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COMMENT

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Limiting the climate impact of the Trump administration

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ABSTRACT The climate actions of the current US administration under President Trump will undoubtedly impact US domestic emissions. They could even potentially influence global action. But some will last longer than others. A simple heuristic for analysing actions is by looking at a combination of their likely attributable future emissions and 'lock-in potential'. Lock-in potential refers to the probable lifespan and reversibility of emissions producing actions. Using the lens of lock-in potential reveals that the actions of Trump that have received the most backlash are often the least damaging. Low lock-in potential actions are measures that are easily reversed and will only shape US emissions in the short-term. This includes withdrawal from the Paris Agreement, which could realistically last less than three months. Withdrawal may have no lock-in potential if it does not impact the emissions of the US or others. High lock-in potential actions are policies that will change the emissions trajectory of the US in the long-term past 2030 and can only be reversed with high costs. For instance, the approval of the Keystone XL and Dakota Access pipelines will last for half a century or more and could result in additional annual emissions of more than 200 Mt CO_2e. The perspective of lock-in potential is also applied to previous executives. Even progressive presidents such as Obama have been constrained and possess poor climate credentials due to the underlying culture and structure of US climate politics. This long-term view suggests that the fundamental problem is not the Trump administration. Instead, it is the domestic fossil fuel lobby and Republican party, which have shaped the policy course of Trump and other executives. Trump is not an aberration for US climate policy, but a predictable symptom of a locked-in pattern of behaviour.

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Introduction

The 2015 Paris Agreement on climate change faces its first test with the election of President Trump and a Republican majority in both houses in the US. The Trump administration has put in place an executive order to rollback most of the key domestic climate measures of the previous Obama administration. This includes reviewing and potentially scrapping the Clean Power Plan and approving both the Keystone XL and Dakota Access pipelines. On June 1st of 2017 Trump announced the intention of the US to withdraw from and renegotiate the Paris Agreement.

The policies of the Trump administration will likely result in the US missing its Nationally Determined Contribution (NDC). This is partly because the US would have already needed additional measures on top of the existing policies of the Obama administration to meet the NDC (Climate Action Tracker, 2017). The US currently has a NDC of reducing emissions by 26–28% on 2005 levels by 2025 (Government of the United States of America, 2015). US emissions are now set to stabilise or increase through to 2030 (Climate Action Tracker, 2017; Höhne et al., 2017; Lux Research, 2016). The US pledge is already inadequate. If other countries took comparable reductions then the world would exceed the 2 °C guardrail (Climate Action Tracker, 2017; Meinshausen et al., 2015). Yet some commentators are calling for the US to take an even lower target in exchange for staying in the agreement (Diringer, 2015).

The actions of the Trump administration clearly constitute a setback for US climate policy. However, the larger issue is whether the dismantling of climate policies now will have a lasting impact on US and global emissions. Can the current actions of Trump shape US emissions for decades to come? What measures will have the largest and longest-term impact on US and global emissions?

To answer these questions, I will examine how the different policies of the Trump administration could 'lock-in' emissions in the future.

Delay Kills

Climate change as a long-term problem must be able to withstand short-term political changes. Reducing emissions over the coming decades will require a deep transformation that carries across fluctuations in leadership and popular sentiment. Decarbonisation must not just persist, but accelerate despite elections, coups and ideological upheaval.

The conundrum is that often the short-term actions ultimately determine the emissions trajectory of individual countries. While a President or Prime Minister may only hold power for a few years, their decisions can shape a countries' emissions for decades to come. The problem is one of 'lock-in': delaying climate action in the present can lock-in emissions-intensive activities and infrastructure (Kemp and Jotzo, 2015). This makes reducing emissions in the future either far costlier or impossible.

'Lock-in potential' can be thought of as the lifespan of emissions directly related to or attributable to a policy, decision or project, while accounting for how easily the action can be reversed. For example, the approval of a new coal-fired generator with a lifespan of half a century would have a lock-in potential of 50 years. The lock-in potential is high since infrastructure is not easily changed bar premature retirement. Actions that will last for a short period of time, and/or that can be easily amended and reversed have low lock-in potential. Lock-in potential, combined with the future level of emissions avoided or caused by a decision provides an estimate of the overall emissions impact of an action in the long-term. This perspective provides a long-range lens of analysing current policy actions.

