IHS ENERGY: CRUDE OIL MARKETS

Do Investments in Oil and Gas Constitute "Systemic Risk"?

October 2016

ihs.com

STRATEGIC REPORT

Daniel Yergin
Vice Chairman, IHS

Elena Pravettoni
Senior Economist, IHS Energy

Contents

Do Investments in Oil and Gas Constitute “Systemic Risk”?

Key implications

Some central banks and financial regulators have raised concerns that climate change may pose “systemic risk” to the financial system. In September 2015, Mark Carney, Governor of the Bank of England, declared that climate change—in particular “transition risk”—could threaten financial stability via a sudden and significant collapse in asset values. In response, the Financial Stability Board, which reports to the G20 governments and is chaired by Governor Carney, launched a task force to develop a climate risk disclosure framework for market participants.

- **An energy transition that unfolds over decades does not pose “Lehman-style” systemic risk to the global financial system.** Other financial authorities have challenged the extent to which transition risks could undermine financial stability given the market’s ability to price in longer-term risk as well as the sheer scale of the market.
- **Low commodity prices are currently providing a significant “stress test” to the oil and gas industry.** The price collapse after the end of the commodity supercycle has had limited impact on the global financial system thus far.
- **New disclosure framework could be the first step to further regulatory action.** The belief that climate risks are not appropriately being priced into the market could lead to a more active role by central banks and financial regulators in defining climate risk, regulating investments, and shaping environmental policy. This comes at a time when central banks are coming under the spotlight for taking on more expansive roles in the overall economy.
- **The unintended consequences of a disclosure framework could be high.** They could include undermining the competitiveness of investor-owned energy companies vis-à-vis state-owned national oil companies as well as higher prices for consumers.

—October 2016

Page intentionally blank

Do Investments in Oil and Gas Constitute "Systemic Risk"?

Daniel Yergin, Vice Chairman, IHS
Elena Pravettoni, Senior Economist, IHS Energy[1]

Introduction

Since 2014, some central banks and financial regulators have raised concerns that climate change could pose a risk to longer-term financial stability. This view was notably articulated by Mark Carney, Governor of the Bank of England, in a speech in September 2015. He declared that an abrupt transition to a 2°C scenario could threaten to "destabilize markets, spark a pro-cyclical crystallization of losses and a persistent tightening of financial conditions."[2] In his "Tragedy of the Horizon" speech, Governor Carney also cited the "carbon bubble" thesis, stating that a key risk to financial stability could come from potential sharp drops in the valuation of oil, gas, and coal companies, owing to stranded reserves that may never be produced.

In December 2015, the Financial Stability Board (FSB), which is chaired by Governor Carney and reports to G20 governments, announced the creation of the Task Force on Climate-related Financial Disclosures (TCFD).[3] The aim of the TCFD is to develop a set of voluntary, unified guidelines on climate risk disclosure, to be delivered in December 2016. Depending on the type of disclosures requested and the extent to which it is adopted across jurisdictions, such a framework could have significant implications for fossil fuel companies and investors. With its efforts, the TCFD is charting a new area of focus for financial regulators in seeking to define climate-related financial risks and policies.

The issue raised by the Bank of England and the FSB has potentially far-reaching impact and requires careful consideration. The purpose of this report is not to address environmental policy in general or the dynamics of an energy transition. Rather, it is more specific—to contribute to the thinking and discussion about whether an energy transition poses systemic risk for the global financial system, particularly from the point of view of investments in the oil and gas sector.

Overall, an energy transition that unfolds over decades does not constitute abrupt systemic risk to the financial system. The assessments of other central banks and financial authorities have differed from that presented by Governor Carney. Sweden's Financial Supervisory Authority, for example, has pointed to the ability of markets to price in a transition that will take place over a longer period. In 2012, the previous Governor of the Bank of England came to a different conclusion from Governor Carney.

A key consideration in this debate is the valuation of oil and gas reserves. IHS analysis demonstrates that oil and gas company valuations are primarily based on reserves that will be produced and monetized over a 10–15 year period—a relatively short time frame in which an energy transition is unlikely to unfold.

Furthermore, the recent oil price collapse has proven to be a high-stress "stress test" for the oil and gas sector. According to IHS Herold, 82 global oil and gas companies lost 42% of their market value from June 2014 to

1. The authors would like to thank IHS Markit colleagues Nancy Meyer, Associate Director, Lysle Brinker, Director, and Atul Arya, Senior Vice President and Chief Energy Strategist.

2. "Mark Carney: Breaking the tragedy of the horizon – climate change and financial stability," Speech by Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board, at Lloyd's of London, London, 29 September 2015.

3. The FSB coordinates with member institutions on regulatory, supervisory, and other financial sector policies, with the aim of strengthening financial systems and the stability of international financial markets. Its member institutions comprise national central banks, finance ministries, and financial regulation authorities, as well as international standard-setting bodies such as the Basel Committee on Banking Supervision and the International Accounting Standards Board. The members of the G20 are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States, and the European Union.

