OIL PRICES AND THE NEW CLIMATE ECONOMY

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EXECUTIVE SUMMARY

After several years at high levels, oil prices dropped by more than half between June 2014 and January 2015. This realignment has caused companies and countries to reconsider their energy choices. They have to account not just for current lower prices, but also for the economic implications of uncertain and volatile oil prices, and for what this means for longer-term trends.

This note addresses some of these issues, building on the findings and recommendations of Better Growth, Better Climate: *The New Climate Economy Report, published last September by the Global Commission on the Economy and Climate.*[1] The report found there were many actions countries could take to promote better growth, while also reducing GHG emissions from energy use. The overall conclusion of this note is that opportunities for structural change in economies and energy systems remain even with a situation of lower oil prices.

1. **Low oil prices offer welcome short-term economic relief for consumers, but medium- and long-term prices remain uncertain. Energy price volatility is high and hurts economic growth.**

Overall, cheaper oil provides a stimulus to the world economy, but with uneven effects. The world now uses 90 million barrels per day, so an oil price of, say, US$60 instead of $100 would save consumers US$1.3 trillion per year. Despite losses to oil producers, globally the net effect is positive. Modelling by the International Monetary Fund (IMF) suggests that if prices stay low, global GDP will be 0.3–0.7% higher in 2015, and 0.2–0.8% higher in 2016 than it would be otherwise.

Countries cannot bank on future low fossil fuel prices. While it is tempting to think lower prices are here to stay, history tells us that large price swings are a poor guide to what happens next. Even now, forecasts for the next five years vary between troughs as low as US$20/barrel, to a steady return to $100/barrel levels. For 2016 alone, recent expert polls show guesses in the range of US$59–85/barrel.

The sharp drop in prices has a sting in its tail: price volatility hurts the economy. While uncertainty is a fact of life, oil is special: its market value is 5% of world GDP, its price can move by 50% within a matter of months, there are few short-term options to reduce consumption, and it has widespread knock-on effects on other key inputs to economic activity. Energy price volatility is therefore a major concern. It hurts the economy, delaying business investment, requiring costly reallocation of resources, reducing consumer expenditure, and slowing job growth. Thus, even as consumers enjoy the benefits of low oil prices, volatility is now a top concern of energy leaders worldwide. Conversely, reducing exposure to energy price volatility has economic value. Countries can do so by discouraging wasteful consumption, increasing energy efficiency, and expanding non-fossil energy supply.

2. **Low oil prices offer an opportunity: countries can seize the day to improve energy pricing and reform subsidies to achieve long-term benefits.**

The "true cost" of fossil fuels is higher than what consumers pay. Distorted energy prices stand in the way of a better growth and development path for many countries. Price controls undermine investment in much-needed infrastructure and can threaten the build-out of energy supplies. Subsidies for fossil fuel consumption reached US$550 billion in 2013, encouraging waste while straining public finances. Few countries have energy prices that fully reflect the harm of pollution to public health and the environment, while most also lack the carbon prices that can underpin structural change towards a lower-carbon economy. Whether oil prices are high or low, there are benefits from correcting these various deficiencies.

Lower oil prices can open up a space for reforms. There is momentum around the world to improve energy pricing: 27 countries are reforming energy subsidies, including Egypt, Indonesia, Ghana, and India, while Morocco and Jordan are among those considering additional steps; 40 countries and over 20 sub-national jurisdictions

now apply or have scheduled the introduction of a carbon price, while another 26 are actively considering them. Many countries are stepping up efforts to tackle air pollution. These policies have strong long-term benefits, but often founder on short-term resistance and transition costs. The current low fossil fuel prices create an opportunity to overcome such difficulties. Consumers accustomed to high prices, but now paying less, may be more open to reform.

3. Despite low oil prices now, there are good reasons to continue to expand investments in renewable energy for electricity production.

A long-term focus still favours steps to reduce dependence on fossil fuels (which would also reduce GHG emissions), but decision-makers need to take a fresh look at their options and recognise the changes in the landscape.

Cheaper oil does not compete directly with renewable energy for electricity production, but can bring lower natural gas and coal prices, with wider impacts. Oil itself barely features in electricity production globally, and technologies such as solar photovoltaics and wind energy are therefore not affected by the oil price itself. However, lower natural gas prices associated with cheaper oil can change electricity choices: strengthening the near-term case to switch from coal to gas and reducing electricity prices, while making renewable energy source less cost-competitive in the short run. In the long term, however, a shift to gas cannot depend on the indirect impact of lower oil prices, but would require lower fundamental costs and improved availability of natural gas itself. Achieving GHG benefits in such a scenario, in turn, depends on getting policy right, from steps to reduce methane leakage, to continued support for the deployment and development of fully CO_2-free energy.

Costs of renewable energy are falling and have low volatility, making these sources of energy an attractive option regardless of short-term oil price movements.

- Oil prices offer less guidance to choices about electricity than is often assumed. Continued low gas and coal prices are not assured, and the link to oil is weakening in key geographies.
- The costs of solar and wind power continue to fall fast, and these energy sources have little if any operating cost (and therefore low volatility once built). Renewable energy can thus effectively lock in the cost of energy production for 20 years or more. By contrast, fossil fuel prices have no such trend, are uncertain even five years ahead, and also have significant short-term volatility.
- The best wind power and solar photovoltaic (PV) projects can already compete even with cheaper natural gas. There are steps countries can take now to reduce the cost of renewable energy solutions further, notably by enabling lower-cost finance.
- Renewable energy can mitigate pressing problems that do not show in the market price for energy, including energy security concerns, air pollution, as well as exposure to future fossil fuel price volatility.

Overall, oil itself is less important for electricity markets than commonly thought, and renewable energy continues to be an attractive strategic option even with lower current fossil fuel prices. However, using modern renewable energy is not without challenges. To benefit, countries need to start the process of "learning by doing", putting in place local supply chains, new financing models, stable policy to attract investment, and the know-how for grid integration.

4. In the longer term, low-carbon policy could help maintain lower fossil fuel prices.

Large consumers can gain from lower fossil fuel prices in low-carbon scenarios. Energy efficiency and alternatives to fossil fuels (renewable or nuclear) have already taken the pressure off fossil fuel markets. In the longer run, ambitious low-carbon policy could reduce fossil fuel prices by as much as 30–50%. To capture this benefit, the large consuming economies of the world would need to act in concert. They also would need to continue such policies even as the prices of those fuels fall to lower levels.

