent of such demand by 2040, up from less than 1 percent today.



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energy is one of the fundamental drivers of sustained economic growth and human progress, and over the past 150 years fossil fuel energy has enabled the greatest advancements in living standards in recorded history

<sup>1</sup> IEA, *World Energy Outlook 2016*, Energy Access Database, [worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/](http://worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/)

<sup>2</sup> This scenario is meant to represent a world in which policies sufficient to limit long-term warming to 2° C above pre-industrial levels have been implemented.

**The following market data/projections provide support for this sustained fossil fuel demand:**

- Globally, demand growth is driven by emerging markets. Although demand from the Organisation for Economic Co-operation and Development (OECD) countries is expected to decrease in the long term due to efficiency improvements, the IEA found that demand in those developed countries actually grew slightly in 2015 and 2016 due to a response to lower prices.
- In the United States, the Energy Information Administration (EIA) expects battery electric vehicle sales to increase by 2040 from less than 1 percent to 6 percent of total light-duty vehicles sold, and plug-in hybrid electric vehicle sales to increase from less than 1 percent to 4 percent over the same period.<sup>3</sup> Although the increasing market share of electric vehicles will be a factor in reducing the demand for oil, the overall demand for oil is still expected to increase because only 10 percent of global oil demand comes from cars. As IEA Executive Director Fatih Birol has noted, only 1 in 100 cars currently sold is electric, so “[e]ven if you assumed that, as of tomorrow, every second car sold was electric, global oil demand would still increase.”<sup>4</sup>
- The EIA projects that in the United States, because the increase in freight travel demand will be offset by rising fuel economy standards, heavy-duty vehicle energy consumption will be approximately the same in 2040 as it was in 2016.<sup>5</sup> Demand for air transport will rise through 2040, leading to a 40 percent increase in jet fuel consumption by 2040, despite efficiency improvements.<sup>6</sup>

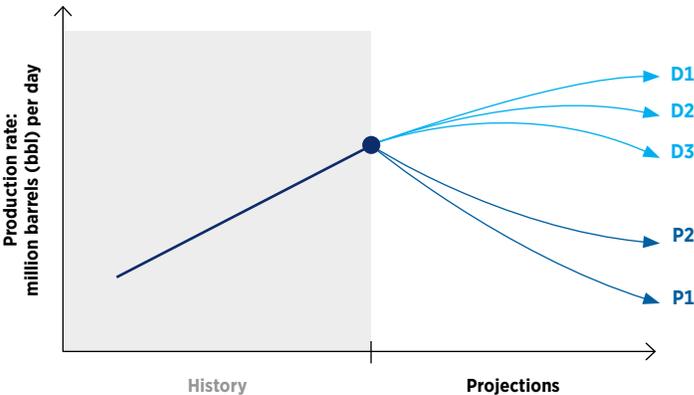
**energy supply**

Trillions of dollars will need to be spent to keep the world supplied with energy in the decades ahead. According to the IEA, the majority of the investment will be spent on fossil fuels.<sup>7</sup> The IEA predicts in its latest *World Energy Outlook* that 60 percent of the \$44 trillion in investment in energy supply through 2040 will be in fossil fuels, slightly less than the 70 percent of total energy investment spent on fossil fuels over the past 15 years.<sup>8</sup>

A significant amount of the spending will be used to enhance production from existing oil and gas fields as they naturally decline with age, rather than in developing new resources. The industry limits its base business production decline rate through the deployment of innovative technology and investment in existing fields. Filling the gap between ongoing demand and the natural decline requires continual investment and provides another opportunity to adapt strategy consistent with market signals (see chart to the right).

Even under an aggressive climate policy scenario such as the IEA’s 450 Scenario, **oil and natural gas will meet 44 percent of global energy demand by 2040.**

