# From Diesel to Electric: How Energy Efficiency and Electric Utilities Can Partner to Electrify Rural Manufacturing Operations

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## ABSTRACT

Several small manufacturers in rural Vermont depend on diesel generators to power their operations. Sparsely populated landscapes and high infrastructure upgrade costs challenge businesses and utilities interested in electrifying their operations via the grid. Seasonal businesses and family-owned companies are the most reluctant to electrify. The prospect of financial and operations failures give them a particular sense of vulnerability. So how can electric distribution utilities reach and connect more of these businesses, even though it requires a substantial investment that can feel out of reach?

For the Vermont Electric Cooperative, the answer involved partnering with the state energy efficiency utility, Efficiency Vermont, to bring technical and financial resources to the most challenging projects. This partnership quickly yielded several successful line extension and system upgrade projects, delivering a cleaner and more predictable power supply to customers. These early successes also demonstrated that this partnership model provides outstanding customer value and can be applied nationwide to decarbonize rural industries.

This paper discusses the partnership's processes, strategies, actions, and successful applications for electrifying rural manufacturers' operations. It also discusses the influence of electric tariffs, bundling energy efficiency measures into line extension projects, and the understated value of providing the customer with a comprehensive economic analysis.

## Background

If life in rural Vermont were reduced to a single painting or coffee table puzzle, it would likely feature some combination of dirt roads, farm animals, red barns, snowy mountains, serene ponds, and colorful forests. Vermonters themselves might even paint that picture. After all, the state is one of the two most rural states in the country.[1] But with this picturesque rural character that has come to define the state are practical challenges for many residents and employers.

Near the top of that list of challenges are the availability, cost, and reliability of energy delivery. Despite a rather extensive electric distribution network, some locations and corridors have no electricity, or the available electricity delivery cannot meet customer requirements. Many of these locations fall within the service territory of Vermont's cooperative electric utilities, long tasked with bringing affordable electricity to rural areas characterized by a low number of customers per mile of line. The Vermont Electric Cooperative (VEC), for example, serves approximately 41,000 utility meters in their 2,056 square-mile service territory. To meet service demands, the co-op maintains 136 miles of transmission line, 303 miles of underground conductor line, and 2,438 miles of overhead distribution lines (Vermont Electric Coop n.d.). In some of the isolated pockets of their service area, it is not unheard-of to find a customer density of less than one per mile of line.

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[1] Based on the percent of its population that lives in rural census districts (U.S. Energy Information Agency 2020). The other is Wyoming.

As the distribution utility (DU) serving a low-density electric network, VEC has a constrained budget for expanding service to new customers. Their commitment to their members to provide affordable and reliable service, means they prioritize spending primarily on critical maintenance and system improvements. New customers who want to connect their remote businesses must pay for a new service line extension; this cost might be more than they can afford, unless they can obtain assistance from the utility. This is especially true for customers requiring three-phase power, which carries a higher cost per extended mile of line. Further complicating the issue for businesses requiring three-phase power is its limited availability. In VEC's service territory, for instance, 82 percent of their overhead distribution lines are single-phase only—for good reason. Most of the service territory is residential or agricultural, and thus has little need for three-phase power (Vermont Electric Coop n.d.).

So, who are these new users of three-phase power, and what other options exist for them?

In many cases, they are family-owned and operated small businesses that have historically generated their own electricity using diesel-electric generators. Such businesses might be aggregate producers, sawmills, or maple sugaring operations, which must be co-located with the resources they use. Sawmills, which can be sited independent of the resource (that is, logs can be brought to them for processing), are still frequently located outside populated areas, due to the land requirements and operational noise pollution. Many mills also began as small, intermittent, family-run operations decades ago, when the physical, industrial, and electrical landscape looked much different. These smaller mills often had to generate their own power, since the three-phase electricity needed for their operations was not readily available. Consequently, diesel engines became the heartbeat of these sawmills, whether directly coupled to a saw or to a generator electrifying the mill.

