



→ Buildings, forklifts, and automobiles: Insights on utility electrification efforts and opportunities

By Chris Watson, ICF

Introduction

Electric vehicles (EVs), building heating technologies, and commercial and industrial equipment are quickly emerging as attractive electrification or fuel switching opportunities for utilities. These electric technologies have the potential to decrease customer costs, decrease greenhouse gas (GHG) and smog causing emissions, increase utility revenue, and benefit customers broadly. However, not all electrification of everything everywhere provides these beneficial outcomes.

The goal for utilities isn't electrification. The goal is beneficial electrification.

This paper offers insights and considerations aimed at maximizing the benefits while mitigating the potential challenges of electrifying transportation, buildings, and commercial and industrial equipment. It also includes actionable recommendations for utilities to move ahead with [beneficial electrification planning and implementation](#) with the best likelihood of driving short term success and readiness for a broader mid- and long-term energy transition with key stakeholders.





Electrify everything?

Electrification is currently happening across most economic sectors and in every region but not at the same pace or efficacy. Only about a third of U.S. energy use today is electric, so an effort to “electrify everything” would likely take decades simply because the electric generating, transmission, and distribution capacity online today isn’t nearly enough to serve all energy demand. Direct use of natural gas (predominantly for heat) and petroleum (for transportation) serves a massive amount of energy demand in the United States. However, electricity can be a more efficient and lower carbon source of energy, which means there is great promise for substantial beneficial electrification when available generating capacity allows.

While some utility stakeholders are calling to electrify everything, electrification is not always cost-effective for customers. It can exacerbate energy inequities when disadvantaged communities aren’t able to participate or reap the benefits. It can negatively impact grid reliability due to new systemwide demand peaks or localized stress at key points on the grid. It can create new system costs that net out the revenue gain for utilities. And the assumption that all electrification reduces GHG emissions is not so clear cut. The GHG intensity of electricity varies widely based on the generating supply mix across service territories and temporally, so the emissions benefit of electrification needs to be considered carefully at the local level.

Utilities must lead a careful and collaborative process across diverse stakeholder groups to ensure they can pursue beneficial electrification programs that will meet their goals and serve all stakeholders equitably.

What is beneficial electrification?

Beneficial electrification promotes the replacement of fossil-fuel end-use equipment with electric in specific instances that benefit:



The customer in an equitable fashion through affordability and reliability



The environment by reducing GHG emissions



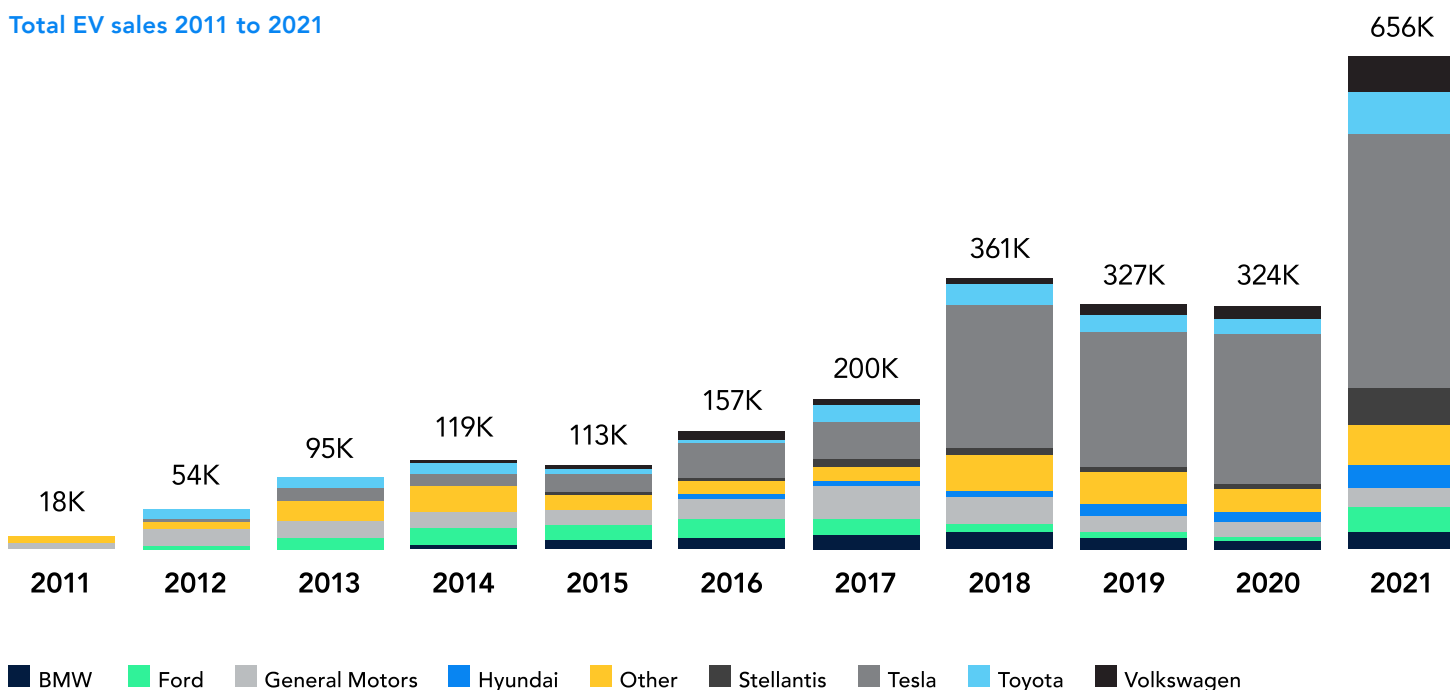
The utility by increasing sales revenue and minimizing system impacts and costs