Previous studies have found that the delay of mitigation is the single largest determinant of success in meeting long-term targets, weighing more heavily than climate sensitivity, energy demand or the level of an global carbon price (Rogelj, 2013; Hatfield-Dodds, 2013). Recent analysis suggests that partly due to lock-in dynamics, global emissions can peak no later than 2020 (Revill and Harris, 2017; Figueres et al., 2017). The long lifespans and lock-in potential of electricity generating infrastructure means that in order to keep limit global warming to 2 °C no new fossil-fuel-based electricity plants can be built after this year (2017) (Pfeiffer et al., 2016). Timing is key: delaying deep decarbonisation measures in the US and elsewhere will lock the world into temperatures above 2 °C.

The problem of emissions lock-in is particularly pertinent for the Paris Agreement. The deal is based around a disconnect between inadequate, short-term targets and ambitious long-term goals. The pledges are nationally determined and highly influenced by short-term political changes There are no enforcement mechanisms to ensure that countries meet their pledges.

Optimistic estimates that donot include tipping point suggest that current pledges put the world on track for a temperature change of 2.6–3.1 by 2100 (Rogelj et al., 2016). In contrast, Paris commits the world to limiting temperature rise to 'well below 2 °C'. Achieving this goal (or at least a 66% chance) will require global CO_2 emissions to reach net zero sometime between 2060–2070, and net greenhouse gas emissions shortly thereafter (Rogelj et al., 2015). Even quicker action may be needed when the possibility of positive feedbacks and tipping points are considered (Cai et al., 2016).

Domestic Lock-In

Current actions under the Trump administration are likely to have a modest, but lasting impact on US domestic emissions.

Below in Table 1 is a summary of the lock-in potential and additional emissions for several key Trump climate policies. The additional attributable emissions in 2025 for the Clean Power Plan Review, the revision and scrapping of methane targets and standards, as well the abolition of vehicle emissions standards are all based on the most recent estimates from Climate Action Tracker (Höhne et al., 2017). Emissions calculations for Keystone XL and the Dakota Access Pipelines are based on a collection of other best available sources (Erickson and Lazarus, 2014; Lazarus and Erickson, 2013; Stockman, 2016).

The revision of the Clean Power Plan could have the largest impact on US emissions, but the lock-in potential of this action is

Table 1 The lock-in potential and potential emissions from key trump climate policies

Policy	Lock-in potential	Additional attributable emissions in 2025
Approval of the Keystone XL pipeline	50 years	0–110 Mt CO_2e
Approval of the Dakota Access Pipeline	50 years	0–101.4 Mt CO_2e
Abolition of vehicle emissions standards	15.6 years	22 Mt CO_2e
Review of Clean Power Plan	N/A	200 Mt CO_2e
Revision of methane targets and standards	N/A	99.2–109.2 Mt CO_2e

highly uncertain. The Clean Power Plan was the centre point of the Obama administration's climate policy and aimed to reduce US emissions from the power sector by 32% on 2005 levels by 2030. Trump has ordered the EPA to review the plan, with the likely intention of scrapping it, or significantly watering it down. However, reviewing the plan will face numerous legal hurdles. The lengthy process could take longer than the first term of Trump. Moreover, market forces are increasingly making the legislation less important. The plummeting cost of wind and solar could very well lead to electricity utilities and providers shifting towards renewable energy regardless of the regulation (Ryan, 2017). The complicated legal process may also lead to companies choosing to hedge their position by assuming that the plan may survive or be revived by a future president. At this stage, it is difficult to tell what the lock-in potential of this action could be. It could be close to zero, or if it shapes the infrastructure choices of energy providers it could be far longer (Table 2).

The revision of methane targets and standards established under Obama are in the same basket as the Clean Power Plan. It is difficult to see how their revision will legally unfold and the impact depends on how industry responds the policy removal. Firms may predict that a future president will reinstate the measures and find it imprudent to deviate significantly in the short-term. The threat would be that they would be establishing high-methane activities and infrastructure that would need to be changed at a greater cost later.

