ELECTRIC MUNICIPAL UTILITIES AND THE TRANSITION TO A CLEAN ENERGY FUTURE

A Guide for Municipal Utility Leaders

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Ken Colburn retired as RAP's director of US programs in 2020. He continues to contribute to the clean energy transition part-time through his LLC, Symbiotic Strategies.

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Authors, Researchers and Contributors:

Regulatory Assistance Project (lead author)
- Megan Anderson
- Camille Kadoch
- Ken Colburn
- Ruth Hare
- Donna Brutkoski

Pace Law
- Janine Midgen-Ostrander
- Craig Hart
- Jessica Laird

Climate Cabinet Education
- Emma Fisher
- Nick Arnold
- Ethan Kirkham

Pleiades Strategies
- Frances Sawyer

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Design: Tim Newcomb, Newcomb Studios

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A GUIDE FOR MUNICIPAL UTILITY LEADERS

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Executive Summary

Municipal utilities play a central role in the American energy system by providing critical services to their customers. They keep the lights on, power hospitals and schools, enable industry and jobs and increasingly fuel our transportation. The 2,003 municipal utilities in the United States provide electrical power to nearly 15% of Americans, serving as a leading source of employment and economic development in their communities.[1] Municipal utility leaders — whether elected or appointed — thus share a vital responsibility to do right by their constituents and to oversee their utility in a way that delivers optimal value for their community and customers.

The electric utility industry is undergoing a transformation today that is on par with some of the biggest industrial transformations in history. Just as computing and telecommunications rapidly evolved from capital-intensive industries with centralized operations to customer-driven, distributed business models, the energy sector is quickly transforming to be ever more consumer-centric, modular and distributed. These changes are catalyzed by advances in technology, shifting economics, climate policy and customer demands for cleaner energy.

By engaging in this transition proactively, municipal utilities can pursue synergistic benefits for their own operations, their customers and the communities they serve, while positioning themselves to reduce emissions and build systems resilient to climate change. Wind and solar are now the cheapest forms of new generation in most of the United States, and their market share is growing rapidly. Storage and other technologies are coming online to help balance electricity load, including to address the intermittency of renewable generation sources. The clean energy transition provides a unique opportunity for municipal utilities to utilize these resources to provide safer, cleaner, more reliable and more affordable service to their customers.

This paper is designed to provide a guide for municipal utilities seeking to make responsible, forward-looking planning decisions and investments within a clean energy transition while meeting their bedrock obligations to balance load and ensure service reliability in an economic manner.

1 American Public Power Association. (2021a). *2021 statistical report.* https://www.publicpower.org/system/files/documents/2021-Public-power-Statistical-Report.pdf

This Executive Summary provides an entry point for each of the main components of the clean energy transition. Each topic is explored in greater depth in the full report.

The Clean Energy Transformation

The clean energy transformation can be broken down into three trends that are accelerating in parallel, each of which has the power to drive immediate benefits for the utility, customers and the broader community.

Essential components of the clean energy transition include:

1. Energy efficiency
2. 100% carbon-free electricity
3. Electrification

These changes are being set in motion and supported by advances in technology for energy management, generation and storage. And they are driving costs down rapidly, with wind and solar now the least-expensive sources of new generation in most of the United States. In many locations, it is cheaper to build new solar or wind than it is to simply operate aging coal and gas generating facilities.[2] There are key technical constraints — balancing load, ensuring consistent voltage, interconnecting distributed resources — but there are proven methods today to address what once were barriers to wide-scale deployment. Use of these resources now allows the utility to be better positioned for the years to come.

The clean energy transformation is also being driven by policies at the local, state and federal levels that call for or require carbon emissions reductions or the speedy deployment of clean energy through clean energy standards or renewable portfolio standards, as have been adopted in 29 states. Moreover, utility customers are becoming increasingly engaged with their utilities and calling for programs that deliver measurable economic, social and environmental benefits to them and their communities — the same benefits that the clean energy transition can deliver, as illustrated in Table 1.

This transformation is unfolding today and will continue to unfold over the next decade. There are immediate, low-cost, proven actions to take now that will have immediate impact and will also facilitate future actions that can be adopted in subsequent phases of the transition.

Municipal utilities and other public power entities have the opportunity to act nimbly in response to these changes. Due to their not-for-profit status and local governance structure, municipal utilities have a unique opportunity — and clear responsibility — to deliver value to their customers and the public. They can do so by actively pursuing a clean energy transition. The policies and programs that drive emissions reductions align synergistically with multiple community, customer and utility objectives. Efficiency, clean energy and electrification empower a municipal utility to serve its customers more economically and equitably and with much lower environmental impact.

2 Energy Innovation. (2021). *The coal cost crossover 2.0.* https://energyinnovation.org/publication/the-coal-cost-crossover-2021/

The Importance of Municipal Utility Leadership

In periods of rapid change, the job of municipal utility leaders is all the more important. Municipal utilities are usually governed by a board or other municipal entity elected or appointed to exercise judgment on behalf of utility customers and the broader community. Taking steps to begin a clean energy transition today will enable utilities to capitalize on the opportunity to create energy systems for their communities that will realize the multiple benefits of transition. Waiting to act, by contrast, may leave utilities stuck in an outdated model that subjects them to higher costs, less flexibility and greater dependence on outside influences.

In helping to spur and navigate these changes, utility leaders can meaningfully improve the lives of their neighbors. They can advocate for lower bills for all customers and for programs that bring local jobs to their community. They can clean up the air and water by reducing or eliminating pollution from fossil-fueled generating facilities and energy end uses. Leaders can help low-income families by reducing the significant energy burden they face while making their homes safer and healthier to live in.

This guide outlines the actions that a municipal utility can take to engage in the clean energy transition. It provides examples from other utilities that have charted a similar path. This Executive Summary offers an overview of a utility planning process in which the board and staff work together to set goals, understand the options available to them, articulate a path forward and begin to implement a plan. It then outlines a menu of clean energy policies and programs, including energy efficiency programs, beneficial electrification, demand management, clean energy generation, and policies to reduce energy burden.

The guide concludes with an examination of good governance practices that can help utilities engage their customers and community stakeholders along the way. Following this Executive Summary, the guide addresses each of these topics in depth with a rich set of examples, recommendations, proven financing mechanisms and implementation insights. In short, this guide is a comprehensive toolkit for leaders ready to bring transformational best practices to their own utilities.

The Benefits of the Clean Energy Transition

By transitioning to clean energy, municipal utilities have the opportunity to create a more flexible and resilient electric system that realizes many more benefits than the traditional model where power was simply produced in a centralized location to serve demand. The benefits that accrue from more distributed and sustainable energy systems have often been underrecognized, but their value is significant and can be compounded through intentional planning. The benefits can include those shown in Table 1.

Table 1. **Benefits of the clean energy transition**

Benefits to Customers	
Lower Utility Bills	Municipal utilities can lower bills for families and businesses through energy efficiency programs and renewable energy procurement. Energy efficiency is consistently the lowest-cost, highest-value action a utility can undertake. Wind and solar are the cheapest new generation sources in most of the United States today. Moreover, new wind and solar now cost less to build and operate than operating an existing coal or gas plant.
Healthier Homes	Customers who benefit from home weatherization programs are less susceptible to extreme heat and cold, as well as mold and moisture hazards. When homes are electrified, indoor air quality directly benefits from the removal of combustion byproducts within the home.[3]
Reduced Energy Burden, Particularly for Low-Income Residents	Prioritizing energy efficiency, and especially putting programs in place for low-income customers in combination with other policies, can reduce costs specifically for those customers through lower bills and improved, more efficient living environments.

3 Seal, B., & Krasner, A. (2020). *Gas stoves: Health and air quality impacts and solutions.* Rocky Mountain Institute. https://rmi.org/insight/gas-stoves-pollution-health/

Benefits to Communities	
Local Jobs	Municipalities create more local jobs and keep money within the local economy when they invest in energy efficiency, weatherization, beneficial electrification and transitioning their energy system to locally sourced clean power. By investing within the community, municipalities support opportunities for local companies by making them more competitive through affordable, reliable electricity.[4]
Cleaner Air and Water	Traditional fossil-fueled energy sources damage public health as a result of the air and water pollution that comes with the transportation, storage and combustion of fossil fuels and disposal of its waste products. Transitioning to clean energy significantly reduces local air, water and waste pollution.
Healthier Communities	Municipal utilities can improve public health by investing in energy efficiency, beneficial electrification and renewable energy. These changes can help residents avoid illnesses and deaths from heart, respiratory and other ailments caused or exacerbated by pollution.[5]
Climate Change Mitigation and Resilience	Municipalities are feeling the impacts of the changing climate in their own backyards as they grapple with the community and economic ramifications of higher-intensity storms, more widespread and prolonged droughts or floods, and more frequent and severe wildfires.[6] By implementing energy efficiency programs and deploying renewables, utilities can dramatically reduce total carbon emissions, which mitigates worsening climate change and helps ensure a more resilient, reliable energy system in the face of more extreme weather events.

