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Energy Master Plan Comments: New Jersey Clean Energy Policy Framework

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Overview. The Global Warming Response Act (GWRA) set a deep decarbonization target for New Jersey - to reduce CO2e emissions statewide, across all sectors, by 80% from 2005 levels. New Jersey's clean energy policy shares these climate mitigation goals, focused on substantially reducing the greenhouse gas emissions of the state's power supply -- whether regional or in-state -- while protecting the health of our communities from the harmful effects of related emissions. To do this, the state has focused on deploying growing levels of renewable energy and energy efficiency through policies such as various energy efficiency requirements, the renewable portfolio standard (RPS), solar requirements, and the offshore wind renewable energy credit (OREC) program.

To ensure these resource-focused policies achieve the state's goals, the Energy Master Plan needs to go beyond such individual policies to provide an overall planning framework for developing an efficient, integrated portfolio of all these resources that also includes critical complementary and enabling resources, such as flexible load, demand response, energy storage, and the electrification of both transportation and thermal loads in buildings. Such an efficient, integrated and balanced portfolio is essential for achieving the state's emission reduction goals in the most reliable, resilient and cost-effective manner. The EMP should evolve to include regular, periodic use of cutting-edge power system design and operation tools, with market-based inputs for technology costs and performance, to understand how these clean energy resources interact with each other and to identify, update and stay on the most beneficial and cost-effective decarbonization pathways. This same process will help identify new or modified policies that will best support progress on those pathways.[1]

This kind of planning framework is essential to achieve a 100% clean energy economy for New Jersey. Such an economy would eliminate all in-state energy-based emissions, as well as out-of-state emissions directly associated with energy consumption in New Jersey. Such an economy will depend on decarbonization of not only the state's own electricity generation, but that of the regional electric grid as well. And it will require the electrification or use of other emission-free energy sources instead of natural gas and other fossil fuels in heating, cooling, transportation and various industrial processes. Some types of energy use in certain sectors such as heavy transportation, shipping, industrial uses, or

[1] New Jersey's current policy suite closely resembles those recommended in "An Examination of Policy Options for Achieving Greenhouse Gas Emissions Reductions in New Jersey," by Rutgers and Georgetown Climate Center, September 2017. For an example of how system analytics can help identify the most efficient policies and combinations of resources, see the Energy Policy Simulator developed by Energy Innovation, available at: https://energyinnovation.org/what-we-do/energy-policy-solutions/ . For an example of how a much more detailed power system model can be used to identify more and less cost-effective pathways for a state to decarbonize, see "Minnesota's Smarter Grid - Pathways Toward A Clean and Affordable Transportation and Energy System", July 2018, prepared by Vibrant Clean Energy, LLC, for McKnight Foundation and GridLab, available at: https://www.mcknight.org/wp-content/uploads/MNSmarterGrid-VCE-FinalVersion-LR-1.pdf .

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aviation, may not be ready for full electrification or carbon-free fuels by 2050. Nevertheless, the state can determine pathways to achieve at least 80% reduction of CO_2 by taking aggressive actions in those sectors where higher reductions are possible and cost-effective, as well as identifying and supporting new zero carbon technologies needed to achieve full energy sector decarbonization.

Using the sort of decarbonization pathway planning framework discussed above, the administration should identify pathways to achieve the GWRA goals, with economy-wide, energy-related emission targets in five-year increments. These pathways and interim targets should be updated every four years, using new, market-based cost and performance data for commercially available clean energy technologies. The EMP should also plan for bi-annual monitoring and reporting.

Power sector, transportation and buildings emissions reductions

It is clear that achieving the GWRA goals will require deep reductions in emissions for New Jersey's power sector, and the parallel electrification of large portions of transportation and building systems. The studies cited above suggest these three efforts will be central parts of a low-cost pathway to deep decarbonization in New Jersey. Thus, it is of central importance that the EMP be guided by identifying the right mix over time of solar, wind, storage, flexible load - including newly electrified buildings and transportation -- that will achieve these goals with maximum reliability, resilience and cost-effectiveness. The legislature, administration and BPU can then develop appropriate policies to support, implement and evaluate these "right mix over time" pathways.[2]

The EMP should also address the electrification of building systems for heating and cooling.