Vehicle Emissions Standards are more easily revoked, but are likely to have a lesser impact on US emissions, adding approximately 22 Mt CO_2e. to annual emissions in 2025. The lock-in potential of changing vehicle emissions standards is relatively low. It is estimated to be 15.6 years, based on recent estimates of the average lifespan of current vehicles (Bento et al., 2016). Once again, the lock-in period and emissions impact is uncertain since it depends on how industry responds to the potentially short-term rollback of measures. It also depends on several other uncertain variables such as car purchases and scrappage rates over the coming years.

The lock-in potential of approving both the Dakota Access and Keystone XL pipelines are far more certain and higher than other actions. The Keystone XL pipeline has an estimated life-expectancy of approximately half a century (Swift et al., 2013).[1] Both could produce additional annual emissions of over 100 Mt CO_2e. Combined, this could make the two projects more damaging to the atmosphere than the review of the Clean Power Plan. The exact emissions impact of these pipelines is uncertain and could be close to zero if the oil is transported through an alternative low-cost means. Analysis suggests that the effect of the pipelines on global oil market prices will result in significant additional annual emissions (Erickson and Lazarus, 2014; Lazarus and Erickson, 2013; Stockman, 2016).

The longest and most deleterious actions the Trump administration are ones, which approve or streamline the development of emissions-intensive infrastructure. Overall the decisions, which have received the most attention and backlash have the lowest lock-in potential. A similar lesson can be taken from a long-term lock-in potential view of the international actions of Trump.

Avoiding Long-Term International Impacts

The domestic actions of the US are limited when compared to the risk of their actions influencing other countries. The domestic changes imposed by Trump are likely to lead to an emissions increase of 0.4 GtCO2 by 2030 (Höhne et al., 2017). This is only a relatively minor compared to the current 2030 emissions gap of 12–14 GtCO2. In contrast, if other countries were to follow Trump in delaying climate action then the Paris goals would become unattainable (Sanderson and Knutti, 2016).

There are three primary actions that the US can take in terms of climate diplomacy: withdrawal from the Paris Agreement, the cancellation of climate financing to developing countries, and the obstruction of current negotiations. The first two have already been done.

The decision of the Trump administration to withdraw from the Paris Climate Agreement has been met with international derision and concern. Yet withdrawal has little lock-in potential and no impact on US emissions.

Article 18 of the Paris Agreement stipulates that withdrawal can only take place 3 years after entry into force. Formal withdrawal then only takes effect 1 year after the notification of withdrawal is received. Altogether it is a four-year process beginning on the entry into force of Paris on the 4th of November 2016. Accordingly, withdrawal could not take effect until the 4th of November 2020.

While withdrawal is a legally lengthy process, re-joining the agreement would be exceedingly quick. The US previously joined the Paris Agreement through a presidential-executive agreement. This was done solely by Obama via an executive order. It did not need the consent of the Senate. A future President could similarly re-join the Paris Agreement in a matter of days through an executive agreement.

It is currently impossible to predict the lifespan of the withdrawal decision. It depends largely on the outcome of future elections and the choice of future post-Trump executives. It may be locked in for less than 3 months. The winner of the 2020 election will be inaugurated on the 20th of January 2021. If Trump loses and the future president decides to re-join as a matter of priority, then the US could be back under the umbrella of Paris before the end of January 2021.

It is conceivable that the domestic actions of Trump may restrict the mitigation options of future executives, or at least make them costlier. This could in turn dissuade a future president from re-joining the Paris Agreement. However, as noted earlier the lock-in potential of Trump's domestic action are unlikely to be considerable. Most measures may be easily changed. Moreover, higher emissions should not act as an impediment from re-joining Paris, since the agreement does not require parties to meet their pledges.