**oil and natural gas production decline and alternate demand cases**

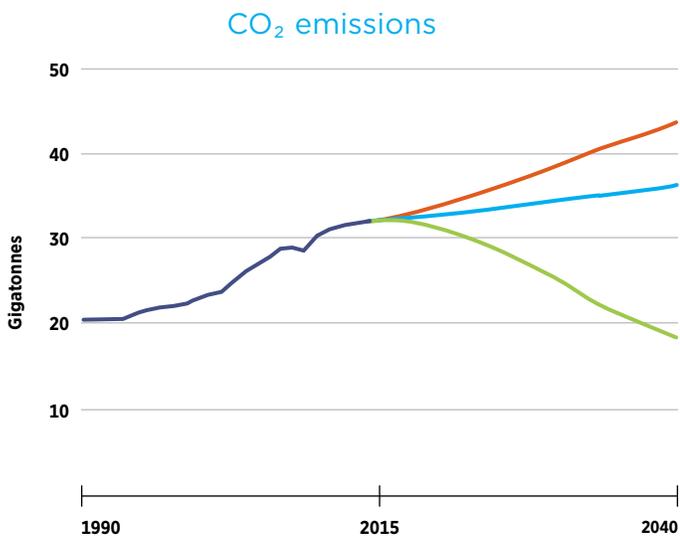
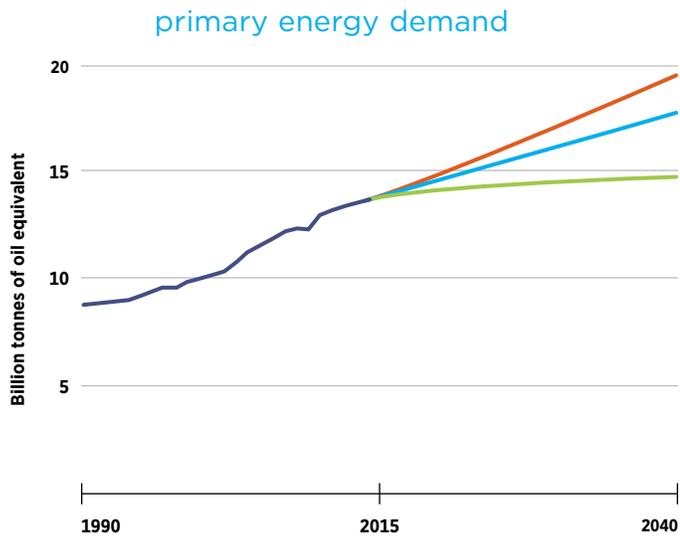


**D1, D2, D3:** Alternate demand scenarios  
**P1:** Existing production—expected decline  
**P2:** Existing production—decline rate reduced with increased investment

Note: For illustration only. Not drawn to scale.

3 EIA, *Annual Energy Outlook 2017*, eia.gov/outlooks/aeo/pdf/0383(2017).pdf  
 4 Pilita Clark, Andrew Ward, and Neil Hume, “Oil Groups ‘Threatened’ by Electric Cars,” *Financial Times*, October 18, 2016.  
 5 EIA, *Annual Energy Outlook 2017*, eia.gov/outlooks/aeo/pdf/0383(2017).pdf  
 6 Ibid.  
 7 IEA, *World Energy Outlook 2016*, worldenergyoutlook.org/publications/weo-2016/  
 8 Ibid.

## global primary energy demand and related CO<sub>2</sub> emissions by IEA scenario



- Current Policies Scenario
- New Policies Scenario
- 450 Scenario

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### energy prices

At the most fundamental level, the dynamics of the fossil fuel industry are driven by energy prices. As part of the Company's strategic planning process, we use proprietary models to develop a range of future price trajectories. These trajectories are developed through a rigorous assessment of supply and demand for each product line that takes into account risks and uncertainties using probabilistic methods, and they are tested against third-party views.

#### Input parameters include:

- Economic activity (overall and regional);
- Technological advances;
- Policy and regulation;
- Consumer preferences and behaviors;
- Costs of competing energy sources;
- Regional variations in supply (e.g., gas vs. oil, heavy oil vs. light oil, etc.); and
- Geopolitical, market and other risk-related factors.

These price trajectories include consideration of a range of possible inputs to ensure the analysis is robust across a variety of scenarios.