Evaluation of new natural gas infrastructure and climate goals

Under the Global Warming Response Act, New Jersey must reduce emissions across all sectors 80% by 2050. Natural gas is now the primary source of emissions from the electric, residential and commercial sectors. Deep decarbonization will require dramatic reductions in natural gas use in the future, which is counter to the build-out of additional, unneeded gas infrastructure that will result in stranded assets, saddle ratepayers with unnecessary costs, and drive up emissions.

In addition to proactive steps that support the clean technologies needed for deep decarbonization, it is also important to prevent the development of fossil fuel infrastructure whose use would undermine these plans and the achievement of the state's goals for reducing greenhouse gas emissions -- and which will not be needed in a world in which the GWRA goals are actually achieved.[3] To help avoid such impediments to success and stranded costs when success is achieved, the EMP should describe specific

[2] See "The development of deep decarbonization pathways for New Jersey" in the Appendix for more details on how this process could work.

[3] Response to question 5. How should the state analyze the construction of additional fossil fuel infrastructure during the transition? How can the state plan to accommodate this infrastructure in both its short-term and long-term clean energy goals? What statutory or regulatory changes will be needed for the state to make and implement these determinations?

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mechanisms that would require state agencies to consider the impact of proposed projects on greenhouse gas emissions. Agencies should be required to deny permits or approvals for projects that would interfere with state's plans to achieve the 2050 emissions goals and interim targets. This authority and requirement should be defined for the Board of Public Utilities, New Jersey Department of Environmental Protection and others with purview over proposed energy infrastructure projects.

Clarifications and responses to selected policy questions

New Jersey can lead with a new approach to clean energy policy

A common, unifying theme in our answers to many of the questions posed for each of the EMP hearings, is that, thanks to dramatically falling costs and high levels of penetration of new clean energy technologies, New Jersey, like the nation and the world, need new analytical and policy approaches to clean energy deployment and decarbonization.[4] Simply put, for the last 30 years, the overwhelming clean energy challenge was to deploy enough new, more expensive, clean energy technologies to get these technologies across the threshold of commercial viability. Now that solar, wind, batteries, and digitally controllable load are all highly commercialized and are increasingly cheaper than traditional resources, the challenge is integrating all these new technologies into the electric system in ways that reduce consumer costs, increase reliability and resilience, while replacing fossil fuel-based electricity and its associated emissions. We know these results are possible, but they cannot be achieved by continued reliance on old policies intended to simply deploy more renewables and energy efficiency. Instead, they require the integrated system-based planning, with market inputs, discussed above and in the Appendix.

New Jersey was an early state in developing legislation to address climate change. As an example, in the 90s, it was understood that it was essential to promote the development of renewable energy, particularly solar and wind, and that these industries needed financial incentives to develop these resources. Policies were developed that, rather than focusing on emissions reductions, focused on promoting specific technologies and industries. Fortunately, New Jersey played a role in the early development of the solar industry and currently has 2,500 MW of installed solar capacity. Currently,

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[4] Many questions from the EMP hearings are addressed in this section, including:
12. What portfolio mixtures can the state utilize in achieving its 100% clean energy goal? What can a transition portfolio mixture resemble in 2030 and what portfolio mixtures can the state utilize in 2050?
6. How should the state invest in and encourage innovative technologies for renewable energy and energy efficiency?
7. Evaluate existing clean energy policies and programs: where are they most/least effective, and are they aligned with the 100% clean energy by 2050 goal? If not, what modifications can be made, if any?
9. How should the state address the baseload needs v. intermittent elements of clean energy generation? What is the role of energy storage in the conversion to 100% clean energy?
18. What efforts are most successful towards making clean energy and energy efficiency measures affordable and accessible to all?

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New Jersey is moving ahead to develop another new industry - offshore wind - and continues to support the development of solar and wind in New Jersey and in PJM.

But simply expanding renewables is no longer a sufficient policy solution. In the not-too-distant future, when generation from offshore wind begins and in-state solar continues to grow, New Jersey will face a new challenge: how to integrate higher levels of renewables, cost-effectively. New policies will arise from analysis that looks at a complex electric system that crosses state boundaries, as described above.

