

New Jersey Climate Change Policy

An Assessment of Current Climate Change Laws and Creating an Appropriate Policy Package for New Jersey

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Contents

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| 1. Summary | 3 |
| 2. Importance of Climate Change Policy | 3 |
| 3. Current NJ Political Climate | 4 |
| 4. Challenges of Climate Change Policy | 5 |
| 5. The 2000s: Climate Change Mitigation Policy | 7 |
| 6. Modern Day: Climate Change Adaptation Policy | 9 |
| 7. New Jersey Climate Change Policy 2000-2017 | 12 |
| 8. NJ Climate Change Policy 2018-Present | 14 |
| 9. Climate Challenges Still Facing New Jersey | 18 |
| 10. Proposed Climate Change Policy Package for New Jersey | 23 |
| I. Smart Growth With Green Infrastructure | 23 |
| II. Public Transportation..... | 24 |
| III. Land Conservation | 25 |
| IV. Urban Planning | 25 |
| V. Regional Laws | 26 |
| VI. Energy | 28 |
| VII. Environmental Justice | 28 |
| VIII. Coastal Protection | 29 |
| IX. Inland Water Policies | 30 |
| X. Funding | 31 |
| 11. Policy Recommendation Summary | 32 |
| 12. Conclusion | 33 |

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1. Summary

This paper functions in three different segments. The first portion of the paper (Sections # 1-6) reviews the history of climate change policy in America in order to give the reader an understanding on the challenges and history of climate change policy, which is in its infancy compared to other policy topics. This portion also overviews what other states have done in regards to climate change policy that may be worth considering for New Jersey. The second portion of the paper (Sections # 7-8) hones in on New Jersey climate change policy in particular, and overviews all New Jersey climate change laws passed up to March 1, 2019. The third and final portion of the paper (Sections #10-12) highlights challenges New Jersey has yet to face with climate change policy, and incorporates policy from the first section in order to produce a comprehensive climate change policy package for the state of New Jersey.

2. Importance of Climate Change Policy

Before jumping into the annals of climate change policy, it is important to understand why climate change policy is needed. According to the EPA's 2016 climate change report, the current serious effects of climate change in America include an increase in temperature across the country, more intense single-day precipitation events, more frequent and stronger hurricanes, extended droughts, increased river flooding and coastal flooding, an increase in spread of diseases and viruses, an increase in size and strength of wildfires, higher water temperatures, and rising sea levels (EPA). Every part of the daily lives of Americans will be effected by climate change in the coming years, and many of these changes are happening faster than anticipated (EPA).

The time window to stop these changes has passed, it is now time to adapt. In turn, the academic conversation on climate change has shifted in recent years from questioning if climate change is happening to preparing for the inevitable effects of climate change on a global, federal, and local level (Bierbaum *et al.* 2012). In turn, legislators in the US are now tasked with drafting and passing laws on how we must adapt to climate change in order to protect Americans and our environment (Bierbaum *et al.* 2012).

3. Current NJ Political Climate

New Jersey is in a unique situation in regards to climate change policy. The election of Phil Murphy as governor of the state in 2018 transformed the state from a policy standpoint. After producing virtually no climate change legislation for 8 years, New Jersey suddenly has had a barrage of climate change laws and executive orders passed in the last year and a half (NJDEP). With the speed and recent nature of these laws, it is important to understand the context and possible effectiveness of legislation being passed. It is also essential to determine if more policy is needed on the topic, and if so, where in particular the state is still lacking.

The timing of this paper is also imperative because the state has begun experiencing the negative effects of climate change in recent years. For instance, 2018 was the wettest year on record for the state of New Jersey, and this is alarming because there was not a single major hurricane or nor'easter that produced an abnormal amount of rain to skew this data (Melisurgo 2018). Instead, the state experienced above average precipitation amounts consistently throughout the year (Melisurgo 2018). Flash flooding caused millions of dollars of damage in NJ in 2018, as storms have been much more intense because of climate change (Melisurgo 2018). This means storms will drop more rain on the state in a shorter amount of time in the coming years, which creates a big problem considering the number of storms is also expected to increase

(Melisurgo 2018). The state's storm water infrastructure failed in several places this summer, highlighting just one of the reasons climate policy is needed *now* rather than later in New Jersey.

4. Challenges of Climate Change Policy

Climate change policy itself is an incredibly difficult policy topic for lawmakers to understand and effectively legislate because of several different factors (Bierbaum *et al.* 2012). In a historical context, climate change adaptation policy is in its infancy, which means there is a striking lack of peer-reviewed literature on the successes and failures of certain climate change adaptation measures (Bierbaum *et al.* 2012). Going off of this, because of the uncertainty of the timing and degree of the effects of climate change, it is hard for legislators to gauge how much adaptation is "enough" (Bierbaum *et al.* 2012). Also, climate change policy historically has differed between the local, state, federal, and global levels because of differing opinions on the issue from different parts of the world (Rabe 2011). Lastly, the effects of climate change itself will be different in different parts of the country (EPA). For instance, a western state may want to create laws that will help the state adapt to increased wildfires, while a state in the Gulf could need entirely different legislation to adapt to rising sea levels (EPA).

One of the more alarming aspects of climate change policy has been the ever-changing role of federalism in regards to governing climate change (Rabe 2011). Nearly all US climate change legislation up to 2000 was filled with idealist rhetoric and no actual plans of policy to mitigate the effects of climate change (Rabe 2011). When President Bush announced that the US would not participate in the Kyoto Protocol, a new era of climate change legislation began for the United States, with individual states taking the lead (Rabe 2011). This occurred because the United States, unlike nearly all other developed countries, lacked a federal climate change plan throughout the Bush presidency (Rabe 2011).

With states taking the lead, the race to pass experimental climate change mitigation policy began. States like California quickly began passing laws aimed at reducing the state's greenhouse gas (GHG) emissions (Pyke *et al.* 2008). These policies were revolutionary for their time, and soon states began passing policies that incentivized the development of green energy, stricter emissions standards on cars, and long term goals of reducing reliance on non-renewable energy (Rabe 2011, Pyke *et al.* 2008). Many state's governors even began blocking the construction or expansion of coal power plants, because the governors began to believe that these forms of energy would be obsolete in the coming decades (Rabe 2011). States formed regional agreements as well, in which coal plants and other major GHG producers in the region would be taxed for their carbon output and in turn need to either offset this production with afforestation or buying carbon credits. (Pyke *et al.* 2008). The general message sent from all of these states was that if the federal government was going to be inactive with legislating climate change, then the states would solve the problem with proactive subnational policies (Berke and Ferguson 439).