#### IEA 450 Scenario

One such scenario is the IEA's 450 Scenario, which is premised on the assumption that a hypothetical combination of policy-driven improvements in energy efficiency and carbon taxes is enacted to limit atmospheric CO<sub>2</sub> concentrations to 450 ppm.<sup>9</sup> Implementing the 450 Scenario would be a tremendous challenge, requiring increasing investments in energy production and distribution infrastructure, changes in consumer behavior and lifestyles, and the imposition of a variety of policies. The IEA acknowledges this, noting that the 450 Scenario is not a prediction or forecast, but rather an illustration of a possible path that society could pursue to achieve its climate change goals. (Key findings from that assessment are noted in Chevron Risk Management and Governance beginning on Page 8.) In the charts to the left, the IEA contrasts its hypothetical 450 Scenario with its New Policies Scenario, which represents the IEA's current expectation of demand and emissions trajectories, and their Current Policies Scenario, which assumes no changes in policy moving forward.

<sup>9</sup> IEA, *World Energy Outlook 2016*, [worldenergyoutlook.org/publications/weo-2016/](http://worldenergyoutlook.org/publications/weo-2016/)

# chevron risk management and governance

**We utilize various processes ultimately overseen by the Board of Directors to set direction for our organization, guide our actions, manage risk and deliver shareholder value.**



## mitigating risk

The Company uses mature processes to assess and mitigate risk and support decision making, including mitigation of climate change risks. These processes include the following:

**Enterprise Risk Management.** Chevron's Enterprise Risk Management (ERM) process provides corporate oversight for identifying major risks to the Company and ensuring mitigation plans are in place. The ERM process includes an annual risk review with executive management and the Board of Directors that identifies risks inherent in our business. Risks assessed through this process include financial, operational, geopolitical, commodity pricing, security, geological and technological as well as climate change risks.

**Strategic and business planning processes.** The Strategy and Planning Committee is responsible for managing the strategic and business planning processes at the Board's direction. These processes are designed to ensure that our business remains resilient under a variety of circumstances, and they include examination of external points of view, ongoing assessment of the dynamics of the energy marketplace, monitoring of policy and regulatory developments, and examination of trends, such as advancements in technology and evolution of consumer preferences.

**Portfolio management.** Chevron actively manages its portfolio of assets to meet objectives in accordance with its strategic and/or business plans. Due to the large number of simultaneous future uncertainties that affect decisions, Chevron uses probabilistic analysis to evaluate our portfolio and individual investments. A decision to invest in an asset and add it to the Company's portfolio is made based on the then-current view of factors, including anticipated future cost, performance, market, pricing and regulatory conditions. Changes in anticipated demand, pricing, competitiveness and regulation become apparent over time, leading to revised capital allocation and redirection of the portfolio.

**Commodity pricing.** Our comprehensive, proprietary forecast of commodity prices drives our business planning and underlies specific project appropriations. Because pricing is determined in a competitive marketplace, probabilistic assessments are used to reflect in our price outlooks the market uncertainties over which we have no control, with prices modeled in low, medium and high scenarios.

## chevron risk management and business planning

Chevron has robust risk management processes in place that we believe effectively address climate-change-related risks. Greenhouse gas emissions issues, climate change risks and carbon pricing risks are considered in Chevron's strategies, business planning, and risk management tools and processes. When assessing the business risk posed by a carbon-restricted world, Chevron considers the world's energy demand, the role fossil fuels play in providing that energy, the evolution and advancement of energy and climate policies, and the advancement of new energy technologies. The following describes some of the specific ways GHG issues and climate change risks are taken into account in these processes.

### Analysis of carbon-constrained future

In addition to our routine suite of supply, demand and pricing analyses, Chevron has analyzed the impacts of supply, demand and resultant pricing levels under a reduced-demand/GHG-constrained scenario, including consideration of the IEA's 450 Scenario, described above.

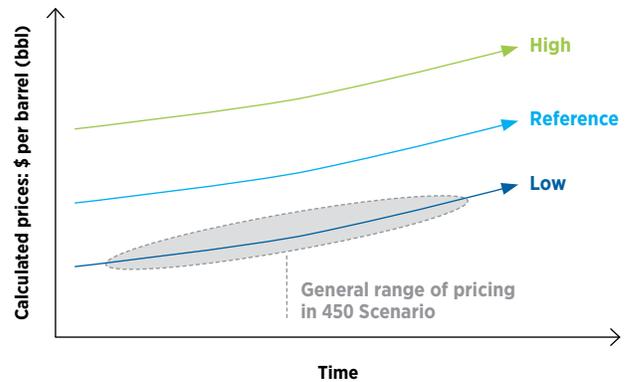
#### These are the key findings from that analysis:

- The pricing levels modeled for the IEA 450 Scenario generally align with the low end of the price trajectory range being used throughout Chevron's various planning processes. In essence, our investments have already been stress-tested against such a low-demand environment through our routine, established processes (see chart to the right, above).
- Certain high-cost assets around the world could be impacted by the hypothetical GHG-constrained case. Given the reduced demand and pricing impacts of this hypothetical modeling scenario, this is an expected modeling outcome. In the event that this GHG-constrained case were to manifest itself, these high-cost assets, for which a final investment decision has yet to be made, would not find a place in our investment portfolio given our risk management processes. However, even applying this hypothetical scenario, given the ongoing demand for energy, lower-cost assets remain competitive, including those assets already producing, which would continue to produce (see chart to the right, below).

### Internal carbon pricing outlook

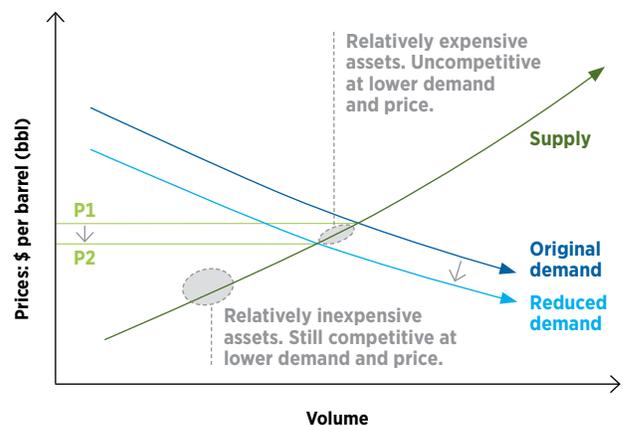
Chevron is exposed to a number of direct financial costs relating to GHG/climate regulation. The most prominent are payments for allowances for internal emissions under cap and trade systems and payments of carbon taxes on internal emissions. Some of these costs may be ultimately borne by customers in the competitive marketplace, mitigating their impact. The Company incurs additional expenses for monitoring, reporting and verifying emissions as well as collecting, accounting for and disbursing carbon taxes and allowance costs that it collects on products it sells.

## price trajectory ranges



Note: For illustration only. Not drawn to scale.

## hypothetical supply stack showing impact of reduced demand on asset competitiveness



P1: Original price

P2: Reduced price

Note: For illustration only. Not drawn to scale.

Since 2007, as part of its ongoing planning process, Chevron has generated an internal outlook of future carbon prices.<sup>10</sup>

Given the uneven state of GHG regulation around the world, this outlook is framed on a regional basis. The outlook is based on an assessment of economic conditions, energy demand, policy evolution, technology developments and costs of abatement, among other factors. This assessment brings together corporate experts and regional operating personnel.

#### Capital project approvals

Individual investments are developed, approved and implemented in the context of the strategic plan and segment-specific business plans. The business segments develop investment proposals supporting appropriation requests that are evaluated by management and, as appropriate, reported to the Executive Committee and/or the Board of Directors.

Since 2008, our internal carbon price has been considered in the economic evaluations supporting major capital project appropriations.

A number of GHG-related factors are considered in project appropriation assessments and documents. These factors include an annual profile of anticipated project GHG emissions (both Scope 1 and Scope 2<sup>11</sup>), economic analysis of the current Company-endorsed carbon price outlook as applied to the project's anticipated emissions profile and an assessment of the options to reduce GHG emissions and/or optimize energy efficiency.

Following the process described above, Chevron continually considers the possible policy and/or regulatory actions associated with carbon pricing as applied to our current production portfolio.

#### Policy and regulatory risk

Policies addressing climate change and GHG emissions vary widely around the globe, both in substance and in the pace of implementation. This variation occurs at country-by-country and subnational levels.

Governments around the world have a variety of GHG/climate regulations with which Chevron is required to comply. The Company actively monitors emerging GHG/climate regulation.

Further, the Company routinely engages with government officials considering such regulations to share its views on regulations under consideration, the practical aspects of implementing specific proposals, and the possible impacts to the Company as an investor in the energy sector, as well as the impacts to consumers. Chevron's ongoing efforts to understand the impact of policy on the different parts of our business—particularly supply, demand and pricing—and to work with governments to ensure they fully understand the perspectives of a major participant in the industry all serve to address this risk. These efforts help us better evaluate how GHG/climate regulation may unfold in certain jurisdictions where we operate, thereby informing a number of elements of the ongoing strategic analysis described above.