4 Energy efficiency and renewable energy benefit the local economy in a number of tangible ways. For example, a study conducted for Efficiency Vermont concluded that for every $1 million spent on energy efficiency, there was a net gain of 43 job-years. Every $1 of program spending results in a net increase of nearly $5 in cumulative gross state product, an additional $2 in Vermonters' incomes over 20 years and more than $6 in gross energy savings. Optimal Energy & Synapse Energy Economics. (2011). *Economic impacts of energy efficiency investments in Vermont — Final report.* https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/EVT_Performance_Eval/Economic%20Impacts%20of%20EE%20Investments_2011.pdf

5 U.S. Environmental Protection Agency. (2021). *Estimating the health benefits per kilowatt-hour of energy efficiency and renewable energy.* https://www.epa.gov/statelocalenergy/estimating-health-benefits-kilowatt-hour-energy-efficiency-and-renewable-energy; Seidman, N., Shenot, J., & Lazar, J. (2021, September 28). Health benefits by the kilowatt-hour: Using EPA data to analyze the cost-effectiveness of efficiency and renewables. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/health-benefits-kilowatt-hour-epa-data-cost-effectiveness-efficiency-renewables/; Lazar, J., & Colburn, K. (2013). *Recognizing the full value of energy efficiency.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/recognizing-the-full-value-of-energy-efficiency/

6 Intergovernmental Panel on Climate Change. (2021, August 7). *Climate Change 2021: The physical science basis.* Working Group I contribution to the Sixth Assessment Report. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf. See also: Intergovernmental Panel on Climate Change. (n.d.). IPCC WGI interactive atlas. https://interactive-atlas.ipcc.ch/

Benefits to the Utilities	
Cost Savings	The utility can save money through improved electricity system efficiency by strategically deploying solutions to fix perennial stressors on the system. Measures such as reducing total electrical consumption; shaving peak demand and otherwise shaping load; deploying automated demand management; strategically positioning resources within the distribution grid to reduce the need for substation and transmission upgrades; and utilizing storage to extend the benefits of renewables enable the utility to build a safe, reliable, resilient, flexible, affordable and efficient system.
Lower Financial Risk	Local clean energy projects can have shorter lead times, easier permitting, and less onerous financial requirements, thus making investment decisions simpler and subject to less risk. Instead of developing and being responsible for a centralized plant, or even entering into a long-term contract to acquire power from such sources, a municipality can enjoy greater control of its system through investments in clean distributed local resources.
Reduced Policy Risk	States and municipalities are setting greenhouse gas reduction targets and clean energy standards. These requirements may require municipalities to directly or indirectly contribute to emissions reductions. Citizens may also increase requests to their municipal utility to increase investment in cleaner energy resources. Even where such legislation or targets are not in place today, municipalities can anticipate such requirements and choose to act now to mitigate future risk in their resource planning.
Energy Security	Unlike larger, centralized resources that can cause severe grid stability issues when there are unexpected outages, distributed resources can boost grid resilience.[7] Distributed, flexible resources do not leave the utility as vulnerable to reliability concerns when one central generating resource stops producing.
Resilience to Weather Disasters	Higher-intensity storms, unprecedented heat waves and deep freezes, more widespread and prolonged droughts and floods and more frequent and severe wildfires are making the grid harder to operate and maintain. Distributed technologies such as rooftop solar photovoltaics, community solar gardens, generators, local storage and microgrids can provide power locally (and/or to critical loads like first responders and hospitals) during times when the grid is down, flexibly keeping critical services going in emergency situations.
Protection from Fuel Supply Shortages	Events like the 2021 winter Texas freeze and natural gas price spike demonstrate how vulnerable utilities are to wild swings in fuel availability and cost. Renewables have a fixed operating cost that removes risk exposure to global fuel markets, saving utilities and ratepayers money.

7 Intergovernmental Panel on Climate Change, 2021. The events in Texas in the winter of 2021 demonstrate the domino effect that can occur when some fossil-fueled generation is not available. Although that event was especially unfortunate, it is not unprecedented; fossil-fueled resources are subject to numerous insecurities due to weather, transmission availability, price increases and even geopolitics. The electric system is vulnerable to attacks and natural disasters. Using diverse domestic energy efficiency and renewable energy resources enhances energy security by minimizing the vulnerability of the electricity system when attacks or natural disasters occur.

The Clean Energy Toolkit

The leadership of a municipal utility sets the strategic direction for the utility and establishes the policies that staff will execute to reach the utility's goals. In doing so, leaders work closely with staff to ensure they have the relevant information and resources needed to make decisions that will benefit their community.

Municipal utility leaders have a responsibility to shepherd their utility through the changes in technology, generation mix, policy and community demands that are shaping the energy sector today and the opportunity to lead the way toward a 100% clean energy future that serves customers, the utility and the local community well.

For a municipal utility seeking to lead through these changes, the following toolkit offers suggestions for a path forward. In it, you will find insights on resource planning; a guide to proven energy efficiency programs, clean energy generation and demand management technologies; a primer on beneficial electrification; policies to reduce energy burden for customers; and best practices in good governance to guide your decision-making processes.

The remainder of this Executive Summary opens the door to these topics. Each is explored in greater depth in the full report. Examples are included throughout the document offering proven models to follow.

Planning

Planning is the process by which a utility prepares for the future, seeks community input, articulates the values that it wishes to deliver for its community, ensures its financial health and defines an operational plan to serve its customers. Planning has always been a critical aspect of utility operations, but its importance is heightened during periods of high technological and policy change like we see today.

The importance of planning has increased significantly due to several macro trends happening concurrently. In their planning processes, today's utilities are incorporating demands for 100% clean energy, advances in technology of both generation and demand-side resources, the need to make infrastructure more resilient to weather disasters, and renewed calls for direct economic benefits to the communities they serve.

Goal Setting and Benchmarks

Planning begins with an understanding of where the utility needs to go. Utilities can set many different types of goals, such as those focused on economic performance, reliability, affordability and other key topics. The best goals are specific, ambitious and time-bound and built upon a deep understanding of current and future community needs, economic realities and technological progress.

An increasingly common goal for a utility is a carbon-free electricity goal or carbon reduction target. The Lincoln Electric System board in Nebraska, for example, voted for 100% net carbon-free electricity by 2040.[8] Rochester, Minnesota, has set a 100% clean energy target by 2031, understanding that "setting an ambitious, long-term renewable energy target demonstrates political commitment, and can provide both stakeholders and the population an understanding of the long-term vision for the jurisdiction."[9] Sacramento Municipal Utility District, which serves 1.5 million customers, has set an ambitious goal of 100% carbon-free electricity by 2030.[10] As the utility notes in its plan: "This ambitious goal puts the Sacramento Region on the map as an example to follow and a region where innovative, climate-friendly businesses want to be."

These utilities are responding to technological changes, policy signals and customer demands and are setting goals that will guide their planning processes and decision-making.

Integrated Resource Planning

In the resource planning process, typically referred to as integrated resource planning, the utility takes a comprehensive look at opportunities on both the supply and demand sides. Staff and leadership work together to define the utility's future generation mix and design programs advancing energy efficiency, demand management, beneficial electrification and other community benefits.

Technological advances have furthered a paradigm shift in the planning process from an almost exclusive focus on energy supply to a more integrated analysis that includes both supply-side and demand-side levers. These tools include large- and small-scale renewables, smart meters, connected household devices, storage, demand management, energy efficiency, vehicle electrification, consumer engagement programs and other solutions further discussed below. These changes are unlocking opportunities for utilities and customers to save money. In a time of rapid change, such as our own, the planning process becomes all the more important.

This process should be built upon a strong working relationship between the board and staff. Both the board and staff have crucial roles to play in the planning process, in which the board sets strategic direction, represents the community and asks the right questions and the staff works diligently to surface all the needed information and operational knowledge to inform smart policies. The staff then implements the policies the board has established.

Ideally, the planning process is transparent and follows good governance practices, such as creating a clearly structured calendar, opening opportunities for formal public comment, educating customers on decisions and holding public meetings.

Resource Development and Procurement

A utility must develop its resource portfolio to procure the energy resources that will achieve the plan's objectives. Aligning resource procurement with planning ensures the utility matches its planning goals and

8 Lincoln Electric System. (n.d.). *LES decarbonization goal.* https://www.les.com/les-decarbonization-goal

9 City of Rochester. (2014, September). *Proclamation*. https://www.rochestermn.gov/Home/ShowDocument?id=9421

10 Sacramento Municipal Utility District. (2021, March). 2*030 zero carbon plan.* https://www.smud.org/-/media/Documents/Corporate/Environmental-Leadership/ZeroCarbon/2030-Zero-Carbon-Plan-Executive-Summary.ashx

modeling with resource procurement decisions.

Clean energy technologies are often more modular and typically involve shorter project timelines, easier permitting and lower project costs than a traditional generating facility. In addition, there are now a variety of options to structure ownership of generation assets. For example, a utility might own and build its own large-scale renewable energy facility; contract for power delivered via the transmission grid such as from a utility-scale solar or wind developer; develop a community solar garden within the distribution grid; or encourage customers to install behind-the-meter generation, owned by the customer, a third party or the utility.

To navigate these options, many utilities utilize all-source competitive bidding. This process surfaces least-cost market-based opportunities across a variety of technologies and economic models to meet utility needs at low cost and low risk. Thus in a single solicitation, a utility can evaluate the trade-offs between specific utility-owned and -built generation, third-party- or customer-owned generation, and demand-side distributed energy resources to make the best choice for its customers.