The current low prices present an opportunity to avoid future "stranding" of assets. Producers are now cutting back on investment in the development of high-cost oil resources that are no longer viable under lower oil prices. This creates an opportunity both to avoid future "stranding", and to avoid commitment to future fossil fuel use that follows from the development of these resources.

1. INTRODUCTION

After several years at high levels, oil prices dropped by more than half between June 2014 and January 2015, leading many to ask questions about the implications for the economy and for countries' and companies' energy choices. Although such price swings have happened before, the issues being discussed are indeed quite important. This note addresses some of them, building on the findings and recommendations of *Better Growth, Better Climate: The New Climate Economy Report*, published last September by the Global Commission on the Economy and Climate.[2]

The theme of the New Climate Economy report is how to capture opportunities for structural economic change that improve economic performance, while also reducing greenhouse gas (GHG) emissions. This includes a number of changes in energy systems. A key recommendation is to make energy prices reflect wider objectives: enabling the investment in new infrastructure, phasing out fossil fuel subsidies, introducing a carbon price as part of fiscal reform, and ensuring that energy prices reflect the substantial negative health impacts of fossil fuel use. The report also argues for accelerating the transition away from coal power to cleaner electricity sources, noting the potential to address acute air pollution problems, tap into the improving competitiveness and availability of alternatives, and avoid lock-in to high future greenhouse gas (GHG) emissions. The report points to several factors that would enable a faster transition, including the improving cost-effectiveness and of renewable energy technologies, the lower cost of natural gas in some geographies, opportunities to increase the pace of energy innovation and improve energy efficiency, and better ways to finance low-carbon infrastructure. Overall, the NCE report finds that there is far less tension than is often assumed between building a good energy system that is secure, affordable, and clean, and reducing the energy system's climate impact. Indeed, the two require many of the same steps.

This note re-examines some of these issues in the context of much-lower oil prices. The central message is that the policy response needs to keep an eye on the longer term. Fossil fuel markets move drastically and unpredictably, but good policy does not. There are opportunities created by lower energy prices to support reforms with long-term economic benefits, from improved energy pricing to fiscal reform. Overall, however, countries economic and energy strategies need to be based on longer-term considerations.

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2. HERE TO STAY? FUTURE OIL PRICES REMAIN UNCERTAIN

Oil prices fell from a peak of US$115 per barrel ($/bbl) in June 2014 to less than US$50/bbl in January 2015. The price seems to have stabilised around US$60/bbl for Brent since then.[3] This was a break with several years of prices hovering in a narrow band around US$100/bbl. It was also against widely held expectations. As recently as last October, the International Energy Agency had forecast steady price increases for many years to come, reaching US$112–116/bbl in 2020[4] with similar outlooks expected by the US Energy Information Administration,[5] the World Energy Council,[6] and other agencies.

The price drop occurred after a combination of new sources of oil and sluggish demand, and alongside an appreciation of the US dollar. In 2006–2013, US oil production grew from 8 to 12 million barrels per day (mb/d), mostly due to the shale revolution.[7] For comparison, this increase is larger than total production from Algeria, Libya and the North Sea. Global oil demand growth, in turn, slowed significantly: in 2014, oil consumption increased by just 0.7%, compared with an average of 1.9% per year prior to the 2008–09 recession.[8] One reason is slower economic activity; another is that high prices have induced strong efforts to improve energy efficiency and reduce dependence on oil.

These factors in turn have led to a change in how oil markets work. In the past, members of the Organization of the Petroleum Exporting Countries (OPEC) have constrained their oil output to maintain prices. In November 2014, they broke with this practice. Prices had been sliding for some months, but OPEC failed to agree to production cuts and announced that it would maintain production at 30 million barrels per day.[9] For the time being, at least, OPEC thus has chosen not to act as a swing supplier, removing a major factor that previously kept prices high.[10, 11]

2.1 Large swings in oil prices are normal, and future prices are highly uncertain

While oil price shocks are always dramatic when they occur, large and unexpected swings in oil prices are nothing new. Dramatic swings in prices took place already in the 1930s.[12] Political turmoil in various countries since the early 1970s has led to repeated production losses and price spikes.[13] Price drops also have come suddenly. Major agencies had projected rising oil prices throughout the 1980s, but in 1986 prices dropped by 50%.[14] Prices fell again in the late 1990s, and by the start of the 2000s forecasts clustered around oil prices of US$20-25/bbl by 2010, and not much higher for 2020.[15] *The Economist* went further, suggesting in 1999 that a world of US$5–10/bbl might be around the corner, because this price decline was "fundamentally different" from past ones.[16] Only five years later, prices were reaching US$50/bbl, higher than they had been for 20 years.

Cheap gas price Citgo © Mike Mozart / flickr

Predicting oil prices is therefore a thankless task. Past consensus has often been proved wrong. Currently, no consensus is even in sight, and views diverge widely about what prices should be expected in the next few years. The IEA still expects that upward pressures will win out and prices will rise again, likely to levels of US$100/bbl.[17] Many others agree.[18] Futures markets were recently betting that prices will rise to US$90/bbl by 2020,[19] while recent expert polls show guesses for 2016 in the range of US$59–85 /bbl.[20] However, others believe that prices will now remain low,[21] and some have suggested that oil prices might fall as low of US$20/bbl before rebounding to higher levels.[22]

How should policy-makers respond to such diverging views? First, they can take advantage of low prices in the near term to smooth the way for energy reforms that will have longer-term benefits. Second, they can play it safe and accept that there is no certainty about what oil and other fossil fuels will cost within the next 5–10 years. They may start by taking a long view, noting that there is no strong trend in fossil fuel prices over the last century.23 While the past is a limited guide, this should caution against claims that prices will now be either inexorably rising or steadily falling in the future.[24]

Third, policy-makers should recognise that energy price volatility is here to stay. Prices can move suddenly and dramatically. Even before the recent drop, oil price volatility was increasing faster than the volatility of other commodities. Oil price shocks have continuously increased in size and frequency.[25] Over the past year, crude oil volatility has increased as prices have fallen,[26] and the market remains volatile.[27] Decision-makers are aware of this: the World Energy Council's recent Energy Monitor survey of energy leaders identified volatility as "the new normal", and a key concern of energy leaders around the world.[28]

2.2 Low oil prices provide a short-term economic stimulus overall, but with uneven effects

Lower oil prices will hurt producers, but they will benefit oil consumers. Overall, they will give a boost to the global economy – even though the world is much less dependent on oil than it used to be. Four decades ago, nearly half of global energy came from oil, but in 2012 it was just one-third,[29] and outside transportation, oil is just 6–12% of the energy used.[30] The oil intensity of the global economy in 2013 (in barrels of oil used per US$1 million of GDP) was half that of 1973.[31] This change came about because of higher prices, but also because countries feared future price spikes and supply disruptions following the 1970s oil shocks.