Transportation electrification: Hitting the accelerator

The most rapid area of electrification, and the one in which utilities are taking the most proactive approach with new programs to steer beneficial electrification, is transportation. This is largely due to the success of EV manufacturers bringing attractive new models to the market and broad government support across federal and state levels.

After remaining relatively flat from 2018-20, EV sales in the United States doubled in 2021 to 656,000 units, according to Atlas EV Hub.

Total EV sales 2011 to 2021



Source: [Automakers Dashboard – Atlas EV Hub](#)

Forecasters expect EV sales growth to remain robust. Ambitious new EV targets, funding, and incentives from the private sector and federal government will further fuel the growth of EVs, particularly through support from the Bipartisan Infrastructure Law and Inflation Reduction Act.

With petroleum-based transportation accounting for nearly a third of U.S. energy use and GHG emissions, the transportation sector is likely to incur the largest wave of electrification, particularly in the near- to medium-term.



Impact on utilities and greenhouse gases

Transportation electrification policy and market forces could result in a 20%-50% increase in electricity demand over the next 30 years, which is great news for utility revenue projections. However, if that new load comes in the form of unmanaged charging, it could add nearly 450 GW to peak demand¹ nationwide in the 4-5 p.m. hour, which could drastically drive-up costs for new infrastructure and negatively impact reliability. Fortunately, managed charging can help shift that demand to off-peak hours, thereby mitigating much of the direct need for major new infrastructure.

In its recent report "[The impact of electric vehicles on climate change](#)," ICF predicts a 27% decline in 2050 on-road transportation GHG emissions compared to 2020, if current policies remain in place. However, aggressive nationwide transportation electrification combined with a nationwide grid powered primarily by clean energy could lead to an 82% GHG reduction.

There are several additional reasons utilities may favor pursuing beneficial transportation electrification. Transportation electrification reduces hazardous air pollutants that negatively affect health, often of those in the most disadvantaged communities. And importantly, most utility systems will be able to handle the added load from EV charging without creating a new systemwide demand peak, if they are able to implement some level of effective managed customer charging.

Programs at a glance

Given the potential benefits of transportation electrification, U.S. utilities have already made more than 200 filings to create new programs or initiatives.

Of 209 transportation electrification-related utility filings, 132—or about 60%—have been approved, with 62 pending as of July 2022. Of the 44 denied or withdrawn, almost all were due to the proposals being too ambitious or not ambitious enough with the utility invited to return with a revised proposal.

Filings asking for line extensions were approved 100% of the time, followed by a 96% approval rate for make-ready infrastructure programs and an 86% approval rate for EV ownership-related programs. Filings seeking to create incentives for EV supply equipment were approved 69% of the time.

Building electrification: A big opportunity with big challenges

According to a 2022 American Council for an Energy Efficient Economy (ACEEE) report on building electrification², utility programs aimed at this segment of the economy are frequently "stacked" with other measures, such as weatherization. ACEEE reports that 24% of programs including building electrification measures require weatherization work to qualify while an additional 50% encourage weatherization work. These programs are almost always delivered in regions, states, and municipalities with decarbonization goals and ambitions.