Even when adequate single- or three-phase power lines are nearby, a few businesses have chosen to stay off the grid for other reasons. The experience of many gravel pit operators, for instance, highlights another historical issue disproportionately plaguing rural manufacturers in the state: year-round demand charges, despite only seasonal operation. Gravel pits that need power to run their crushers and asphalt plants typically operate from April through November. The electricity rates, however, do not go down when the machines stop operating, because traditional electricity tariffs continue with a minimum demand charge during the winter and spring months. This practice quickly inflates a seasonal operation's annual total cost of energy.[2] Carrying even a fraction of their high demand charges into the off season can be a costly proposition for gravel pit operators, because of the high power demands of operating rock crushers and asphalt plants. To avoid this off-season charge, some operators have chosen to power or supplement their operations with generators, because they already buy fuel for other pieces of heavy equipment used on site. Relatively speaking, they are likely to have cost-friendly, bulk delivery fuel contracts.

Whether out of necessity or by choice, many seasonal and other manufacturers operating in the rural parts of Vermont have embraced diesel-electric generators to power their businesses. Such customers and their energy challenges have not gone unnoticed by regional distribution utilities. In fact, many DUs have tried for years to find solutions that work for customers—with relative success. Nonetheless, all of Vermont's DUs will soon have to go the extra mile as a

[2] The minimum demand charge during the off-season is a percentage of an operation's maximum demand during the preceding 11 months. This is known as a "demand ratchet" and is a common feature of demand-based rates in New England. The minimum demand charge is specified by each distribution utility, but typically ranges between 50 and 80 percent above the regular demand charge.

statewide effort takes root, to decarbonize everything from homes to hospitals to factories. This effort will include customers currently beyond the end of the distribution lines, or lacking local three phase power availability.

## New Requirements and Opportunities for Distribution Utilities

In June 2016, the Vermont Public Utilities Commission (PUC) implemented the State's Renewable Energy Standard (RES; Vermont PUC n.d.). This standard goes beyond a simple mandate that distribution utilities increase the percentage of renewable energy supplying their networks to include provisions related to "energy transformation." This provision of the standard is known as *Tier III*. According to guidance issued by the PUC in the implementation of the standard, "Energy transformation projects are those that reduce the fossil-fuel consumption of a DU's customers and the greenhouse gas emissions associated with that consumption" (n.d.). The statute requires that nearly all distribution utilities acquire fossil fuel savings equivalent to 12 percent of their annual electric sales via energy transformation projects by the year 2032, with annual incremental requirements and penalties for failure to meet the requirements (Vermont Electric Cooperative 2019).[3] The RES therefore not only requires utilities to "green up" their grids, but also to participate in converting fossil fuel-based equipment to electric alternatives.

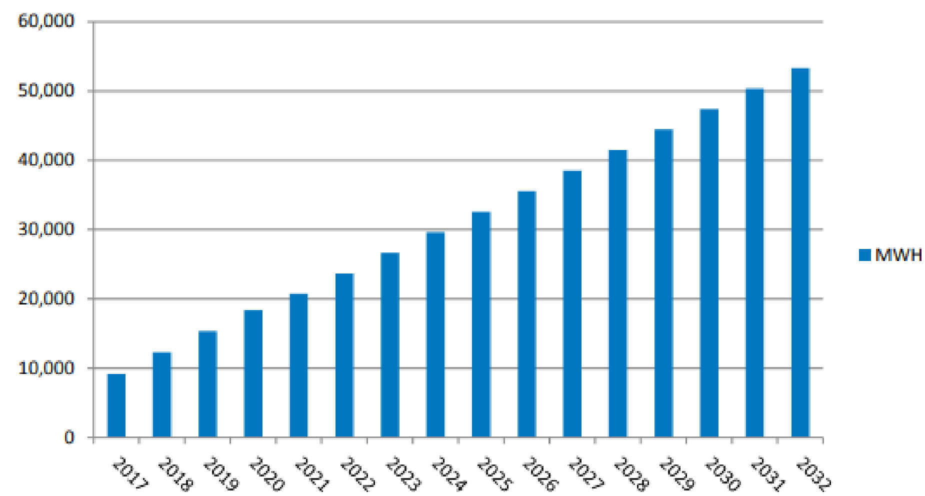


Figure 1. VEC's estimated annual Tier III MWh requirements. *Source:* Vermont Electric Cooperative 2019.