December 2015—equal to $1.4 trillion in market capitalization.[4] Yet, this fall has had minimal systemic impact on the global financial system thus far. Since oil prices fell below $100/bbl in September 2014, the Dow Jones Index has risen 6%.

The growing focus on climate change by central banks is occurring at a time when independent central banks are coming under the spotlight for taking on more expansive roles in general. Some critics have argued that this new initiative represents an overextended reading of their mandate to protect the financial system from systemic risk.

The risk for central banks

Traditionally, central banks have been concerned with inflation and price stability, economic growth, and employment objectives. The focus on climate change follows in the wake of a widening of the role of central banks since the financial crisis of 2008. Since 2008, central banks have gained greater responsibilities, expanding their regulatory reach in financial stability and protecting the economy from systemic risk.[5] The term "systemic risk" gained much wider currency after 2008 and denotes, in the words of the International Monetary Fund (IMF), a risk that has the potential to lead to a "broad-based breakdown in the functioning of the financial system." It is also defined by the breadth of its reach across institutions, markets, and countries and is intertwined with the notion of an immediate financial collapse.[6]

The new focus on climate change as systemic risk marks a move beyond the traditional purview of monetary and financial authorities, and this has been described as a step into an area beyond the core remit of central banks. Investors and economists have questioned the extent to which issues of climate risk were appropriately within the purview of the Bank of England and described this new initiative as "over-reach."[7]

Furthermore, there is the question of why the FSB is placing greater attention on climate risk in terms of systemic risk as opposed to other types of economic uncertainties. These might include a real estate bubble or mounting debt in Asia, the disruption of the global trade system, tech valuations, and technology-related threats such as cybersecurity or flash crashes due to system errors. Would the advent of driverless cars and car sharing, with potentially large impacts on auto sales around the world, constitute systemic risk? Some express concern that very low or negative interest rates in themselves could pose systemic risk by their impact in driving up the price of equities and undermining returns on debt. On 21 September 2016, the OECD warned, "Financial instability risks are rising, including from exceptionally low interest rates and their effect on financial assets and real estate prices."[8]

This enlarged focus could add to the already growing debate about whether, as politically independent unelected institutions, central banks have, in the words of the *Financial Times*, become "too expansive." According to Willem Buiter, chief economist at Citigroup and a former member of the Bank of England's

4. See the IHS Herold Insight *Peer Group Study: IHS Herold-covered companies suffer median market loss of 40% in 2015; share performance continues to favor companies with stronger balance sheets.*

5. Historically, the Federal Reserve in the United States held a dual mandate: to maintain stable prices and achieve maximum employment. In 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act expanded the responsibilities of the Federal Reserve, adding another official mandate: to regulate systemic risk and protect financial stability. Similarly, the Bank of England gained overall supervisory responsibility for the UK financial sector and a mandate to monitor systemic risks in 2012. The European Central Bank (ECB) also gained greater powers, with new responsibilities for the creation of a eurozone-wide banking union and for the supervision of Europe's largest financial institution. In 2010, the European Systemic Risk Board—chaired by Mario Draghi, president of the ECB—was established as an independent EU body to oversee the stability of the EU financial system and prevent and monitor systemic risk.

6. International Monetary Fund, "Responding to the Financial Crisis and Measuring Systemic Risk," *Global Financial Stability Report,* April 2009.

7. "Mark Carney under attack from investors," *Financial Times,* 4 October 2015. Economics professor Tony Yates, a former Bank of England senior official, warned of "over-reach." See "Carney on Climate: Central bankers stray from mandate," *Financial Times,* 30 September 2015. See also "Who put Mark Carney in charge of our climate policy?" *The Telegraph,* 1 October 2015.

8. OECD, Interim Economic Outlook: Global growth warning: Weak trade, financial distortions, 21 September 2016.

Monetary Policy Committee, "Central bankers are punching well above their weight. This could lead to a backlash and to central banks losing their operational independence."[9] Kevin Warsh, a former governor of the US Federal Reserve Board, has expressed concern that central bankers have overreached "their policy remit."[10]

Bank of England view on climate risk and financial stability

In September 2015, the Bank of England's Prudential Regulation Authority (PRA) published a report on the impacts of climate change on the UK insurance sector. The report identified three types of risk arising from climate change:

- **Physical risk** refers to the impact on insurance liabilities and the value of financial assets from extreme weather–related events that could damage property or disrupt trade.
- **Liability risk** refers to the legal issues that could hit parties deemed responsible, and especially their insurers, through requests for compensation from losses and damage suffered from climate change.
- **Transition risk** refers to the financial risk from the process of adjustment to a lower-carbon economy. It relates to the potential for an abrupt change that leads to a sudden, large-scale correction in the value of carbon-intensive economic activity.[11]

In his "Tragedy of the Horizon" speech, Governor Carney identified transition risk as a key concern for financial stability, equating transition risk to a potential 2008 Lehman-scale event. He stated that an abrupt transition to a lower-carbon world could cause a sudden collapse in asset values, particularly those that are highly carbon-intensive, and in overall valuations of companies and in their ability to repay debt. In turn, this could have effects on the portfolios of investors, banks, and insurers and potentially cause dislocations across the financial system—which would qualify as a systemic risk.