Still, oil prices continue to matter to many economies, so the recent price drop provides very welcome relief for net consuming countries, many of which are struggling with sluggish economic performance. In 2013, high prices meant that the value of oil was almost 5% of global GDP, similar to the value 30 years before.[32] The world now consumes 90 million barrels per day, so an oil price of, say, US$60 instead of $100 saves consumers globally as much as US$1.3 trillion per year. The opposite holds for producers. For example, the International Monetary Fund (IMF) projects revenue losses of US$425 billion in 2015 for oil exporters in the Middle East and Central Asia alone.[33] The economies of many producing countries moreover are highly dependent on hydrocarbon exports, so lower prices can quickly affect government budgets and economic growth.

There also are other reasons why oil prices matter: the swings in prices are large compared to those of just about any other goods and services, and demand for energy often cannot be reduced quickly to mitigate the impact of high prices.[34] Falling oil prices can also have a number of indirect effects. Lower energy costs reduce production costs throughout the economy, with knock-on effects on prices and consumption of a range of goods and services. Governments may see energy tax revenues decline, but other revenues rise as consumer spending increases. Many importing countries will also see short-term improved trade balances. For example, if low oil prices persist, India could eliminate the large negative trade balance it has developed over the past several years.[35]

The net economic impact of the recent drop in oil prices depends on what happens next. Modelling by the IMF suggests that it may increase global GDP by 0.3–0.7% in 2015, and by 0.2–0.8% in 2016.[36] The World Bank suggests that a 10% decrease in oil prices would boost importing economies by 0.1–0.5% and dampen exporting economies by 0.8–2.5%,37 and has also suggested that global GDP growth could be 0.5 percentage points higher if oil prices were to remain lower throughout 2016.38

2.3 Oil price volatility hurts the economy

The short-term stimulus of cheaper oil has a sting in its tail: oil price volatility and uncertainty are economically harmful in their own right, an effect that partially offsets the benefits of sudden drops in prices. One study of the US economy found that oil price volatility (as opposed to changes in the level of oil prices) accounts for a significant share of fluctuations in output growth.[39] Another study of the US economy found that "[a]n increase in the price of crude oil from, say, $40 to $50 per barrel generally matters less than increased uncertainty about the future direction of prices (increased volatility)".[40] A study of Canada, meanwhile, found that higher oil price volatility can reduce the growth rate of output by about 1.2%;[41] a study of Asian economies also found a significant impact.[42]

There are several reasons for this. Oil price volatility may delay business investment by increasing uncertainty.[43] It also can require costly reallocation of resources,[44] and reduce consumption by inducing precautionary saving by consumers.[45] The resulting reduced output growth can depress employment growth

and increase unemployment.[46] In addition, when prices and wages take time to adjust, a range of inefficiencies result from more volatility in the prices of key inputs.[47] One consequence of these combined effects is that reductions in oil prices do not benefit the economy as much as price increases hurt it.[48] For modest price movements, this effect may in fact be so strong that lower oil prices fail to have much positive impact.[49]

In other words, dependence on fossil energy has a volatility penalty. Measures to reduce this dependence can help prevent economic harm. Options include reducing the energy-intensity of the economy, improving energy efficiency, and increasing the share of non-fossil energy.

3. AN OPPORTUNITY TO CORRECT COURSE

The New Climate Economy report identified improved energy pricing as a key step to a better growth trajectory in many countries. Where prices are kept below the cost of new supply through price controls, for example, they often lead to underinvestment, and can hold back energy access and economic development. Similarly, energy subsidies distort economies, and are often an inefficient way of helping the poorest. Moreover, energy prices currently do not take into account significant harmful effects, notably air pollution, that are associated with some forms of energy use. Meanwhile, taxing energy (or, from a climate point of view, carbon) offers the opportunity to raise revenue to finance reductions in other taxes, notably capital and labour taxes that discourage economic activity. Improved energy pricing thus offers significant promise as countries look for better future economic growth – a fact that underpins two of the Commission's recommendations: for the elimination of fossil fuel subsidies and the introduction of a price on carbon as part of overall fiscal reform.

Energy sources © Bill Abbott / flickr

At the same time, policies which raise the cost of energy often are difficult to enact. The politics of short-term pain often trumps that of longer-term benefits, and distributional effects often need to be addressed. The NCE report therefore recommended a gradual approach to discover the right set of policies and institutions to advance overall welfare, putting the initial policies in place over the next 5–10 years and increasing ambition thereafter.

The low oil price now offers an opportunity to start that process. Lower fossil fuel prices (even if they prove to be temporary) can help overcome the initial political hurdles that have delayed energy price reform in the past: consumers who have become accustomed to paying double the price for gasoline in recent years may object less if some of the oil price declines are offset by reduced subsidies or increased taxes.

3.1 Lower energy prices create an opportunity to reduce fossil fuel subsidies, with a range of potential economic benefits

Energy subsidies have far-reaching negative effects. They can aggravate budget deficits and therefore reduce state capacity, and in energy-importing countries also exert pressure on the balance of payments. They also can depress growth by depressing investment in the energy sector, diverting public spending from areas that otherwise would better promote growth, and distorting the structure of the economy towards lower-value and energy-intensive sectors. By pushing up energy consumption, subsidies also increase any health damage and other adverse effects associated with energy use. Finally, in many cases, subsidies are regressive, widening the gap between rich and poor compared to more targeted welfare mechanisms.