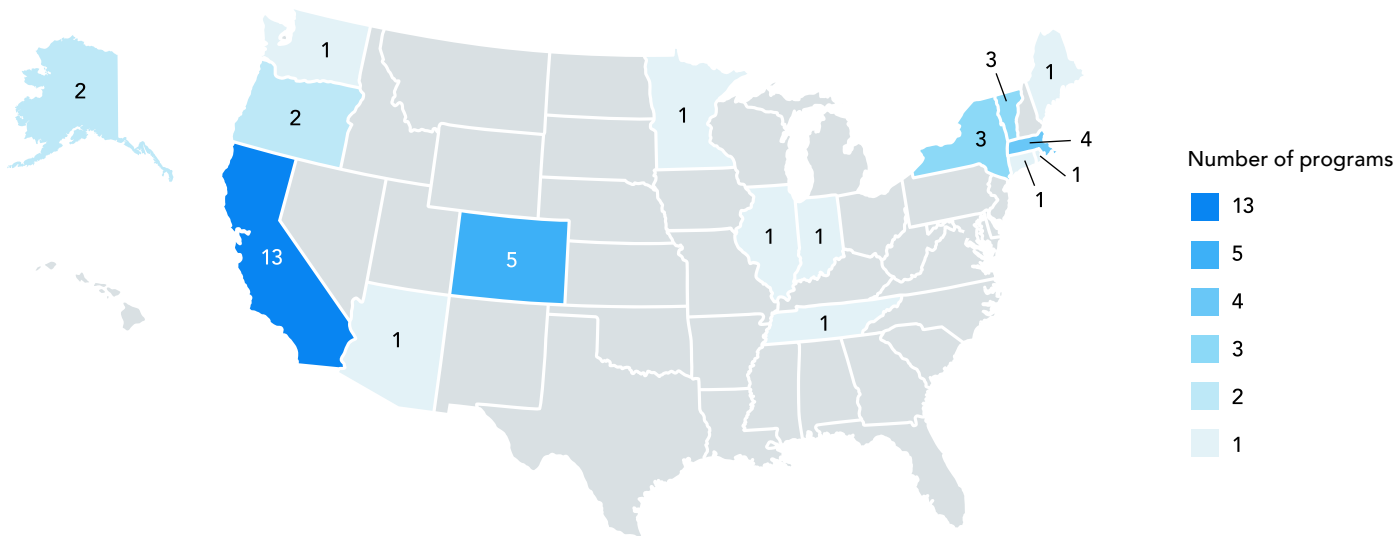
ICF recommends this stacked approach with building electrification programs, given the complexity of work that must be done to electrify heating. Building electrification efforts often involve costs of \$10,000 or more per project and significant disruption in a home or business. When customers give a utility entry into their home or businesses for such large projects, utilities should be prepared to offer and do additional demand-side work such as energy efficiency or weatherization upgrades while they're at it. Existing energy efficiency programs aimed at commercial and residential heating as well as weatherization could also be modified to include things like heat pumps and electrification.

¹ [The Impact of Electric Vehicles on Climate Change | ICF](#)

² [Building Electrification: Programs and Best Practices | ACEEE](#)

Programs at a glance

ACEEE reports that U.S. utilities had launched 42 building electrification programs, largely driven by state policy directives and climate goals. Given the states where clean energy and climate goals are strongest, it's perhaps no surprise that building electrification programs are concentrated on the West Coast, Northeast, and New England, with several also approved in Colorado.



Source: <https://www.aceee.org/research-report/b2201>

Most of the programs to date are pilots and target energy end users such as homeowners, with a few aimed at contractors and home builders. Programs are most commonly focused on residential space heating and water heating measures, such as providing incentives for air source and ground source heat pumps or electric water heaters.

Mind the peak

The energy required to serve heating demand in buildings is very different from that required to serve transportation. The seasonal, energy dense profile for heating demand is not a perfect fit for electric infrastructure to serve.

In particular, meeting high heating demand with electricity in winter would create massive new systemwide peaks in many utility service territories. Those new system peaks would potentially trigger hundreds of billions of dollars of aggregate grid and generating infrastructure.