The "Tragedy of the Horizon" speech marks a change from an assessment made by the previous Governor of the Bank of England in 2012. The Bank in 2012 concluded that carbon-intensive investments do not represent a threat at the systemic level. It identified three conditions that would have to be in place in order to consider the threat systemic: the exposures of financial institutions to carbon-intensive sectors are large relative to overall assets; the impact of policy and technology working to reduce returns is not already being priced into the market; and any subsequent correction would take place over an insufficiently long period for the relevant financial institutions to adjust their portfolios in an orderly manner.[12] Its conclusion at that time was that these conditions were not met.

Deflating the "carbon bubble"

The "Tragedy of the Horizon" speech specifically pointed to the transition risk from a reassessment in the valuation of fossil fuel companies. Governor Carney stated that any limits on carbon could "render the vast majority of reserves 'stranded' – oil, gas and coal that will be literally unburnable without expensive carbon

9. "Central banks: Peak independence," *Financial Times,* 8 November 2015.

10. Kevin Warsh, "The Federal Reserve Needs New Thinking," *The Wall Street Journal,* 25 August 2016.

11. The PRA report identified five possible "triggers" for an abrupt transition—public policy and regulation, technology, investor preferences, physical events, and developments in climate science—each of which could potentially lead to market disruption. See "The impact of climate change on the UK insurance sector," Prudential Regulation Authority, Bank of England, September 2015.

12. "Letter from the Governor of the Bank of England to James Cameron Esq., Climate Change Capital," 1 February 2012.

capture technology." He suggests this could compromise financial stability as "19% of FTSE 100 companies are in natural resource and extraction sectors."[13]

These statements closely reflect language used by the Carbon Tracker Initiative in its contested "carbon bubble" thesis. In a series of research papers published from 2011 to 2014, the Carbon Tracker Initiative labeled fossil fuel companies as overvalued because large percentages of global fossil fuel reserves would be unable to be consumed (and therefore produced and monetized) if the world were to keep carbon emissions below thresholds that limit the rising of global temperatures below 2°C.

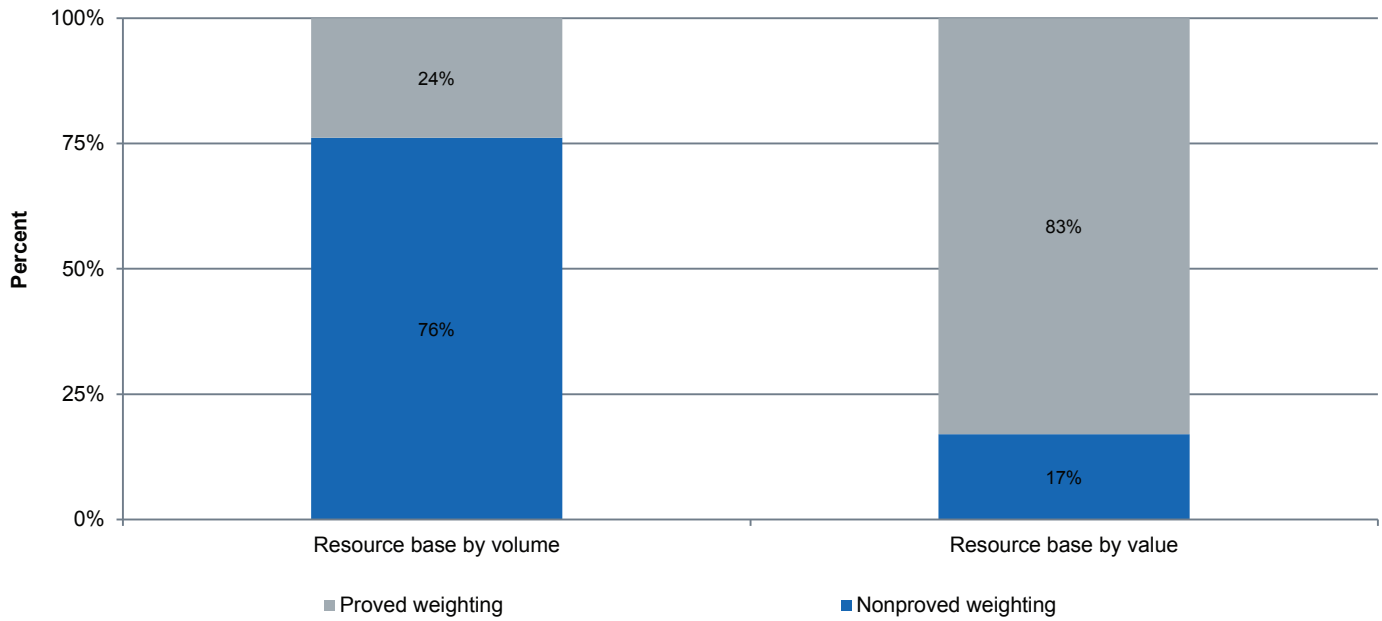
The "carbon bubble" thesis needs to be examined very carefully. In 2014, IHS conducted an analysis of oil and gas company valuations in the financial marketplace that largely disproved the overarching claims made by the Carbon Tracker Initiative. IHS research indicates that the risk of overvaluation of oil and gas companies is limited, owing to how fossil fuel reserves are valued and contribute to the market capitalization of oil and gas companies.[14]