These effects have escalated as subsidies have grown large: in 2013, consumption of fossil fuels was supported to the tune of US$548 billion in 2013, over half of which was oil products[50], while fossil fuel exploration and production in OECD countries was supported through tax breaks or direct subsidies by as much as $55-90 billion per year. But many countries are now taking steps to reduce them. As many as 27 countries are now undertaking reforms, with reductions in subsidies in countries such as Egypt, Indonesia, Ghana, and India, and several others including Morocco and Jordan among those considering additional steps.[51] While countries are not cutting subsidies because of cheaper oil alone, lower oil (and other energy) prices will make it much easier. In the past, many attempts to reduce subsidies have stumbled on their unpopularity, with widespread protests at sudden price increases (such as in Nigeria in 2012, or in Indonesia in 2003).[52] As the unsubsidised price is (at least for the time being) now lower, the immediate impact of subsidy reform is softened, opening up a political space for reform. Countries would do well to take this opportunity.

3.2 Carbon pricing has momentum, and the case remains strong with low fossil fuel prices

The Global Commission on Economy and Climate recommended that governments introduce a strong, predictable and rising carbon price as part of fiscal reform strategies, prioritising the use of the revenues to offset impacts on low-income households and to finance reductions in other, distortionary taxes. Carbon pricing is the most economically efficient way to tackle the greenhouse gas market failure.53 A price discourages emissions and promotes investment in low-carbon infrastructure, efficiency and innovation. It also can help avoid the regulatory failures that can occur with command-and-control approaches. Moreover, as discussed in the NCE report, the cost to the economy need not be big. Carbon pricing can be introduced as part of a broader fiscal reform package, where taxes are shifted away from things we want to encourage, such as labour and business activities, and towards taxing "bads" such as pollution and resource use.

Lower energy prices also open up a political opportunity to introduce or increase the ambition for a price on carbon. The magnitudes involved need not be great. For illustration, a US$25/tonne CO_2 price adds around $0.25 to a gallon ($0.06 to a litre) of gasoline or $10 per barrel of oil[54] – much smaller than the fall in prices from over $100 to under $50/bbl. As with energy subsidy reform, consumers accustomed to paying double the price for gasoline are unlikely to struggle if the carbon price is raised as the same time as the oil price falls. (For coal, by contrast, a charge of US$25 per tonne CO_2 would nearly double the price, as it translates to around $50 per tonne of coal.)

There is momentum to build on. A recent World Bank report shows that about 40 countries and over 20 sub-national jurisdictions now apply or have scheduled to apply carbon pricing through a carbon tax or emissions trading scheme. Another 26 countries or jurisdictions are considering carbon pricing.[55]

3.3 Current prices often fail to reflect the true cost of energy

Fossil fuels continue to be sold at prices that do not reflect the full range of negative impacts associated with their use. Current lower fossil fuel prices can offer an opportunity to start adjusting prices so they reflect harmful local and regional impacts of energy use, notably on human health.

Emissions from the burning of fossil fuels cause air pollution, particularly severe in urban areas in rapidly developing countries, which damages the health and productivity of millions of people. Outdoor air pollution caused an estimated 3.7 million premature deaths in 2012.[56] This is harm on a scale much greater than had

been thought even recently.[57] In the 15 countries with the highest greenhouse gas emissions, air pollution, largely associated with the burning of fossil fuels, causes health damages equivalent to 4% of GDP.[58]

Energy prices in most countries do not reflect these costs. Consumers therefore use more fossil fuels than what would benefit society as a whole, while alternatives appear less viable. Work from the IMF finds that taxes on most fossil fuels would need to be substantially higher in most countries to reflect the harm caused by their use, especially if including factors such as congestion or negative impacts on energy security.[59] Lower fossil fuel prices can open up an opportunity to correct energy prices so they are more in line with the damage caused.

4. EVOLVING ENERGY SYSTEMS

The recent drop in oil prices comes as significant momentum has built up to find alternatives to fossil fuels. This takes many forms, from improving energy efficiency across sectors, to rapid innovation and expansion of renewable energy for electricity generation, to a range of clean-tech developments across electric vehicles, lighting and other applications.

Could a new area of cheaper fossil fuels slow or stop this incipient energy transition in its tracks? That seems unlikely, not least because as discussed above, countries cannot really bank on a future of low, stable fossil fuel prices. Moreover, in most markets, the transition hasn't just been driven by the high cost of fossil fuels, but by a wide range of desired benefits: from local development opportunities, to energy security, to cleaner air and a safer climate.

That said, countries may need to adjust their energy policies in response to the new situation. We highlight four areas here:

- With natural gas prices dropping along with oil prices, governments may want to consider an expanded role for natural gas in their energy supply, including as a replacement for coal in the power sector.
- Renewable energy for electricity generation continues to offer significant promise but requires some protection from short-term movements in fossil fuel prices.
- The longer-term development of alternatives to oil in the transportation sector still depends on policy support, and there is a risk that current momentum is dissipated if policy is weakened.
- Longer-term, low fossil fuel prices could be not a challenge but one of the resulting benefits of low-carbon policies taking the pressure off prices for fossil fuels.

4.1 Lower oil prices will make natural gas cheaper as well, but it is unclear whether large effects will persist longer-term

The influence of oil prices goes far beyond just transportation. Lower prices will cascade to some degree to other forms of energy, including electricity.

The reason is that oil prices influence the costs of other fossil fuels via a range of interactions (see box). Short-term natural gas prices are most strongly affected, as they often are directly linked to the oil price, and now look set to fall in several geographies. Coal prices also can be affected, albeit less strongly. Both these fuels, in turn, have an impact on the cost of a range of activities, including heating in buildings, industrial processes, and electricity production. This means that even though oil is barely used for electricity generation in most large markets, low oil prices are also likely to mean lower electricity costs. Overall, lower oil prices have indirect impacts across the economy, even in sectors where oil itself is not a significant source of energy.

Nonetheless, there are a number of limitations to these influences (see box). The impact in the United States will be much smaller than in Europe or Asia. There also are signs that the link from oil to natural gas is weakening. Even if sustained lower oil prices were coming, policy-makers cannot necessarily bank on such a scenario leading to enduring low gas prices. Longer-term, gas prices would only stay low if the cost of production of natural gas itself is kept low. Low oil prices alone are not sufficient to redraw the competition between natural gas and its alternatives, whether coal or renewable energy.