As ICF details in its paper "Building electrification: Steps to start now amid an uncertain future,"³ the mantra for electric utilities pursuing building electrification as a form of beneficial electrification should be: "**Mind the peak.**" Building electrification program planning and implementation should be designed to electrify heating loads that fit within the system's grid and generating limits.

³ [Building Electrification: Steps to Start Now | ICF](#)

**Commercial and industrial (C&I) equipment electrification:
The forgotten favorite**

Industrial electrification measures targeting equipment such as forklifts, scrubbers and sweepers, material handling equipment, and process heating were among the original electrification programs and should still be part of any beneficial electrification program. However, the success of programs to electrify commercial and industrial equipment is often forgotten, as is the opportunity to do much more.

Programs targeting beneficial electrification of industrial and commercial equipment have proven successful, making an impact with target customers and advancing utility goals. Utility C&I customers often have sustainability goals, and they are seeking solutions. They also consistently seek cost-cutting opportunities, and electrifying equipment can be a path to energy cost savings.

C&I customers have plenty of equipment to electrify, from heat pumps and boilers to forklifts and refrigerated trucks and rail cars. Because of the array of possibilities, industrial and commercial equipment electrification programs can start small as narrow pilots and have plenty of room to grow.



Case in point

Florida utility JEA's initial electrification efforts launched in 2014, targeting replacement fossil fuel-powered technologies such as forklifts, cranes, airport ground support equipment, and manufacturing equipment with highly efficient electric technologies. After a successful first phase of the program, JEA launched an expanded second phase of the program in 2020, set to last five years. This second phase broadens qualifying electrification efforts to include transit, school buses, beverage carts, drones, conveyor systems, and commercial fleets.

Learn more about how JEA's commercial and industrial electrification program is leading to increased demand and revenue for the utility, savings for customers, and GHG emissions reductions in ICF's client story, "[Re-charging incentives for electrification.](#)"

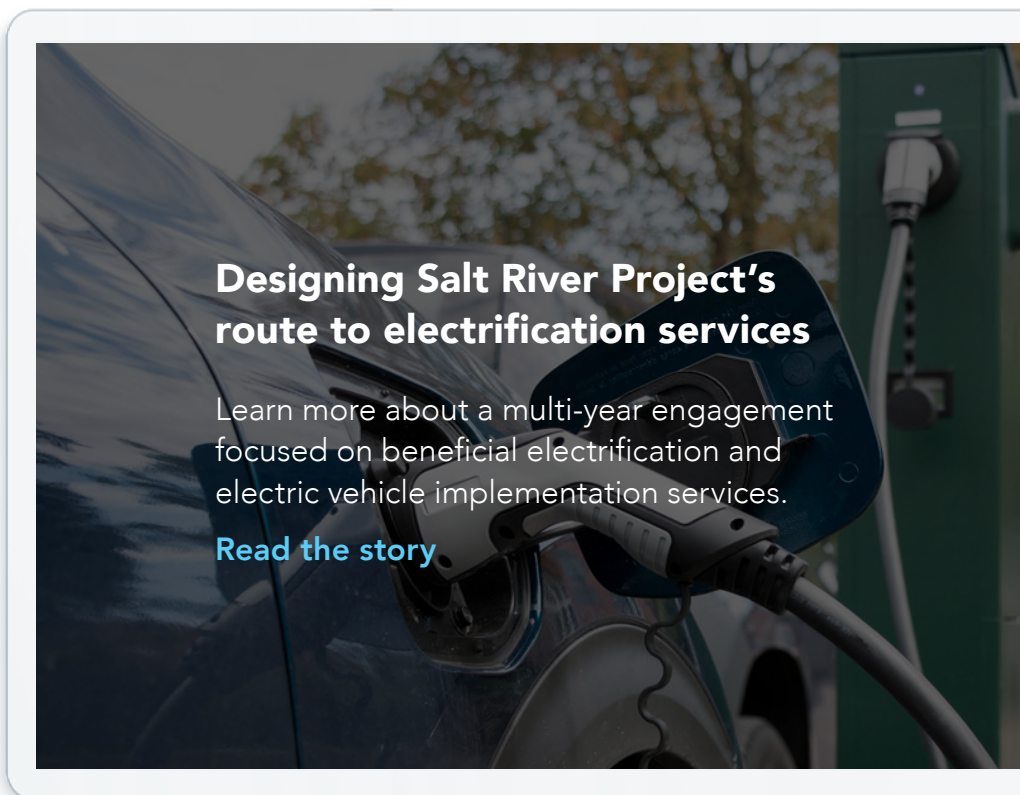
Why now?

