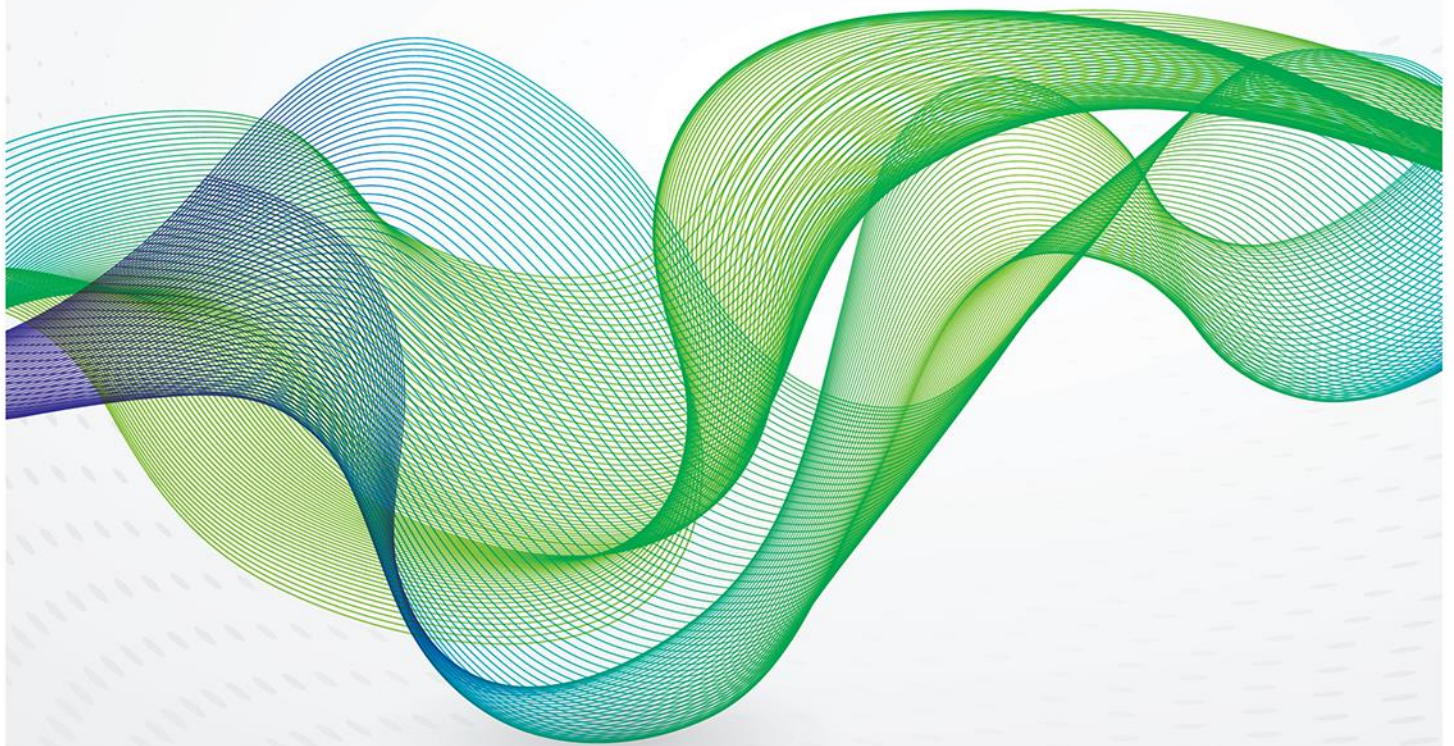
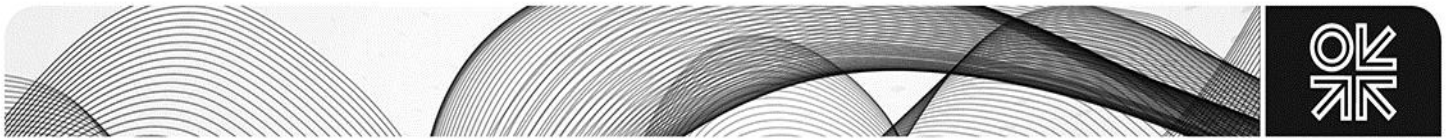


June 2017

The Significance of the US Withdrawal from the Paris Agreement on Climate Change





It is obviously too early to know the lasting significance of the US decision to withdraw from the Paris Agreement¹. We don't even know for sure if and when the US will formally withdraw, since the process of withdrawal takes about four years and could be reversed by the Trump administration or by the next one. Furthermore, there is significant uncertainty regarding the extent to which Trump Administration policies and climate-relevant budget cuts will be implemented, whether the US will meet its Paris pledges in spite of federal policies, or how other countries will respond over time.

From those who are committed to fighting climate change and who see the opportunities it affords, there has been condemnation of the US decision and concern about the negative consequences. Even before that decision was taken, the prospects of dangerous climate change were real. The Paris Agreement was a helpful first step, but the worry from the outset was that it would founder when a number of nations confronted the short-run costs of complying with their commitments. The withdrawal of the US from the Paris Agreement could encourage other countries to withdraw, break their pledges or fail to strengthen future commitments.