The power to legislate climate change became reserved to the states, and the states that passed the most aggressive laws quickest soon became policy examples for other states that were behind the curve (Rabe 2011). California's climate plan became the gold standard for other states to follow, and when the era of state-dominated climate policy ended, many aspects of California's plan were used by President Barrack Obama's team as they created a federal climate action plan (Rabe 2011).

The dynamic of climate change federalism shifted back to the federal government with the SCOTUS 2007 decision in *Massachusetts V. EPA* (Rabe 2011). In this case it was determined that it was the EPA's job to essentially set the standards for climate change for the nation, because the actions of some states could be causing negative effects from a climate

change aspect on other states. (Rabe 2011). During President Obama's 8 years in office, the federal government began following the precedent set through the SCOTUS decision by taking the lead on climate change legislation (Rabe 2011). This shifted power from the states to the feds, but Congressional logjams stopped any major initiatives from being passed, leading many states to keep pushing their own climate action plans and not waiting on the federal government (Rabe 2011, Burke & Ferguson 2010). With the election of Donald Trump in 2016, it appears the power has yet again swung back to the states, as the president has said on the record that he does not believe in climate change (Nuccitelli).

5. The 2000s: Climate Change Mitigation Policy

Despite the challenges of climate change policy, there still have been a slew of successful measures passed on the subnational level that have actually given certain states an economic and political advantage (Rabe 2011). These policies can be easily implemented in New Jersey, and are worth reviewing so that the successes and failures of other states can be analyzed and possibly applied in NJ. All of these mitigation measures focus on reducing a state's GHG emission or taxing those who go over a cap (Roach 2011). For instance, ten northeast states formed a regional agreement in which they taxed any energy producers who went over a capped amount of carbon sequestered, and the states made \$800million in the first two years of the initiative (Rabe 2011; Roach 2011). The industries soon adapted so their carbon outputs would be below the cap, which didn't help the states economically, but did help the region environmentally (Roach 2011).

The biggest facet of climate change mitigation policy has been the passing of legislation across many different states setting renewable energy mandates (Rabe 2011). Through these mandates, states pledge to change the way the state produces its energy to a certain percentage of

renewables by a specific year (Roach 2011). These laws often are loaded with tax incentives that lead to large investments in the state by the private sector to construct the energy infrastructure needed to reach the goals of these mandates (Roach 2011; Rabe 2011). This increase in investment leads to jobs and a stronger local economy (Rabe 2011). These target numbers vary from state to state, with California calling for 33% renewable energy sources by 2020, but New Jersey only aiming for 22.5% by 2021 (Roach 2011).

Another successful mitigation effort has been the initiative to reduce car emissions (Pyke *et al.* 2008). States with this type of legislation incentivize the use of biofuels in cars, while also checking end-of-pipe emissions to ensure no vehicles are over-polluting (Pyke *et al.* 2008). A non-climate change benefit of these programs has been the reduction of smog in these areas relative to the increase in transportation (Rabe 2011). California incentivizes those who use high efficiency cars by delegating certain lanes on the freeway solely for passenger vehicles that are using alternative fuels (California Air Resources Board). In total, these sort of laws help clean the air of the state, and these types of laws are more effective in states with cities and recurrent smog issues.

Yet another successful climate change mitigation measure has been the promotion of electric efficiency (Roach 2011). Utilizing a smart grid, consumers who knowingly reduce their usage on critical peak days for the electrical grid are rewarded with credit when it comes time to pay their bills (Roach 2011). This puts the power to save money and energy in the hands of the consumer, and research through pilot programs has shown that when given this option, consumers consistently opt to mitigate their usage during peak times, leading to as much as a 50% reduction in peak usage from some consumers (Roach 2011).

In total, all of these effective climate change policies show that subnational governing entities have been successful in reducing their state's GHG production without hindering the state economically. In fact, these policies have actually made money for the states that passed them, which shows how these policies can actually turn a profit while also helping the environment (Rabe 2011). In fact, many states have aggressively pursued these policies because the local lawmakers understand that by taking the lead, their states will be at the forefront of a major energy shift (Rabe 2011). This has led to rapid investment from states into renewable energy sources so that their state can possibly become a hub for renewable energy (Rabe 2011). These policies have also given the states that acted early more political prowess, as the success of certain state's programs has led to other states and regions needing expertise and advice on how to implement similar laws (Rabe 2011).

6. Modern Day: Climate Change Adaptation Policy

The successes of the states that acted fast with climate change mitigation policy in the 2000s can not be overlooked, but the policy spectrum with climate change has now shifted from mitigation to adaptation. That being said, the 2018 political environment is eerily similar to the early 2000s. Much like how President Bush opted out of the Kyoto climate agreement, President Trump also backed the US out of the Paris Climate Agreement while stripping many of President Obama's climate change laws (Halper). This creates another opportunity for states to take the lead with climate change adaptation policy much like how the states did in the 2000s with climate mitigation policy. It is important to remember however that while there has been over a decade of research and publications on climate change mitigation policy, there is an apparent lack of literature on climate change adaptation policy (Mees *et al.* 2013).

In the wake of President Trump's decision to leave the Paris Climate Agreement, many cities and states across the nation immediately vowed to still uphold the terms of the agreement (Halper). For these lawmakers, there will be no federal guidelines or standards to assist them in enforcing the international agreement (Halper). Legislators will need to account for the uncertainty, controversy, scientific impact, and social complexities of climate change policy (Mees *et al.* 2013). Economic instruments will be heavily relied upon to help weigh the financial costs of certain policies amid all this uncertainty (Dobes *et al.* 2014). In these scenarios, the cost of the adaptive policy will need to be weighed against the cost of not taking action (Dobes *et al.* 2014). These costs are not purely economic either... geography, human lives, and social issues are also wrapped into these multi-disciplinary analyses (Mees *et al.* 2013). After weighing all of these complex costs of climate change policy, there are still plenty of viable policy options to choose from.