The argument advanced by the Carbon Tracker Initiative does not distinguish between different types of reserves. In fact, while companies have a wide discovered resource base, it is the proved reserves that are the main driver of a company's valuation.[15]

IHS found that about 80% of the value of most publicly traded oil and gas companies is based on their proved reserves, which accounts for roughly 20% of the resource base of global international oil companies (IOCs) by volume (see Figure 1). Their valuation is based on the present worth of expected cash flow from projects and

Figure 1

Proved reserves account for low percentage of the total resource base by volume but account for majority of valuation for global IOCs (year-end 2015)



Note: 8% discount applied.
Source: IHS

13. Mark Carney, "Breaking the tragedy of the horizon."

14. See the IHS Special Report *Deflating the Carbon Bubble.*

15. Proved, probable, and nonproved reserves factor into a company's valuation; however, proved reserves, as defined by the US Securities Exchange Commission (SEC), are the primary driver of current value. IHS analysis is based on SEC's definition of proved reserves.

reserves that will be produced in the short to medium term (proved reserves are typically monetized within 10–15 years) and are consequently at minimal risk of being stranded. Therefore, there is little risk of oil and gas companies being overvalued by potential climate policy restrictions.

Moreover, the alarm over stranded reserves and company valuations fails to take into account the reality that publicly traded IOCs represent only a small percentage of the world's total reserve base. Only 7% of total world oil and gas reserves are fully accessed by IOCs, and the vast majority are controlled by state-owned national oil companies (NOCs).[16] Reserves of state-owned companies are clearly not part of investor portfolios and therefore would not create any direct risk to private financial investors.[17]

How long are "transitions"?

An energy transition that unfolds over decades does not seem to fit the definition of systemic risk (see the box "Energy transitions unfold over decades"). Indeed, other financial authorities question the likelihood that a transition to a lower-carbon economy would be disruptive and abrupt and have pointed to the ability of markets to react and price in such risks over time.

Sweden: Transition risk as a structural trend

In March 2016, Sweden's Financial Services Authority responded to a request by the Swedish government to examine the exposure of the country's financial system to climate risk. The Financial Services Authority

Energy transitions unfold over decades

Today climate change policy is pushing the world toward a new energy transition, seeking to replace fossil fuels with non–carbon-emitting energy sources over several decades. This is occurring at the same that global energy demand is rising, along with population and GDP. The global energy transitions of the past have shown that such energy transitions are slow, taking decades to unfold.*

Coal was developed as an energy source in the 19th century. Yet in 1840 it made up only 5% of world energy supply, and it wasn't until around 1900 that it reached 50%. While the modern oil industry was born in 1859, it took over a century for oil to overtake coal as the world's largest source of energy.

The history of past transitions suggests that the unfolding of a lower-carbon energy economy, possibly supported by carbon capture, will also be a gradual process. The energy economist Vaclav Smil, an expert on energy transitions, has commented that "even a greatly accelerated shift towards renewables would not be able to relegate fossil fuels to minority contributors to the global energy supply anytime soon, certainly not by 2050."** The extensive amount of capital invested in the energy system, the long life spans of energy assets, and the interconnectedness of energy systems—combined with a growing world economy—all point to the reality of a slower pace of change. The latest outlook from the International Energy Agency (IEA), as depicted in its central "New Policies" scenario, underscores this point (see Figure 2).

*Daniel Yergin, "The Power Revolutions," *The Wall Street Journal,* 21 August 2015.