However, there is another view, namely that the decision will act as a wake-up call, which is much needed precisely because current policies and commitments, even without a US withdrawal, are inadequate to the challenge. Indeed, some might argue that the US decision might help to rally support among the remaining "troops" in the battle against climate change. This view may seem optimistic, but there is evidence that governments increasingly see decarbonisation as being consistent with national goals and that the costs of decarbonisation are falling as clean energy technologies become more competitive.

In spite of the uncertainty about the long-term impact on the climate, the author² thinks the significance of the US decision can best be understood as follows. First, it reflects a broader attack by the Trump Administration on multilateralism, inspired or at least supported by a zero-sum worldview shared by some of the President's senior advisors. This attack weakens US influence in world affairs and encourages China to play a more significant role. This may be a temporary phenomenon, with the US returning to play a more constructive role. However, it may be impossible to put humpty dumpty back together again. Second, the decision appears to be mainly a matter of signalling to domestic lobbies and supporters. Although there is a risk that other countries will withdraw or weaken their commitments, the US decision is unlikely to reverse the global trend towards decarbonisation. Third, energy companies in the US are likely to face the same challenges as they did before the decision, namely the need to prepare for decarbonisation.

This comment first explores the significance of the US Administration's rejection of multilateralism. It then explores President Trump's reasons for abandoning the agreement and what the consequences are likely to be. The final section considers the implications for the US energy sector before drawing conclusions.

Multilateralism under attack

The US decision to withdraw from the Paris Agreement is consistent with President Trump's recent attacks on multilateralism, as evidenced at the NATO and G7 meetings, with the withdrawal from the Trans-Pacific Partnership and with the threat to withdraw from NAFTA. One cannot rule out that the US Administration will challenge the multilateral trade regime, the UN Convention on the Law of the Sea, implementation of UN Sustainable Development Goals and the UN Summit on migration. It is not hard to find evidence that more challenges are likely. For instance, the Economist Magazine recently interviewed the President and wrote

"Mr Trump's plans for a huge renegotiation of NAFTA are arguably an escalation rather than a departure. The depth of his suspicion of the World Trade Organisation (WTO) looks like a fundamental

¹ http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

² David Robinson is a Senior Research Fellow of the Oxford Institute for Energy Studies, President of David Robinson & Associates, Academic Advisor to the Brattle Group of Economic and Financial Consultants and Senior Advisor to Oxford Climate Policy. The contents of this Comment are the author's sole responsibility. They do not necessarily represent the views of the organisations with which the author is associated or any of their members.

shift... The WTO's most-favoured-nation principle means that America cannot raise its tariffs against countries that impose high tariffs on it, as Wilbur Ross, Mr Trump's commerce secretary, has suggested it logically should... There are real drawbacks to the current multilateral trading system... But these drawbacks are quite unlike the restraints it places on the muscular reciprocation that Mr Trump's team contemplates. Those restraints are not failures: they are part of the point of the pact."³

The Trump Administration's approach undermines US credibility in world affairs. The US has supported multilateralism since the Second World War. On occasion, the country has withdrawn from international agreements or refused to ratify them (e.g. the Kyoto Protocol). It has also refused to be bound by certain decisions taken by organisations the US helped to establish (e.g. the International Court of Justice in the Hague). However, this is the first time since the Second World War that the US has openly rejected or seriously questioned the value of a number of multilateral institutions and agreements they helped to establish, on the grounds that what is good for others is probably bad for the US. If this isolationist (zero-sum) view had been adopted after the Second World War, the US would not have supported the Marshall Plan or the many other initiatives that have benefited the US and the rest of the world.

The world is a more dangerous place because of the US challenge to multilateralism, without mentioning the additional risk posed by an apparent alliance between the leaders of the US and Russia. President Trump has provoked former allies, especially countries that ostensibly share common values, while strengthening ties with countries and leaders who do not share those values.

There is a serious risk that the Trump Administration's actions will have a lasting and damaging effect on US influence in global affairs. One would hope and expect that future US administrations will want once again to be trusted parties to multilateral agreements and to strengthen alliances with the world's democracies. However, the US withdrawal from the Paris Agreement and its challenge to other multilateral agreements requires the rest of the world to ponder the future of global governance. At the very least, the decision opens the door widely for the largest and fastest growing emerging countries, notably China, to become more influential. It remains to be seen whether what follows will be preferable to the multilateral system we know. In the case of the UNFCCC, for instance, there are fears that China will be more influential in the development of the Paris rulebook (the rules and processes providing operational guidance to fulfil the ambition of the Agreement), which could end up being weaker than it would have been had the US been at the table pressing for stricter rules on, for instance, transparency.

Why is the Paris Agreement important?

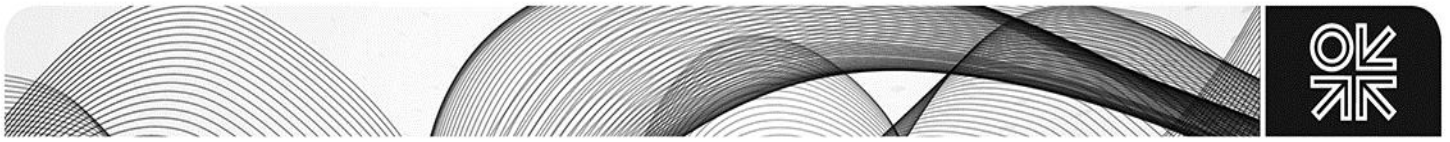
The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. It does so by agreeing to peak global greenhouse gas (GHG) emissions as soon as possible and reach net zero emissions in the second half of this century.