Moving forward, policy development should be based on two fundamental principles:

1. Comprehensive, integrated and optimized package of policy solutions.
   The potential for high levels of in-state and out-of-state renewable energy will, to a large degree, depend on the amount of flexible load, storage and transmission made possible through electrification of transportation and building systems, flexible load development, storage policy, and transmission planning.

2. Harness the power of the market.
   State policy and planning must continually seek market-based input on costs, performance and scale characteristics of all the resource types mentioned above. And, wherever possible, technology-neutral, market-based mechanisms should be relied on to achieve goals at least cost - while recognizing that technology- and location-specific policies may initially be needed to jump-start new technologies.

Early policy development in other states illustrates the drawbacks of incenting specific technology solutions without analysis that reveals where and when they add value to the system. California and other regions adopted policies that have resulted in significant curtailment of renewable resources, and the need for substantial fossil fuel resources to achieve a reliable and resilient electric grid, as exemplified by the "duck curve." While California is taking steps to mitigate the growing curtailment of solar energy caused by its ever-sagging "duck curve," many of these solutions are expensive and may themselves fail to integrate into a flexible, efficient overall grid supply.

New Jersey has the opportunity to do better and adopt policy solutions that are far more cost-effective. New Jersey's participation in PJM also provides an inherent advantage, since it allows a much less costly and more efficient regional approach to system balancing, renewable integration, flexible load and storage operation and planning. We can use these advantages to become a leader in the next phase of clean energy development, with implications not only for PJM states, but other regions as well.

100% clean energy goal for the power sector

The governor has directed that the Energy Master Plan address how to achieve 100% clean energy by 2050, only 31 years from now. Deep decarbonization pathways for the power sector should be evaluated in the light of the primary goal of achieving deep decarbonization across all sectors. This approach will allow the least-costly approaches to emerge, especially if the plan is both implemented through and informed by market-based approaches, such as all-source solicitations and competitive procurement. Multi-sector planning for decarbonization is especially important because of the deep synergies between flexible load and high levels of renewable development, since by definition much of the current and future flexible load is in other sectors - such as HVAC equipment in residential, commercial and industrial buildings, electric vehicles, and energy storage for end-use and critical services resilience needs. Accordingly, specific goals for each sector should be based on an integrated analysis, periodically updated in light of new technologies and opportunities.

Given that the primary goal is to maximize the reduction of greenhouse gas emissions, within cost and operational constraints, modeling and analysis should consider all resources that are emissions-free. [5] This is especially important since virtually all deep decarbonization analyses agree that eliminating the final 20% of carbon emissions from the power sector is likely to be much more expensive than the first 80%. New, safe and affordable clean energy technologies and solutions will be needed to achieve full decarbonization, and innovation and growth of such technologies should be encouraged rather than discouraged.

New Jersey's authority regarding the regional electric grid

While states have the authority to adopt policies to reduce emissions within their borders, they lack such authority for emissions from resources connected to the larger electric grid outside their own borders. Further, wholesale power markets are under federal, rather than state jurisdiction. New Jersey is part of a 13-state regional electric grid (PJM) that is responsible for providing electric service and that operates a wholesale power market intended to provide reliable energy at competitive and fair costs. The state's electric distribution systems connect to PJM, and deliver power from this wholesale market to New Jersey customers. These systems are operated by four New Jersey electric utilities, regulated by the Board of Public Utilities.

While New Jersey can and should regulate harmful emissions from generation located within New Jersey, electricity from these generation sources is not all consumed by New Jersey customers -- much is consumed outside of the state. Similarly, New Jersey consumers actually consume electricity generated across PJM, by resources located both inside and outside of the state. Thus, to provide emissions-free generation to New Jersey residents, the state's clean energy policies must go beyond simply regulating or even eliminating in-state emissions.

Effective policies will also recognize the role of PJM markets in determining both the type of generation that is connected to the grid, and the mix of electric generation that is used every hour to balance the total amount generated across the region with the total amount consumed, which is essential for reliability. For example, the state's Renewable Portfolio Standard (RPS) displaces fossil fuel-based

[5] Response to question 1, "For the purposes of the Energy Master Plan (EMP) and reaching Governor Murphy's goal of 100% clean energy usage in New Jersey by 2050, how should clean energy be defined?"