In planning, resource development and procurement, it is important to return to the goals the utility has set. Through local economic development and construction, it is often possible, for example, for a utility to drive job creation in the community it serves.

It is possible through good planning and resource development for a utility to lower bills, increase grid resiliency and flexibility, reduce emissions and create local jobs — or bring any combination of such benefits to the community.

A Clean and Equitable Energy Future

To meet the needs and goals identified in the planning process, a utility has a menu of resource options that it can use to maximize benefits for the utility and its customers.

Energy Efficiency

Energy efficiency programs provide the greatest value for utilities and customers, as they provide savings to both the customer and the utility. The U.S. Department of Energy estimates that the average household could save $200-$400 per year through a basic efficiency upgrade.[11] The cheapest electrons, after all, are the ones you do not use. In promoting efficiency, utilities can directly improve quality of life for residents by making homes healthier, lowering energy bills and making interior spaces more comfortable. These benefits are particularly transformational to low-income customers, who experience the highest energy burden, spending on average 8.6% of their income on energy costs, which is almost three times the 3% spent by the average U.S. household.[12]

11 U.S. Department of Energy. (n.d.). *Why energy efficiency upgrades.* https://www.energy.gov/eere/why-energy-efficiency-upgrades

12 Rose, E., & Hawkins, B. (June, 2020). *Background data and statistics on low-income energy use and burden for the Weatherization Assistance Program.* Oak Ridge National Laboratory. https://weatherization.ornl.gov/wp-content/uploads/2021/01/ORNL_TM-2020_1566.pdf; and U.S. Department of Energy. (n.d.) Low-income community energy solutions. https://www.energy.gov/eere/slsc/low-income-community-energy-solutions#:~:text=According%20to%20DOE's%20Low%2DIncome,be%20as%20high%20as%2030%25

For the utility, strategic and well-sited investments in energy efficiency can decrease total energy needs, saving utilities from maintaining, purchasing or developing the highest marginal cost power they use. Utilities are also shielded from price volatility within fuel markets and can sometimes avoid substation and transmission upgrades through efficiency measures at the grid edge. Moreover, as energy efficiency is modular and flexible to implement, there is a low cost to programs, and they can be highly targeted for the desired grid benefit.

Utilities can design and implement a number of energy efficiency programs to achieve different goals and provide multiple benefits to different customer types. As efficiency programs rely on customer participation, it is critical to include community voices within the planning process early to ensure that programs are designed to best meet customer needs.

Energy efficiency programs typically incorporate an energy audit, a menu of solutions for a homeowner or other building owner, and a financing mechanism to fund upgrades or weatherization. The energy audit identifies inefficiencies in current appliances, drafts within the building envelope and other opportunities for energy savings. Proposed solutions may include upgrading to more efficient models of appliances — such as refrigerators, stoves, air conditioners, furnaces or boilers — or adding insulation. Utilities can look ahead to demand management and incentivize the adoption of networked appliances that can be utilized to moderate demand during high-use periods.

To pay for these programs, utilities have a suite of financing mechanisms available. The mechanism used is often dependent upon the targeted beneficiary of the program, with several financing mechanisms specifically structured to advance solutions to low- and moderate-income customers.

The dominant mechanism is to factor the cost of programs into customer rates, just as purchasing power or building a power plant would be. This ratepayer charge is particularly used by investor-owned utilities, which receive a guaranteed rate of return on all investments. Municipal utilities may also finance efficiency programs themselves or institute on-bill financing, in which the utility can receive a payment for the upfront cost of an efficiency upgrade via a customer’s monthly utility bill. These on-bill programs can be direct debt repayment, in which the charge is additional to the cost of electricity, or tariffed, in which the customer and utility share the cost savings from the efficiency upgrades until the consumer debt is repaid. Tariff-based on-bill financing, such as the Pay As You Save (PAYS) program, is designed to increase the accessibility of efficiency programs for low- and moderate-income households.

For low-income customers, there are also specific programs designed to help reduce energy burden. Federal weatherization programs like the U.S. Department of Energy's Home Weatherization Assistance Program uses a formula to distribute funding across the nation. These programs may be supplemented by state and local programs. Utilities can deliver meaningful community value by prioritizing low-income customers in their own efficiency program design, in addition to equitable consumer protections, such as disconnection moratoriums, extended payment plans, and bill assistance through discounted rates, grants and debt forgiveness.

Across efficiency programs, the keys to well-designed and successful measures include: Customers incur little or no upfront cost; utilities wisely utilize low-cost financing for improvements; and the cost is recovered through savings over time. Education and community outreach are essential to the success of these programs, as the outreach a utility does with its customers will have a material impact on how many and which customers take advantage of any given program.

Capturing Demand-Side Flexibility

Demand Management, Time-of-Use Pricing and Net Metering

As emphasized before, there is a paradigm shift in the energy sector. After decades of focusing solely on supplying enough energy to meet demand load, utilities are now actively managing supply *and* demand.

With this change, bringing customers along in the transition to the clean energy system is critical for achieving a utility's goals, because customers' behavior and program participation will have a direct impact on grid flexibility, efficiency and activity. In managing demand, customers are active stakeholders whose trust, decisions and purchases will influence the success of utility programs and policies.

For example, through technologies and customer engagement, utilities can now leverage tools like time-of-use pricing and other demand management — in which customers shift or reduce their energy usage in response to a utility cue and often utility compensation — and behind-the-meter generation to add flexibility, resiliency and cost savings to their operations. In doing so, utilities are shaping energy demand in new ways that were not previously possible but that will drive value for customers and the utilities in the years to come.

Through time-of-use pricing, for example, utilities can guide customers to make choices that shift load from peak hours, when the marginal cost of energy is high, to off-peak hours, when the marginal energy cost is less. Traditionally, utilities design their generation supply around the peaks of daily use, typically in the late afternoon and early evening when businesses are still functioning but workers and schoolchildren begin to return home to turn on the air conditioner or turn up the heat, cook dinner, watch TV, do laundry and engage in other high-energy activities. Time-of-use rates can be used to incentivize customers to lower their peak usage and do high-energy tasks during other hours. These shifts can be manual choices prompted by a request from the utility but increasingly are automated by smart appliances able to schedule their usage around pricing structures.

In addition to measures to move load to avoid daily peaks, utilities also have to grapple with significant weather events that put extreme pressure on grid systems for longer periods of time. These events, such as the 2021 Pacific Northwest heat wave or the 2021 Texas freeze, are becoming increasingly common due to climate change and they can lead to brownouts and blackouts. Many utilities have built (or kept old) power plants known as peaker plants, which are rarely called upon but are available when the grid approaches maximum capacity. These expensive options can potentially be replaced by well-designed demand management programs, which can reduce utilities' peak demand by an average of 10%.[13]

With an increasing percentage of renewables on the grid, demand management is also highly useful for absorbing peak solar and wind loads through electric vehicle charging, space heating or water heating.

Net metering, which provides tariffs that encourage behind-the-meter generation and storage, is another customer engagement tool that utilities can use to shape customer behavior. Through net metering and user-friendly interconnection regulations, customers can install solar photovoltaics and storage at the grid edge, which can provide cost savings, grid benefits and security for customers. Through net-metering programs, customers are compensated for the energy they produce that is sent to the grid. Where present, net

13 Nadel, S. (2017, February 9). *Demand response programs can reduce utilities' peak demand an average of 10%, complementing savings from energy efficiency programs.* American Council for an Energy-Efficient Economy. https://www.aceee.org/blog/2017/02/demand-response-programs-can-reduce

metering, driven by state and local policies, has been very successful at increasing the amount of distributed resources.

Net-metering policies are typically set up differently for different customer groups and can be targeted to different technologies like solar, geothermal, storage and wind. Within a utility service territory, net metering can also be subject to system size caps, which set parameters for individual system size, or program size caps, which establish a cap for the total capacity of net-metering systems installed. There is high variability in how utilities credit excess behind-the-meter generation when it is shared onto the grid.

Promoting Beneficial Electrification for Buildings and Transportation

Electrification is a pillar of a clean energy transition. Electrification will increase demand for electricity from the utility, provide the utility greater flexibility within its operations to meet that demand and allow for end uses to be met more efficiently, which can decrease carbon emissions. Electrification can also help offset reductions in energy demand from energy efficiency programs and any demand or revenue reductions from increased distributed energy resources.

End uses traditionally powered by gas or oil — such as transportation, cooking, home heating and certain industrial processes — can be switched to run on electricity. For many end uses, electrification already makes economic sense, such as electrification of space and water heating and cooling in many locations, and greatly accelerating trends are opening new doors to electrification. For example, 2019 marked the first year in which more than 2 million electric vehicles and plug-in hybrid vehicles were sold in a single year; by 2030, they are expected to make up more than 25% of the global new car market.[14] The electrification of heavy industry, including smelting and kiln processes, is a sector seeing huge research and development investment today.