Regardless of the time length, withdrawal will have zero effect on US emissions. Legally, it simply means that the US is no longer required to submit a new pledge every 5 years. It could have wider effects on global emissions, by creating a domino effect and causing others to free-ride, withdraw or put forward weaker targets in the future. So far it appears to simply galvanised international and domestic action. As I argued in a commentary in Nature Climate Change earlier this year, there are fewer risks

Table 2 The lock-in potential of international actions under Trump

Policy	Lock-in potential
Withdrawal from the Paris Agreement	Zero, 3 months or longer. This depends on whether it influences the mitigation policies of other countries and is carried on by future presidents
Cancelled international climate financing	Decades, depending on the type of infrastructure
Watering down of the Paris Rulebook.	Decades (the lifespan of the agreement), unless the decisions are amended. This seems unlikely

and more opportunities if the US withdraws from the Paris Agreement (Kemp, 2017). Overall, withdrawal will likely be short-lived and simply act as a formality with no impact on US or global emissions. Arguably, since it has no direct impact on emissions, it has no lock-in potential.

The cancellation of climate financing is likely to have a far greater impact in terms of lock-in potential and emissions increase. The US was previously the largest donor to the Green Climate Fund, the central financing body of the UNFCCC. It was scheduled to provide US$3 billion, approximately one-third of the fund (Green Climate Fund, 2017). To date, it has only deposited $1 billion. The remaining $2 billion will not be forthcoming in the coming years. The 'America First' budget promises to cut all climate financing to the Green Climate Fund, the UNFCCC secretariat and other international climate programmes.

The lock-in potential and impact on emissions from cancelled climate funding is difficult to calculate, but could be significant. A significant number of developing countries have made either their pledges, or increased ambitious plans, contingent on international assistance from developed countries (UNFCCC, 2015). The cancellation of climate financing could lead to countries who are currently in an early developmental phase choosing to invest in fossil fuel based infrastructure, rather than low-emissions projects that could have been aided by US finance. At this stage, it is impossible to determine whether this will occur and to what extent. It is reasonable to expect that the cancellation of funding may impact energy infrastructure choices, which could have a high lock-in potential.

The actions of the US in climate negotiations also have a far greater lock-in effect than their legal participation. Trump has also vowed to attempt to renegotiate the agreement. The Paris Agreement could be amended via a three-quarters majority vote; but this is highly unlikely to occur. It was a delicately struck deal and countries would view reopening it as akin to opening Pandora's box. What is more likely and possible is the US attempting to water down and obstruct ongoing negotiations on the rules of the Paris Agreement. Currently, the world is crafting the details and provisions of the Paris Agreement. This collection of rules is known as the 'Paris Rulebook'.

The Paris Rulebook. is likely to be largely carved in stone since decisions and agreements under the climate regime are rarely amended. Despite over two and a half decades of trouble existence and numerous proposals, the original UNFCCC treaty has never been amended. The Kyoto Protocol has rarely been amended and in relatively minor ways, as occurred under the Doha amendments of 2012.

Withdrawal from Paris has a lock-in potential and no impact on US emissions. The severing of US climate financing and obstruction of ongoing negotiations will have a far greater long-term impact.

A Symptom of a Locked-in Condition

The Trump administration it is not a complete aberration for US climate policy. A sober look through the lock-in lens suggests that previous presidents, including Obama, were far from ambitious climate leaders. The US has generally been an environmental laggard with a penchant for shaping international institutions to its desires. The actions of Trump are indicative of an entrenched systemic rejection of strong environmental policies rather than a rogue leader.

The Bush administration is well remembered for having rejected ratification of the Kyoto Protocol. However, the Clinton administration never tabled the agreement for ratification, nor did Obama attempt to do so. US engagement with the climate negotiations, both in general terms and specific negotiating positions has been marked more by continuity across presidents rather than discord (Paterson, 2009).

The US shaped the Kyoto Protocol and could subsequently not ratify it. Just over a decade later it moulded the Paris Agreement and promptly withdrew from it. The announcement of withdrawal under Trump was predictable since it is an extension of the pattern of US climate engagement and the long-running opposition of the Republican establishment against emissions reductions efforts.