For coastal areas, there is an immediate need to replenish and fortify natural and manmade sea barriers in order to adapt to rising sea levels (Pyke *et al.* 2008). Dune replenishment by the Army Corps of Engineers after Hurricane Sandy is an excellent example of caution, as the dunes of New Jersey's barrier islands are now better equipped to protect the islanders from the devastation that Sandy caused (NJDEP). Off shore breakwaters and wetlands are also being constructed around areas in NYC where coastal flooding was the worst from Sandy (Rosenzweig & Solecki 2013). Had these climate change adaptation measures been erected before the storm, damage could have been minimized, but with the amount of stronger hurricanes expected to increase, at least these adaptive measures will protect these coastal areas from future storms (Rosenzweig & Solecki 2013).

A re-mapping of flood zones that includes the effects of climate change also should be considered by local legislators trying to adapt to climate change (Rosenzweig & Solecki 2013, EPA). Major recent flooding events in urban areas like Houston and Nashville illustrate how the storms occurring today are more intense than the storms of the past that were used as benchmarks to make old flood maps (Kimmelman). In fact, New York City called for an entire re-mapping of its flood zones after Hurricane Sandy, with mayor Bloomberg citing unforeseen changes from climate change as the reason behind the need to re-map (Rosenzweig & Solecki 2013). As rain storms are expected to continue becoming more intense, protecting people from what used to be 1 in 100 year floods is going to be imperative for law makers.

Following New York City's precedent can help other cities adapt to flooding and get at risk people out of their homes before the storm even hits (Rosenzweig & Solecki 2013). Policies introducing building codes that mandate flood resistant buildings can help minimize damage for developed areas like Houston and New Orleans that are constantly at risk of flooding (Mees *et al.* 2013). Other cities are updating and modernizing their storm drainage systems so that the increased intensity of storms can be properly handled by the city's municipalities (Bierbaum *et al.* 2012). Legislators in Chicago are increasing the amount of permeable surfaces in the city to help with water drainage (Bierbaum *et al.* 2012), while nearly all American cities are instituting green rooftops to help minimize drainage into overloaded storm drain systems (Bierbaum *et al.* 2012; Rosenzweig & Solecki 2013; Mees *et al.* 2013).

Aside from these specific examples, there are countless other excellent experimental policies being implemented by local governments across the country that will soon serve as an example for other areas with similar climates (Bierbaum *et al.* 2012.). Much like the early 2000s, it is now time for subnational policy makers to learn from these pioneering climate change

adaptation strategies and weigh the enormous cost benefit analyses behind these policies in order to save their constituents from the impending dangers of climate change.

7. New Jersey Climate Change Policy 2000-2017

Looking at the history of New Jersey's climate change laws, there are a few laws passed between 2000 and 2017 (*NJ.gov*). These existing laws were passed in the pioneering times of the early 2000's when then the original wave of climate change mitigation laws were passed in many liberal-leaning states across the nation (*NJ.gov*). The crown jewel of the state's original climate change laws is the "Global Warming Response Act", a mitigation bill aimed at reducing the state's release of greenhouse gases (*N.J.S.A 26:2C-37*). The law's main goals are to reduce the state's greenhouse gas emissions to 1990 levels by 2020, and then reduce emissions to 80% below the 2006 level by 2050 (*N.J.S.A 26:2C-37*). The state's emissions fell below the 1990 level in 2008, and has not surpassed this level since (*NJDEP*). The NJDEP claims the state is also ahead of schedule to meet the 2050 emissions goal set by this law (*NJDEP*).

On top of this, the New Jersey Energy Master Plan was passed in 2011 as a supplement for the Global Warming Response Act (*LTR-11-0664*). The plan has 5 main goals to assist the state's energy producer's reach the emission guidelines set by the Global Warming Response Act (*LTR-11-0664*). The five main goals include: 1. Lower the cost of energy for all New Jersey customers, 2. stimulate a diverse array of new and renewable energy sources, 3. reward energy efficiency and conservation while also reducing peak demand, 4. Capitalize on emerging technologies for power generation and transportation, and 5. Support the state's energy portfolio standard of 23.85% renewable energy sources for the state by 2021 (*LTR-11-0664*).

In order to supplement the New Jersey Energy Master Plan, the Solar Act of 2012 was passed the following year in order to further incentivize solar power as an energy option for electricity producers in New Jersey. Specifically, the law set a mandate that 4.1% of electricity sales in the state must come from solar sources by 2028 (*P. L. 2012, c. 24*). The New Jersey Board of Public Utilities (BPU) was specifically cited by this law as the department in charge of setting new standards and incentives to see the law's goal come to fruition (*P. L. 2012, c. 24*). One of the more important pieces of the law also encouraged the implementation of solar fields on underutilized lands in the state (*P. L. 2012, c. 24*). This specific program created by the law allowed the state to give Solar Renewable Energy Credits (SRECs) to the owners of solar energy generation plants on these "underutilized" lands. These lands include brownfields, areas of historic fill, and properly closed landfills (*P. L. 2012, c. 24*).

Diving deeper into SRECs, the state has had this solar credit program since 2001 in order to incentivize clean energy. Energy producers earn an SREC every time their solar facilities generate 1,000 kilowatt-hours of energy (*P. L. 2012, c. 24*). These numbers are all tallied through the state's SREC tracking system, which automatically credits a power customer's electricity bill (*P. L. 2012, c. 24*). The value of an SREC varies based off the current supply and demand of energy, but as of March 2019 the weighted average price of a credit was \$222.70 (*SREC Trade*).

The effects of these laws have been felt in New Jersey already, as the NJDEP has reported a 26% reduction in the state's CO₂ emissions from electricity generation and a 70% decrease in the state's reliance on coal as of 2016 (*NJDEP*). New Jersey has been among the national leaders in states that relied least on fossil fuels, but the state still has a high reliance on natural gas (*NJDEP*). In fact, natural gas accounted for 55% of the state's electricity generation in 2016, which is 15% more than the amount produced in 2011 (*NJDEP*). In comparison,

renewables accounted for a mere 5% of the state's electricity generation in 2016, while nuclear power accounted for 38% (*NJDEP*). Thus, while the state has weened itself off of a reliance on coal for electricity generation, the state still gets a very small fraction of its electricity from renewable sources.

After the passage of the New Jersey Energy Master Plan, there is a glaring lack of climate change legislation during the years of Chris Christie's governorship from 2010-2017. While New Jersey was ahead of the curve during the early years of climate change policy in the late 2000's, as other states shifted policy from climate change mitigation to climate change adaptation, New Jersey remained stagnant. That being said, there has been a multitude of climate change laws and executive orders passed in the opening months of Phil Murphy's term as governor in 2018.

