



Executive Summary

New Mexico has made important commitments to transition its economy away from fossil fuels and toward carbon-free³ energy sources. Many cost-effective and carbon-free technologies are available to approach these goals, but deploying them will require focused effort. The transition to a carbon-free, efficient energy system also presents new opportunities for innovation, job creation, and equitable economic growth.

In response to these challenges and opportunities, on Feb. 26-28, 2020 an interdisciplinary group of local, national, and international experts met at the Santa Fe Institute to discuss strategies for the deep decarbonization of New Mexico's economy. This report draws on discussions from the workshop and subsequent conversations with several New Mexico stakeholders. It focuses on areas of innovation that are well-suited for New Mexico and its communities.

Our discussions highlighted a number of technologies and policy tools to manage the variability of solar and wind power and to help New Mexico reach both the 2030 goal under the Energy Transition Act (ETA) and chart a course to achieving the 2045 goal of 100% carbon-free electricity. These tools include short- and long-term energy storage, identifying and enabling flexible demand through the electrification of energy services such as transportation and heating, and promoting stronger regional coordination. Importantly, the transition to carbon-free electricity can create jobs, and aid in economic recovery from Covid-19. Moreover, the benefits of the ETA could be enhanced, and other opportunities created, by broadening decarbonization targets to look beyond the power grid to other sectors of the economy such as transportation and industry.

Here is a brief summary of the primary insights emerging from our workshop discussions and subsequent research and conversations with local experts. We look forward to learning more from additional experts and stakeholders in New Mexico and the region. We plan to hold follow-up workshops and update this document as new strategies and opportunities appear.

Job creation and economic recovery. Clean energy already employs more people than the coal industry, and clean energy jobs have grown more quickly over the past few years than economy-

³ We use the term 'carbon-free' to refer to the lowest greenhouse gas emitting technologies available today, recognizing that they have non-zero lifecycle greenhouse gas emissions intensities.

wide jobs as a whole. In New Mexico, deploying, integrating, and managing wind energy, solar energy, energy storage, and other clean energy technologies can create jobs and economic development opportunities across the state. These include replacement energy resources in San Juan County and a range of economic development opportunities for Pueblos, Tribes, and Nations. Methane monitoring technology, including new software to achieve targeted sampling, methane capture, and the plugging of abandoned wells can create new jobs in the Permian basin. Weatherization and efficiency programs can be scaled up to reduce energy consumption and help customers save on energy bills that represent a larger share of low- and middle-income households' expenditures. Job training programs can be expanded to help people enter the trades relevant to renewable energy and efficiency. Equitable economic growth opportunities can be created deliberately, through progressing toward decarbonization goals by incentivizing innovation that supports job creation. New Mexico's low-cost solar and wind energy can be used to attract data centers and other companies seeking to locate their operations in areas offering carbon-free power.

Decarbonization across the state's economy sets up the potential to exploit cross-sector synergies. Setting specific, binding greenhouse gas reduction goals like those in the ETA for other major sectors, including transportation, heating, and oil and gas production can provide a platform for capturing several key innovation opportunities. Cross-sector targets can incentivize the electrification of new energy services such as switching residential and commercial heating from natural gas to electricity, and transitioning to electric vehicles that make more complete use of renewable energy. These transitions would, in turn, help create new jobs. These policy goals can be set with a range of benefits in mind. For example, in the transportation sector, cities and counties can strategically incentivize the design of EV charging infrastructure while encouraging mixed-use neighborhoods and affordable housing, including multifamily housing, close to employers. Broadband internet in rural areas could allow telecommuting while strengthening education and economic development. Cross-sector goals might also incentivize more strategic growth of renewable energy exports from New Mexico to other states, to diversify the state's economy.

Embracing innovation to ensure grid stability while relying on variable sources of renewable power. Traditional fossil-fueled power plants help provide stability through rotational inertia. A carbon-free power grid can achieve the same stability with weather-dependent renewable energy sources by combining energy storage, fast-response management of flexible demands, power electronics, and better regional interconnections. Utilities in New Mexico are already planning investments in grid-scale energy storage to balance a variable electricity supply from wind and solar energy at time scales that allow recovery from sudden grid disturbances. New Mexico utilities are also beginning to experiment with demand response. Building on these efforts, New Mexico utilities are well-placed to operate at the cutting edge through a concerted effort to validate trusted models of these resources, and to experiment with long-term storage, predictive models of supply and demand, and the use of fast-response, flexible demands, among other technologies. Utilities in New Mexico and their regulators should continue to foster an environment where new ideas for maintaining grid stability can be rapidly tested, and validated concepts allowed to move forward.

Regional coordination. Greater regional coordination will streamline the path towards New Mexico's energy transition by reducing overall costs, averaging weather conditions across the Southwest to smooth variations in the output of wind and solar power generators, balancing supply and demand, and sharing the costs of regional transmission and interconnections. It can also create economic opportunities for New Mexico to export surplus renewable power. For instance, far more wind power could be generated in the Eastern part of the state than is

consumed within the state. Selling this power to Arizona, Nevada, Colorado, and Southern California would create new sources of revenue and help diversify New Mexico's economy.

Supporting electrification of more energy services. Many uses of electricity, like water heaters and electric cars, are flexible in terms of when they need power as long as temperatures and charging levels meet the customer's needs. With the help of interconnected devices that communicate with grid operators, we can shift demand to hours when renewable energy is plentiful. Just as regional interconnections can help smooth out variations in solar and wind by averaging weather conditions across space, demand management and storage can help average supply and demand over time.

Innovation to achieve soft cost reduction. The hardware costs of solar, wind, and energy storage are rapidly decreasing as global demand drives investment and technological progress. New Mexico can be a leader in reducing the "soft costs" of these technologies, including design, permitting, installation, inspection, and interconnection. Streamlining permitting processes for both distributed and utility-scale generation will create additional jobs and workforce expertise. While distributed generation is generally more expensive than utility scale generation, distributed generation and storage, including rooftop solar, community solar, and microgrids are of interest to some communities and can be supported alongside a concerted effort to innovate edge-of-grid technology and to build a skilled workforce.

Anticipate technological change in regulation. New Mexico's electric utilities and cooperatives are making long-lasting capital decisions in the face of rapid technological change. Regulators should encourage planners to incorporate the pace of technological change into current investment decisions. Expected cost declines in renewable energy and storage, and forecasted changes to the energy system to meet decarbonization goals, should be taken into account when considering options for new generation or replacement power. Fossil fuel plants may need to have shorter lifetimes than projected, run less than expected, or become stranded assets—costing ratepayers more and creating barriers to decarbonization. Replacement of retired power plant capacity should come from carbon-free energy technologies such as renewables, storage, and demand response. Considering data-based trends and forecastable system-wide changes to meet legally-mandated decarbonization goals is a rational approach to regulatory decisions. Ignoring these changes amounts to placing bets on outcomes that are very unlikely and/or not in line with New Mexico's ETA.