All countries agree to undertake ambitious nationally determined contributions (NDCs), which they will periodically revise upwards. Developed countries agree to support developing countries, through various means of implementation (finance, technology and capacity building), both in emissions reductions and in adapting to climate change.

It is an important multilateral agreement because it has very broad support (195 countries are signatories)⁴ for taking a first step together towards solving one of the world's most serious problems.

³ "Make his day: reassessing global trade", *The Economist*, May 13-19, 2017, p 18. See also the reference to the US position at the UN Ocean Conference that took place last week (5-9 June) in New York: paragraph 2 in Friday June 9 proceedings. <http://enb.iisd.org/oceans/sdg14conference/enb/>.

⁴ Only Syria and Nicaragua did not sign. Nicaragua refused to sign because the agreement did not punish those who failed to meet their pledges, and did not ensure that the rich countries would adequately compensate the developing countries (like Nicaragua) for the damage caused by climate change. Syria was an international pariah when the Paris Agreement was



The Paris Agreement sets an obligation for all countries, developed and developing, to prepare, communicate and maintain NDCs⁵, which shall contain emission reduction (mitigation) measures. For this reason, it is very different from the Kyoto Protocol, which only included mitigation commitments from Annex B countries: the industrialised countries and the Economies in Transition. Indeed, the main reason why the US left (and others followed them) was that the Protocol did not require any mitigation of emissions from the developing countries, and in particular from China.

The Agreement does have a compliance mechanism, but it does not oblige countries legally to meet their pledges. It relies on “naming and shaming” the countries that do not meet commitments, which is a very weak sanction. The agreement is as flexible as could be imagined, precisely to make it easy for every country to sign and to make it possible for the US to ratify the agreement without a vote in the Senate. Without that flexibility, there would have been no agreement acceptable to almost all countries. However, the lack of serious sanctions could be a fatal flaw, unless countries choose to comply because doing so serves their national goals, including sustainable economic growth.

The initial level of ambition in the Paris Agreement is clearly insufficient to address the challenges of climate change. Full implementation of unconditional commitments would result in emission level estimates in 2030 that are most consistent with scenarios that limit global average temperature increases to below 3.5°C in 2100 with a greater than 66 per cent probability.⁶ This temperature increase would have dramatic consequences for the climate – for instance including flooding in some areas, drought in others – and would cause serious social, political, economic and geopolitical instability. That is why the Paris Agreement required all signatories to maintain successive NDC that should become more ambitious over time.

In short, the Paris Agreement is only a first step and there was no guarantee that it would succeed in heading off climate change, even before President Trump came to power. On the other hand, it was a major achievement and offered the only basis available today for addressing the issue together. US withdrawal from the agreement is bad news primarily because it would make it easier for other countries to withdraw, not comply with their pledges or refuse to make more ambitious pledges in future.

Why did the US choose to leave the Paris Agreement?

The President’s justification for leaving the agreement was misleading and almost certainly not the real reason. He argued that the Paris Agreement disadvantaged the US and benefited other countries, leaving US workers and taxpayers to absorb the cost. He also said that the US was ready to join under better terms for the US.

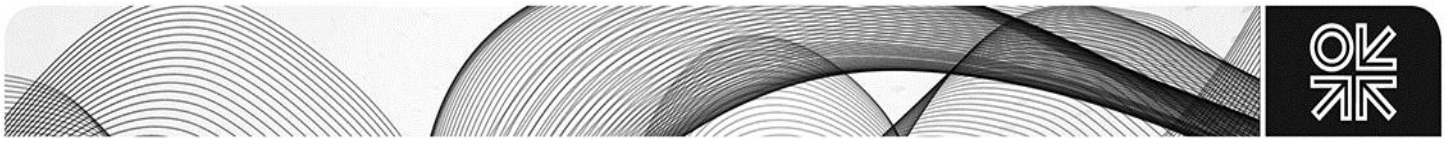
First, there is no evidence that the agreement disadvantaged the US or that withdrawal would bring back US jobs. In particular, the historic decline of employment in the coal sector is primarily due to the greater competitiveness of natural gas. To the extent that the regulations were accelerating the closure of coal, these were national, state and municipal regulations and had nothing to do with the Paris Agreement, which imposed no restrictions on US exports or domestic policies.

Second, there is also no evidence that the agreement was unfair to the US. Each country defined its own targets. The US administration under President Obama committed to a 26-28% reduction of greenhouse gas emissions by 2025, compared to 2005 levels. The Agreement does not allow backtracking (reducing commitments), but arguably the US Administration could have changed its own targets. Suggesting that the US was ready to negotiate a better deal was either a smokescreen or reflects a misunderstanding about the Paris Agreement and the difficulty of achieving an

signed, making it nearly impossible for Syrian leaders to travel. For the detailed numbers, see http://unfccc.int/paris_agreement/items/9444.php

⁵ The nationally determined contributions are voluntary national commitments to mitigate greenhouse gas emissions and to support adaptation to the consequences of climate change.