Even the efforts of the most progressive leaders have been relatively unimpressive. The achievements of Obama are modest at best and had little lock-in effect. The 2025 pledge set by Obama under the Paris Agreement equates to a paltry 12–19% on a 1990 baseline. The US was not on-track to meet this insufficient target even with the Clean Power Plan. Additional measures would have been needed (Climate Action Tracker, 2017), and many of the emissions reductions achieved under Obama were simply due to gas crowding out coal. As noted above, most of the executive measures enacted by Obama have been repealed or face an uncertain future at best.

While well-intentioned, Obama has likely also done lasting damage to international climate efforts. It was under Obama that the Paris Agreement was watered down to exclude binding obligations (Kemp, 2016). The strategy of the Obama administration was well-intentioned, but ultimately short-sighted. The resulting Paris architecture is now largely written in stone. It is intended to be the main platform for international climate policy over the coming decades and is unlikely to be amended.

Moreover, it was under the Obama administration that the shale gas revolution has occurred. Both oil and gas production skyrocketed under the Obama presidency, leading to the US becoming the largest gas producer in the world. This has slowed US emissions in the short-term by displacing coal from the energy mix. However, the climate benefits are highly questionable. Higher fugitive methane emissions could lead to shale gas having a larger climate impact than oil or gas, and being comparable to coal over a century timescale (Howarth et al., 2011; Howarth, 2014). One recent study found that US methane emissions increased by approximately 30% over the period of 2002–2014, contributing to the growth in global methane emissions of 30–60% over the past decade (Turner et al., 2016). This surge is likely at least partly caused by the increase in domestic US gas production and distribution.

While the gas and oil boom has been driven by technological changes, it was also enabled by federal policy under Obama. The Obama administration streamlined the approval of gas export terminals and projects (Dunn and Clelland, 2013). Moreover, it did nothing to stand in the way of growing oil and shale gas production. Even previous concessions and privileges for the fracking industry inherited from the Bush regime were kept in place. This includes exemptions for hydraulic fracking from clauses of the Clean Air Act and Safe Drinking Water Act (Downie and Drahos, 2015).

Both the shale and oil gas revolutions resulted in significant new infrastructure, such as export terminal, being constructed. These have a significant lifespan of decades and, therefore, a high lock-in potential. Both this and the diluted design of the Paris Agreement are lasting aspects of Obama's climate legacy.

These were pursued for the same reason why Obama could only put forward an insufficient NDC and why Trump chose to withdraw from Paris. The reason is institutional. The prevalent climate denial of the Republican party and the powerful domestic fossil fuel lobby has consistently limited the actions of Democratic Presidents and pushed Republican towards climate recalcitrance. It's worth remembering that the actions of Trump, ranging from withdrawal to pipeline approval, all align perfectly with the 2016 Republican Party energy platform.

The Lessons of Lock-In

The climate actions of Trump that have faced the most opposition will likely be the shortest lived and potentially least damaging. It was Trump's announced withdrawal from Paris that generated the greatest amount of national and international backlash. Yet, it is an action with likely the shortest-term impact. It could be reversed in less than 3 months. Other actions such as the review of the Clean Power Plan face a bumpy legal road and may not be completed before Trump finishes is first-term.

In contrast, many of the actions that have received comparatively less attention could shape US and global emissions for decades. Domestically, the approval of the Keystone XL and Dakota Access Pipelines could cause additional annual emissions of over 100 Mt CO_2e for the next 50 years. This would place the pipelines in direct violation of the need to reach net zero carbon emissions by 2050. Internationally, the cancellation of climate financing could lock-in emissions-intensive infrastructure overseas. The renegotiation of the Paris Agreement, or weakening of the Paris Rulebook are also likely to effects, which echo through to 2050.

The lens of lock-in potential suggests that Trump is a hurdle, but not a fatal setback on the path to net zero emissions. None of the actions by Trump directly rule-out the US, or the world, reaching net zero emissions by mid-century. The larger problem is not the lock-in imposed by the actions of trump, but the institutional lock-in that the US finds itself in. The fundamental problem is not the Trump administration, but the domestic fossil fuel lobby and Republican party, which have shaped the policy course of Trump and other executives.

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Note

1 I have assumed that the Dakota Access Pipeline has a similar lifespan.

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Additional information