8. NJ Climate Change Policy 2018-Present

In the first calendar year of governor Murphy's term, there has been plenty of talk from the governor's office about the state becoming more resilient in the wake of climate change. The governor and state legislature has yet to pass any sweeping bills on climate change, but executive orders and other policy decisions have been made by the governor to help catch the state up with climate change adaptation policy.

The first major action by the governor to combat climate change happened on January 29, 2018. The governor signed executive order #7, which reinstated New Jersey into the Regional Greenhouse Gas Initiative, and initiative for states in the North East to drastically cut their greenhouse gas emissions (*Executive Order 7, 2018*). Governor Christie had previously allowed the state to not follow the guidelines of the initiative.

In February 2018, Murphy signed another executive order committing New Jersey to following the CO2 standards set by the United Nations. The law reads:

“The State shall join the United States Climate Alliance and uphold the Paris Climate Accord, lower greenhouse gas emissions, and address the threats posed by climate change in accordance with the goals established therefor by the alliance.” (P.L.2018, c. 3)

This committed the state to cutting pollutants like methane and black carbon, while increasing funding for clean energy (*P.L.2018, c. 3*). The Accord is considered the most up to date policy recommendation in the international community, and New Jersey’s solidarity with the rest of the international community was well received. This signing signaled a host of changes in the states attitude towards climate change. Governor Murphy later released the state’s key initiatives in its fight against climate change, which include statewide energy planning, energy efficiency, and resiliency.

Governor Murphy also signed Executive Order #28 in May 2018 to overhaul the state’s Energy Master Plan in order for the state’s new goal to be 100% renewable energy sources by 2050 (*Executive Order 28, 2018*). Aside from 100% renewable energy by 2050, the other 4 main goals of the plan include 1. Growing NJ’s clean energy economy 2. Ensuring reliability and affordability for all electric customer 3. Reducing the state’s carbon footprint 4. Advancing new technologies for all NJ residents (*Executive Order 28, 2018*). The Master Plan, which was already one of the state’s more effective climate change laws, became much more aggressive with the Murphy revisions, and supplemental laws and executive orders have been passed in order for the goals of the revised master plan to be met.

One of these supplemental policies is Executive Order #8, which was signed in January 2018. This Executive order called upon all relevant New Jersey state agencies, including DEP and BPU to ensure the state follows the guidelines of the Offshore Wind Energy Development Act of 2011 (*Executive Order 8, 2018*). While the act was never fully enforced during the Christie administration, this executive order by Murphy instructed all state agencies that they must ensure the plan gets implemented to a full extent in order for the state to reach the plans goal of 3,500 MW of offshore wind power development by 2030 (*Executive Order 8, 2018*). This would be enough electricity to power over 500,000 houses. The executive order also reinstated a tax credit system for wind power that was dismantled by the Christie administration (*Executive Order 8, 2018*).

To further supplement the goals of the new Energy Master Plan, governor Murphy signed the Clean Energy Act in May of 2018 (*P.L.2018, c.17*). The act is arguably the biggest action by the governor and state legislature to combat climate change, and it created several new initiatives and programs to help push the state towards 100% renewable energy by 2050 (*P.L.2018, c.17*). Some main policy pieces of this plan include the Community Solar Pilot Program, DrivegreenNJ, and the state's renewable portfolio standard (*P.L.2018, c.17*).

The community Solar Pilot program, run by NJ BPU, allows utility customers to purchase solar credits in solar projects in their service territory even though the projects won't be on the customer's property (*P.L.2018, c.17*). This gives utility customers who can't have solar panels on their property a chance to invest in solar by purchasing credits, reducing their electric bill (*P.L.2018, c.17*). The program is expected to start in the coming months, and it is in the last stages of drafting rules and regulations.

To account for CO₂ emissions from transportation, the state also launched its “drivegreenNJ” plan as part of the Clean Energy Act, which is an educational program aimed at educating NJ commuters on their options when picking a new car (*P.L.2018, c.17*). The program highlights the benefits of electric vehicles, and provides estimates for cost savings with the state’s tax breaks for electric vehicles, cost of gas, and locations of superchargers for electric vehicles (*P.L.2018, c.17*).

The states renewable portfolio standard that was created by this act is considered one of the most ambitious renewable energy plans passed by any state. The Standard mandates that all electricity providers in the state sell energy from at least 35% renewable sources by 2025 and at least 50% by 2030 (*P.L.2018, c.17*). The standard also mandates that 5.1% of the state’s energy to come from solar sources in particular by 2021 (*P.L.2018, c.17*).

The Clean Energy Act also focused on energy efficiency, calling for utilities in the state to cut electric usage by 2%, and specifically natural gas usage by 0.75% (*P.L.2018, c.17*). The law further focuses on energy storage, mandating that utilities have the infrastructure in place to be able to store 600MW of energy by 2021, and 2,000MW by 2030 (*P.L.2018, c.17*).

The state DEP has also increased efforts to develop a state coastal resiliency plan to cope with effects of climate change already being felt in the state through its Office of Coastal and Land Use Planning. Storms in the last few years have highlighted that the state’s storm water infrastructure and coastlines are not prepared for the more frequent and intense storms of the 21st century. The state’s resiliency plan’s intention is to correct these issues. It is imperative that New Jersey’s coastline and shore towns remain protected from hurricanes that will be more intense in the coming decades (*Office of Coastal and Land Use Planning*). The tourism economy from the shore is worth billions of dollars, and the state experienced the effects of an unprotected coastline

after the Jersey shore was decimated by Hurricane Sandy (*Office of Coastal and Land Use Planning*). Rising sea levels have led to higher high tides as well, which have led to localized flooding on barrier islands on sunny days. While the official plan has not been released, the state says an emphasis will be placed on adaptation policies, for the effects of sea level rise and increased storm water discharge are already being felt, and current scientific research strongly suggests these changes cannot be reversed and will only get worse in the coming decades (*Office of Coastal and Land Use Planning*).