⁶ http://uneplive.unep.org/media/docs/theme/13/EGR_2015_Technical_Report_final_version.pdf, page xviii.



agreement of this complexity. In any case, there is no apparent willingness on the part of other countries to renegotiate.

For anyone involved in climate change negotiations, the charge of unfairness rings hollow. For many years, the US under different administrations has demanded an agreement that covers most of the world's emissions, leaves each country to determine its own contribution and is transparent. The Paris Agreement was crafted to meet US demands and make it possible for the US to join.

Third, the President also complained that the Paris Agreement involved too large a US contribution to the Green Climate Fund, to which the developed countries had pledged \$10 billion to finance mitigation and adaptation in developing countries. The US pledged \$3 billion and has already paid \$1 billion. The \$3 billion corresponds approximately to the US share (29%) of accumulated emissions of greenhouse gases since 1850, which is about \$9 per capita. If the US refuses any further contribution beyond the \$1 billion already paid, the contribution will amount to about \$3 per capita, a bit more than South Korea.

Finally, the decision to withdraw from the Paris Agreement does not change federal policy. It was simply confirming policy decisions that had already been taken by the Trump Administration, and the inability or unwillingness of Congress to approve contributions to the Green Climate Fund.

The conclusion is that the reasons given by Mr Trump for leaving the Paris Agreement are misleading. What seems much more likely is that his decision was a way to signal to his supporters, both voters and financial backers, that he was keeping his election promises. It also reflects the views of many of his senior advisors who consider multilateral agreements in zero-sum terms; where benefits for other countries imply net costs for the US.

Will the US decision accelerate global climate change?

The impact of the decision on climate change depends fundamentally on three factors: (a) how the rest of the US reacts; (b) how the rest of the world reacts; and (c) the impact on investment and innovation with respect to low carbon technologies. The author does not think that the decision will have a substantial negative effect on actions to combat climate change on a global level, but that it will damage the US reputation and its standing in world affairs, as explained earlier. It may also encourage scientists and investors in low carbon technologies to look outside the US for opportunities.

The US reaction

It is unclear whether, in practice, the US will meet the commitments made by the Obama Administration under the Paris Agreement. Had the Clean Power Plan (CPP), which focused on reducing emissions from coal-fired generation, been implemented as initially proposed by the Environment Protection Agency (EPA) under the Obama Administration, modelling by the US Energy Information Agency suggests that the US could have met its Paris pledge. However, on February 9, 2016, the United States Supreme Court ordered the EPA to halt enforcement of the plan until a lower court ruled in the lawsuit against the plan. So, even before the election of President Trump, it was likely that the US would need to take additional steps at the federal level to comply with its Paris commitments. Since taking office, President Trump has called for the plan to be "reviewed" and his 2018 budget defunds the plan.

In summary, court action or simple non-enforcement by the EPA could kill the CPP; neither of these is contingent on the US decision to withdraw from the Paris Agreement. However, given current and prospective gas, solar and wind power generation costs, it may be that the CPP is superfluous because coal plants are no longer economic.

In response to the US decision to withdraw from the Paris Agreement, we have seen other actors picking up the baton:

- The governors of New York, California and Washington formed the United States Climate Alliance, whose goal is to convene US states committed to upholding the Paris Agreement and

take aggressive action on climate change. Since then (and at the time of writing), the Governors of Connecticut, Delaware, Hawaii, Massachusetts, Minnesota, Oregon, Puerto Rico, Rhode Island, Vermont and Virginia have joined the alliance. These states represent over 35% of the US population and more than 30% of US GDP. The signatories are mainly Democratic Party governors but two Republican governors also signed (Massachusetts and Vermont).

- “We Are Still In” is a coalition (at the time of writing) of 9 states, 149 cities and counties, over 900 businesses/investors and over 190 colleges and universities. They are committed to meeting the US nationally determined contributions under the Paris Agreement.
- “America’s Pledge”, spearheaded by Bloomberg Philanthropies, has been dubbed a “societally nationally determined contribution.” States, cities and other groups can sign on to meet the U.S. pledge to the Paris Agreement.⁷

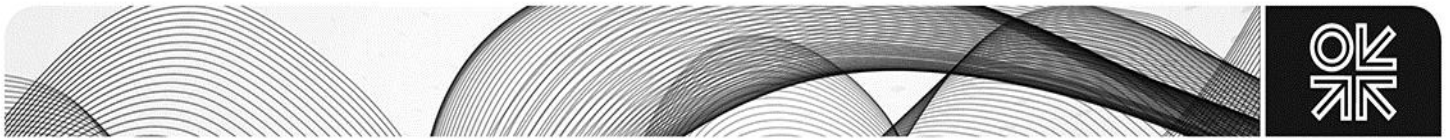
It is too early to say precisely what these coalitions will do, but they do indicate a powerful reaction to the President’s decision. Here are some of the ways that sub-national governments and other actors can act to enable the US to meet the pledges made in Paris.