Oil prices influence the price of natural gas and coal, but impacts differ by region and over time

Large volumes of natural gas are sold through contracts that directly link natural gas prices to the price of oil (oil indexation).[60] There also are several indirect links between the two commodities, ranging from competition between oil and gas end-use markets, to factors such as integration of oil and gas production, and the need to use oil products to transport liquefied natural gas.[61]

These factors play out differently in different geographies.[62] In the United States, the influence of oil on natural gas is relatively limited and indirect, and prices are mostly driven by market fundamentals for natural gas itself: the cost of gas supplies from different sources, and the demand in key end-use markets including heating and electricity generation.[63] In Europe and Asia, however, oil indexation is common. The drop in oil prices therefore is expected to start to result in significantly lower prices for natural gas in the first months of 2015. The effect is likely to be most pronounced in Asia: according to one assessment, a price of US$75/bbl of oil would correspond to a price of liquefied natural gas (LNG) around US$10–11/mmbtu,[64] down from the US$15–18 range observed over the past few years.[65] Such downward pressure is reinforced by factors in the gas market itself, including new LNG supply.[66]

There also are signs that this oil-natural gas link may be weakening. For example, in the EU 75% of natural gas was oil-linked in 2005, but by 2012 the number was down to 50%.[67] Similarly, in Asia the original logic behind oil-linked prices has been under question.[68] While the impact of past oil-linking will now feed through, it thus is unclear that lower oil prices can keep down gas prices for new supply in years to come. In particular, low prices may make some of the pipeline of LNG projects on which future supply would depend unprofitable[69] – in turn putting upward pressure on future prices.

The link from oil to coal is substantially weaker than it is for natural gas. For example, starting inoal prices began to decline even as oil prices remained stable. There are indirect links, including because oil is an input to coal production, and via the competition between coal and natural gas (in turn linked to oil) in several end-use markets and especially electricity generation.[70] However, the trends in recent years leave open the possibility that oil and coal prices are more weakly linked than in the past.

In the short to medium term, however, natural gas prices in Europe and Asia are likely to fall more than the price for coal. This improves the economics of switching from coal to gas, notably in the power sector. The effect is likely to be most pronounced in Europe, where the mix of coal- and gas-fired generation is highly sensitive to prices and there is spare capacity available to rapidly shift from one to the other. Although the long-term trend is away from coal in most European countries, in recent years lower coal and carbon prices have improved the economics of coal-fired generation relative to that of natural gas. This has resulted in a shift towards increased reliance on coal, something a realignment to lower gas prices could reverse. In fast-growing regions, including much of Asia, there is much less spare generating capacity, so short-term effects are more limited.

If a longer-term shift in prices were to materialise, it could help shift investment out of new coal-fired capacity and towards new gas-fired power. However, as noted, this would likely depend on lower fundamental costs for natural gas itself, rather than indirect influences via the oil price. It also may require other, supporting policies such as CO_2 pricing, air pollution regulation, or policies to support the pipelines and other infrastructure

required for supply. Moreover, countries cannot count on lower-cost and more abundant natural gas to automatically lead to lower GHG emissions. Absent counteracting policy, factors including methane leakage, increased energy intensity, and reduced use of zero-carbon energy risk offsetting much of the GHG benefit of lower coal use.[71]

4.2 Cheaper fossil fuels may challenge renewable energy in the short term, but falling costs and other benefits mean the case for renewables remains strong

The NCE report highlighted renewable energy sources (RES) for electricity generation sector as a significant opportunity to expand future energy supply. The question therefore arises whether lower oil prices challenge this conclusion. There is some immediate logic to this: if lower fossil fuel prices were to persist, the cost gap between renewable energy sources and fossil fuel-based options to meet electricity demand would widen. However, it is far from clear that this situation has arrived.

The link from oil to renewable energy for electricity production is indirect, as oil itself fuels just 5% of global electricity generation.[72] Lower oil prices cause lower natural gas and coal prices, these spill over to reduced electricity prices, which in turn can make investment in renewables less financially attractive. It is difficult to gauge how large this impact will be, and it depends in large part on the political response. In the short run, the impact may in fact be limited, as many countries either procure electricity from RES through mechanisms that are only partially dependent on fossil fuel or electricity prices, or which directly target a quantity of generation.[73] If lower natural gas and coal prices were to persist, however, this would drive renewable energy sources further away from "parity" with fossil fuel options. Countries or markets may then choose to give renewables a smaller role in their future energy choices.

Overall, however, there are several reasons why renewable energy can continue to be a valuable contributor to energy supply even in a world of lower oil (and natural gas) prices:

First, it is far from clear that an era of enduring low-cost, fossil fuel-based electricity supply has arrived. Low oil prices may or may not persist. The link to an enduring low cost for natural gas (and/or coal) in turn is weakening, as discussed above. Commitments now to future reliance on natural gas or coal for power generation therefore have to bet on significant unknown quantities. For the sake of illustration, if recent polls of forecasts and forward curves were roughly right oil prices would be around $80-$90/bbl when plants decided upon today become operational in two years' time, but a band of uncertainty potentially stretching as widely as $50-150/bbl for the remainder of the plant's lifetime. By contrast, renewable energy investments are by their nature long-term commitments, with costs decoupled from the gyrations in fossil fuel prices. Nearly all of the cost is incurred upfront (except in the case of bioenergy), after which costs are effectively be locked in for 20 years or more. For this period, depending on how contracts and market pricing function, users can be insulated against fossil fuel price risk, while countries importing fossil fuels also benefit from improved energy security and other benefits. Private-sector parties increasingly also see this value, with several recent announcements to enter into long-term purchasing agreements of a nature that are unavailable for fossil fuel-based power.[74]