#### Physical

For decades, Chevron has managed risks associated with the impact of severe weather on our operations. These long-standing practices are being applied and extended to reflect possible climate impacts. For example, Chevron is ensuring the ongoing resilience of our infrastructure, both for current operations and for those being developed and/or considered.

#### Furthermore, we have:

- Undertaken a global assessment of possible impacts to our assets, including those resulting from the possibility of increased frequency and/or severity of storms, rising sea levels, temperature increases or decreases, and interruptions in water supply availability;
- Participated in a joint industry project with experts at the National Center for Atmospheric Research to better understand possible changes in the frequency and magnitude of hurricanes in the Gulf of Mexico over the next 50 years and are using information from this work to support the meteorology and oceanography (metocean) design basis for offshore Gulf of Mexico assets; and
- Worked with host governments to ensure that the design basis for particular long-lived asset investments reflects views of possible metocean scenarios.

<sup>10</sup> The term *carbon price* here refers both to the value of CO<sub>2</sub> emissions allowances as traded in a cap and trade or similar program and to the carbon tax rate applied to emissions, expressed in terms of U.S. dollars per metric ton of CO<sub>2</sub> equivalent (\$/t).

<sup>11</sup> Scope 1 refers to emissions generated on-site as a result of our operations. Scope 2 represents indirect GHG emissions from consumption of purchased electricity, heat or steam used in our operations.



The *Asia Excellence* departed Barrow Island off the northwest coast of Western Australia in March 2016 with the first Gorgon LNG cargo for delivery into Japan.

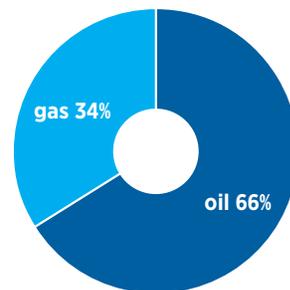
Chevron believes that the risk-based approach undertaken to address possible physical impacts is appropriate given our prior investments in asset integrity for critical infrastructure, our application of updated metocean standards into existing and future investments where appropriate, and the anticipated lifespan of possibly impacted assets relative to the time frame of anticipated significant impacts.

### Chevron portfolio management

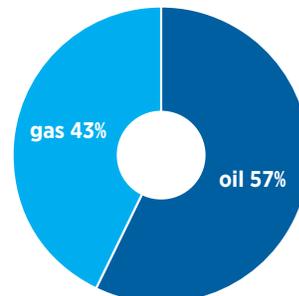
As a premier developer of energy resources with a focus on capital efficiency, Chevron expects to play a prominent role in meeting global energy demand as energy and climate policies evolve. To accomplish this, we continually refresh our portfolio, taking into account our views of future market and regulatory conditions. For example, we are taking actions to redirect investment to the low-cost asset classes, such as in the Permian Basin of West Texas, where Chevron has a structural competitive advantage. We have also increased the weighting of gas in our portfolio. With the 2016 start-up of the Gorgon Project in Australia and the anticipated 2017 start-up of the Wheatstone Project in Australia, Chevron will enhance its position of being a preferred supplier of relatively low-carbon liquefied natural gas (LNG) to customers in Asia, largely for power generation. In 2016, gas production was 34 percent of our total oil and equivalent gas production. At 2016 year-end, proved gas reserves were 43 percent of our total oil and gas reserves. We expect our gas production to grow in coming years because of our reserves position, which is a reflection of our increasing gas investments around the world.

## chevron oil & gas production and proved reserves

2016 oil & gas production (BOE per day)



proved reserves (YE 2016 BOE)



BOE = Barrels of oil-equivalent

### Consideration of the “stranded assets” concept

The “stranded assets” concept posits that as a result of regulatory, market and physical changes in the energy market associated with the transition to a low-carbon economy, some fossil fuel energy and power-generation resources will cease earning an economic return at some point prior to the end of their investment-designated economic life. Proponents posit that the restrictions in fossil fuel consumption would cause financial losses for firms holding impaired energy assets.<sup>12</sup>

One of the critiques of this theory is that it neglects the fact that even in the carbon-constrained scenarios, a significant demand for fossil fuels remains, as noted above. As already discussed, given the ongoing level of demand, changes in regulation and the resultant impacts on demand that will manifest over time, the industry in general—and companies like Chevron in particular—will be able to adapt investment patterns and portfolios to these policy and demand circumstances.