- Many US states will maintain and probably strengthen their current climate change policies. Most of the northeast and west coast states actively support decarbonisation, for instance through emissions trading, energy efficiency policies and the promotion of renewable energy.
- The Canadian Prime Minister and the Minister of the Environment and Climate Change have declared their support for collaboration with US sub-national governments, for instance through coordination of emission trading schemes (e.g. Quebec and California).⁸
- Many of the more conservative US States in the middle and the south of the country (e.g. Texas) support renewable energy because they can take advantage of good wind and solar conditions and federal subsidies. Indeed, federal subsidies for renewable power are likely to continue.
- A significant part of the financial and corporate sector will defend their reputations and their investments in new clean and smart energy technologies and services in the US and abroad. The list of companies that have expressed opposition to withdrawal from the Paris Agreement is long and includes GE, Unilever, Goldman Sachs, Apple and Google. These investors could well “vote with their feet” by investing abroad in low carbon technologies where political conditions are more favourable.
- Major US oil and gas companies, notably ExxonMobil, have expressed their opposition to the US leaving the Paris Agreement. They would have preferred a “seat at the table” and are no doubt concerned that they (and the US) will be isolated and have little if any influence on the negotiations. It is worth noting that the European oil and gas industry has publicly recognised the need to facilitate decarbonisation, whereas the US oil patch has not.
- Corporate boards of directors, company executives, shareholders and financial institutions will be reluctant to invest in carbon intensive activities where they face potential stranded assets⁹. Natural gas is now replacing coal in the power sector mainly for economic reasons and, even if new coal-fired generating plants were economic in the short run, future regulations could cause plant shutdowns. Thus, investment in new coal-fired plants implies a serious risk of stranded assets.
- There will be legal battles over any federal policy that weakens environmental protection, brought by states, cities, environment, faith-based and other interest groups. For instance, litigation could make it very hard to change the EPA regulations limiting CO₂ emissions (performance standards) on new or refurbished coal-fired power stations.
- There will be strong local opposition to siting of new coal-fired power stations and related transport assets. Groups like Friends of the Earth have stopped most coal-fired power stations from being built.

⁷ <https://www.bloomberg.org/program/environment/americas-pledge/>

⁸ <https://www.nytimes.com/2017/06/07/world/canada/canadas-strategy-on-climate-change-work-with-american-states.html>

⁹ Stranded assets are assets that have experienced unanticipated or premature write-downs, devaluations, or conversion to liabilities.



- There is growing concern about air quality in the major cities. Although this concern is not necessarily related to climate change, low carbon energy and electric vehicles will improve local air quality and build citizen support for decarbonisation.
- Citizens are more conscious of the climate change issue than ever before. Although this issue is not at present a major election issue, there is significant support for tackling climate change in most states.
- Political support for Trump Administration policies will be more hotly contested in Washington as Congressional elections approach in 2018. We have already witnessed refusal to pass legislation in the Senate that would have overturned existing regulations governing methane leaks.

In short, it would be a mistake to think that federal government will be able easily to reverse the trend in the US towards clean energy and environmental protection. There are many groups who will push back and others who will quietly look for countries or regions with policies that support innovation and investment in low carbon technologies.

Let us not forget that the US commitment in the Paris Agreement involved financial flows to the least developed countries. President Trump has cancelled that US commitment. The reaction from sub-national actors has begun. Senator Michael J Barrett of Massachusetts has introduced a bill that would enable taxpayers in that state to allocate tax rebates and other contributions to the UN Least Developed Countries Fund¹⁰. The City of Seattle has now pledged to uphold its portion of the US former commitment to the Paris Agreement, including the city taking the lead to support the Green Climate Fund¹¹. These examples could open the door to similar initiatives throughout the country.

Although we cannot say at this stage to what extent the Trump decision will affect US emissions, we can say that the reaction of other actors in the US will send a signal to the world that many individuals, organizations and sub-national governments in the US are still actively engaged in fighting climate change. These other actors will also be very active on the world stage, not only on an informal basis in the UNFCCC negotiations, but also directly in collaboration with partners in other countries.¹²

The international impact

The departure of the US will not stop negotiations related to the implementation of the Paris Agreement, and may not even slow them. Indeed, while the international climate change community is seriously disappointed by US withdrawal, there are many who would prefer the US to be outside the agreement rather than slowing the process from within.

However, there is still a lack of clarity with regard to what President Trump's announcement means for US participation in the negotiations. If the US follows the formal route out, then it will remain a party for some years still, which means it has a seat at the table, and could potentially seek to weaken the outcomes. Many are arguing that the US should not participate in the negotiations.

The evidence so far suggests continued commitment to the Paris Agreement from the world's other major emitters. The leaders of Germany, France and Italy issued a joint statement to the effect that they stand by the agreement, which they said was not renegotiable. Leaders from Canada, Australia and other countries have also responded in a similar way. Not surprisingly, the UNFCCC issued a statement to the same effect. China and India have so far defended the Paris Agreement. This is not just due to a sense of international responsibility. Governments increasingly see the penetration of renewable energy and the fight against climate change as meeting multiple national policy objectives,

¹⁰ <https://malegislature.gov/Bills/190/SD2138>. For more details, see the Oxford Climate Policy blog: <http://oxfordclimatepolicy.com/blog/massachusetts-un-least-developed-countries-fund/>

¹¹ <http://www.climatechangenews.com/2017/06/14/seattle-pledges-support-green-climate-fund/>