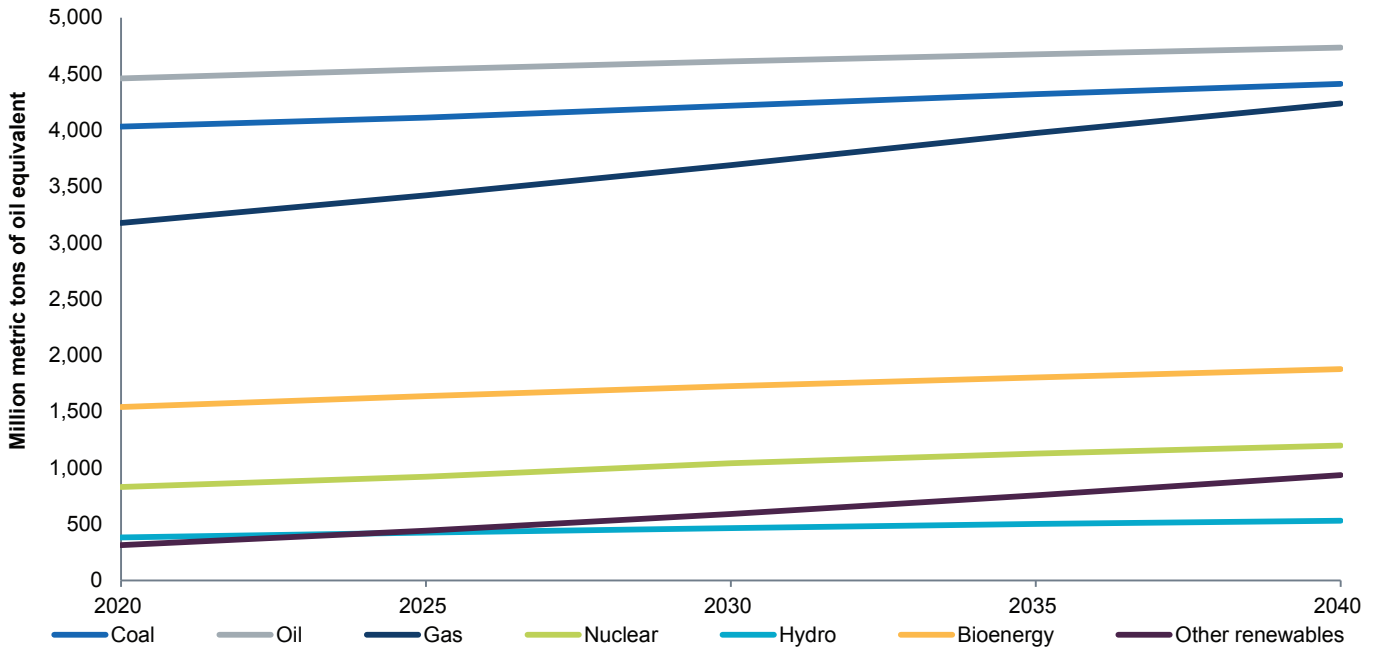
**Vaclav Smil, *Gradual greening: Power density and the hydrocarbon habit,* CLSA U Blue Books, September 2016.

16. IHS Upstream Data, April 2016.

17. Saudi Aramco is considering an initial public offering of stock.

Figure 2

IEA world total primary energy demand (New Policies scenario)



Source: Based on IEA data from the World Energy Outlook © OECD/IEA 2015, www.iea.org/statistics. Licence: www.iea.org/t&c; as modified by IHS

referred to transition risk as long-term structural risk, more similar to demographic transition and technology shifts, whose effect "can be very significant indeed and far from unproblematic, but does not usually lead to crises – in the sense of shifts that are sudden, unforeseen and difficult to manage and that have major implications for society."[18]

The report concluded that the risk of the core functions of the financial sector being disabled or seriously disrupted was "very low."[19] Under a longer time frame, financial markets have the ability to react and take risk into account in their planning and operations, digesting inputs over time and reacting accordingly. They are accustomed to monitoring and managing internal and external risks.

Dynamic response of markets to risk

The view that financial markets react to risk over longer time frames has been expressed by Warren Buffett, chairman and CEO of Berkshire Hathaway Inc., which owns several major insurance companies, including The Berkshire Hathaway Reinsurance Group, General Reinsurance Corporation, and GEICO. In his 2015 annual shareholder letter, Buffett commented on the difference between long-term threats and immediate financial risk. He stated that while long-term change may be a problem for society, "it is not a financial problem for today's investor." Insurance policies, for example, are customarily written on an annual basis and can be repriced each year to reflect changing exposures.[20]

18. Finansinspektionen, Climate Change and Financial Stability, 7 March 2016.

19. Ibid.

20. Warren Buffett, 2015 Berkshire Hathaway Annual Letter to Shareholders.

In the letter, Buffett also emphasized the ability of operational as well as financial companies to adapt to changing environments. Dynamic adjustment of calculations around risk is performed not only by financial firms in their portfolio management but also by companies.

The current stress test

Owing to the long-term nature of their business, oil and gas companies regularly review their portfolios to take into account the changing risk environment. Today, the industry's risk management focus includes transition risk, although assessments also consider other risks for companies such as war and nationalization, operational safety issues, commodity price risk, and GDP growth.