In addition to driving electricity demand, electrified vehicles and appliances will offer increased load flexibility to the utility. Electrified and connected water heaters, space heaters and vehicles are prime demand levers for the utility to manipulate to reduce or shift demand over various time spans. Through electrified end uses like cars, for example, utilities can productively

14 Walton, B., Hamilton, J., Alberts, G., Fullerton-Smith, S., Day, E., & Ringrow, J. (2020, July 28). *Electric vehicles: Setting a course for 2030.* Deloitte. https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/electric-vehicle-trends-2030.html

utilize peak solar and wind generation by incentivizing charging that coincides with those times of day, functionally storing that energy for later use. Similarly, through networked water and space heaters, utilities can shift demand within a day to shave peak loads during the busiest time of day.

The electrification trend provides benefits for consumers too, as many electrified appliances are more efficient and thus cheaper to run than their fossil-fueled counterparts and offer quieter and more finely controlled operation. There are also significant health benefits to removing combustion from homes and neighborhoods. Replacing a gas stove with an induction cooktop or a gas furnace with a heat pump improves indoor air quality by reducing nitrogen dioxide levels. Homes without combustion appliances have about half the levels of nitrogen dioxides as home with combustion appliances, with indoor levels often exceeding those outdoor. Nitrogen dioxide is an irritant for the eyes, nose, throat and respiratory tract and can cause bronchial and lung issues, including increased risk of respiratory infections especially in young children.[15] Replacing internal combustion engine vehicles with electric vehicles similarly improves local air quality by reducing air pollution and toxic emissions.[16]

Municipal utilities can incentivize more rapid adoption of electric technologies through rebates, education, pricing and other mechanisms. As with other programs, they can target different policies and programs at different customer classes. For example, Twin Rivers Unified School District in Sacramento, California, now operates one of the nation's largest electric school bus fleets, supported by Sacramento Municipal Utility District.[17] The utility and Twin Rivers are also exploring vehicle-to-grid capabilities of the chargers.[18] Such vehicle-to-grid programs and active demand management offer a highly strategic means for a utility to balance supply and demand through engagement with its customers.

Clean Energy Generation

Solar and wind are among the lowest-cost, if not the lowest-cost, generation resources today. Between 2009 and 2021, the cost of wind energy declined 72% and the cost of utility-scale solar declined 90%.[19] In 2020, renewable energy became the second-most-prevalent source of electricity in the United States.[20] Long dominated by coal, nuclear and gas facilities, utilities are now responding to economics, corporate and residential customer demands and environmental benefits and procuring more renewable power by the day.

Given the modular and flexible nature of renewables, wind and solar open up new ownership structures for utilities seeking to procure power. Municipalities can opt to build and own their own clean energy facilities, either at large or utility scale or as a smaller resource, such as community solar gardens on the distribution grid. For example, municipal utilities as different as River Falls Utilities in Wisconsin[21] and Los Angeles Department of Water and Power have installed community solar gardens to help meet local demand and provide benefits within the distribution grid.[22]

In addition to building their own resources, municipal utilities can procure utility-scale renewable power from third-party providers or bid for it on the open market.

Renewable energy, in particular solar, provides an opportunity for utility collaboration with local municipal authorities. Local governments can help foster a positive

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15 U.S. Environmental Protection Agency. Nitrogen Dioxide's Impact on Indoor Air Quality. https://www.epa.gov/indoor-air-quality-iaq/nitrogen-dioxides-impact-indoor-air-quality#Health_Effects

16 Driscoll, C., Fallon Lambert, K., Wilcoxen, P., Russell, A., Burtraw, D., Domeshek, M., Mehdi, Q., Shen, H., & Vasilakos, P. (2021, July 12). *An 80x30 clean electricity standard: carbon, costs, and health benefits.* Clean Energy Futures. https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2343/2021/07/CEF-80x30-7.15.21.pdf

17 Tackett, R. (2021, January 6). *Twin Rivers receives 10 additional all-electric school buses.* School Bus Ride. https://school-busride.com/twin-rivers-receives-10-additional-all-electric-school-buses/

18 Ciampoli, P. (2021, February 1). *Public power utilities, others pursue vehicle-to-grid opportunities.* American Public Power Association. https://www.publicpower.org/periodical/article/public-power-utilities-others-pursue-vehicle-grid-opportunities

19 Lazard. (2021a, October 28). *Levelized cost of energy, levelized cost of storage, and levelized cost of hydrogen.* https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/

20 U.S. Energy Information Administration. (2021, July 28). *Renewables became the second-most prevalent U.S. electricity source in 2020.* https://www.eia.gov/todayinenergy/detail.php?id=48896

21 River Falls Municipal Utilities. (n.d.). *River Falls Community Solar.* https://www.rfmu.org/892/Community-Solar

22 Los Angeles Department of Water and Power. (n.d.). *Shared solar.* https://www.ladwp.com/ladwp/faces/ladwp/residential/r-gogreen/r-gg-ressolar/r-gg-rs-sharedsolar?_adf.ctrl-state=112ab5gc04_49&_afrLoop=272150163533011

environment for renewables developers through transparent siting requirements, well-run permitting processes, the use of municipal open space for utility or community-scale energy installations and the use of municipal rooftop or parking lot space for solar photovoltaic systems.

Good Governance

As local utilities accountable to municipal citizens, municipal utilities are a manifestation of community members coming together to meet local needs. Municipal utilities, as organizations fully under local control, have a very special ability to reflect their hometown values.[23]

It is not always simple for community members to know how to engage. Municipal utilities represent a diverse and often confusing set of governance structures. Each is unique, though each is also responsive to the public and community.

In earning local trust, municipal utilities must build strong community relationships and engage their customers and community in their planning processes and decision-making. At the most basic level, this effort means demystifying their processes in a clear and transparent way so that utility customers know how to find the information they need and how to submit input. It is helpful for the utility to provide an easily searchable public overview of its statutory mandate, oversight structure, utility management and financial information for its customers, ideally on an easily navigable website.

This transparency is critical for a publicly owned entity, particularly as it navigates changes driven by advancing technologies and the clean energy transition. Subject to sunshine laws and public records requests, utilities are encouraged to proactively make transparency a part of their operating culture by hosting public meetings, documenting meeting minutes, providing well-structured and publicized opportunities for public comment and sharing clear recaps of their decision-making with customers.

The clean energy transformation is exciting, and it is something that customers and communities are demanding. Utilities have the opportunity to bring their key stakeholders into the room and to leverage their collective expertise and experience to bring about the diversity of community benefits discussed in this Executive Summary.

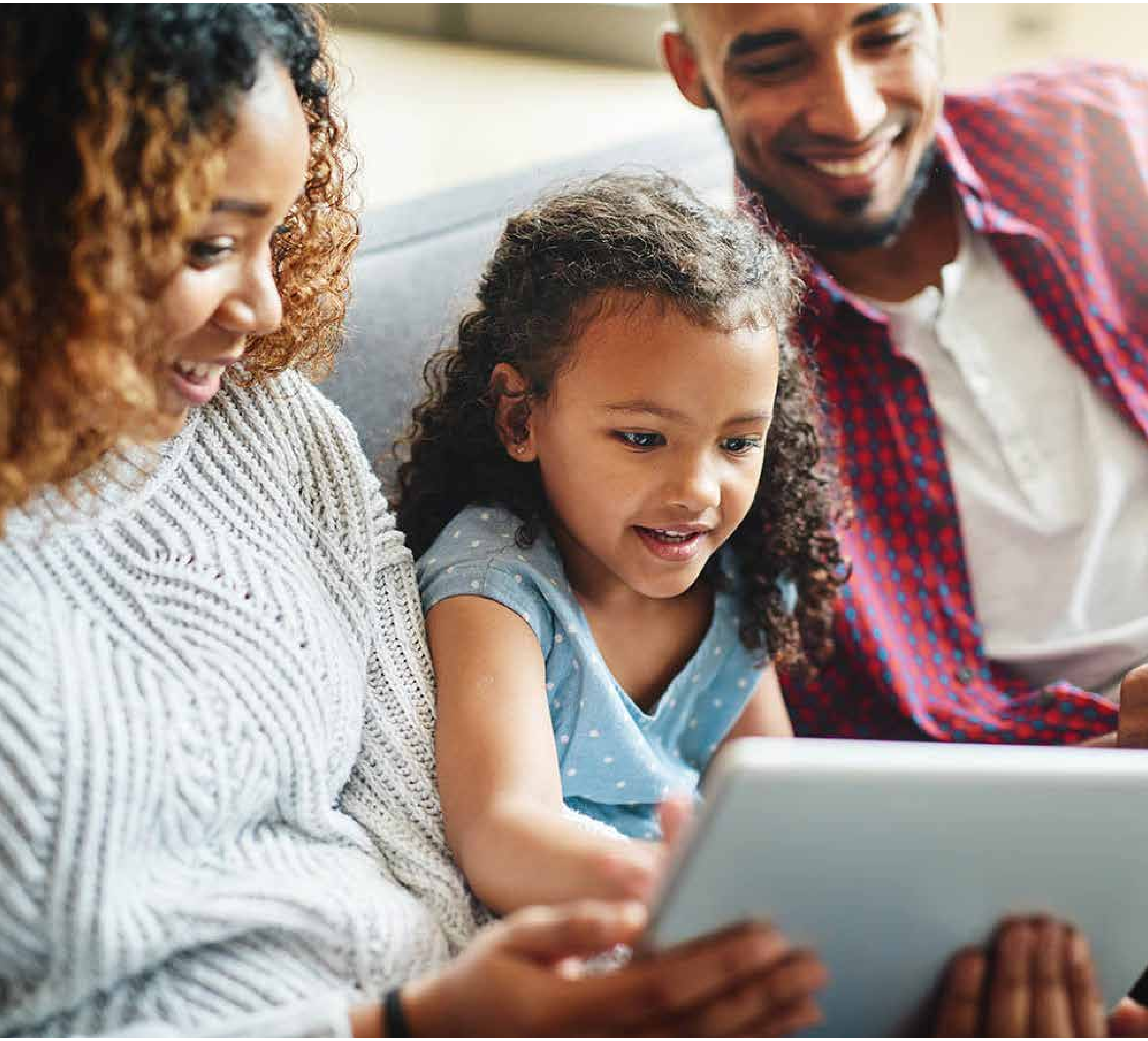
23 American Public Power Association. (n.d.). *What is public power?* https://www.publicpower.org/system/files/documents/municipalization-what_is_public_power.pdf