Reaction to the new regulation has been understandably mixed, although some utilities support the RES. That is, it draws attention to the needs and challenges of electric utilities and provides a structure for strategically electrifying the state with renewable electricity. VEC, for instance, is embracing the challenge to electrify fossil fuel-using equipment and to decarbonize the state, as is required by Tier III of the RES. This statute does not mandate the use of any particular product or service, and allows for flexibility in how each distribution utility will meet its targets. Recognizing that many remote homes and businesses inside their service territory still rely on fossil fuel-fired generators, VEC created its Clean Air Program (CAP), which

[3] Municipal electric utilities serving fewer than 6,000 customers will only be required to acquire fossil fuel savings equivalent to 10.66 percent of their annual electric sales by the year 2032 (Renewable Energy Programs n.d.).

…offers customized opportunities to members with off-grid or underserved homes or businesses to replace fossil fuel usage with electricity. These opportunities may include service upgrades or line extensions, the costs of which are shared between the utility and the member through customized agreements. (Vermont Electric Cooperative 2019, 3).

Funding for the program is allocated annually and used to reduce the customer cost for projects that meet VEC's screening criteria. All CAP proposals are evaluated for an incentive level that delivers positive rate impacts to members, while addressing the customer need. Project participants typically pay about 75 percent of the cost of the line extension, thus signifying commitment to the continued use of electricity. However, incentive amounts are flexible, because project costs and customer economics vary widely. Ultimately, CAP opportunities present the chance to electrify off the grid customers and do so in a way that is responsible and beneficial to all of VEC's membership.

**New Pilot Rate to Support Strategic Electrification**

A common concern of off-grid customers is demand charges. This concern is amplified if the customer has a low load factor or operates seasonally and would be subject to a demand ratchet.[4] Unfortunately, many of the remaining off-grid customers fit this description. These are typically sugaring operations, sawmills, and gravel pits. To address these concerns, VEC created a new Non-Demand Time-of-Use Pilot rate that eliminates demand charges and demand ratchets, as shown in Figure 2 and Table 1. Only new customers joining the utility through VEC's Tier III programs are eligible for this rate, and it is elective. Customers can choose to be billed under one of VEC's other approved and applicable rates, if it would be more cost effective.

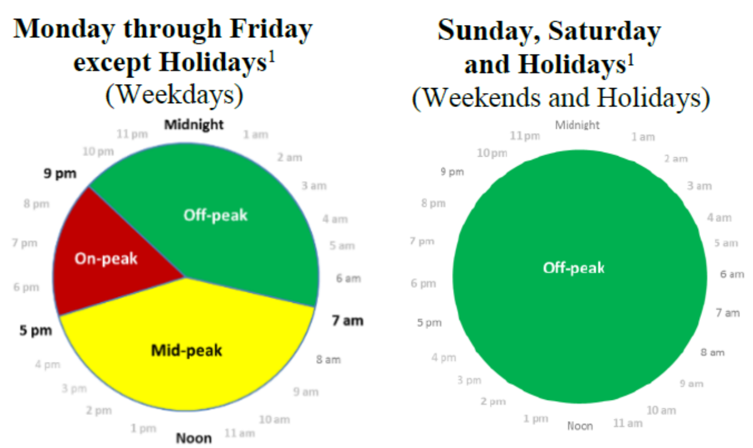


Figure 2. Schedule of off-peak, mid-peak, and on-peak hours for large commercial customers, by day of week, under VEC's Non-Demand Time-of-Use Pilot. *Source*: VEC Schedule of Electric Rates.

[4] Load factor = average load ÷ maximum load for a given period. Load factor is most useful as a metric when aligned with the billing period, as in: monthly kWh ÷ monthly peak kW x hours per month.