Second, in favourable environments renewables now already compete even with comparatively low-cost natural gas. Solar photovoltaics (PV) provide the starkest illustration of this. 2014 saw a new benchmark for PV costs, with long-term contracts in Dubai at a price just below $US60 per MWh.[75] As the International Energy Agency and others have pointed out, at these levels, solar PV is already competitive with natural gas at prices as low as US$4.5–6/mmbtu. For comparison, the average price of natural gas in shale-rich United States in 2013 was US$4.5/mmbtu,[76] while prices in most of the world were much higher (US$16 in Japan, US$10 in Germany).77 The Dubai benchmark came on the back of very favourable conditions that cannot be replicated in all parts of the world, including efficient engineering solutions, low-cost financing, and good insolation. Nevertheless, a price of US$80/MWh for utility-scale solar PV is now being achieved in a wide range of geographies, including South America, the Middle East and North Africa, the United States, and parts of China.[78] This corresponds to natural gas at US$7–10/mmbtu, which again is lower than natural gas prices have been in many locations for many years, and lower than the natural gas prices expected in Asia even with current lower oil prices. Overall, the conclusion – wholly unforeseen even a few years ago – is

Solar array Alberta ©Green Energy Futures - David Dodge / flickr

that solar PV already can compete even with (by recent standards) comparatively "cheap" natural gas in many parts of the world. A similar story can be told for wind power, which can deliver electricity at costs of US$50–60/MWh in many geographies, and lower in the most favourable locations.[79]

Third, prices for both solar PV and wind power are still coming down fast. The factory price of PV modules has historically fallen by 15–24%,[80] and by 10% per year since 1980.[81] Between 2011 and 2014 alone, the average price of installed PV halved.[82] As a result of these and similar reductions in other renewables, US$270 billion invested in RES in 2014 bought 36% more capacity than what resulted from US$279 billion invested in RES in 2011.[83] It is, as ever, difficult to project how prices and performance will continue to evolve.[84] In addition, cost reductions are not necessarily automatic, but the variety of underlying learning processes depend to some degree on continued investment and deployment. But it is clear that if current trends were to continue, even a substantial drop in fossil fuel prices would not put renewables out of economic range for long; at 10% cost reductions per year, it takes only six years to halve costs.

Fourth, countries have many other reasons to continue to pursue renewable energy, ranging from air pollution to energy security.[85] The volatility of fossil fuel prices discussed above adds another reason. According to one study, a 10% increase in the share of renewables would avoid typical annual GDP losses induced by fuel price volatility in the range of US$29–53 billion in the US and the EU and US$144–221 billion globally.[86] Another study found that the US would have avoided $67 billion of lost GDP and Japan and Germany US$30 billion in recent years had their energy mixes relied on 10% more renewables instead of fossil fuels.[87] Other studies have found that accounting for hedging values can have a material effect on the relative economic case of wind or nuclear power vis-à-vis fossil alternatives.[88] Estimates of this nature are difficult to make with precision, and they therefore are not commonly or necessarily widely accepted. Nonetheless, it is clear that reducing exposure to fossil fuel price volatility has economic value.

Finally, having the future option of renewable electricity may require action now. For many countries, the prospect of reliance on renewable energy for electricity generation can seem like turning to an unknown quantity, and requires addressing a range of challenges. The high share of upfront costs and low marginal cost may not be easily accommodated in markets designed for fossil fuels, which often have the opposite characteristics. The integration of variable renewables to power systems imposes additional costs, and may require adjustments to the way power systems are run, ranging from trading arrangements, grid investments, and adjustment to the way fossil fuel plants are run. New financing solutions may be required to drive costs down, and in turn depend on achieving a stable and conducive policy framework capable of attracting the required investment.[89] Renewables continue to offer a medium- and long-term attractive option to meet energy needs against a range of fossil fuel price scenarios, and the low costs now being achieved in favourable settings show the prize available. But getting there, and having a genuine option to exploit this opportunity in years to come, requires countries to start now to build local supply chains, mobilise the right sources of capital, implement credible and stable policy regimes with a track record to convince investors, and adapt the way their electricity systems are run. Doing this successfully requires long-term policy stability. The main risk to renewables therefore might not be lower fossil fuel prices *per se*, but rather if countries pin their long-term

policies too much to short-term fossil fuel price movements.

4.3 A low-carbon transition would result in lower long-term fossil fuel prices

Looking to the longer term, the relationship between lower fossil fuel prices and non-fossil energy solutions (including energy efficiency) is still more intricate. In one sense, they are in fact complements: the growth in renewable energy in recent years has already taken pressure off natural gas and coal markets, much like the growth of nuclear power did in earlier decades. Similarly, absent the improvements in energy efficiency over the past decades, the world would have needed to source much larger volumes of energy supply,[90] with significant upward pressures on prices.

These effects mean a low-carbon transition could actually lead to lower fossil fuel prices in the long term. IEA analyses suggest that oil prices could be as much as 35% lower in a 2°C scenario than under business as usual by 2040.[91] Modelling carried out for the New Climate Economy project suggest effects may be as much as 50%.[92] Moreover, concerted action by a group of large economies would suffice to get much of the effect, even absent a comprehensive low-carbon agreement. If fossil fuel suppliers were to respond by accelerating their extraction to avoid future lower prices, this effect could be further strengthened.[93] As a related point, for net consuming countries, low-carbon policy – such a carbon or energy consumption tax that creates a "wedge" between the price received by producers and that paid by consumers – reduces the transfer of resource rents to producers.[94]

Conversely, in such scenarios, lower fossil fuel prices also would put a question mark on the development of high-cost oil resources. This may lead to "stranding" of assets: the oil deposits that are not viable to extract, but also exploration and extraction investments currently being made that are predicated on prices higher than those obtainable in a mitigation scenario.[95] As expected, investments are being scaled back in response to lower prices. The IEA expects a 17% drop in investments from 2014 to 2015 (the largest drop ever recorded),[96] as oil majors reduce their capital expenditure – Shell by US$15 billion over the next three years,[97] BP by about 20% in 2015 and Total by 10% in 2015.[98] Excluding onshore resources in the North America, 2014 witnessed the smallest volume of new oil and gas discoveries since 1995.[99] Current low oil prices may thus provide an opportunity to recalibrate investment strategies to avoid future stranding.

The world will continue to rely on significant volumes of fossil fuels for decades to come. This is true even in the most ambitious decarbonisation scenarios. By reducing prices, policies to support a low-carbon transition can make this fossil fuel consumption less costly for consumers. Realising this particular benefit depends on achieving a stable policy framework that does not respond to lower fossil fuel prices by abandoning steps towards lower-carbon solutions.