¹² See for instance, the collaboration among sub-national governments through the Under2MOU, whose signatories commit to reduce their greenhouse gas emissions 80 to 95 percent below 1990 levels, or limit to 2 annual metric tons of CO₂-equivalent per capita, by 2050. A total of 175 jurisdictions spanning 35 countries and six continents have signed or endorsed the MOU. Collectively, they represent 1.2 billion people and \$28.8 trillion in GDP – equivalent to 16 percent of the global population and 39 percent of the global economy. The Under2 MOU originated from a partnership between California and Baden-Württemberg. <http://under2mou.org/background/>

including job creation, improved energy access, lower air pollution, better health, and the creation of new and sustainable industrial and commercial businesses with global market potential.¹³

China and the EU are two of the candidates expected to take a leadership role. With the election of President Trump, China saw an opportunity to lead on climate change negotiations and international trade. This was reflected in President Xi's speech to the World Economic Forum earlier this year. Within the UNFCCC negotiations, China would almost certainly seek to be part of a coalition of developed and developing countries, probably including at least the EU, Canada and the BASIC countries¹⁴.

It makes sense to imagine the EU working with China to defend the Paris Agreement. The EU has been at the forefront of the fight against climate change for many years. Indeed, the EU took the lead when George Bush withdrew the US from the Kyoto Protocol in 2001. Soon after President Trump's announcement, China and the EU prepared a joint statement on climate change and clean energy, to be issued following their meetings in Brussels. The EU-China draft statement, which was leaked, began with the following:

"The EU and China consider climate action and the clean energy transition an imperative more important than ever. They confirm their commitments under the historic 2015 Paris Agreement and [to] step up their co-operation to enhance its implementation."

This statement was not issued as planned, apparently due to disagreements on trade policy, in particular related to global overcapacity of steel. If and when that statement is issued, it will mark an important watershed in the process of implementing the Paris Agreement without US involvement.

It would especially make sense that China and other emerging countries, notably India, are in the leadership group, because capping and then reducing emissions growth in these countries is necessary to tackle climate change effectively. The challenge is to do this in a way that does not hamper economic growth and prosperity in these countries. Climate Action Tracker estimates that reductions in projected global carbon emissions growth in China and India could outweigh the expected emissions jump in the US. Large emission reductions seem within reach due to the evident commitment by these major countries to adopt a lower carbon path (e.g. more renewables, electric vehicles, less coal) for national reasons, including local air quality, national security and industrial strategy. Again, there is no reason to be complacent, especially given the continued use of coal, but the tide is shifting in the direction of decarbonisation¹⁵.

One question that will arise has to do with the impact of climate change policy on industrial competitiveness and international trade. If costs of energy are substantially lower in the US than they are in countries that are actively fighting against climate change, one can imagine the temptation to relocate to the US, as well as proposals for trade restrictions (border tax adjustments) on imports from the US. This topic has been part of the UNFCCC negotiations for some years and is very contentious, not least because the decision to relocate is based on many considerations, only one of which may be environmental regulations. However, the issue will be less important to the extent that low carbon energy becomes competitive with fossil fuels.

Impact on technology and cost of decarbonisation

Probably the best prospect for accelerating emission reductions and meeting the challenge of climate change is through the development of low carbon technologies that are economically more attractive than fossil fuels, for instance: renewable power plus storage to replace conventional generation; and electric vehicles to replace vehicles with internal combustion engines. US withdrawal from the Paris

¹³ The renewable industry is often part of the government's job-creation targets. For instance, renewables in India employ over 400,000 people and rising. In contrast, Coal India Limited, which produced 80% of Indian coal, employs just over 300,000 people – down from nearly 500,000 a decade ago.

http://www.se4all.org/sites/default/files/IRENA_RE_Jobs_Annual_Review_2016.pdf

¹⁴ Brazil, South Africa, India and China.

¹⁵ One indication of this is the decline in global coal consumption over the past two years, especially in the US.

<https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of-world-energy-2017-full-report.pdf>

Agreement may slow investment and research into these and other low carbon technologies in the US. However, it seems unlikely that this will be the case in other countries, given the recent progress in driving down the cost of these technologies, and provided political support continues.

US federal policies could slow the development of clean energy technologies in at least two ways. One is by cutting government support for research; this means some interesting technologies may not be developed or that costs do not fall as fast as they might. Since clean technology improvements could accelerate decarbonisation throughout the world, a cut in US government research is bad news. The other is by cutting federal government funding for low carbon energy investment. Under the last administration, the federal government positively discouraged investment in coal-fired generation in developing countries, for instance through its influence on World Bank lending and through OECD restrictions on export credit guarantees for coal-fired plants. The Trump government could use its influence to favour carbon intensive investment in the US and abroad, for instance helping to finance coal fired power stations to support the US engineering-construction business or US coal exports.

Nevertheless, we should expect continued innovation and cost reduction in low carbon technologies, regardless of US federal policies. This is because the President's policies are unlikely to stop global demand growth for renewable power, electric vehicles, storage and other low carbon technologies. Investment in research and development of clean energy technologies will continue in the US and abroad, financed by public and private sectors. It is true that the cost of storage (e.g. batteries) plus intermittent renewables is still higher than the cost of conventional power stations in most cases; this makes it difficult for renewables to replace fossil fuels without some form of financial support. Furthermore, the speed with which electric vehicles will gain market share is uncertain. But research and investment around the world are moving in the direction of clean energy. Private investors are increasingly reluctant to support new coal-fired power stations in the US, Europe, China, India and in many other countries due to the risk of stranded assets and the availability and falling cost of low carbon alternatives. The same is true for the electrification of transport; research and investment is moving towards electricity. As the cost of electricity-based transport falls, so will the demand for petroleum products. India has set itself the apparently impossible target of all new vehicles being electric by 2030, but that target is a sign of India's ambition and indicative of the risk faced by the oil sector.