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electricity production throughout PJM, but also requires additional PJM resources to balance supply and demand when the wind stops blowing or the sun stops shining. Adding the right amount and types of flexible load and storage in New Jersey can increase the amount of clean energy consumed in both the State and the rest of PJM, while reducing the amount of fossil fuels burned outside of New Jersey to balance the variability of renewable resources on the PJM system -- including, but not limited to, the renewable resources located within New Jersey. And, importantly, optimizing this amount of flexible load and storage to match renewable resource needs can also result in lower cost clean energy policies and lower cost energy bills for New Jersey residents and businesses.

New Jersey benefits greatly from participation in the regional grid

The substantial benefits for New Jersey, such as those just noted, from being part of a large regional grid will only grow as the amount of renewable generation increases within both New Jersey and PJM -- which is bound to happen, both due to wise state policies and to the growing economic advantage of wind and solar over traditional fossil resources.

- PJM's large geographic footprint means smoother and less costly balancing of supply and demand while integrating large amounts of variable renewable energy sources like solar, wind and offshore wind.
- The diversity of renewable resources across a large region and the substantial amount of complementary distributed storage, flexible load and renewables available within New Jersey make it possible to decarbonize while maintaining reliability at a much lower cost than trying to rely only on limited resources within the state.
- The unified electricity market and PJM's transmission planning process mean New Jersey's clean energy policies can accelerate the deployment of clean energy resources in other states within PJM.
- New Jersey can play a leadership role with other states to accelerate the adoption of smart clean energy policies and resources across PJM.

3. What is the most significant obstacle to getting to 100% clean energy by 2050? How can the state address it?

Many proposed policies focus on particular solutions rather than the overarching objective, which is to reduce greenhouse gas emissions. The overriding goal of emissions reduction needs to remain the focus of all policies. As discussed, optimal deep decarbonization pathways for the power sector will also ensure reliability and resilience of the electricity system, at low costs while achieving the greatest levels of decarbonization. Further, pursuing cost-effective pathways and policies will be essential in order to maintain continued public and political support for clean energy policies.

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For the power sector, clean energy costs continue to decline, which suggest that actual cost reductions over the status quo are possible through selecting optimal pathways and smart policies. These outcomes will support and accelerate achievement of the clean energy goals. By the same token, higher than necessary costs (and lower emissions reductions) will create a significant obstacle to achieving emissions goals and clean energy goals. Higher costs can occur when policies are overly prescriptive about specific technologies and ignore competitive market processes and results. To a great extent, programs can be designed to be technology-neutral between various competing clean energy solutions, which will support the least cost approach to achieving program goals, whether the goals are expressed as tons of emissions reduced, MWh produced, or investments avoided.

The state should also explore and adopt steps to reduce the costs to use Class I renewables for compliance, such as competitive contracting for new projects versus buying clean energy certificates on the spot market or at legislatively mandated prices. By moving to a less costly procurement approach for a significant portion of the clean energy portfolio, more money will be available to invest in higher cost resources that address additional legitimate public policy goals.

2. Should the definition of clean energy contain flexibility between now and 2050 to allow for transitional fuels to be used and phased out over time? What intervening steps should be taken to complete the transition?

There is no need to incorporate “transitional fuels” into a definition of clean energy.

It is already implied that each sector will be using fuels that will be phased out over time by new policies or markets. Transitional fuels such as coal, natural gas, and petroleum products produce emissions, and emission reduction pathways imply their use will diminish over time, and they will eventually be replaced by clean sources. By defining interim emissions targets policymakers would set milestones for how quickly transitional fuels will be phased out. The state need not pick winners and losers and can rely on market forces to sort out which fuels decline at what rates.

Currently, almost all emissions in the electric sector in New Jersey are from natural gas. The clean energy policy framework described previously will result in a range of new policies. Such policies will continually reduce the amount of natural gas used for electric generation within New Jersey. New policies will also reduce the amount of natural gas used for residential and commercial sectors (building systems), the primary fuel source for these sectors.

4. How can the State immediately begin to transition to clean energy production and distribution? What intervening steps should be considered to clean existing technology? **How should stranded costs be addressed?**

As a de-regulated state, there is no risk to ratepayers from stranded assets such as gas generation plants. Private actors decide whether to invest in new gas generation plants in New Jersey, and whether to reduce output or close plants. The state can encourage decisions that are consistent with the state's emissions goals and reduce the risk of losses to these private developers of fossil fuel assets by providing clear and consistent signals about state policy.