Summing up the state's busy year in climate policy, Governor Murphy has been vocal and public about his emphasis on climate change adaptation in the state. The state's 2018 climate change policy laws placed a special emphasis on energy. The governor's ambitious energy master plan has primed the state to produce large amounts of renewable energy, while having the efficiency and storage advances needed to better utilize this energy. Coastal areas, and flood prone inland areas are also being closely observed and will likely see new regulations in the coming years in order to adapt to increased storm water discharge and rising sea levels. Compared to the 8 years prior, 2018 was a banner year for climate change policy in New Jersey, but is it enough?

9. Climate Challenges Still Facing New Jersey

The state has passed an impressive amount of climate change policy within the last year, but a lack of policy for 8 years has created a large policy gap that will take more than a year to fill. There are many climate challenges and problems the state will need to overcome in the coming years, and more policy will be needed to keep progressing the state.

The state's public transportation shortcomings have been well publicized in recent years. NJ Transit, the state agency in charge of public transportation, has fallen victim to an aging infrastructure and lack of funding in recent years even though ridership continues to increase (McGeehan 2018). NJ Transit is the largest state public transportation system in the US, serving around half a million riders a day (*NJ Transit 2017 Annual Report*). Frequent delays, train failure, and safety concerns have plagued NJ Transit and limited the capabilities of the state's public transportation system (McGeehan 2018). The Atlantic City Rail Line has been shut down for several months, and although the state intends to reopen the line in May, it still highlights the faltering of the current state of NJ Transit (McGeehan 2018). The largest source of greenhouse gases in New Jersey is transportation, and an ailing public transit system that leads to people choosing to commute in their own vehicles will only be increasing GHG emissions in the state in the coming years.

Most municipalities in the state are also not walkable or bike-friendly. The state DOT spent only 2.5% of their capital budget on pedestrian/bicycles in 2016, signaling a lack of support from the state in these initiatives (*NJDOT*). Bikeways and greenways have proven to be successful and practical alternate transportation methods in cities and suburbs of other states, but New Jersey has lagged behind in this department (Nowak & Dwyer 2007; Searns 1995). GHG emissions will only continue to increase if commuters choose to use personal vehicles rather than bicycles and walking (Nowak & Dwyer 2007). New Jersey cities are prime locations for greenways and bikeways, but lack of funding and interest from the state has kept this from becoming a possibility (*NJDOT*). New Jersey's urban areas also lack ample green space and parks, which creates heat islands in these cities (Nowak & Dwyer 2007). Heat islands trap heat and make cities like Newark much hotter than surrounding suburbs. With the expected temperature

increases in the coming decades from climate change, urban areas are expected to experience even stronger heat island effects, increasing health risks from heat for urban populations (Nowak & Dwyer 2007).

Land preservation is increasingly becoming a paramount priority for the state as well. There are several established nonprofits in the state that have successfully worked to protect land in NJ over the last few decades, but state action is needed in order to preserve the little open space left in NJ (*New Jersey Conservation Foundation*). New Jersey already has an impressive 1.2 million acres of land protected, but NJ is also already the most densely populated state in the union (*New Jersey Conservation Foundation*). A lack of preserved open lands will lead to higher temperatures in the state due to large heat islands from urbanization and suburban sprawl (Nowak & Dwyer 2007). Development of non-protected lands in NJ is also incredibly detrimental for water recharge from storms (Daniels & Leping 2005). With the expected increase in storms and storm intensity due to climate change, the state desperately needs open space to allow water to percolate back into the water table rather than flood communities (Daniels & Leping 2005). Specifically, the Highlands and Pinelands are two areas of principal importance for land preservation (*NJDEP*). Both of these protected areas provide crucial water recharge zones for the state's drinking water, and they both help- mitigate river and watershed flooding from storms. Current trends indicate that New Jersey will become the first state in the US to reach full build-out in thirty years (Mansernus 2003). This is the most alarming aspect of land preservation in New Jersey, for the state does not have much time to preserve these lands from development in order to quell effects of climate change.

A lack of funding for the state's environmental programs and departments have hindered the effectiveness of climate change policies. The state's Blue Acres and Green Acres programs are

also inadequately funded (*Environmental Policy Guide*). These two programs are essential funding assets for land acquisition and preservation, so full funding will be essential for the state to maximize its capabilities in suppressing climate change's effects (*NJDEP*). The state's Department of Environmental Protection has experienced staff and budget cuts in recent years, which is counterproductive for an agency that has been receiving more objectives, sub-agencies, and mandates from the state in the last year (*Environmental Policy Guide*). Simply put, the governor's objectives to fight climate change will be solely rhetoric if he does not amply fund and staff the agencies he has tasked with solving these problems.

There are currently several proposed pipelines in New Jersey that would transfer natural gas from fracking operations in Pennsylvania into the Garden State for consumption (Kummer 2019). Two of these pipelines are proposed to go through pinelands districts, with one natural gas company continuing to construct the pipeline without a completed environmental impact statement (Kummer 2019). There is a third pipeline that is proposed to go through suburban areas of Hunterdon and Mercer County as well. For a state that's claiming to have 100% renewable energy by 2050, these pipelines will only lead to an increase in natural gas consumption (and greenhouse gas emissions) in NJ.

Another obstacle confronting the state's ambitious clean energy initiatives is aging nuclear facilities. The state used to have three nuclear power plants, but the Oyster Creek plant in Lacey Township was decommissioned in September 2018 (Johnson, 2019). The remaining two plants received \$300 million in subsidies from the state in order to keep them running, but these facilities are also aging (Johnson, 2019). Nuclear energy comes with its own political controversies and it appears the state does not plan to build new nuclear plants at this time (Johnson, 2019). Nearly all newly constructed power plants in the state have been natural gas

powered over the last decade, which is a trend that cannot continue if the state plans to account for the lost energy consumption when the last two nuclear plants in the state close while also reaching 100% clean energy by 2050. The subsidies intend to keep nuclear power plants running in the state for the next few years, but serious policy decisions need to be made on nuclear power's role in the state's energy production for the coming century.