Conclusion

The trends, technologies, policies and programs highlighted in this paper form a complete package that can provide the lowest cost option for a utility striving to serve reliable electricity to its customers and communities. The clean energy transition likewise provides numerous co-benefits that publicly elected or appointed utility leaders can celebrate and seek out, from local jobs to better health.

These transformations present challenges to utilities but not insurmountable ones. We hope this guide and the examples within it will provide a grounded technical resource for utilities seeking to lead their communities through the changes occurring in the utility industry today.

In the end, these best practices can point the way to positive results for the utility, customers and community.



Full Report

I. Introduction

The energy sector is in a period of significant transformation. The confluence of technology advances, requirements to decarbonize to address climate change, and the numerous benefits of transitioning is driving regulators and utilities to transform how they serve customers. A transition can benefit customers through lower utility bills, healthier homes and a reduced energy burden, in particular for low-income residents. Communities can benefit from investment in energy locally, including local jobs and investment staying within the community, cleaner air and water, healthier communities, and contribution to climate change mitigation. Utilities can also benefit from a shift in approach: A transition to a greater focus on energy efficiency, distributed energy resources, electrification and clean and local energy generation can result in cost savings for the utility, a lower financial risk, reduced risk of being caught behind coming carbon policy, greater security of energy supply, increased resilience to extreme weather and protection from fuel supply shortages. In short, municipal utilities can take advantage of changing circumstances to better serve their customers and community and to strengthen the utility itself.

This guide provides resources and guidance for municipal utilities and others who wish to engage in a shift toward a clean energy transition. It explores the many pieces that may be involved in such a transition, beginning with robust resource planning, then provides information about building a clean and equitable energy future and finally discusses principles of good governance to guide the process and future operations.

Throughout this guide, examples of what other municipal utilities are doing provide concrete ideas, challenges and solutions. We welcome your input into this guide and perhaps examples for inclusion in future editions.

II. Resource Planning: The Cornerstone of a Smart and Equitable Energy Transition

Planning has always been a critical aspect of utility operations, but its importance has grown during periods of high technological and policy change like we see today. Planning is the process by which a utility prepares for the future, seeks community input, articulates the values that it wishes to deliver for its community, ensures its financial health and defines an operational plan to serve its customers.

A. A Changing Planning Landscape

Several trends are changing the way that utilities plan, including advances in technology that allow for supply- and demand-side planning, clean energy goals and emissions benchmarks, changing and more extreme weather patterns driven by climate change, and recognition that utilities can drive significant community value with a focus on equity and inclusive process. These trends set the context in which the utility must develop a plan for future operations.

1. Advances in Technology: Managing Supply and Demand

Traditionally, utilities have managed their electrical systems by evaluating customer demand and procuring supply to meet that demand. Today, technological advances enable utilities to manage both supply and demand. This shift opens the door for utilities to find solutions that meet a variety of community and customer needs, as well as solutions that minimize their own costs.

These technological changes offer new ways for a utility to provide value for its customers and community, but fully realizing the benefits these technological changes enable requires thoughtful planning. For example, on the supply side, utilities are developing or purchasing more renewable resources from both large utility-scale facilities and distributed generation sources. Many are enabling behind-the-meter generation options like rooftop solar. These technologies may have a different generation curve than fossil-fueled plants. The availability of behind-the-meter resources that do not operate 24 hours a day, seven days a week, is leading to reconsideration of the paradigm whereby generation follows load. Instead, as more demand management and rate design options are made available through technological gains, load can follow supply.

On the demand side, energy efficiency programs can decrease load, while vehicle charging and space and water heating can be shifted to allow load to match supply. Demand management programs can shave demand off the highest peaks and can shift newly electrified load to times of the day when less-expensive renewable resources are abundant, such as programs that take advantage of grid-connected water heaters. Smart meters and grid-connected appliances, combined with helpful rate structures, are making such programs more feasible.

Energy storage can further enable the ability to shift demand to match supply and maximize the use of renewable energy. Energy storage is becoming a major factor as storage costs, particularly battery costs, drop. Storage offers a way in which a utility can take greater advantage of low-cost renewable resources by utilizing those resources to charge storage when renewable resources are available and using that storage when renewable generation is limited. Storage can thus deliver renewable energy even when renewable resources are not physically available. In addition, storage resources can provide many grid services, such as balancing and ancillary services, and thus reduce the need for distribution or transmission system upgrades.

Smart pricing structures compound storage opportunities by enabling electrified water heaters and electric vehicles (EVs) to act as storage, which incentivizes charging when renewable resources are plentiful and provides a resource to the grid during peaks.

Many of these technologies are discussed in more detail in Section III-B, "Capture Demand-Side Flexibility," alongside financing options and program design examples. Municipalities can use the planning process to determine how these options can come together to serve customer needs.

2. Clean Energy's Emergence as a Least-Cost Resource

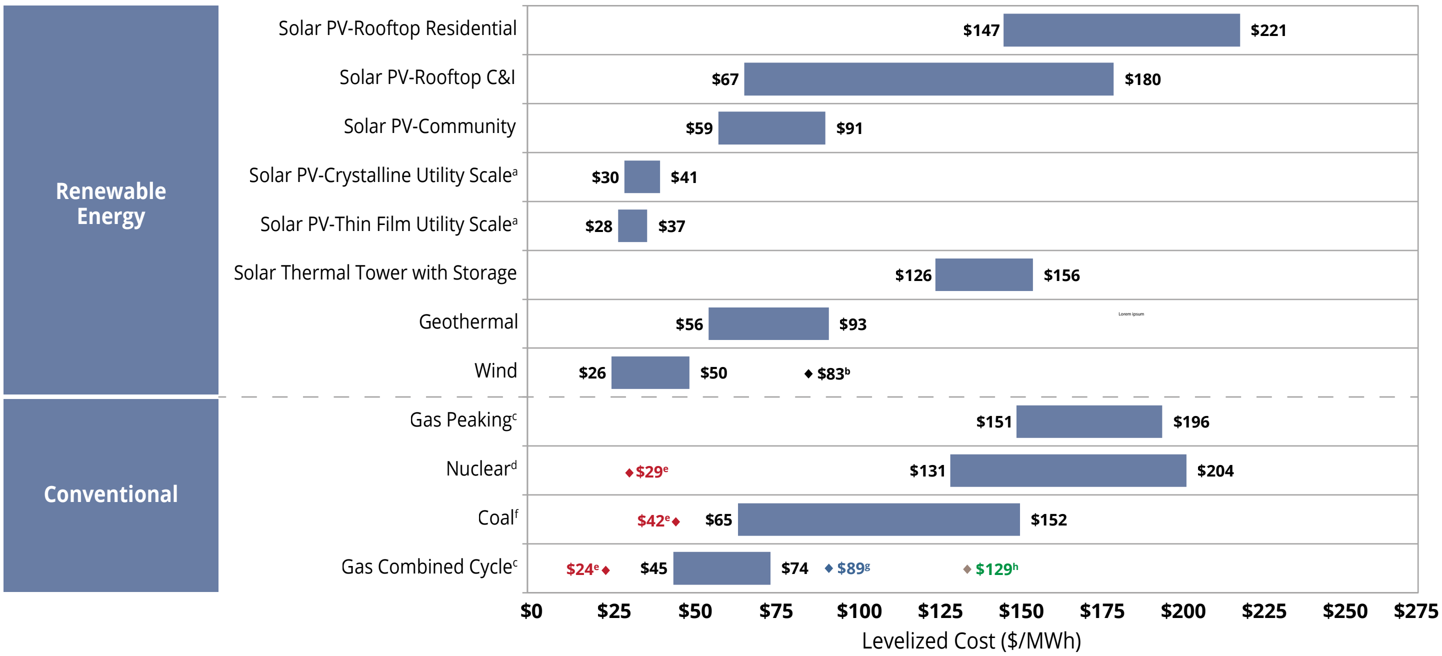
The costs of clean energy resources have dropped exponentially in recent years, and they are now the least-cost resources in many situations. As a result, utilities are no longer procuring these resources solely in response to renewable energy targets. As the analysis below demonstrates, clean energy resources can be less expensive than both new-build fossil-fueled resources (as shown in Figure 1[24]) and the marginal cost to run existing fossil-fueled resources (Figure 2[25]).