One type of stranded asset for which ratepayers will be at risk is intrastate natural gas pipelines and interstate pipelines for which regulated gas utilities hold long-term contracts. It is expected that by 2030 there could be a significant reduction in gas consumption in New Jersey across all uses, which could affect the utilization rate of both interstate and intrastate pipelines. To protect New Jersey customers, it is absolutely essential to project future gas consumption and refrain from building additional infrastructure that will become underutilized as demand for gas diminishes, as it must for the state to achieve both its broad clean energy and its GWRA goals. As recommended above, state agencies with purview over proposed energy infrastructure projects can reduce the risk of stranded assets and should be required to evaluate the greenhouse gas impacts of such projects and to deny permits for projects that are inconsistent with GWRA targets.

13. Should changes be made to zoning and planning laws and requirements to allow for the development of clean energy generation?

Currently, there is little development of solar on industrial rooftops. A task force should be created to identify causes and possible solutions for this challenge, which could include changes to state or local regulations.

Another area for investigation is the wide variation by community in the cost of permitting and inspection for solar development. The soft costs in New Jersey are high and strategies to reduce costs, where possible, should be explored.

The state needs to clarify and strengthen siting criteria for renewable energy projects to protect environmentally sensitive areas, upland forests, critical wildlife habitat, prime soils and lands prioritized for open space, farmland or historic preservation. Incentives and other policies should be identified to encourage solar projects on brownfields, landfills, rooftops, parking lots and marginal lands. Careful research, planning and stakeholder engagement are needed to ensure environmentally-sound siting of offshore wind projects.

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APPENDIX

The development of deep decarbonization pathways for New Jersey

A smart portfolio of clean energy resources could now offer the lowest cost pathway for New Jersey consumers. This means New Jersey no longer has to choose between policies that protect community health, natural resources and climate and those that protect our pocketbooks. We can have both, if the energy master plan focuses on growing an optimized portfolio of renewable energy, flexible load, and electrification of key sectors of our economy.

The reason is simple -- the underlying economics of such optimized portfolios are increasingly being found to be more favorable than the current gas-heavy, renewable-light portfolio, even in a low-cost gas environment.

That may seem surprising to stakeholders accustomed to paying considerably more for renewable energy than for natural gas generation. But not only will a gas-fired electric grid cost more than a well-balanced renewable energy-based future, the cost advantage of clean portfolios means new gas assets face the very real risk of becoming financial disasters for their investors and owners after 2030, if not sooner. This should be a sufficient reason to avoid growth in gas-fired generation, in addition to the fact that significant amounts of gas-fired electricity production are incompatible with the deep decarbonization needed to preserve a healthy planet and a vibrant economy.

How do we know this?

The elements of low-cost pathways to 2050 have become clearer in the past year as policymakers and advisors in other states have used modeling tools to identify clean energy pathways to 2050. These models simulate the energy production needed to balance load and provide reliable service over long timeframes, based on different combinations of primarily renewable resources. Such models have recently been used in Hawaii, California and Minnesota to evaluate pathways to achieve 80% to 100% clean energy goals by 2050.

Insights from the Minnesota study, in particular, should be of interest to New Jersey policymakers. The study considers scenarios to reduce the entire state economy's CO2 emissions by 80% from 2005 levels by 2050. This level of deep de-carbonization would require significant electrification of transportation and building heating and cooling systems, along with a reduction by 91% of emissions from the electric sector.

The model considers all types of generation as it creates a low-cost pathway, including nuclear, gas, coal, hydro, solar and wind. The model optimizes **combinations** of generation, flexible load, storage and transmission that would provide reliable service, achieve at least 91% reduction of electric sector emissions and produce the lowest cost way to implement a number of different pathways to 2050. The different pathways explore alternative policy approaches, such as making all the renewable investment in Minnesota versus making some in other states with higher quality or more diverse renewable energy supplies, building more interstate transmission or only building intrastate transmission.

The study found that for Minnesota:

- All of the pathways included high levels of renewables, increased flexible load and storage, and significant electrification, which added additional flexible and inflexible load.