In short, US federal policies will reduce public financial support for research, development and penetration of low carbon technologies. However, technological development of low carbon energies is probably now unstoppable due to the widespread policy commitment elsewhere (including at different levels of government in the US), the fact that costs are falling so rapidly and because the financial resources are available from private sources. If this is accurate, the US decision might temporarily slow the decarbonisation trend but is very unlikely to stop it.

Implications for oil, gas, coal and power

The US decision to withdraw from the Paris Agreement is unlikely to alter the challenges facing the energy sector in the US. Companies should be preparing for decarbonisation. This is true even if decarbonisation is ultimately insufficient to avoid the worst effects of climate change.

The experience in the European power sector suggests that energy companies in the US and elsewhere should not underestimate the speed with which decarbonisation can affect them. It suggests not only a need to prepare for decarbonisation, but that investors will increasingly demand disclosure of financial risks (i.e. stranded assets) related to climate change.

Electricity and coal

The experience in the European electricity sector is that of unintended, disruptive consequences of policies favouring decarbonisation. In particular, policy and financial support for the penetration of intermittent renewable power has broken conventional electricity markets: these markets no longer provide signals for efficient investment, operations or consumption. This is because existing markets were designed for systems relying heavily on coal and gas-fired generation, with an industry structure that was centralised and where consumers were passive. Today, intermittent renewable power is

gaining market share, consumers are able to be active participants (generating and storing electricity and managing demand) and the system is becoming more decentralised. In addition, CO₂ emission prices impose a penalty on coal; even though that penalty has been small in most EU countries, reform of the European emission trading system is very likely to increase the price of these emissions.

These changes, in particular the penetration of renewables with very low marginal costs and the development of smart energy systems, are driving down wholesale energy prices and displacing conventional power. The result has been to reduce significantly the value of conventional power stations (nuclear, coal, natural gas) and accelerate closure of those plants. The affected companies have seen their share value drop significantly, as a reflection of the stranded assets they own. A number of the biggest ones (RWE, Eon, Engie) have changed their corporate strategy and structure, focusing more now on decarbonised energy, networks and consumer solutions. One can expect a similar trend towards decarbonisation, decentralisation and digitisation in the power sector of most other countries, along with the risk of stranded assets.

For the power sector in the US, abandonment of the Clean Power Plan and the absence of any climate change policy will postpone some of the effects we have witnessed in the EU. For instance, some expensive pollution control equipment requirements will be eliminated, there will be no federal tax on CO₂ emissions and the government may provide financial assistance for coal plants. These changes could provide some respite for coal-fired plants that might otherwise be shut earlier. However, there is no certainty that this support will outlive the Trump Presidency.

Regardless of federal policy, the future of coal-fired generation in the US is dark. Coal-fired plants there are old (on average over 30 years) and financial markets have shown very little interest in investing in new stations. On the day that President Trump announced the withdrawal of the US from the Paris Agreement, Public Service Enterprise Group, the parent of PSEG Power, announced the closure of the two largest coal plants remaining in New Jersey. This is indicative of a longer-term trend away from coal. There will almost certainly be no wave of investment in new coal-fired power stations in the US. The economics don't work: inexpensive natural gas continues to force coal off of the grid in states across the country. Opposition is fierce from local populations, environmental groups and politicians at all levels. Financial markets are nervous about the potential for stranded assets. In addition, the US is able now to ensure national security of electricity supply with domestic shale gas and therefore does not need coal to play that historic role over the medium term. Meanwhile, incremental employment in renewables and natural gas far outweighs the loss of employment in coal. Indeed, if coal mining increases, it is very likely to be capital intensive to save on personnel costs and is likely to be aimed at export markets rather than domestic ones.

Apart from the decline in coal-fired generation, the penetration of renewables and the decentralisation of the electricity system in the US will threaten the profitability of nuclear and to a lesser extent gas-fired stations, and could undermine the traditional utility model. Already nuclear plants are receiving subsidies due to declining wholesale energy prices. As in the EU, stranded assets are becoming a reality and the question is now about who will pick up the cost.

Oil and gas

In Europe, the European Commission began the decarbonisation process by promoting renewables in the power sector¹⁶. The promotion was relatively easy, but the consequences were painful and unexpected. However, the political focus is now on decarbonising heat and transport – a much more difficult task because it involves changing the behaviour of citizens. This decarbonisation is required to achieve the EU's political objective of reducing greenhouse gas emissions by over 80% by 2050 compared to 1990. That would imply no coal, a significant decline in oil product consumption and at best flat gas sales, with renewable electricity replacing oil in transport and natural gas in heating. In the UK, for instance, the electrification scenario for heating could leave natural gas with about 10% of

¹⁶ In 1997 the EU began working towards a renewable energy supply equivalent to 12% of total EU energy consumption by 2010. In 2009, the Renewables Directive set binding targets for all EU Member States in order to reach a 20% share of energy consumed in the EU from renewable sources. In practice, most of the incremental renewable energy is electricity generated from renewable sources, in particular wind and solar.

its current heating market in 2050. Even if the EU does not fully achieve its objective, efforts to move in that direction can be very disruptive and it would be unwise to underestimate the impact.