Several water issues also provide an obstacle for the state's plan of climate resiliency. Increased development in New Jersey has led to a subsequent increase in ocean run-off (*Environmental Policy Guide*). Many NJ sewer systems lead to the ocean rather than a cleaning facility, especially in coastal regions. One of the more serious effects of climate change that does not receive as much publicity as sea level rise is an increase in acidification in the ocean (*Environmental Policy Guide*). Higher CO₂ content in the air leads to increased CO₂ uptake in the oceans, which has led to the ocean becoming more acidic (Doney *et al.* 2009). Highly acidic waterways become uninhabitable, and acidic areas of ocean in other parts of the world have already led to major die-offs of coral, crustaceans, and fish (Doney *et al.* 2009). NJ's high rate of ocean run-off accelerates the localized acidification of the Atlantic Ocean and New Jersey's back bays. If the state continues to allow high volumes of run off to enter the ocean, the sea life of New Jersey's oceans, bays, and estuaries will become increasingly threatened (*Environmental Policy Guide*). Climate change is already making these waterways more acidic, but the sewage aspect can be controlled by the state (*Environmental Policy Guide*). Limiting ocean run-off will slow this concerning acidification trend and provide cleaner water for New Jersey's lucrative fishing, clamming, and aquaculture industries.

Environmental justice is the biggest social issue facing the state in relation to climate change. It is abundantly clear that the state will be experiencing some major effects from climate change

in the coming decades and lawmakers will likely continue to produce policy to adapt to these changes (*Environmental Policy Guide*). It is important to make sure these new laws do not solely safeguard richer, whiter NJ communities while leaving poorer municipalities unprotected. The State's office of Environmental Justice has not been fully staffed or funded in previous years, hindering any effective environmental justice policing from taking place at a full capacity (*Environmental Policy Guide*). New Jersey cities like Trenton, Newark, Elizabeth, and Camden all are lacking public parks and greenspace yet they also have high rates of exposure to industry pollutants (*Environmental Policy Guide*). High income coastal municipalities have undergone major coastal resiliency projects to protect the towns from hurricanes in the future even though many North Jersey municipalities comprised of lower income minority communities also underwent significant damage from super storm Sandy (*Environmental Policy Guide*). The state must ensure that climate adaptation projects and funding are evenly distributed to all municipalities. For New Jersey to reinvigorate its energy sector, the state also needs to ensure that environmental justice for minority communities isn't compromised in order to meet statewide energy goals.

10. Proposed Climate Change Policy Package for New Jersey

Keeping in mind the laws already passed by the State, as well as the major climate challenges the state still faces, the following policy recommendations would fill the policy gap created by the Christie administration. This paper has already demonstrated that climate change is an incredibly dynamic issue that requires adaptive policy every year, but this policy recommendation would meet the current needs of the state as of 2019.

I. Smart Growth With Green Infrastructure

An imperative aspect of environmental policy is ensuring that any proposed laws do not hamper economic growth in the region. Like most of the country, the state's infrastructure is in need of repair and renewal. New Jersey's high population density creates consistent traffic and commute issues on a daily basis around the major metropolitan areas of the state (Rosenzweig & Solecki 2013). Plans like the Gateway Tunnel need to be supported and funded in order to reduce stress on other entryways into New York City. Any new construction in the state needs to consider environmental interests and impacts before construction begins. New York has some of the nation's strictest environmental safety laws with construction (Rosenzweig & Solecki 2013). Mandating and economically incentivizing LEED certification for new buildings and infrastructure projects will allow the state to continue to grow while also mitigating natural resource exploitation, and GHG emissions. New York has already shown that these laws do not hinder construction and development because of the high demand to live and work in the region, so adopting similar laws to New York will not be economically damaging to the state or state construction contractors (Rosenzweig & Solecki 2013).

II. Public Transportation

A consistent source of funding for NJ Transit is essential for the state to reach its GHG emission goals outlined in the State Energy Plan. NJ Transit was once considered one of the best state run public transportation systems in the country, so it is not an impossible feat to return NJ Transit into a model for other states. Rail service needs to be returned to Atlantic City and Princeton needs to occur before the summer tourism months. The state must also consider lobbying for federal assistance to build the Gateway Tunnel to NYC, as well as new light rail services connecting to existing lines in Bergen County and Camden//Gloucester Counties. New trains, more staff, and low rates are three essential aspects to making NJ Transit a more viable

transportation alternative for commuters. While the governor has made this specific topic a priority in 2019, continued funding will be needed for years to come in order to not only make NJ Transit practical, but also it to sustain this level of achievement for years to come. Bigger subsidies for people who drive electric vehicles will help incentivize some to convert to renewable sources. For larger public transportation projects like the Gateway Tunnel, federal capital will be needed to fund these types of essential billion dollar projects.

III. Land Conservation

Land conservation is possibly the most time-pressed issue for New Jersey's climate change policy. All unprotected land in the state is forecasted to be developed within the next thirty years (Mansernus 2003). Land development is ecologically damaging for a long list of reasons, but pertaining to climate change, land development will only exasperate temperature increases and intensify risks of health implications for urban populations that will be exposed to higher temperatures. Within cities, land conservation needs to be mandated by the state in order to protect against heat islands, localized urban areas with higher temperatures than the surrounding area. Outside of cities, aggressive land conservation by the state will allow for larger swaths of permeable surfaces that will help mitigate flood risks from increased floods that are expected to happen in the state if proper policy is not implemented (Rosenzweig & Solecki 2013).

IV. Urban Planning

Aside from reducing heat islands, there are many other urban policies needed to help adapt to climate change. Cities must invest into creating more heat shelters for vulnerable groups. Greenway projects need to also be implemented within cities and between them as well. Greenways in cities like Indianapolis and New Orleans have led to reduced car usage as people

have chosen to walk or bike to work on the greenways, reducing urban GHG production (Nowak & Dwyer 2007; Searns 1995). Greenways will also reverse heat island effects, as research has shown neighborhoods adjacent to urban parks have consistently experienced lower temperatures than other parts of the same city (Nowak & Dwyer 2007; Searns 1995). Increased emphasis on open land in cities also needs to happen for New Jersey's dense north east corridor (Nowak & Dwyer 2007; Searns 1995; Rosenzweig & Solecki 2013; Bierbaum *et al* 2012). Cities like New York and Chicago have implemented similar programs in order to reduce flooding risk in these highly impermeable areas (Rosenzweig & Solecki 2013; Bierbaum *et al.* 2012). Additionally, green rooftops need to be mandated for high-rises and other structures to further reduce the amount of water runoff in urban areas (Bierbaum *et al.* 2012).