One way in which oil and gas companies test their resiliency against future changes in market dynamics is through internal stress testing. This includes testing the sensitivity of company asset values and profitability to future risks such as carbon prices or changes in supply and demand that could affect a company's commodity price outlook. It is common for oil companies to stress test their portfolios against significantly lower oil and gas prices than prevailing market conditions.

The oil-price decline over the past two years has provided a real-life, high-intensity, externally driven "stress test." From June 2014 to January 2016, oil prices fell from a high of $112/bbl (Brent) to $31/bbl—a decline of nearly 75%. The price collapse directly affected the oil and gas sector, resulting in job losses, lower capital spending, dividend reductions, bankruptcies among smaller players, and increased debt leverage among larger companies. According to IHS Herold, 82 global oil and gas companies lost 42% of their total market value from September 2014 to year-end 2015, resulting in US$1.4 trillion in lost market capitalization.[21] At the same time, companies are adjusting their cost structures to the lower price environment.

Meanwhile, the oil price shock has had minimal systemic impact on the global financial system thus far. Since oil prices fell below $100/bbl in September 2014, the Dow Jones has risen 6% (see Figure 3). By comparison, the recent losses of $1.4 trillion for the oil and gas sector are nowhere near the total losses across all sectors incurred during the 2008 financial crisis, when US$31 trillion of equity value was destroyed in a single year.

The scale at which losses in the oil and gas sector could impact regional and global financial systems would depend on the nature of those systems and their exposure to the sector. Generally, however, the diversification of the global economy provides a considerable buffer to oil and gas sector shocks. To view this within the context of the broader market, energy companies are estimated to account for about 6.2% of global market capitalization according to the S&P Global Broad Market Index (BMI) (see Figure 4). Moreover, relative valuations of different major sectors are continually shifting within the framework of the global financial system.[22]

Policy response: Climate-related financial disclosures

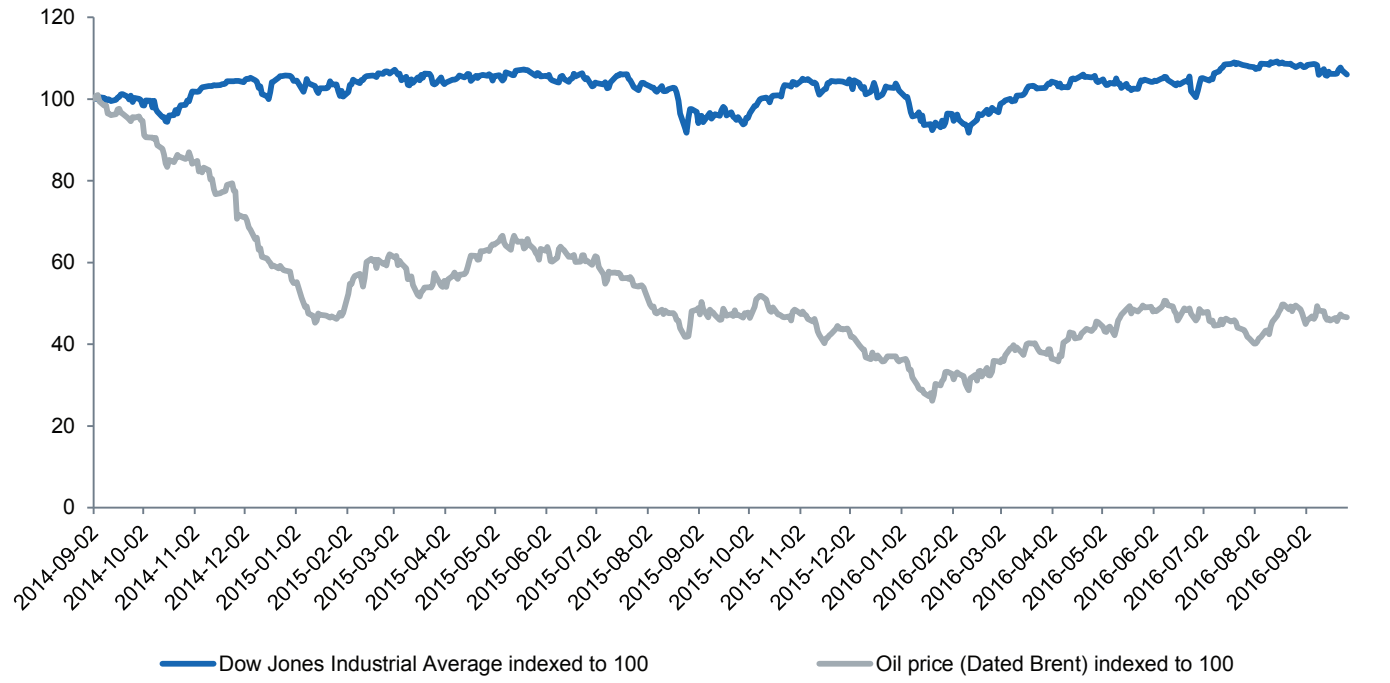
In April 2015 the G20 nations asked the FSB to examine climate-related financial risks. Later that year, during the United Nations Climate Change Conference (COP21) in Paris, the FSB announced the establishment of the new high-level Task Force on Climate-related Financial Disclosures. Implicit in the development of the TCFD is the belief that market participants are not able to correctly price in climate risk, and therefore central banks and governments need to step in.