For the oil and gas industry in the US, the prospect of decarbonisation may seem a long way away. President Trump has issued a number of Presidential Decrees whose aim has been to reverse many of President Obama's own decrees. President Trump's decrees are intended to allow drilling in sensitive regions (e.g. the Arctic, national parks), lower the costs and risks associated with environmental damage, and facilitate permitting, for instance for pipelines.¹⁷ They will be contested fiercely by a phalanx of environmental and conservation groups. If the oil and gas business can overcome this opposition, the decrees could substantially increase US oil and gas production in the medium term, along with employment in those sectors, and could enhance US influence on world energy markets. The influence on world markets is especially relevant for natural gas, because the US is a low-cost producer with the potential to reduce world gas prices through exports.

However, the effect of the Presidential Decrees on world markets will take time and depend on many factors, including world prices. US oil production has risen since the November OPEC-non OPEC agreement, but this increase was related to rising oil prices and declines in costs related to productivity improvements and lower drilling rig costs, not to Trump Administration policies. Furthermore, at current world prices near \$50/barrel and as long as the expectation is that prices will not remain above \$60/bbl for a sustained period, it seems unlikely that major oil and gas companies will commit to E&P in high cost regions, such as the Arctic.

US policies are far less important determinants of the long-term future of oil and gas than competition from electricity. In particular, the momentum behind the development of electric transport may imply a significant decline in oil's main market. A massive conversion to electric cars seems unlikely in the short term, and Tesla's value (now greater than GM's) may be related as much to battery technology and renewables power storage as it is to its cars. Furthermore, Trump policies will probably include an elimination or relaxation of policies favouring electric vehicles. Nevertheless, investment in electric vehicles (cars, trucks, motorbikes and bicycles) is growing throughout the world and the question is now about the speed of electrification of transport rather than whether it will occur.

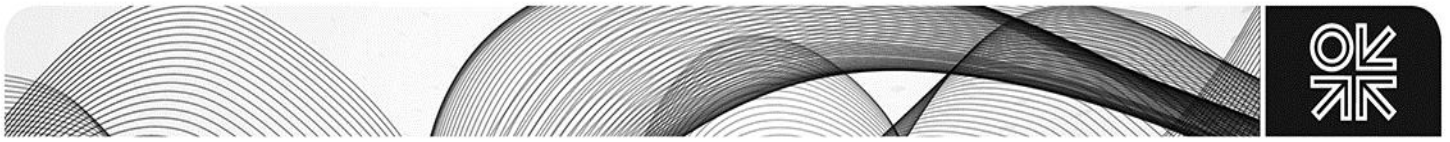
Conclusion

The author contends that, while regrettable, the US decision to withdraw from the Paris Agreement is unlikely to have a major negative impact on the world's prospects for addressing climate change, at least in the short term. Government support for the Paris Agreement outside the US appears strong and there is also support within the US at state and city levels of government, within the financial and corporate sector and from civil society. Furthermore, technological innovation and scale economies are rapidly driving down the cost of renewable energies, batteries, smart energy solutions and electric vehicles. These technology trends began with policy support and still require that support, but further cost reductions are expected, thereby reducing the cost of decarbonisation.

This conclusion is not intended to make the process of decarbonisation sound easy or irreversible. Slower decarbonisation is quite possible and it is still very likely that the world will suffer serious climate change as a result of not acting early enough. But to the extent that the process of decarbonisation has solid political support and is becoming economically sustainable due to declining costs of clean energy technologies, the US decision to leave the Paris Agreement is unlikely to reverse that process.

The experience with decarbonisation in Europe suggests that there are climate-related financial risks for US companies that own or are planning to invest in assets using fossil fuels, especially coal-fired power stations. Natural gas will progressively replace coal in the US generation mix, and renewable power will gain market share at the expense of both gas and coal. Furthermore, because of the very low variable costs of renewable power, penetration by wind and solar PV will depress wholesale prices and margins for conventional power stations, especially coal and nuclear. Distributed energy resources, including rooftop solar, storage and demand response, will further erode market shares

¹⁷ For a list of the relevant legislation, see <http://columbiaclimatelaw.com/resources/climate-deregulation-tracker/>



and profitability of conventional generation assets. These changes will require new energy market designs and regulations for a financially viable decarbonised system. In the transition, some assets will be stranded.

Finally, the US decision to withdraw from the Paris Agreement reflects a rejection of multilateral institutions and agreements that have supported a period of unprecedented global economic expansion and the absence of global conflicts on the scale of World Wars I and II. Under President Trump, the US offers no leadership on matters that involve protection of the environment and improving the welfare of the world's poorest and most vulnerable. This is an invitation for rethinking global governance and amounts to an invitation to China to play a more important role. It seems inevitable that the US will eventually want to re-engage in a more productive way with its former allies. However, in the meantime, the rest of the world will move on and it is not clear whether the world will be better or worse as a result.

It is too early to predict the long-term implications for climate change of the US decision to withdraw from the Paris Agreement. However, the initial indications are that the implementation of the agreement will continue and that the process of energy decarbonisation may slow but will not stop.