V. Regional Laws

Specific regions of New Jersey will need specialized protections in order to affectively protect each part of the state from climate change. The Pinelands and Highlands regions both need continued protections as other undeveloped lands in the state begin to become developed. The Highlands and Pinelands serve as ecologically critical areas for water table replenishment (*Environmental Policy Guide*). The state is expected to at times undergo harsher droughts than it has in the past because of climate change, and water demand is expected to increase as development grows in NJ (*Environmental Policy Guide*). This makes water recharge essential in order for the state to have aquifers and reservoirs stocked at sustainable levels (*Environmental Policy Guide*). The forests of the Highlands and Pinelands also serve as excellent carbon sequestrers, and converting these forests to developed land would destroy the state's last major areas that seize carbon rather than produce it (*Environmental Policy Guide*). Wetlands in the Pinelands serve as a sink for pollutants in water runoff as well, which leads to less acidification

for NJ waterways (*Environmental Policy Guide*). Considering this laundry list of benefits, it is critical that the state block development in and around these regions and work to preserve these protected lands.

Several other regions of the state would benefit from localized laws and protections as well. Watersheds for the Delaware and Raritan rivers need to be protected. Developed areas adjacent to these rivers must be bought out by the state in order to fight increased flooding (Kirshen *et al.*, 2008). Converting decrepit industry around the Raritan River into undeveloped wetlands would decrease flooding, river acidification, and increase carbon sequestration in the region (Kirshen *et al.*, 2008). On the Delaware, undeveloped lands need to stay undeveloped in order to protect these same three principles. The Raritan, Barnegat, and Delaware Bay also need laws with stronger environmental protections as well. Increased sea level rise threatens the communities on these bays, and increasing the amount of undeveloped land bordering the bays would decrease tidal and inland flooding risks while also decreasing acidification. Stricter laws about fertilizer usage in towns adjacent to these bays and rivers will also help decrease the effects of acidification (*UMASS*).

The state needs to also halt further development in and around the Meadowlands protected district. The wetlands of the Meadowlands stand as the last large natural protection for many people in North Jersey from rising sea level and storm surge. Replacing these wetlands with impermeable surfaces and buildings not only risks the lives and property of the newly constructed buildings, but also surrounding areas that had previously been protected by the Meadowlands (Saleh *et al.*, 2014). Several highways and train lines run through the Meadowlands before crossing the Hudson into NYC (Saleh *et al.*, 2014). With increased development in the Meadowlands near these vital transportation arteries could lead to flooding of

roads and bridges, which would be economically damaging if this infrastructure would be destroyed by storm surge (Saleh *et al.*, 2014).

VI. Energy

The state has already made major steps towards greatly reducing GHG emissions with the state's Energy Master Plan and the Governor's commitment to power the state with 100% renewable energy by 2050 (*P.L.2018, c.17*). That being said, these rhetorical policies need concrete energy changes in order for the state's goals to be fulfilled. If the state does not commit to constructing new nuclear power plants, there will need to be much more solar and wind programs than the pilot programs currently implemented. Solar credits and wind credits need to be increased far past current amounts.

Carbon credit systems and taxes needs to be implemented not only for coal power plants, but natural gas as well. The three proposed natural gas pipelines in the state all need to be denied permits. These pipelines will be obsolete in 30 years if the state truly follows its renewable energy initiatives, so the long term viability and cost effectiveness of the pipelines is questionable (*P.L.2018, c.17*). Any state funding that would have been directed towards the pipelines would need to be diverted to renewable energy initiatives instead. New Jersey must also follow California by implementing a law that would mandate all new houses built in the state be built with solar panels.

VII. Environmental Justice

With the rapid procession of climate laws being passed, the state must ensure that all residents receive equal and fair protection from the effects of climate change. Federal funds granted in response to climate emergencies like storm surge, flooding, and drought must be justly distributed through all municipalities. The state must protect poorer flood prone areas from

flooding with the same funding it provides high income municipalities. An emphasis on public transportation investment needs to occur in poorer communities as well. The state must freeze public transportation fares for low income residents in order to maintain ridership.

Clean energy investments must be prioritized for low income areas of the state, which have been the most harshly effected by pollutants from GHG electric production (*Environmental Policy Guide*). Education programs need to be implemented in schools and community centers in order to ensure fair climate education for all state residents. The state's Environmental Justice Commission also needs to be fully funded and staffed in order to safeguard equality (*Environmental Policy Guide*).

VIII. Coastal Protection

Coastal resiliency projects need to be funded in part via federal grants for the Army Corps of Engineers, a group which has already worked on similar projects on the Jersey Shore and NYC (*NJDEP*). While the Corps has already made progress to re-protect the shore, there needs to be a program to add more breakwaters and wetlands around barrier islands in order to further protect these economically critical municipalities from storm surge (Irish *et al.*, 2013). Dune replenishment needs to occur in all shore towns, including towns resisting the Corps construction policies (*NJDEP*; Irish *et al.*, 2013). Urban coastlines in Northern NJ require new dikes and storm walls. Development has increased in these areas since Super Storm Sandy even though many of these areas were inundated during the storm (*NJDEP*). Increased development will only lead to more severe and frequent flooding for these areas when storms hit in the future (Saleh *et al.*, 2014). While storm walls and dikes can protect from coastal flooding and storm surge, inland flooding will also increase in severity and frequency for NENJ as well.

Sea level rise will destroy many of the state's coastal natural wetlands, so the state will also need to begin an ambitious artificial wetlands construction project to protect back bay communities across the state that do not have storm walls like their barrier island neighbors (Kirshen *et al.*, 2008). A re-mapping of coastal flood zones needs to happen for all coastlines in the state as well. New York City underwent a similar re-mapping program after Sandy, and it led to major changes in the flood mapping of the city after researchers accounted for climate changes effects: which includes more frequent storms, more severe storms, higher tides, and more frequent "1 in 100 year flood events" Like Super Storm Sandy. Re-mapped flood zones need to not only be made, but also adhered to by policy makers (Rosenzweig & Solecki 2013). The state needs to stop rebuilds in high-risk locations for flooding. On top of this, the state also needs to halt any new construction in coastal flooding zones. The state cannot stop ocean levels from rising, but it can prevent families from moving into houses that are doomed to flood. This type of adaptive policy has been implemented in gulf coast states, and prevents loss of life (Rosenzweig & Solecki 2013). Failure to incorporate the latest climate data into the state's flood maps and hazard-mitigation plans would be gross negligence, and could endanger thousands of NJ residents, and millions of dollars' worth of property.