IHS Energy, an oil and gas strategic consulting firm, has examined the basis for oil and gas company valuations in assessing the risk of “stranded assets.”<sup>13</sup> IHS found, in part, that “the intrinsic value of most publicly traded oil and gas companies is based primarily on the valuation of proved reserves—90 percent of which are expected to be monetized in 10 to 15 years.” This focus on proved reserves contrasts to the broader classifications of probable and possible resources. IHS goes on to state that “going even further to define [possible and probable resource] assets as being potentially ‘stranded’ is misleading, since the capital spent to acquire and/or discover a resource yet to be classified as proved is usually only a small fraction of the ultimate capital commitment upon attaining final investment decision for full-scale development and maintenance of producing facilities.”

Hence, the combination of ongoing demand for energy even in a carbon-constrained scenario, the evolving nature of possible demand and regulatory changes, and the ability of companies like Chevron to adjust investment patterns and portfolios to reflect these policy and demand circumstances as they evolve ensures that the possible risk from “stranded assets” is minimal and certainly manageable. Because the U.S. Securities and Exchange Commission’s reserves booking rules limit the definition of “reserves” to resources expected to be commercially produced in the relatively near term, the possibility that even an aggressive climate change response scenario such as the IEA’s 450 Scenario could result in the “stranding” of booked reserves is minimal.



## assessing business risk

When assessing the business risk posed by a carbon-restricted world, Chevron considers the world’s energy demand, the role fossil fuels play in providing that energy, the evolution and advancement of energy and climate policies, and the advancement of new energy technologies.

<sup>12</sup> See, e.g., Carbon Tracker Institute, [carbontracker.org/resources](http://carbontracker.org/resources); Carbon Asset Risk Initiative, CERES, [ceres.org/files/investor-files/car-factsheet](http://ceres.org/files/investor-files/car-factsheet)

<sup>13</sup> Nancy Meyer and Lysle Brinker, “Deflating the ‘Carbon Bubble.’ Reality of oil and gas company valuation,” *IHS Energy*, September 2014.



## management of climate change risks within our business segments

Climate change poses different risks to each segment of our business. Potential impacts may include the following:

**Existing Upstream production.** As a general matter, producing assets will continue to produce until the point at which operating costs are not covered. This remains true in a carbon-constrained world, although costs may also be increased from regulations such as cap and trade and/or the imposition of carbon taxes not being absorbed in the competitive marketplace. The Company mitigates these risks through consideration of a range of potential carbon prices into its appropriations evaluations. In addition, Chevron's risk management systems are designed to assess potential physical and other risks to its operations and assets, to plan for their resiliency, and to incorporate uncertainty analysis, considering a range of potential physical risks. Although it is difficult to predict with certainty the timing, frequency or severity of such events, in the near term this risk is less pronounced, and current infrastructure integrity and design standards are appropriate. Over the longer term, the magnitude and timing of these possible risks may impact certain long-lived assets. For these assets, engineering and design standards may be modified to address the possible long-term impacts.

**Upstream resources not yet sanctioned.** As part of our overall portfolio, the Company has a number of Upstream resources that have not yet been developed. For these, the financial impact of a GHG-constrained scenario is relatively modest because of the limited amount of capital invested prior to a final investment decision. Unlike reserves, in which the Company has made major investments, resources have not yet been funded. The Company's final investment decision will be guided by the assessment of prior exploration results; the external factors then foreseen, including market conditions such as supply and demand and the resultant pricing projections; the suite of regulatory measures in place or anticipated; the fiscal terms; the development costs; and resource recovery prospects. In short, possible risks to future asset value of unsanctioned resources are reduced given their early stage of development.

**Upstream resources not yet acquired.** Given the ongoing production of reserves and the depleting nature of oil and gas reservoirs, a company such as Chevron continually replenishes its portfolio with economically attractive assets. This can occur through acquisitions and/or exploration. As with Upstream resources for

which no final investment decision has been made, acquisition and exploration decisions are guided by multiple factors, including the attributes of the current portfolio and the desired portfolio, together with views of the external market and the regulatory context, allowing for adjustments in strategy if a carbon-constrained scenario such as the IEA's 450 Scenario comes to fruition. Consequently, the risk of acquiring assets inconsistent with such a future world is minimized.