Table 1. VEC energy use charges, under the Non-Demand Time-of-Use Pilot for Tier III program participants

| Rate | Cost per kWh |
|---|---|
| Off-peak | $0.12317 |
| Mid-peak | $0.17055 |
| On-peak | $0.30607 |

Time-of-use rates are not new or unique to VEC. However, this rate is a game-changer for sugaring operations (in use for 1 to 2 months per year), gravel pits (operating 6 to 7 months per year), and small sawmills (operating 9 to 10 months per year). The rate aligns their energy bills with their earned income, and generally offers a more favorable overall rate. Businesses that have a more flexible operating schedule can take further advantage of this rate by aligning their production periods with VEC's off-peak and mid-peak schedules. The new pilot rate also reduces the payback period for a line extension, typically making these decarbonization projects affordable for off-grid customers. For example, one previously off-grid customer who was able to take advantage of this new rate is saving nearly 40% on their electric bill, which has reduced the customer's expected simple payback for the line extension to less than three years.

Whereas the new rate addresses one of the challenges in decarbonizing Vermont's rural businesses, it does little to address accessibility to energy supply and the costs to extend the line to remote locations. This is especially true for large customers requiring three-phase power, since the three-phase distribution network is far more limited, and line extensions more costly. Complicating the issue further is the need to balance the program budget with Tier III credits and new electric sales revenue. This conflict became apparent when VEC tried to connect the first sawmill, which required a lengthy three-phase line extension and carried a prohibitively high infrastructure cost. Realizing that the project was in jeopardy, VEC reached out to an unlikely partner for support: the statewide energy efficiency utility, Efficiency Vermont.

## Successful Partnering Leads to Increased Impact

The limit of interaction between DUs and energy efficiency programs has historically come down to one physical point: the electric meter. All activity related to the supply of electricity to a building or operation is the domain of the DU, whereas an efficiency program must work with the customer on the other (demand) side of the meter, to save energy. A line extension would therefore classically be outside the scope of services for an efficiency program, but it does not have to be that way. In fact, the strengths, goals, and resources of an efficiency program complement those of a DU with regard to line extensions.

Take goals for example. Both a DU and an efficiency program share a common goal of fostering economic development, lowering customers' energy costs—and in the case of Vermont or any other state with a renewable energy standard, reducing carbon emissions. The efficiency program's understanding of the customer's operation and internal loads can help to create a load profile and identify coincident peaks, spot underlying power factor issues prior to connection, and assist with new equipment requirements. Finally, an efficiency program might have funds available to help customers who could otherwise not afford to connect to the grid, and would thus continue using their generators. By partnering to take advantage of these strengths, a greater number of customers can be served by these methods, resulting in a higher level of carbon reduction.

Despite the promising returns and potential for higher impact, there was no precedent in Vermont for a DU and an efficiency program to partner together in this capacity on a line extension project. But precedents can change. VEC contacted Efficiency Vermont to inquire about its interest in supporting a line extension. Having never worked together in this capacity meant that relationships were new, and roles and responsibilities undefined. Nonetheless, both organizations determined it was in their respective best interests, as well as in the customer's interest, to pursue a partnership, and forged ahead to find immediate success. The partnership has made a significant difference for the three CAP electrification projects completed to date, with a fourth project scheduled for completion in 2021. Table 2 summarizes the achievements of the VEC / Efficiency Vermont partnership.

Table 2. Tangible results from the VEC / Efficiency Vermont partnership in supporting three line extensions on behalf of customers (values approximate)

| | |
|---|---|
| Number of projects completed (live) | 3 |
| Total length of three-phase line extensions | 2.4 miles |
| Total project costs[5] | $450,000 |
| Total incentives provided | $245,000 |
| Total load electrified | 1,076 MWh / year |
| Estimated diesel fuel savings | 89,000 gallons / year |
| Total $CO_2$ reduction | 393 metric tons / year |

## Tips for a Strong Partnership and Customer Success

Efficiency Vermont and VEC are equally surprised at the early achievements from the partnership and have continued this momentum by partnering on four additional challenging decarbonization opportunities. Both organizations look forward to even more projects that support decarbonization across Vermont. The organizations also mutually recognize that such partnerships could easily be replicated in other jurisdictions. This contribution to the kind of decarbonization strategy that can, on a large scale, create jobs and address the climate crisis comes with both utility and efficiency program insights.