- Scenarios that electrify and de-carbonize are estimated to produce savings of between $600 to $1,200 per Minnesotan household per year by 2050.
- The study also showed that, on average, decarbonized scenarios provided approximately 20,000 more full-time jobs than the baseline scenario (an additional 50%), only for the construction of new generation assets.
- In New Jersey, about 31,000 residents work in energy efficiency according to U.S. Department of Energy statistics for 2017. Given the substantial potential for new work related to electrification, demand-response resources and energy efficiency envisioned in the Minnesota pathways, New Jersey can also anticipate substantial new employment and economic development, as these jobs are inherently local.
- A high level of electrification of transportation and building systems helped achieve these cost savings, both by providing efficient new load and significant flexible load.
- Selecting an optimal, diverse mix of renewable resources also contributed significantly to cost savings, both by substituting less costly for more costly renewable resources and, perhaps more importantly, by selecting a renewable portfolio whose energy production profile over time best matched the profile of load, including flexible load.
- Pathways with diverse in-state and out-of-state renewables and additional interstate transmission were considerably less costly than pathways depending entirely on in-state renewables and transmission, which is of special relevance to New Jersey given its location in the PJM regional grid.
- The cost savings to consumers, relative to a natural gas-dominated business as usual scenario, were significant even with continued low gas prices, and became even more remarkable in scenarios with higher future natural gas prices.
- By 2050, with high levels of variable generation and little to no natural gas use, the electric system can provide reliable electric service, without fail (and with reserve capacity), with enough generation to meet load every 5 minutes throughout the year.

The Minnesota study and similar studies do not provide answers for New Jersey. But these findings are certainly relevant to many questions that New Jersey will be addressing in its Energy Master Plan. New Jersey should deploy these same or similar renewable integration and optimization models to help calibrate and design its new policies and programs to achieve both emissions reductions and potential cost savings.

The findings suggest lessons and areas of inquiry for New Jersey:

- Longer-term, renewable-focused, regional system modeling is required to develop near-term policies. For example, the Minnesota study found that pathways to 2030 that included more natural gas were comparable in cost, but important cost differences emerged after 2030 as gas plants became uneconomic.
- While New Jersey is deregulated and does not directly plan the mix of generation within its borders, its RPS and other energy policies are intended to change that mix, add storage and develop flexible load. Without renewable energy optimization modeling like that used in

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Hawaii, Minnesota and other states, these policies may drive a less economic and effective mix and location of these resources.

- Further, a variety of state policies provide important information to the energy marketplace and will influence decisions by energy firms seeking to build new resources, who must choose between clean energy portfolios and business-as-usual gas generation. In particular, New Jersey is likely to see direct competition between new gas generation versus flexible load, electrified transportation, heating and cooling, and storage to provide the flexibility needed by growing levels of renewables in the state and the region. New Jersey needs to be ready to encourage and support the most efficient, lowest-cost, clean energy portfolios rather than becoming the location of choice for gas plants intended to meet the load balancing needs of the entire mid-Atlantic region.

The findings also suggest lessons and new areas of inquiry for multi-state decarbonization:

- One scenario in the Minnesota study modeled decarbonizing the electric sector by 80% throughout the eastern interconnect (Eastern half of the U.S. from Maine to Florida).
- The larger the geographic area for variable renewable resources, the easier to balance the grid at low cost.
- Again, de-carbonizing the eastern interconnect would reduce energy costs for Minnesota consumers over business as usual – while allowing many other states, including New Jersey, to also achieve greater emission reductions, at a lower cost as well.

This has important implications for New Jersey's approach to clean energy and climate leadership. In particular:

- Multiple states can collaborate on modeling and incentivize the mix of resources that works best for the region, lowering the costs for each state.
- Multi-state collaboration can accelerate market forces that will increasingly favor clean energy resources in the entire eastern interconnection, while providing more attractive commercial clean energy investments for utilities in regulated assets and for competitive clean energy investors for asset types that are open for competition.
- By supporting such optimized clean energy portfolios, state policymakers can drive lower emissions and forestall further gas development in other states as well as their own, by tipping the market toward replacing coal with renewables, flexible load and storage instead of with gas.