**Downstream (refining, marketing and chemical) operations.** Today, Chevron's refining and marketing assets are required to comply with a wide range of existing GHG and climate regulations. The Company's experience informs its views of how these programs are evolving, how they may evolve over time and how best to manage such changes, and we budget for prospective costs of such regulations in our business and strategic planning and our approval of capital project appropriations. By ensuring that our refineries and marketing systems are competitive and efficient, we expect to be in a position to meet the remaining demand, even in a carbon-constrained future.

In addition, the emergence of fuels and processing technology could impact Downstream operations. For example, we are preparing to meet the requirements of biofuels mandates. We have evaluated a variety of alternative feedstocks as the basis for biofuels production. We are actively demonstrating the feasibility of marketing biologically derived fuels made from processing these feedstocks through existing facilities with existing runs of petroleum.

In contrast, demand for petrochemicals is largely independent of demand for transportation fuels. According to IEA figures, 10.7 million barrels per day (bbl/day), or 12 percent of petroleum production, was converted into these products in 2015. In the IEA's New Policies Scenario, this is anticipated to grow to 15.7 million bbl/day, or 15 percent of global oil demand, by 2040.<sup>14</sup>

<sup>14</sup> IEA, *World Energy Outlook 2016*, [worldenergyoutlook.org/publications/weo-2016/](http://worldenergyoutlook.org/publications/weo-2016/)

# chevron climate strategy

Chevron shares the concerns of governments and the public about climate change risks and recognizes that the use of fossil fuels to meet the world's energy needs contributes to the rising concentration of greenhouse gases in Earth's atmosphere. GHGs contribute to increases in global temperatures.

We apply cost-effective technologies to improve the energy efficiency of our base business operations and capital projects. As we work to address climate change risks, we must create solutions that achieve environmental objectives without undermining global economic growth and our aspirations for a better quality of life for all.



## chevron climate change policy principles

These four principles have guided our actions and policy views for the past 10 years:

### principle 1

Reducing greenhouse gas (GHG) emissions is a global issue that requires global engagement and action.

### principle 2

Policies should be balanced and measured to ensure long-term economic, environmental and energy security needs are all met, costs are allocated in an equitable, gradual and predictable way and actions consider both GHG mitigation and climate change adaptation.

### principle 3

Continued research, innovation and application of technology are essential to enable significant and cost-effective mitigations to climate change risks over the long term.

### principle 4

The costs, risks, trade-offs and uncertainties associated with GHG reduction and climate change adaptation efforts and policies must be transparent and openly communicated to global consumers.

[learn more > chevron.com/climateprinciples](https://www.chevron.com/climateprinciples)



## chevron actions and investments

The steps we have taken to manage greenhouse gases include significant investments, some of which are listed here and summarized in this section:

- › Flare reduction
- › CO<sub>2</sub> injection
- › Energy efficiency
- › Technology, research and development
- › Biofuels

### chevron actions and investments

#### Flare reduction

Chevron flares and vents natural gas for safety and operational purposes, and in areas where pipelines or other gas transportation infrastructure and utilization alternatives do not exist. We are working to reduce natural gas flaring and venting and the resulting GHG emissions. For example, we have developed internal country-specific plans to minimize gas flaring. In addition, we are a founding member of the World Bank-led Global Gas Flaring Reduction Partnership.

In early 2010, Tengizchevroil (TCO), in Kazakhstan—Chevron has a 50 percent interest in TCO—stopped flaring natural gas except when necessary for safety. Through the four-year, \$258 million gas utilization project, TCO has achieved a 94 percent reduction in the volume of gas flared compared with 2000.

For more than 15 years, Chevron has invested in a series of flare reduction efforts in western Africa. Since 2009, our Agbami facility off the shores of Nigeria has been operating with no routine flaring because the associated gas is reinjected, demonstrating the ability to develop new oil production facilities without routine flaring.