### Communicate Expectations to Build Trust

Building trust and respect with a new partner can be a difficult task. To establish the initial level of trust, VEC and Efficiency Vermont spoke honestly and openly about expectations, which led to an agreed-upon understanding of each organization's respective roles and responsibilities, notably:

- **No stealing of customers or projects.** This principle applies only to partnerships in which each organization has no overlapping managerial or administrative roles. That is, it can apply to a DU and that utility's efficiency program operated by a third-party administrator; or it can apply to a DU and a statewide energy efficiency utility. It is less applicable for DUs running their own efficiency programs, and which therefore have

[5] Cost does not include labor performed by the customer, which in some cases was significant.

customers in common. But the project feature of this principle also pertains to each entity, because each operates under different regulatory structures.

Nevertheless, both parties need to acknowledge that such projects can take a long time to create and carry out. Therefore, the parties typically have a history by the time they are mutually introduced. Whichever party introduces the project idea should become the project lead, unless they agree upon different roles.

- **Show up together.** Important communications triggers, especially communications with consequential outcomes, should be discussed and agreed upon ahead of time. It is very important that the customer experience consistent messaging by the parties.
- **Maintain transparency.** There should be no restrictions on contacting the customer directly. However, customer requests for information should first be shared by the partners to ensure this information has not yet been addressed or provided. Likewise, information from the customer should be equally shared so that both organizations are working with the same information.
- **Promote energy efficiency.** Efficiency improvements will further help the customer manage their energy costs, and each project can result in the efficiency program's or utility's identifying additional energy-savings measures unrelated to the project involving the DU. In some instances, such opportunities might even result in connection equipment that can be downsized. Efficiency opportunities should therefore be included as part of the project scope.
- **Customer advocacy.** Both parties want what is best for the customer. Therefore, each party should retain the right to notify the customer of any adverse costs or operating impacts from the project.
- **Shared savings.** Incentive amounts to the customer and the energy savings split between the supply side DU and the demand side efficiency program should be negotiated for each project. Customer economics, as well as the budget constraints of each partner should inform the incentive offer and savings split.

These principles are a starting point. Regardless of the guidelines, Efficiency Vermont's and VEC's collective experience has been grounded in forthright and transparent communication. Limiting the number of active participants—perhaps designating a point person for each party—helps shorten communication lines and ensures that all parties are kept up to date.

Finally, poker faces and stern demands are not conducive to a partnership that must adapt, by project, to meet each customer's unique situation. Both parties must recognize that they mutually benefit from such projects and therefore should be motivated to make each work, with high levels of customer satisfaction that guarantee the future such projects.

**Get Creative with Incentives**

Although Efficiency Vermont and VEC understand their respective roles in sharing customer incentives and claiming energy savings, there are other ways to offer financial support for projects that are not directly tied to fuel savings. For instance, Efficiency Vermont and VEC jointly electrified a large diesel-driven pump that would operate more efficiently with a variable-speed drive. Efficiency Vermont financially supported the installation of the drive, which resulted in electricity savings, whereas VEC financially supported the electrification of the pump, which resulted in fuel savings. The packaged offering provided the same level of financial support to the customer, but without reducing the savings appeal to either the DU or the efficiency program. The savings resulting from the variable frequency drive also shortened the customer payback for the project.

Incentivizing efficiency improvements unrelated to an electrification project at the time of electrification might be bewildering to some customers. But for others, it could present an excellent opportunity to take advantage of all the benefits available to them. The first facility that the two parties electrified together had maintenance and equipment needs whose costs would be difficult to bear, in light of the large cost of a line extension. Recognizing this challenge and knowing that these improvements would also save energy, Efficiency Vermont offered the customer a cash incentive to use freely on any needs the customer deemed important. The customer used Efficiency Vermont's incentive to re-light their dimly lit mill, significantly improving visibility and safety in the mill, while delivering energy savings. This incentive therefore not only helped the customer make some needed improvements that affected its operational bottom line, but also shortened the payback of the line extension project by reducing the electric bill. Efficiency Vermont also provided an incentive for the line extension itself.