21. See the IHS Herold Insight *Peer Group Study: IHS Herold-covered companies suffer median market loss of 40% in 2015; share performance continues to favor companies with stronger balance sheets.*

22. S&P Global BMI, 29 July 2016 data.

Figure 3

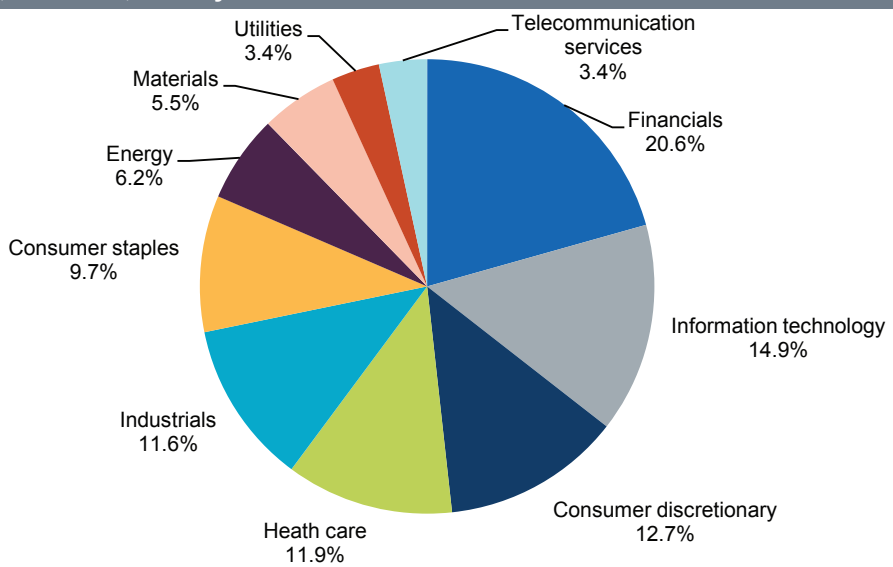
Dow Jones Industrial Average and oil price (Dated Brent) (indexed to 100)



Source: S&P Dow Jones Indices, Argus Media Limited

Figure 4

Sector breakdown, S&P BMI, 29 July 2016



Notes: Sectors based on the Global Industry Classification Standard (GICS®) developed by S&P Dow Jones Indices and MSCI. The weightings for each sector of the index are rounded to the nearest tenth of a percent; therefore, the aggregate weights for the index may not equal 100%.
Source: S&P Dow Jones

The objective of the TCFD is to develop guidelines for voluntary disclosure that would promote alignment, allowing information to be comparable across companies for investors and lenders to take into account in allocating capital. The framework, which will be released in December 2016, is expected to encourage companies and investors to disclose levels of climate-related financial risk exposure, increasing transparency in the market. While the FSB can only make recommendations and it is up to individual jurisdictions to make rules, the FSB has the power to coordinate at the G20 level, and such a voluntary disclosure framework could foreseeably be widely adopted.

In March 2016, the TCFD issued its Phase I Report, which provided insight into the type of disclosures under consideration and included the following:[23]

- Quantitative data on emissions associated with operations and assets held
- Qualitative information on transition strategies and the resilience of businesses under low-carbon scenarios
- Scenario and sensitivity analysis that can capture uncertainties and provide forward-looking assessments of risks and opportunities
- Data on historical performance and progress against management-established targets
- Details about company risk management processes, including key risk indicators and key performance indicators

Potential impacts of a climate risk disclosure framework

The TCFD's recommendations come at a time when the oil and gas industry is already facing challenges. Groups that include divestment advocates, some pension funds, and "socially responsible investment" firms have questioned the long-term financial viability of fossil fuel companies in a lower-carbon future.[24]

Disclosure frameworks can vary widely. Some approaches, if widely adopted in the mainstream financial community, could reduce investor appetite for the securities and debt of fossil fuel companies and discourage the market from investing in or lending to them. This shift in capital allocation would be consistent with the Bank of England's aim to bring resources away from "risky" assets that it deems liable to transition risk. In statements made in a visit to Canada in July 2016, Governor Carney called for capital markets to dramatically increase funding for lower-carbon energy investment. He estimated that to address the needs of global carbon reduction, the world would need investments "somewhere in the order of $5- to $7-trillion" over the next 15–20 years.[25]

Governor Carney further amplified his views on green finance in a speech in Berlin on 22 September 2016, in which he described investment in oil and gas assets as posing Lehman-style systemic risk to "financial stability," which he defined as a "climate Minsky moment." Governor Carney called for the development of a global "green bond" market and "green finance" as a way by which "financial stability can be promoted."[26]

23. *Phase I Report of the Task Force on Climate-related Financial Disclosures,* Task Force on Climate-related Financial Disclosures, 31 March 2016.

