VOICES OF EXPERIENCE

electrification

A Stakeholders Guide

Smart Electric Power Alliance

U.S. DEPARTMENT OF ENERGY | OFFICE OF ELECTRICITY

NREL

There are a lot of benefits to electrification beyond decarbonization, and that’s what’s going to drive a lot of the consumer and utility demands.

- Keith Dennis, NRECA

What is Electrification?

Electrification is the process of converting an energy-consuming device, system or sector from non-electric sources of energy to electricity– in homes, buildings, industry, agriculture and transportation.

Why Are People Talking About It?

Electrification can help us meet clean energy goals, lower overall energy costs, and optimize our existing infrastructure and resources. It is an emerging economy-wide decarbonization strategy that is gaining momentum and beginning to impact the electric power industry.

Why Electrify?

LOWER EMISSIONS

LOWERS COSTS

INCREASES FLEXIBILITY

We found in our comprehensive energy plan from a couple years back that under policy passed that pursued high electrification consumers actually would experience lower monthly bills, not just lower rates, but lower bills.

- Mike Judge, Electric Power Division, MA-DPU

Why Electrify?

LOWERS EMISSIONS

Even when fossil fuels are in the generation mix, switching to electric vehicles and other electrification technologies can lower overall emissions. Using electricity generated from clean energy sources further helps communities reach their decarbonization goals.

Why Electrify?

LOWERS COSTS

Electrification technologies are often more energy efficient than fossil fuel technologies. While electric bills may go up, consumers can reduce their overall energy costs by electrifying.

Why Electrify?

INCREASES FLEXIBILITY

Electrification technologies can respond quickly to price signals. Opting to use electricity when it is cheap or when excess solar is available allows utilities to avoid purchasing expensive power at peak times. Flexibility in energy usage also allows utilities to optimize existing distribution assets.

“Beneficial electrification”

is a term coined by Keith Dennis who is a vice president at NRECA and the Director of the Beneficial Electrification League that can help determine—at a very high level—**if the plan to electrify a sector will have a net positive outcome for the people in a community.**

Beneficial Electrification

While electrification can provide many benefits, it is not always the right strategy for every community and may even have unintended negative consequences. Beneficial Electrification is the application of electricity to end-uses where doing so satisfies **at least one of the following conditions without adversely affecting the others:**

1. **Saves consumers money over time**
2. **Benefits the environment and reduces greenhouse gas emissions**
3. **Improves product quality or consumer quality of life**
4. **Fosters a more robust and resilient grid**

What Sectors Are Electrifying?

Transportation

Buildings

Industry

Agriculture

We tend to focus on the economic benefit [of electric technologies] because it's a language everybody can speak, no matter your political affiliation or thoughts on climate change. When you can see an economic benefit to your organization, it's all that much more reason to get involved.

- Rob Wonzy, Alliant Energy

Transportation

Benefits

- Reductions in air and noise pollution lead to greater public health benefits.
- Future electric vehicle (EV) batteries can be used as a grid resource and power buildings during an outage.
- Increased energy efficiency. For example:
  - EVs have a lower lifetime total cost of ownership compared to traditional internal combustion engine vehicles
  - EVs and internal combustion engines vehicles could reach cost parity within 5 years

Transportation

New Electric Technologies

- Light-duty vehicles (Ford F150 Lightning)
- Commercial fleets (delivery trucks, semi trucks, etc)
- Public transportation
  - Buses/school buses
  - Rail systems
- Air travel

The cost of implementing the infrastructure for electric vehicles was well outweighed by the benefits that accrued, including the revenues that were generated from that incremental load that were sold on the system also to an important point.

- Christopher Budzynski, Exelon Utilities

Buildings

Benefits

- Increased load management flexibility
  - New electric technologies provide increased control of energy consuming devices that can reduce demand during peak hours.
  - With the control provided by new technologies, utilities have more flexibility when integrating renewable energy into the grid.
- Energy costs can be reduced as new electric technologies are more energy efficient and require less maintenance.
- Electric devices will lead to safer homes (e.g., gas leaks, open flames, and related fires).
- Improved indoor air.

Buildings

New Electric Technologies

- Water heaters
- Heat pumps
- Timed appliances and timed charging
- Induction cooktops

We've got to begin considering building a stock as a really integral part of the overall energy system. And if we don't invest in the building stock, then we've got to over invest somewhere else.

- Mackay Miller, National Grid

Industrial

Benefits

- Safer work environments
  - Improved indoor air quality
  - Less building modifications needed for proper air circulation
  - Reduced noise pollution provides protection against hearing damage
- New tools have greater energy efficiency and can provide targeted electrical heat from induction or lasers
- Leaner manufacturing, including decreased
  - Labor costs
  - Raw materials
  - Health and safety risks
  - Consumables & tooling costs

Industrial

New Electric Technologies

- Rock crushers
- Forklifts
- Heat pumps
- Boilers
- Furnaces
- Petrochemical cracking furnaces– in development

Industry's just doing it (electrification) because it makes sense. Because it's a good product.

- Keith Dennis, NRECA

Agricultural

Benefits

- Increased energy efficiency reduces energy costs
- More precision from new autonomous technology for irrigation, planting, and harvesting improves operational efficiency and conserve resources
- Safer work environments
- Less building modifications needed for proper air circulation
- Reduced noise pollution decreases hearing damage

Agricultural

New Electric Technologies

- Tractors
- Pumps for waste lagoons
- Agricultural sprayers run via PV
- Irrigation pumps
- Water heaters
- Grain dryers
- Thermal electric storage systems
- Radiant heaters

The cost of technology is one of the biggest hurdles to [electrification]. It's hard [for customers] to look at the total cost of ownership when their margins aren't big to begin with. We're trying to bring in funding sources [for electrification projects] but in order to get grants, audits must be done, and sometimes farmers don't have to go through the process of applying for that audit and having people come in because they've got businesses to run.

- Diane Huis, North Carolina Electric Cooperative

Key Takeaways

- Electrification is an emerging economy-wide decarbonization strategy that is gaining momentum and beginning to impact the electric power industry.
- Reducing greenhouse gas emissions is the primary driver of electrification.
- Even when fossil fuels remain in the generation mix, switching to electric vehicles and other electrification technologies can lower overall emissions.
- Electrification technologies can act as grid resources to provide utilities with operational flexibility to shape, shift, and discharge electricity at optimal times.
- Transportation, buildings, industry, and agriculture are the economic sectors that are starting to electrify.

Further Reading

- Transportation Energy Futures Project by the National Renewable Energy Lab
- Electrification Futures Study by the National Renewable Energy Lab
- What is a SmartGrid?
- NREL's Electrification Futures Study
- Energy Efficiency and Electrification
- NREL Electrification of Industry
- SmartGrid.gov Electrification Resource Library
- Voices of Experience | A Stakeholder Guide to Electrification
- Voices of Experience | An EV Future: Navigating the Transition