24 Lazard. (2021b, October). *Lazard's levelized cost of energy analysis — Version 15.* https://www.lazard.com/media/451905/lazards-levelized-cost-of-energy-version-150-vf.pdf

25 Lazard, 2021b.

Figure 1. **Levelized cost of energy comparison—unsubsidized analysis**

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances



Source: Lazard estimates.

Note: Here and throughout this presentation, unless otherwise indicated, the analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities. These results are not intended to represent any particular geography. Please see page in the original source titled "Solar PV versus Gas Peaking and Wind versus CCGT—Global Markets" for regional sensitivities to selected technologies.

a Unless otherwise indicated herein, the low case represents a single-axis tracking system and the high case represents a fixed-tilt system.

b Represents the estimated implied midpoint of the LCOE of offshore wind, assuming a capital cost range of approximately $2,500 – $3,600/kW.

c The fuel cost assumption for Lazard's global, unsubsidized analysis for gas-fired generation resources is $3.45/MMBTU.

d Unless otherwise indicated, the analysis herein does not reflect decommissioning costs, ongoing maintenance-related capital expenditures or the potential economic impacts of federal loan guarantees or other subsidies.

e Represents the midpoint of the marginal cost of operating fully depreciated gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas combined cycle or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas combined cycle, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper- and lower-quartile estimates derived from Lazard's research. Please see page titled "Levelized Cost of Energy Comparison—Renewable Energy versus Marginal Cost of Selected Existing Conventional Generation" for additional details.

f High end incorporates 90% carbon capture and storage. Does not include cost of transportation and storage.

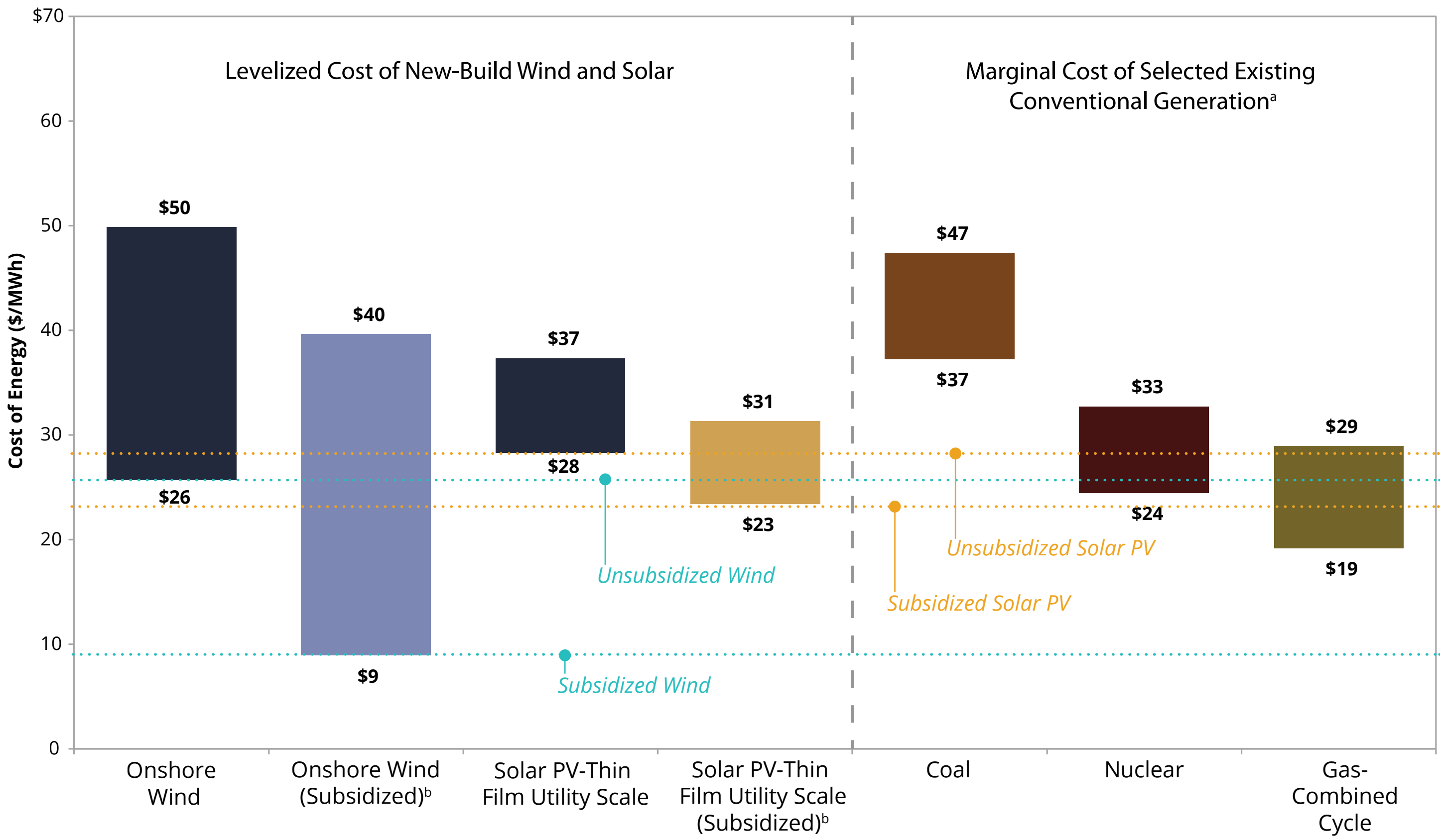
g Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Blue" hydrogen, (i.e., hydrogen produced from a steam-methane reformer, using natural gas as a feedstock, and sequestering the resulting CO2 in a nearby saline aquifer). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $5.20/MMBTU, assuming ~$1.40/kg for Blue hydrogen.

h Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Green" hydrogen, (i.e., hydrogen produced from an electrolyzer powered by a mix of wind and solar generation and stored in a nearby salt cavern). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $10.05/MMBTU, assuming ~$4.15/kg for Green hydrogen.

Source: Lazard. (2021, October). *Lazard's Levelized Cost of Energy Analysis — Version 15*

Figure 2. **Levelized cost of energy comparison—renewable energy versus marginal cost of selected existing conventional generation**

Certain renewable energy generation technologies have an LCOE that is competitive with the marginal cost of existing conventional generation



Source: Lazard estimates.

Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used in the global, unsubsidized analysis as presented on the page in the original source titled "Levelized Cost of Energy Comparison—Unsubsidized Analysis".

a Represents the marginal cost of operating fully depreciated gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas combined cycle or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas combined cycle, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper and lower quartile estimates derived from Lazard's research.

b See page in the original source titled "Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies" for additional details.

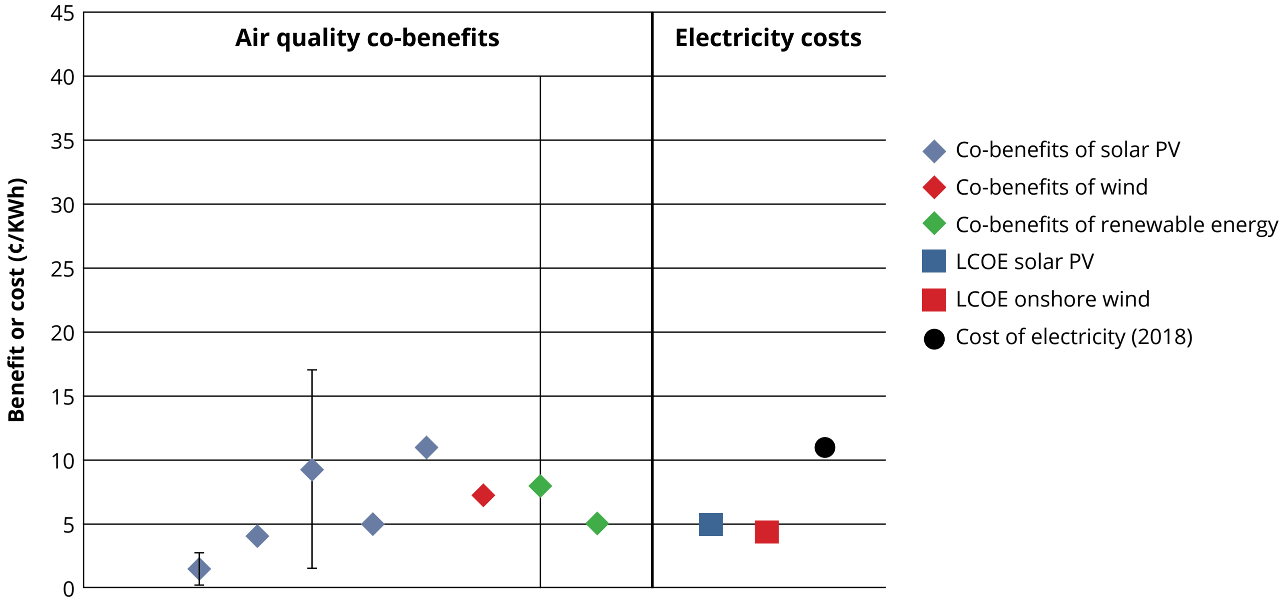
Source: Lazard. (2021, October). *Lazard's Levelized Cost of Energy Analysis — Version 15*