24. Socially responsible investing, also referred to as "sustainable, responsible and impact investing (SRI), is an investment discipline that considers environmental, social and corporate governance (ESG) criteria to generate long-term competitive financial returns and positive societal impact." Adapted from The Forum for Sustainable and Responsible Investment, "SRI Basics," http://www.ussif.org/sribasics.

25. "BoE's Governor Carney warns of $7 trillion green infrastructure need," *Reuters,* 15 July 2016.

26. "Resolving the climate paradox," Speech given by Mark Carney, Governor of the Bank of England, Chair of the Financial Stability Board, Arthur Burns Memorial Lecture, Berlin, 22 September 2016.

In his speech, Governor Carney ascribed the huge drop in the valuation of US coal companies to the fact that "markets bring the future forward, with financial impacts often occurring immediately, even if the real impact is several years into the future." The primary reason for the drop in coal values was the loss of market share to natural gas in US electric generation, owing to the emergence of inexpensive shale gas.[27] Governor Carney also endorsed the "investigation" by the New York attorney general and other attorneys general of "insufficient disclosure of climate change risk by a large energy company."

Investment and lending restrictions have already been adopted by certain major banks and pension funds with respect to coal companies. Should banks and financial institutions limit lending to fossil fuel companies, capital markets and other nonbank financial institutions such as hedge funds and private equity funds could step in. This could raise the cost of capital for fossil fuel investments, and those funds could also be subject to the same pressures.

Moreover, depending on how such disclosure requirements are drafted and implemented, they could also open up new avenues for litigation, penalties, and fines—against fossil fuel companies, banks, and investors.

A disclosure framework that severely impacts financing options for investor-owned companies could have macro-level repercussions on the global oil markets. If the FSB's disclosure initiative results in significant financing cost increases, it could place these companies at a disadvantage with respect to their state-owned rivals. A loss in the competitiveness of investor-owned companies could in turn result in a greater share of the world's hydrocarbon reserves being produced by NOCs. This narrowing of supply sources could lead to higher oil prices than would otherwise be the case, with the result being a negative impact on consumers, employment, and economic growth.

Additional measures in the pipeline?

In addition to disclosure requirements, more prescriptive regulatory measures around climate risk have been mentioned by financial authorities. In his speech in September 2015, Governor Carney pointed to other steps, including guidance from governments on possible carbon price paths and stress testing financial institutions on their climate risk exposure.

Similar suggestions have been made by other European institutions. The European Systemic Risk Board suggested in a study that the exposure of financial firms to climate risk could be incorporated into regular stress-testing procedures, which would consider different transition scenarios. The study concluded, "If stress tests ultimately find that systemic risks are material, research and consultation would be necessary in order to assess which policies are best suited in light of the preexisting prudential stance." Such policies could include measures such as capital buffers and exposure limits.[28]

The kind of measures discussed here could place further pressure on investors holding fossil fuel company equity and debt instruments. Under such policies, financial regulators and central banks would take a much more active role in defining climate risk and regulating investments in such "risky" sectors. It would also mean that central banks are stepping into the arena of environmental policymaking.

27. Coal's share of US electric generation fell from 52% in 2000 to 28% in the first half of 2016, while natural gas's share more than doubled, from 16% to 34%.

28. "Too late, too sudden: Transition to a low-carbon economy and systemic risk," *Reports of the Scientific Advisory Committee 6*, European Systemic Risk Board, February 2016.

Daniel Yergin is Vice Chairman of IHS. He the author of The Quest: Energy, Security, and the Making of the Modern World *and* The Prize: the Epic Quest for Oil, Money, and Power, *for which he received the Pulitzer Prize. The International Association for Energy Economics gave Dr. Yergin its 2012 award for "outstanding contributions to the profession of energy economics and to its literature." In 2014, the US Department of Energy awarded him the first "James Schlesinger Medal for Energy Security"; and in 2015, the University of Pennsylvania presented him with the first Carnot Prize for "distinguished contributions to energy policy."*

Elena Pravettoni is a Senior Economist at IHS Energy and focuses on geopolitical and energy market developments. Her latest work focuses on geopolitical trends in the Middle East and the South China Sea. Ms. Pravettoni holds a Master of Arts in International Relations and Economics from Johns Hopkins School of Advanced International Studies (SAIS) and a bachelor's degree in European Studies from King's College London.