**Third Wheel or Third Party?**

Although Vermont's utilities must meet state decarbonization objectives, customers share no such requirement and therefore must be convinced of the value of decarbonizing their businesses. This creates a natural tension between the customer and the utility, which must sell the customer on the benefits of decarbonized energy use. A third party—in this case, the energy efficiency utility—can help alleviate this tension, but only if it can be seen as a trusted, neutral party and a reliable customer advocate.

For starters, both the DU and the efficiency program should attend important customer meetings whenever possible. This united front will help the customer get to know both parties for the project, and to understand the roles of each organization. This is a matter of each party's respective accountability to the customer.

Next, design the tasks to differentiate your organizations and demonstrate the third-party status of the efficiency program. For example, in metering and analyzing the customer's generating equipment, both the DU and efficiency program have the capability to perform this task; but the DU would typically perform it. Therefore, it should remain their responsibility, unless it is mutually agreed not to. Analyzing the customer economic data should fall to the efficiency program, because no conflict of interest exists. Having the efficiency program perform this duty also establishes it as an independent auditor, providing third-party verification of the analysis. If the efficiency program is successful in establishing itself as a technology and vendor-neutral party, the more the customer will be likely to consult with it if doubts arise.

**Working Together to Highlight the Value of Decarbonizing**

Sometimes customers are motivated to decarbonize their business for personal reasons or out of respect for the communities in which they operate. These altruistic instances tend to be the exception, however. That is, the decision to decarbonize generally comes down to customer economics. The problem is that many customers rely too much on current fuel prices when they make their decisions, not anticipating future market volatility. Figure 3 shows how this simplified approach can quickly create problems later on. What was a savvy investment in 2012 might be considered a bad deal in 2016.


Figure 3. Average price of clear diesel fuel in Vermont, from 2006 to 2021 (data averaged monthly). Data are available only until April 2021. *Source:* VT Agency of Transportation 2021).

Further, a simple analysis based on fuel price does not acknowledge the underlying costs affiliated with using fuel-burning generators. Owners frequently forget to include generator maintenance costs, air quality permits, and productivity losses due to generator outages, when they are calculating what they believe is the true economic impact of decarbonizing their operation. Some of these generator failures can be quite problematic and expensive, too. In conversations with Efficiency Vermont and VEC, one customer said the company was spending $10,000 to $12,000 every other year to rebuild its generator. The maintenance savings for the proposed project turned out to be quite influential in the customer's decision making. It would have been missed, had Efficiency Vermont not dug deeper with its line of questioning to uncover this hidden cost. Such costs are important to capture, because they have a significant effect on the savings possible via electrification.

Equally important to capture is the true cost of electrifying the customer's facility, including the cost improvements needed *behind* the electric meter. This is where the DU's and the efficiency program's complementary strengths become apparent. The DU can scope the entire line extension project, right up to the customer connection point, whereas the efficiency program can work with the customer to determine needed improvements behind the meter. Possible expenses behind the meter are any construction work and electrical equipment required to complete the connection to the facility. Capacitors might be necessary to improve the customer's power factor and to prevent having to pay a penalty.

All contributing project costs should be named and shared openly with the customer to demonstrate that the DU and the efficiency program are working on the customer's behalf to identify all hidden project costs and to provide a comprehensive analysis.

The final product of this combined effort is the comprehensive analysis. It articulates how much the customer is truly paying for energy, what the energy cost would be for the customer if they connect to the grid, and the full cost to connect. Table 3 presents some of the common economic variables considered within each of these cost centers. Providing the customer with a full, itemized breakdown of their operating and project costs has proven to be a catalyst for thought-provoking conversation. It has also proven equally effective at revealing, in a non-judgmental, trust-inspiring way, the full value of decarbonizing their operation.

One final piece of information the customer should have is how quickly the economics of these projects can change. Although simplified energy economics frequently appear to be detrimental to the overall decarbonization conversation, there is no denying the enormous impact that fuel price has on project profitability.