Natural gas plant © Duke Energy / flickr

4.4 The development of long-term alternatives to oil may depend on policy protecting them from short-term movements in oil prices

Countries have pursued policies to find alternatives to oil for a number of reasons. High cost relative to other energy sources has been a major factor across industry, heating, and power

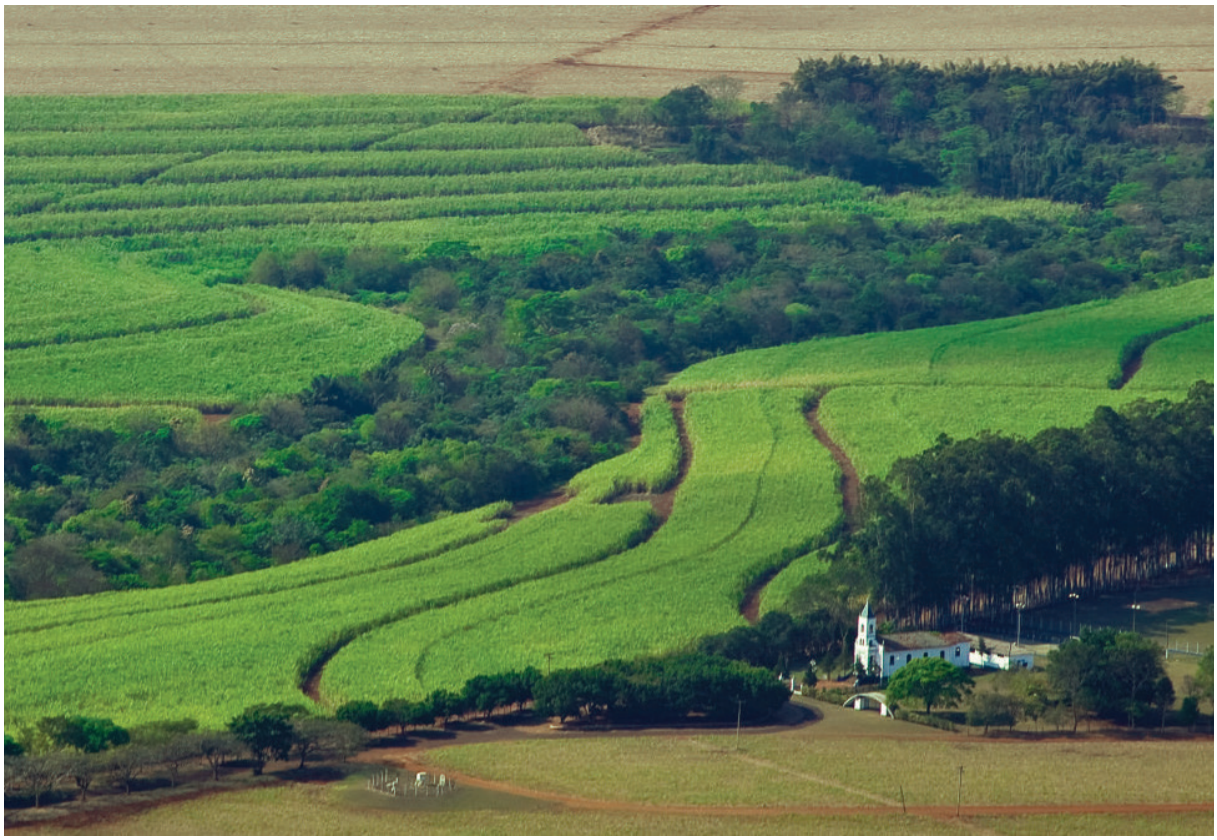
generation. Energy security also has been a major motivating factor for net importers. Oil use is also associated with significant air pollution,[100] and many countries are seeking to address problems in urban areas by finding ways to keep hydrocarbons out of their cities. To this is added the need in any climate mitigation scenario to reduce oil growth, with oil use peaking in the 2030s in pathways that limit warming to 2˚C.[101]

As noted above, these pressures mean that oil is a minor source of energy in sectors other than transportation, which in turn accounts for nearly 80% of global oil energy use.[102] Long-term alternatives to oil therefore depend on new options in this sector, notably for vehicles. The fall in prices may now result in a retreat from efforts that have started to yield significant results.

The high oil prices of the past years have seen significant reductions in the oil intensity of major economies. For example, the US economy has grown by 8.9% since 2007, while demand for finished petroleum products has dropped by 10.5%.[103] Americans are driving less and choosing more fuel-efficient vehicles. Policy has played a role, as US efficiency standards for new light-duty vehicles have been tightened.[104] However, a sustained lower oil price might affect both consumer behaviour and the appetite for further policy to increase efficiency.

High prices had also spurred initiatives to find alternatives to oil. These are still small. Biofuels provide only 2.4% of the energy used in transport,[105] with Brazil, the US and the EU accounting for the large majority.[106] The Brazilian programme (around one-fifth of global production) has seen recent break-even prices of around US$40/bbl, and thus Brazilian ethanol is among the few biofuels that remain competitive even with low oil prices.[107] In the United States and EU, however, flex-fuel vehicles are less common, biofuels are less competitive, and demand is driven in large part by fuel blending mandates. Production therefore may not be much affected in the short run; new mandates in Asia (introduced over the past few years when oil prices were high) will also start to take effect.[108] Also noteworthy is the dampening effect on consumption observed in markets where biofuels are more expensive but blends are mandated, thus acting like a small tax that results in lower gasoline or diesel consumption.[109]

The medium and longer-term effects of low oil prices depend on the environmental and economic sustainability of biofuels. Some have criticised biofuels that require dedicated land as causing unavoidable competition with food production,[110] and providing limited (if any) greenhouse



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Charging electric car © Michael Coghlan / flickr

gas benefits. Others see biofuels as an evolving and essential component of the energy system in the longer run, and argue that these criticisms are more about flaws in specific policies than about biofuels *per se*.[111] The key to a future for biofuels may be to develop and commercialise lignocellulosic-based and other advanced biofuels that draw on a much larger base of raw materials. However, even with upscaling, it will be difficult to compete when oil prices are low.[112] In addition, a more holistic approach has been proposed to reduce the land use impacts of the joint production of biofuels and other bio-based materials.[113]

Lower oil prices also are challenging electric vehicles. Markets appear to think that the near-term outlook has dimmed: as one signal, the share price of Tesla Motors (the only listed company exclusively producing electric vehicles) has fallen by 30% since its peak in September 2014,[114] although it is now at the same levels as it was around a year ago and there are factors other than oil prices that may explain some of the drop. It is unclear how electric vehicles will develop next. Demand has been driven by factors other than just relative prices.[115] Battery prices also are coming down much faster than many had expected.[116] Overall, however, if lower oil prices persist it could make a significant dent in the pace of innovation and momentum of early deployment that has been building up.