Building on past achievements, our Upstream operations have continued to make significant progress in reducing routine flaring through the completion of various gas gathering and flare reduction projects over the past five years. In 2015, our Nigeria/Mid-Africa business unit commenced operation of the Escravos Gas Plant Phase 3B, which will reduce flaring from nine offshore production platforms. In addition, our Southern Africa strategic business unit completed the Nemba Enhanced Secondary Recovery Project, which will reduce our flaring volumes in Angola.



For an in-depth look at Chevron emissions data, refer to the Performance Data section of our Corporate Responsibility Report at [chevron.com/reporting](https://www.chevron.com/reporting).

#### CO<sub>2</sub> injection

Chevron Australia's Gorgon liquefied natural gas project on Barrow Island involves the design, construction and operation of facilities to inject CO<sub>2</sub> into a deep reservoir unit about 1.2 miles (2 km) beneath Barrow Island. This CO<sub>2</sub> is extracted from the natural gas as a part of normal gas-processing operations and would otherwise have been vented to the atmosphere. CO<sub>2</sub> injection will reduce GHG emissions from the Gorgon Project by between 3.4 and 4.0 million metric tons per year.

We also are participating in a project in Alberta, Canada, called Quest. This joint venture injects CO<sub>2</sub> from the Athabasca oil sands project.



The Escravos Gas Plant Phase 3B in Nigeria is focused on eliminating routine flaring of natural gas that is associated with the production of crude oil.

Natural gas-fired cogeneration facilities, such as the Sycamore cogeneration facility located in the Kern River Field near Bakersfield, California, produce electricity and steam and utilize recovered waste heat to support our operations.



### Energy efficiency

Of all the ways to meet the world's expanding energy needs, efficiency and conservation are the cheapest and most beneficial to the environment. Using energy more efficiently helps reduce carbon emissions, lower energy costs and preserve our finite natural resources.

We achieve energy savings in big and small ways. Chevron employees and contractors make energy efficiency a constant priority through everyday acts, such as maintaining our equipment so that it runs smoothly, and through complex projects, such as building high-efficiency power plants. For example, our Power and Energy Management business unit collaborates with other Chevron groups to help oil fields, refineries and other facilities trim energy costs, test new technologies, achieve efficiency gains, manage emissions and improve power reliability.

### Technology, research and development

Chevron continues to be committed to understanding and evaluating the economic viability of investments in renewable energy. These technologies include advanced biofuels, wind power and solar energy, in addition to energy efficiency technologies. We conduct internal research and collaborate with governments, businesses and academia in researching and developing alternative and renewable energy sources. Through these partnerships, we share information and help to advance technology that can lead to more renewable energy for future generations.

### Biofuels

Biofuels are transportation fuels made from recently living organisms. They are renewable, meaning their sources can be regrown. Biofuels are generally divided into three categories:

- First-generation, or conventional, biofuels are made largely from sugars, starches and plant oils, many of which could be consumed as food. Often, blending of these biofuels into transportation fuels is mandated by law.
- Second-generation biofuels are made from nonedible cellulosic plant materials. Chevron is actively involved in the evaluation of options for biomass processing as part of our transportation fuels businesses, particularly in California. To date, our work, as well as that of others, to produce second-generation biofuels has not been successful in identifying an option that is economic at scale without subsidies. However, we are leveraging our current manufacturing facilities to co-process biofuels with traditional petroleum products.
- Third-generation biofuel production from algae and other biological processes is still in the research stage. Most efforts are targeted toward specialty chemical and pharmaceutical products given the challenges in scale and economics associated with fuels production.

Chevron believes that second- and third-generation biofuels could help meet the world's future energy needs if they are scalable, sustainable and affordable for consumers. That's why Chevron is working on developing solutions that meet the criteria of scalability, sustainability and cost under an effective policy framework.

## conclusion

We hope this report summarizing Chevron's risk management and business planning processes as applied to climate change risks will contribute to a better understanding of our Company's business in the marketplace. We believe Chevron's current risk management and business planning processes are sufficient to mitigate the risks associated with climate change. These processes are appropriate to enable the Company to continue to monitor and adjust accordingly as climate policy developments unfold.

In view of the continuing global demand for oil and gas, the substantial future investment required to meet that demand, and the way investment decisions to explore for and/or develop resources are phased and made with a market view in mind, the current risk exposure to the Company even in a restricted GHG scenario is minimal.

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