Table 3. Economic variables in a line extension project analysis

| Current operating cost | Future operating costs | Total cost to convert |
|---|---|---|
| • Annual fuel use<br>• Average maintenance cost*<br>• Air permitting cost<br>• Heat recovery possible (via a combined heat and power system)? | • Service charge<br>• Energy charge<br>• Demand charge<br>• Energy efficiency charge<br>• State sales tax on purchased equipment<br>• Heating and cooling impacts | • Line extension (up to the meter)<br>• Site work<br>• Demand side modifications<br>• Power facto correction<br>• DU incentive<br>• Efficiency program incentive |

*Maintenance costs averaged over the lifetime of the generator to account for scheduled and unscheduled repairs.

Rather than hiding the role of fuel price, it is instructive to the customer to present it in plain view—with context to the customer's actual operation. A sample of an actual fuel price comparison provided to a customer is presented in Table 4.

Table 4. Example of how fuel price can influence the customer economics of a line extension project

| Annual electric use (kWh / year) | Equivalent diesel fuel consump-tion (gallons / year) | Total annual electric costs | If fuel cost = $2.25 / gallon | | | If fuel cost = $2.50 per gallon | | |
|---|---|---|---|---|---|---|---|---|
| | | | Annual diesel operating costs* | Annual operating cost savings | Estimated payback (years) | Annual diesel operating costs* | Annual operating cost savings | Estimated payback (years) |
| 300,000 | 23,250 | $53,174 | $59,813 | $6,638 | 8.0 | $65,625 | $12,451 | 4.3 |
| 400,000 | 31,000 | $70,777 | $77,250 | $6,473 | 8.2 | $85,000 | $14,223 | 3.7 |
| 486,231 | 37,683 | $85,956 | $92,305 | $6,349 | 8.4 | $101,707 | $15,751 | 3.4 |
| 500,000 | 38,750 | $88,380 | $94,688 | $6,307 | 8.4 | $104,375 | $15,995 | 3.3 |
| 600,000 | 46,500 | $105,983 | $112,125 | $6,142 | 8.7 | $123,750 | $17,767 | 3.0 |
| 700,000 | 54,250 | $123,586 | $129,563 | $5,976 | | $143,125 | $19,539 | 2.7 |

*Annual diesel operating costs include blended maintenance costs.

Table 4 shows that even a slight change in fuel price has a significant effect on payback. Such visual aids can be highly persuasive if the customer has concerns about increasing fuel prices—or has not considered the possibility that fuel prices could rise. An equally important point to make in the context of a discussion about fuel price is how susceptible the customer's operation is to fuel price volatility. This vulnerability would be significantly reduced if the customer were to source their electricity from a regulated electric utility, where energy rates are much slower to change and require approval from the regulator.

**Highlighting the Non-Energy Benefits**

Although the economic impacts of decarbonizing off-grid manufacturers are obvious, there are hidden benefits that could be of high value to customers, too. Among the Efficiency Vermont / VEC projects, each customer has found value in non-energy benefits such as reduced maintenance costs, not having to deal with frozen diesel fuel and cold generators, noise abatement, the ability to expand operations without needing additional generators or having to revise their air permits, not needing to file for air permits at all, and improved power quality and voltage stability. Other major benefits of utility-driven electrification include elimination of unexpected generator outages and an increase in property value. These non-energy benefits could be of higher value to the customer than the energy benefits and should therefore be highlighted to the customer.

## Conclusion

The challenge to decarbonize the United States and the world, massively and quickly, suggests a mammoth undertaking that extends beyond the electric grid, wherever one might exist. In the United States, businesses operating off the grid in remote outposts are typically proud, family-owned companies and an important source of employment in their isolated locales. Successfully electrifying these businesses via a clean electricity source is a challenge that therefore must be met, if the nation (and other parts of the world) are to act responsibly. Converting DUs' under or unserved customers will require significant resources, which are likely to be more cost effective with partnerships between efficiency programs and the DUs. Efficiency Vermont and the Vermont Electric Cooperative have proven over the last three years that partnering to serve these remote businesses yields beneficial economic and energy results. The model created by this partnership is straightforward and adaptable. Scaled to a far broader scope, the model could effectively fill a significant service gap among American rural manufacturers as they turn toward decarbonization of their operations.

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