For the time being, alternatives to oil in transport – across energy efficiency, biofuels, and electric vehicles – may be protected to some degree by existing policies. However, these past policy commitments have often been motivated by near-term concern with high prices that now may be subsiding. Lower oil prices may now reduce long-term commitments to investment in finding alternatives to oil: the appetite for investment in new production capacity, the resources dedicated to innovation, and the ambition of new policies. Across alternatives to oil additional improvements and innovation are required for long-term viability – from the need to develop biofuels that do not rely on food crops, to performance and cost improvements for electric vehicles, to the ability to tap into the potential for an estimated 30–50% improvement in energy efficiency.[117]

5. CONCLUSIONS

Reacting to the recent drop in oil prices is anything but straightforward for economic decision makers. In the short-term, consuming countries may be delighted at their improving trade balance or producers troubled by suddenly lower GDP and high budget deficits. But understanding the impact beyond the next few years is much harder. The following conclusions stand out:

There will be a near-term economic boost, but unevenly distributed and of uncertain duration. Oil prices offer welcome short-term economic relief for net consumer countries, while they hurt producers. Overall, cheaper oil provides a stimulus to a sluggish world economy. However, countries cannot bank on future low fossil fuel prices, even over the next five years. There is no consensus on future price trends, and even if there were, history has taught us that the consensus is often wrong.

Energy price volatility is high, and it hurts the economy. Volatility in energy markets is a significant concern of energy leaders worldwide. They are right to worry, as such volatility hurts the economy in a number of ways. Policies to reduce future exposure include those that promote a less energy-intensive economic structure, improved energy efficiency, and non-fossil energy supply.

Countries can seize the day to pursue better energy policies with long-term benefits. There is impetus already towards better energy pricing: cost recovery for infrastructure investment, lower subsidies of fossil fuel consumption, the introduction of carbon pricing, and policies to tackle pollution. The first steps of such measures are often the hardest and can founder on resistance from those who stand to lose in the short term. Current lower market prices for energy can help smooth the way.

There is an opportunity to start the switch from coal to natural gas. Reduced dependence on coal has numerous benefits, from health to climate. Natural gas will look more attractive in the short term, as prices fall alongside the price of oil. This creates an opportunity to take the first steps towards a more long-term shift away from coal, from supportive policy to infrastructure investment. Longer-term GHG benefits would depend on additional policies, however.

Renewable energy remains an attractive option for electricity. Solar, wind and other renewable energy sources continue to have significant promise as cornerstones of future energy supply. Such energy options offer long-term stability, costs that often already are competitive, a promise of continued future cost reductions, and co-benefits that range from energy security to reduced air pollution and the associated health costs. Over-reaction to short-term price swings in fossil fuel markets may be more of a threat than the long-term viability of renewable energy per se.

Longer-term, a low-carbon transition can help reduce the price paid for of fossil fuels. Improved energy efficiency and increasing use of non-fossil energy supply are already taking the pressure off fossil fuel markets. If large consumers act in concert to reduce their future use of fossil fuels, they can make large difference to future prices. However, this requires that they continue to pursue alternatives to fossil fuels even as the prices of those fuels fall to lower levels

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- Physical links: between natural gas and oil production ("associated gas");
- Organisational links: horizontal integration of oil and gas production within single companies;
- Input links: oil-based transportation fuels are a significant cost in liquefied natural gas supply; and
- Financial links: mediated via the correlation between oil prices and (dollar) exchange rates

62 For an overview of many of these issues, see Stern, 2012, *The Pricing of Internationally Traded Gas*.

63 Some links persist, both positive and negative. Much of the recent increase in US oil production is from "wet plays" that also produce associated natural gas. As oil is less valuable, the effective cost of this supply of natural gas is higher, creating an inverse relationship between oil and gas prices. On the other hand, competition between oil and natural gas remains a factor in the heating market (so lower oil prices tend to drag down the price of natural gas somewhat). See Beerepoot, M. and Marmion, A., 2012. *Policies for Renewable Heat: An Integrated Approach*. IEA Insights Series. International Energy Agency, Paris. Available at: https://www.iea.org/publications/insights/name,32244,en.html.

Finally, there is competition for drilling rigs, and as the number of rigs used for oil production is dropping fast, the supply available for natural gas production increases and becomes less costly.

64 Agosta, A., Sutorius, R. and Waterlander, O., 2015. *Another Radical Shift in the Global Gas Market? The Implications of a Sustained $75/bbl Scenario*. Energy Insights. McKinsey & Company. Available at: http://www.mckinseyenergyinsights.com/media/63674/Another-radical-shift-in-the-global-gas-market.pdf.

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In these cases, lower oil prices can feed directly into reduced costs of generating power, and lower prices could make the case for renewable energy weaker. However, according to one recent assessment, renewables are likely to remain cheaper for off-grid electricity even with lower oil prices; see IRENA, 2015. *Renewable Power Generation Costs in 2014*. International Renewable Energy Agency, Abu Dhabi. Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf.

For example, in Angola, solar PV already creates cost advantages compared with diesel power generation, even in a setting with subsidies for diesel power generation; see Bertheau, P., Cader, C., Blechinger, P., Huyskens, H. and Seguin, R., 2014. *The Influence of Fuel Subsidies and Taxes on the Potential for Decentralised PV Power on the African Continent*. Reiner Lemoine Institut, Berlin. Available at: http://www.reiner-lemoine-institut.de/sites/default/files/reiner_lemoine_institut_paul_bertheau_paper.pdf.

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The New Climate Economy (NCE) is the Commission's flagship project. It provides independent and authoritative evidence on the relationship between actions which can strengthen economic performance and those which reduce the risk of climate change. It will report in September 2014 in advance of the UN Climate Summit. It aims to influence global debate about the future of economic growth and climate action.

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