At the same time that the costs of renewable energy resources are decreasing, utilities are responding to calls for cleaner energy coming from customers and policy mandates. Nationally, the United States has committed to a 100% clean energy electricity system by 2035. At least 21 states and Puerto Rico have set 100% clean energy goals,[26] and numerous cities, municipalities and rural electric cooperatives have set similar targets. Regulators and utilities must respond to these requirements. Even where specific targets are not yet a factor, other influences are leading regulators and utilities to consider clean energy. Vocal customers, citing the climate and health impacts of fossil-fueled generation, are demanding more clean energy and more direct involvement with their energy supply. Utilities and regulators are seeing the risks of extending the life of or installing new fossil-fueled generation when future regulatory actions would likely result in stranded assets. As Figure 3 demonstrates, the benefits of investment in clean energy rapidly exceed the costs.[27]

26 Clean Energy States Alliance. (n.d.). *100% Clean Energy Collaborative — Table of 100% clean energy states.* https://www.cesa.org/projects/100-clean-energy-collaborative/guide/table-of-100-clean-energy-states/

27 Gallagher, C. L., & Holloway, T. (2020, November 19). Integrating air quality and public health benefits in U.S. decarbonization strategies. *Frontiers in Public Health, 8,* 563358 (Figure 4). https://doi.org/10.3389/fpubh.2020.563358. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7717953/

Figure 3. **Comparison of selected benefits and costs of renewable energy**



"Graph of the five studies that include air quality and public health co-benefits monetized as cents per kWh (c/kWh) as well as levelized cost of energy (LCOE) for solar PV and onshore wind and U.S. average electricity costs in July 2018 (77, 81-83, 85)."

Source: Gallagher, C. L., & Holloway, T. (2020, November 19). *Integrating Air Quality and Public Health Benefits in U.S. Decarbonization Strategies*

As clean energy resources — which have different characteristics than traditional fossil-fueled supply — become a larger share of a utility's portfolio, utilities will need to change their operations and planning to maximize the benefits of these resources. Greater demand flexibility creates opportunities for utilities to match more malleable demand with supply.[28] These changes can reduce costs and increase resiliency.

3. A Heightened Need to Plan for Resilience to Extreme Weather

Extreme weather is becoming more common in many places. Severe weather can not only endanger communities, they can also endanger the reliability of utility systems those communities rely upon. Flooding from more severe hurricanes and other storm events and larger and hotter forest fires have caused extensive outages. Utility equipment and operations that do not keep up with the threats of more extreme conditions can cause utility systems to break down.[29] These outages have been costly: Fires caused by Pacific Gas and Electric in California, for example, led to prolonged outages that resulted in the loss of human life, loss of fauna and flora, extreme discomfort, property loss for residents and businesses, financial burdens due to spiking prices[30] and disruptions to the economic health of communities and businesses unable to operate for extended periods of times. Utilities have also felt the consequences: increased costs, civil liability for causing outages and even criminal liability for deaths.[31] Adding to the challenge, outages reduce utility revenues needed to cover costs, which can result in rate increases.

To ensure reliable service for customers, utilities are increasingly seeing the need to make their systems more resilient. Resilience can come in many forms, including investing in infrastructure, ensuring a diversity of resources and enabling flexible resources.[32] Experience in the past decade has shown that the key to resilience is to enable flexible resources and demand management so that during extreme weather a larger

28 Murphy, C., Yinong Sun, T. M., Jadun, P., Muradori, M., Nelson, B., & Jones, R. (2021, January). *Electrification futures study: Scenarios of power system evolution and infrastructure development for the United States.* National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy21osti/72330.pdf

29 *United States of America v. Pacific Gas & Electric.* (2022). Final comments of district court upon expiration of PG&E'S probation, No. CR 14-0175 WHA (N. Dist. CA Jan. 19, 2022). https://www.courthousenews.com/wp-content/uploads/2022/01/show_temp.pdf

30 *United States of America v. Pacific Gas & Electric,* 2022; see also Hogan, M. (2021, February 26). *Real-life drama: Learning from a Texas tragedy.* Regulatory Assistance Project. https://www.raponline.org/blog/real-life-drama-learning-from-a-texas-tragedy/

31 United States of America v. Pacific Gas & Electric, 2022.

32 Hogan, 2021.

variety of resources are available.

For example, after Greensburg, Kansas, experienced an EF-5 tornado in 2007 that severely damaged or destroyed "more than 90% of structures in the community," the town set a Long-Term Community Recovery Plan with a comprehensive planning process.[33] Now, Greensburg has rebuilt its municipal utility infrastructure and boasts "100% renewable, 100% of the time," with more resilience to withstand future extreme weather events.[34]

4. Community Economic Considerations

Alongside economic benefits for the utility itself, the decisions that a municipal utility makes determine whether investments in energy stay within the community. Through local renewable generation development, energy efficiency programs and many other tools, a utility can take advantage of existing local companies or bring additional jobs into the community. In addition to the jobs themselves, such investment keeps customer payments within the community economy, thus compounding benefits. These benefits can be both near term and long term, through dedicated workforce development, sustainable programming and more.

B. Goal Setting and Benchmarks

To set planning processes within the broader context of long-term objectives, municipalities can set goals and benchmarks for their energy mix. Setting energy efficiency goals can be a useful place to start, as reducing energy usage is the cheapest way to meet customer demand. Municipalities can then move on to goals and benchmarks to plan for increasing amounts of clean generation or for decreases in emissions. The city of Chula Vista, California, for example, required a reduction in greenhouse gas emissions of 20% below 1990 levels, which it achieved.[35] The city of Grand Rapids, Michigan, has a goal to use 100% renewable energy for municipal operations by 2025. In 2019, 37% of the total electricity consumption from city operations was from renewable resources.[36] These goals and benchmarks can help set a framework for municipalities as they plan for the future.

Municipalities have a number of ways to meet the clean energy goals and emissions reductions benchmarks they set. Some of these options focus on the municipalities' ability to build, procure or permit clean energy. Other options to meet these goals focus on the municipal utility's ability to engage customer participation through rate design signals and incentives.

1. Understanding the Status Quo

Setting goals and benchmarks helps municipalities to keep track of progress. To measure that progress, prior to setting goals, municipalities can first conduct an energy audit to establish usage and the cost of supplying existing energy usage. This data becomes a baseline. Such an audit or inventory enables municipalities to make comparisons, measure success and make new recommendations. This analysis creates a valuable feedback loop for fine-tuning the estimated impact of existing policies and programs on energy reductions and savings.[37]

This information also helps a municipality to set goals. With baseline information, the municipality can set energy reduction long-term goals and shorter-term benchmarks for what can be obtained through energy efficiency (Section III-A), emissions reductions goals, clean or renewable energy goals for new generation and any electrification goals or benchmarks.

2. Types of Goals and Benchmarks

A utility can utilize different types of goals and benchmarks. Some options are listed below, but a utility may choose to develop others.

- **Energy reduction goals** focus on energy efficiency measures that decrease energy use. Some of these goals can focus on reduced energy use from the municipal utility's customers; others can set benchmarks for municipal buildings to achieve.[38] Goals can range from a modest 0.5% per year reduction in energy consumption to 2% per year

33 Greensburg, KS. (2007, August). *Long-Term Community Recovery Plan.* https://www.greensburgks.org/residents/recovery-planning/long-term-community-recovery-plan/view

34 Greensburg, KS. (n.d.). *5 ways we put the "green" in Greensburg.* https://www.greensburgks.org/sustainability/how-we-put-the-green-in-greensburg

35 City of Chula Vista. (2017). *2017 Climate action plan.* https://www.chulavistaca.gov/departments/clean/conservation/climate-action-plan

36 See American Council for an Energy-Efficient Economy. (2021). *Local government climate and energy goals.* https://database.aceee.org/city/local-government-energy-efficiency-goals

37 For more information on setting baselines, see Morse, E., Allan, D., & Frushour, G. (2015). *Best practices in municipal energy management and efficiency.* South Bend Green Ribbon Commission Energy Group. https://clas.iusb.edu/pdf/sustainability-studies/white-papers/SB%20Energy%20Management%20White%20Paper_Final%2012-7-15.pdf

or greater to achieve significant cumulative energy reductions over a span of 10 to 20 years. Increasing the efficiency with which the utility can meet end uses creates additional flexibility to meet demand.

