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CASE STUDY

Los Alamos Electrification Study Sets Foundation for Decarbonized Future

A goal of reducing the Los Alamos carbon footprint via a comprehensive electrification strategy is putting the local public utility at a tipping point to address reliability of an aging grid system.

Challenge

Los Alamos County, New Mexico, is at the epicenter of rapid decarbonization. This is being driven by the combined impact of New Mexico's recently enacted rule limiting future internal combustion engine sales, a county initiative calling for carbon neutrality by 2050, and rapid residential adoption of rooftop solar by residents. These developments are creating an urgent need for substantial upgrades and capacity increases within the local publicly owned power distribution infrastructure.

The community of approximately 20,000 is home to the renowned Los Alamos National Laboratory, the nation's leading scientific research and development center focusing on artificial intelligence, nuclear science and their implications for national security. With an affluent and highly educated population, Los Alamos has enacted a Climate Action Plan, a comprehensive master plan that aims to reach carbon neutrality by 2050.

Residential and commercial customers in Los Alamos County are served by a publicly owned electric and natural gas utility. Meeting the electrification goals spelled out under the action plan would require significantly increasing reliance on the electrical distribution system while eventfully eliminating demand on the gas system.

27.1
additional peak load (est.) in megawatts at 50% electrification

20K
population served by Los Alamos utilities

2050
climate action plan deadline

Though the electric power system has experienced stable power demand for many years, it now has limited capacity to meet increased loads without encountering risks of outages or other system problems.

Solution

With a need to analyze and assess the current state of the system asset health, power flows and system needs, the Los Alamos county authorities engaged 1898 & Co. to perform a study that would serve as a framework for the strategy to rehabilitate the local grid and increase capacity to meet future load growth.

Two core challenges shaped the approach.

First, significant load growth would create stress on the two substations serving the community as well as many of the underground circuits that are at the end of their design lives. The total amount of growth to expect over the next 30 years was unknown.

The second challenge revolved around managing the incremental growth in demand as residents and businesses begin electrifying space and water heating systems, adding electric appliances and increasing reliance on the EV charging infrastructure. This load would require both added system and generation capacity. The adoption rate of these technologies were also unknown.

The 1898 & Co. team analyzed asset health and power flows, modeled adoption across several electrification scenarios, and built hourly load profiles. The model incorporated system performance data to identify where assets and components would be needed. The work also included financial analysis: incremental revenue, capital investment and rate design. The study also looked at staffing needs and the possibility of implementing a phased transition of current staff from the gas utility to the electric utility as demand shifted.

Once an accurate inventory was developed — listing the numbers of gas furnaces, water heaters and appliances that could be converted to electricity, as well as the potential number of EVs — a model was developed to plot out the infrastructure needed to accommodate various conversion scenarios. The model projected only energy efficiency rates under currently available technologies for heat pumps, water heaters and appliances.

The study quantified the relative impacts of power consumer behavior under three possible scenarios, modeling high, medium and low adoption rates.

The first scenario projected the cost and system impact that would result from full adoption by 2055 of all electrification systems and technologies in homes and commercial businesses, as well as 100% EV adoption. This high-adoption model also assumed a 20% improvement in energy efficiency for homes and commercial properties, a 35% penetration of rooftop solar at homes and businesses, and installation of battery energy storage systems (BESS) at 20% of homes and businesses.

Then, two additional scenarios were modeled: one for 50% adoption and the last for 25% adoption.

Under the medium adoption scenario, the team assumed 50% electrification of appliances and HVAC systems in homes and businesses, and a 10% improvement in energy efficiency. Then the model assumed rooftop solar systems installed on 25% of homes and commercial properties, and 10% adoption of BESS.

The low adoption scenario assumed 25% electrification of appliances and HVAC systems and no improvement in energy efficiency. Rooftop solar installation on 12% of homes and commercial properties and 5% BESS adoption rates also were assumed. This scenario is likely the lower boundary condition of what utility planners should expect.

The medium scenario projects EV adoption to mirror the county's historical rate, whereas the low scenario reflects New Mexico's overall average rate.

The analysis showed that under the most modest adoption rate of 25%, Los Alamos would still exhaust power delivery capacity and risk a system deficit in the 2030s. Even with only 1 in 4 residents converting, the local utility would likely need to fund multiple significant system upgrades.

The financial analysis revealed a critical insight: High rates of electrification could pay for their own grid upgrades. The modeling showed that under the high-adoption scenario, revenue generated from increased electricity sales would more than offset the capital cost of building a new substation, all without requiring a rate increase for customers.

Meanwhile, the low-load growth scenario would not generate enough new revenue to cover the capital costs required, including for construction of a new substation in 2040. Utility managers would either have to implement a rate increase to cover the debt for the substation or defer construction altogether.

Along with this forecast of various load scenarios, a power flow analysis identified system circuits that would need to be prioritized to forestall any system overload issues arising by certain future dates. This allowed for recommendations on new projects such as construction of a new substation and portions of underground cabling replacements that would need to be scheduled first.

Results

The power flow simulations and scenario analysis helped to define a slate of targeted substation and conductor upgrades, as well as structured replacement of aging assets. The study has also mapped out the optimal project sequencing to align with regular outages and funding cycles.

The study shows that Los Alamos County had reached a critical juncture where a major capital expansion is no longer a choice, but a necessity. However, paradoxically, a higher electrification rate would generate more revenue, a growth rate substantial enough to fund the required infrastructure investments without additional rate increases for the community.

About 1898 & Co.

1898 & Co. is a global business, technology, and security consultancy serving critical infrastructure industries. We partner with clients to plan, secure and optimize their business. As part of Burns & McDonnell and our 120 years of industry experience, we understand the complexity of your asset-intensive business model, the trends impacting your industry, and the need to ground big ideas in operational realities. Learn more at **1898andCo.com**.

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