Not since the middle of the 20th century with the widespread introduction of electric appliances have

consumers been afforded the number of new electric technologies as we see today. From the electric vehicle to the air source heat pump to unique industrial applications, these new technologies have the potential to reverse recent demand decline brought on by the introduction of vastly more energy efficient lighting and appliances and drive added demand for years to come.

At the same time, enabled by policy and increased efficiency and decreased cost, we have seen the rapid addition of more renewable electric supply over the past decade. The electric systems of today are longer on energy than ever and lower emitting than at any point in the last 80 years.

Beyond the added demand for electric energy, the uptake of these efficient electric technologies has the potential to decrease the demand for the fossil fuels that typically drive transportation and heating load. The opportunity to decrease demand for fossil fuels also creates an opportunity to realize GHG abatement targets related to climate commitments.



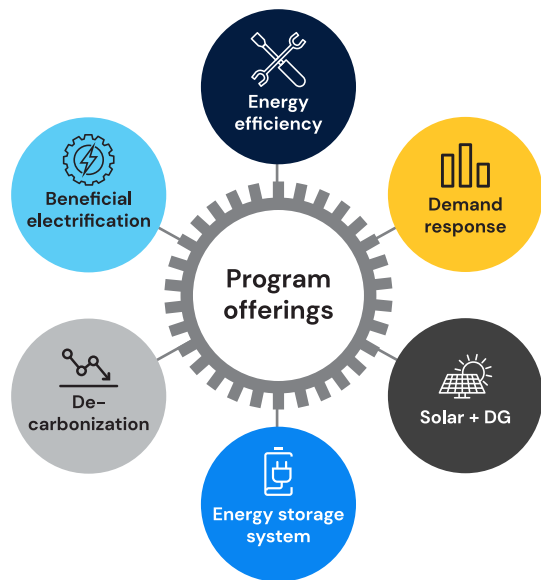
Program planning and implementation: 7 insights to move ahead

This survey of beneficial electrification opportunities and utility programs across transportation, buildings, and industrial and commercial equipment yields several insights utilities should consider as they make plans and implement programs.

- 1. Not all electrification opportunities are created equal.** The goal should be beneficial electrification that manages affordability, equity, reliability, and sustainability.
- 2. Transportation electrification is well-suited to be beneficial** and utilities are consistently successful earning regulatory approval for programs, particularly those focused on deploying make-ready infrastructure. But utilities will want to increase their focus on managed charging as EV adoption rapidly increases.
- 3. Building electrification comes with a warning: Mind the peak!** It can be beneficial across all metrics, provided the effort to electrify heating doesn't create a new peak that drives the need for costly new infrastructure.
- 4. Don't forget about commercial and industrial equipment electrification.** Programs pursuing this form of beneficial electrification are often the easiest path to make an impact with customers. There is ample low-hanging fruit for utilities to target.
- 5. Electrification programs are evolving from the pilot level.** Learning from pilots is leading to fully programmatic approaches, such as JEA's phase two program.

- 6. Once dominated by energy efficiency efforts, utility demand-side programs are becoming bigger, broader, and more bespoke.** As such, utilities should consider stacking measures across these areas in their programs to increase cost effectiveness and better engage customers.

Where are programs headed?



Bigger, broader, and more bespoke

- 7. To launch a pilot or program that achieves beneficial electrification goals, utilities must engage a variety of stakeholders** from government, nonprofits, community organizations, and consumer advocates. Successfully navigating this stakeholder process means utilities must make a convincing case for their programs with data, modeling, and compelling projections of cost-effective benefits.

ICF offers a full suite of electrification services for clients at any stage of the electrification planning and implementation process. These services range from strategic planning to market assessments to impact analyses to program design, delivery, and evaluation.



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Our experts have been embedded in every corner of the energy industry for over 40 years, working at the intersection of policy and practice. We work with the top global utilities, plus all major federal agencies and relevant energy NGOs, to devise effective strategies, implement efficient programs, and build strong relationships with their customers. From creating roadmaps to meet net zero carbon goals to advising on regulatory compliance, we provide deep industry expertise, advanced data modeling, and innovative technology solutions, so the right decisions can be made when the stakes are high. Learn more at icf.com/work/energy.