IX. Inland Water Policies

Coastal flood protection laws are only the tip of the melting iceberg for New Jersey's needed water policies in relation to climate change. An overhaul of the state's storm water infrastructure system is needed in order to account for increased discharge amounts due to climate change. With such high percentages of impermeable surfaces in Northern New Jersey already, the state needs to have a storm water infrastructure system that can effectively drain up to twice the amount of water some of the more archaic systems currently can (Rosenzweig & Solecki 2013).

Here again, the state must rebuild this system using predictors that are adjusted for the effects of climate change, or new systems will be overstrained and possibly fail (Rosenzweig & Solecki 2013). The state also needs to mandate flood resistance structures for any redevelopment or development construction projects in the state (Mees *et al.* 2013). NYC, Houston, and New Orleans have already implemented similar mandates (Mees *et al.* 2013). Minimum capacities for waste water treatment facilities needs to be increased for any newly constructed facilities, and existing facilities need to be subsidized if needed in order for these plants to have the capacity to manage increased storm water discharge. The state needs to begin purchasing high-risk developed properties in flood zones once flood maps are updated to account for climate change. Undeveloped lands that are in high risk flood zones also need to be preserved and managed in order to mitigate flooding damage to developed areas.

X. Funding

Implementation of these policies seems like a clear path to adapting to the effects of climate change for the state, but the issue in New Jersey politics has consistently been finding funding. Raising taxes for environmental initiatives proved devastating in France last year (Borenstein 2018). A gas tax added by President Macron led to mass protests, violence, and unrest from France's middle class (Borenstein 2018). This is alarming, but some towns in NJ have passed plastic bag taxes and have received generally positive feedback from the public (Post, 2018).

Taxing wealthier individuals to fund these initiatives would also seem like a practical route to follow, but the governor has already proposed this measure just to fund the laws he has passed in his first year of office. Funding for existing agencies and programs that will be expanded by these laws will also need to increase. The DEP, DOT, and Green/Blue Acres will all need ample

funding in order for these laws to be fulfilled. Rebalancing the state budget and re-allocating money that was originally intended for these programs will also have to occur.

11. Policy Recommendation Summary

- I. Smart Growth with Green Infrastructure**
 - a. Mandate LEED certification for new construction projects**
 - b. Mandate flood resistance for all newly constructed structures**
 - c. Modernize electric grid by emphasizing efficiency**
- II. Public Transportation**
 - a. Return rail service to South Jersey**
 - b. Acquire federal funding for Gateway Tunnel**
 - c. Construct new light rail systems in Gloucester and Camden Counties**
 - d. Re-fund and re-staff NJ Transit**
 - e. Add new trains and rail cars**
 - f. Increase subsidies for electric vehicles**
- III. Land Conservation**
 - a. Increase efforts to acquire undeveloped land**
 - b. Increase protections on preserved lands**
- IV. Urban Planning**
 - a. Reduce heat islands**
 - b. Build more heat shelters**
 - c. Fund new greenway projects**
 - d. Build more urban parks**
 - e. Mandate green rooftops**
- V. Regional Protections**
 - a. Stop development in the Highlands and Pinelands**
 - b. Preserve undeveloped land in the Delaware and Raritan Watersheds**
 - c. Convert developed land along rivers into wetlands**
 - d. Halt fertilizer usage along New Jersey bays**
 - e. Mitigate sewage run off into New Jersey waterways**
 - f. Stop developing in the Meadowlands**
- VI. Energy**
 - a. Halt construction of natural gas pipelines**
 - b. Increase solar and wind subsidies**
 - c. Mandate that newly built houses must have solar panels**
 - d. Implement a more expensive carbon credit system for GHG producers**
 - e. Consider building safe, new nuclear power plants**
- VII. Environmental Justice**
 - a. Fully fund the state's Environmental Justice Commission**
 - b. Prioritize renewable energy projects in low income areas**
 - c. Freeze public transportation fares for low income commuters**
 - d. Equal funding and protections must be applied to low income communities**
 - e. Implement community environmental education programs**
- VIII. Coastal Protection**

- a. **Finish dune replenishment projects on barrier islands**
 - b. **Protect remaining wetlands**
 - c. **Construct artificial wetlands in bays**
 - d. **Build dikes and storm walls in coastal NE NJ**
 - e. **Re-map coastal flood zones by accounting for climate change**
 - f. **Ban construction and rebuilds in high-risk flood zones**
- IX. Inland Water Policies**
- a. **Re-map inland flooding zones by accounting for climate change**
 - b. **Mandate flood resistance for all newly constructed structures**
 - c. **Re-construct storm water infrastructure by accounting for climate change**
 - d. **Mandate increased capacities for waste water treatment facilities**
 - e. **Convert developed properties at a high-risk of flooding into undeveloped land**
 - f. **Manage undeveloped land along riverbanks**
- X. Funding**
- a. **Fully fund and staff NJDEP**
 - b. **Fully fund Green Acres**
 - c. **Fully fund Blue Acres**
 - d. **Add carbon taxes for GHG producers**
 - e. **Implement a plastic bag tax to fund climate initiatives**
 - f. **Subsidize renewable energy producers in the state**
 - g. **Offer larger tax breaks for properties powered by renewable sources**

12. Conclusion

New Jersey will experience more frequent and severe storms, longer and more intense heat waves, prolonged droughts, sea level rise, a higher frequency of flooding, higher levels of storm surge, acidic waterways, and many other public health dangers because of climate change.

Federal inaction over the previous twenty years has created a current political climate where it is now the state's responsibility to protect its residents from these dangers. Climate laws have finally been passed in New Jersey in recent years, but more laws and funding is needed if the state truly wants to be adapted and ready for the myriad of changes climate change will bring.

The states urban areas, coastlines, watersheds, undeveloped lands, protected areas, and vulnerable populations all must be safeguarded if the state expects to adequately adapt to climate change.

The most alarming conclusion of this study is that in a few years' time, if GHG emissions continue at current paces globally, these laws will be obsolete. Basing climate laws off the standards of the Paris Climate Accords serves as a good benchmark for policymakers, however climactic conditions have continuously deteriorated at a more rapid pace than the accords have predicted over the last decade. Having flexible laws to account for this level of uncertainty must be evaluated in the future. Time is running out not only for New Jersey, but the entire planet. Without tangible climate laws and action by government in the next 5-10 years, Earth and New Jersey's livability in the coming decades will rapidly deteriorate.

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