- **Climate action goals** usually focus on carbon reduction targets, such as emissions reduced by a certain percentage relative to a previous level, to be reached by a specific date in the future. To avoid the worst impacts of climate change, RMI models that the U.S. electricity sector needs to reduce emissions 80% to 83% by 2030, compared with 2005 levels.[39] Many municipalities have incorporated this type of data into their climate action goals. Others have committed to meeting the Paris Climate Agreement greenhouse gas reduction goals. Examples:
  - Akron, Ohio, committed to reducing greenhouse gas emissions 20% below 2005 levels by 2025.[40]
  - Atlanta, Georgia, met a goal to reduce existing municipal operations emissions by 20% by 2020. The municipality now has a goal to reduce emissions from municipal operations by 40% by 2030 and by 80% by 2050 from 2009 levels.[41]
- **Renewable energy goals** require that a certain percentage of energy come from renewables, which may include wind, solar, biomass, geothermal and some hydroelectric facilities. State renewable portfolio standards may apply to municipalities in the state as well.[42]

C. Integrated Resource Planning 101

There are several names for utility resource planning: integrated resource planning, least-cost planning, resource planning. But they all describe the same concept: a process by which many different energy resource options, on both the supply and demand

Beneficial electrification as a path to meeting climate and other goals

Historically, adding load to the grid meant increased emissions. However, the carbon intensity of the electric grid in many states is decreasing as states set standards requiring clean energy to replace fossil fuels by specific dates. Even in places that have not set such goals, the grid is becoming cleaner as renewable energy, frequently the cheapest option, replaces fossil fuels and as demand and supply are coordinated to meet needs more efficiently.

As this trend continues, many analyses find that beneficial electrification will be a necessary prerequisite to meeting climate goals.[43] Electrification is beneficial if it reduces consumer costs over the long term, reduces negative environmental impacts or enables better grid management for a more flexible grid.[44] Beneficial electrification can be included in a municipality's energy efficiency goals because energy-saving electric vehicles and advanced electric space and water heating technologies use less energy than their fossil-fueled counterparts. It can also be included in municipal climate action plans because beneficial electrification reduces greenhouse gas emissions, particularly when incorporated with increased renewable energy and energy efficiency policies. Other municipalities may include beneficial electrification within renewable energy goals, similar to states including storage and other nonrenewable goals in their renewable portfolio standard policies.

38 U.S. Environmental Protection Agency. (2021, February). *State & local government coordination: Benchmarking and building performance standards.* https://www.epa.gov/sites/default/files/2021-02/documents/benchmarking_building_performance_standards_section3.pdf

39 Teplin, C., Subin, Z., Corvidae, J., Guccione, L., Hansen, L., Jhaveri, K., Mulvaney, K., & Rea, J. (2021). *The United States' role in limiting warming to 1.5C.* RMI. https://rmi.org/insight/scaling-US-climate-ambitions

40 City of Akron. (2009, April). *Greenprint for Akron.* https://www.yumpu.com/en/document/read/3939262/greenprint-for-akron-city-of-akron-ohio

41 Atlanta Climate Action Plan. (2015, June 3). *Local actions and policies for reducing city of Atlanta's greenhouse gas emissions.* https://atlantaclimateactionplan.wordpress.com/

42 For a full list of state renewal portfolio standards statutes, see National Conference of State Legislatures. (2021, August 13). *State renewable portfolio standards and goals.* https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx

43 For examples of electrification goals, see American Council for an Energy-Efficient Economy. (n.d.). *Beneficial electrification and energy efficiency policy.* https://www.aceee.org/sites/default/files/electrification-dc.pdf

44 For more information on beneficial electrification, see Farnsworth, D., Shipley, J., Lazar, J., & Seidman, N. (2018). *Beneficial electrification: Ensuring electrification in the public interest.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/beneficial-electrification-ensuring-electrification-public-interest/

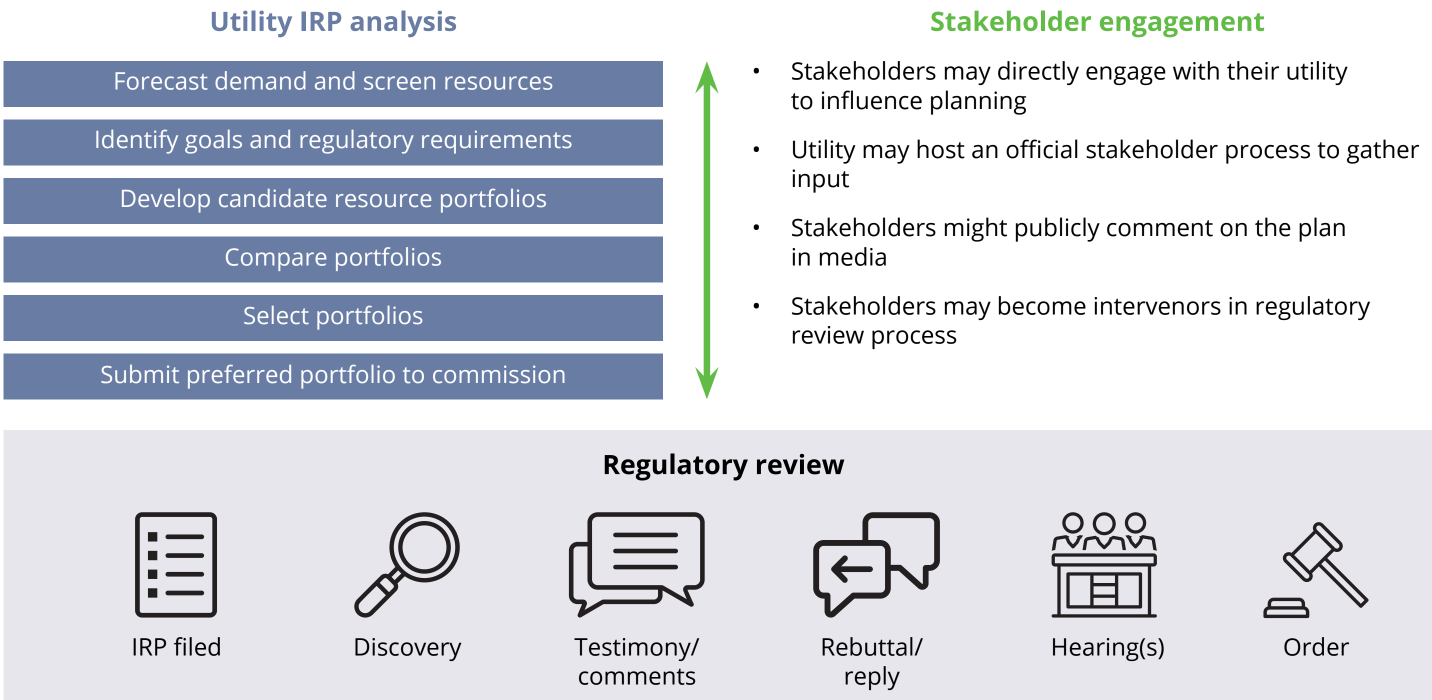
side, can be evaluated in an integrated fashion, with the participation of stakeholders, to arrive at a plan with the least overall cost, within whatever constraints are imposed. For simplicity, and because it is the most recognized term, we will use the term "integrated resource planning" (IRP) to describe the planning processes. It is important to note that the IRP process may vary in size and complexity depending on the size of the utility and the complexity of the system. Developing an IRP process, even if it starts off simply, is a key part of designing a system ready for the energy transition.

All utilities engage in some sort of long-range planning exercise to determine how to acquire the supply and infrastructure needed to serve customers with affordable, reliable and safe electricity. In some jurisdictions, an integrated resource plan is required and must be submitted to the regulatory authority for review and/or approval. Municipal utilities may have their own internal requirements for the review of an integrated resource plan by the board and/or elected officials. Even where such requirements do not exist, an IRP process is a valuable tool for utilities addressing changing circumstances and for planning for the future. IRP processes provide a robust way to do that planning by putting all information on the table, comparing different scenarios to meet demand, exploring options to manage and shape demand and allowing stakeholder input throughout the process to ensure that other perspectives and ideas are included.

The IRP process can create an opportunity for a municipal utility to engage its customers and other stakeholders. In doing so, the utility can both share information about its system, including challenges and opportunities, and receive ideas, input and perspective from outside the utility. We discuss fostering community input in more depth in Section IV, "Good Governance."

There are usually several stages to an IRP process, summarized in Figure 4.[45] First, the municipal utility lays the groundwork by providing information to

Figure 4. **Elements of an IRP development process**



Note: This graphic shows a generalized example of the IRP development process. It does not capture all the variations of analysis, review, or stakeholder engagement, nor the iterations between steps. In this graphic, the regulatory review processes illustrated reflect states in which the regulator has a high level of regulatory oversight.

Source: Based on Bonugli, C., & Ratz, H. (n.d.). *Integrated Resource Plan (IRP) Support Package*

45 Based on Bonugli, C., & Ratz, H. (n.d.). *Integrated resource plan (IRP) support package.* American Cities Climate Challenge Renewables Accelerator. https://cityrenewables.org/resources/integrated-resource-plan-irp-support-package/. For more information, see Duncan, J., Eagles, J., Farnsworth, D., Shenot, J., & Shipley, J. (2021, October). *Participating in power: How to read and respond to integrated resource plans.* Regulatory Assistance Project and Institute for Market Transformation. https://www.raponline.org/knowledge-center/participating-in-power-how-to-read-and-respond-to-integrated-resource-plans/

the board about the planning process alongside key information about existing operations, an explanation of constraining factors and a menu of solutions to meet utility and customer needs. The municipal utility staff and perhaps the board then articulate values and desired outcomes of the planning process. Next, the utility, ideally in coordination with stakeholders, develops various scenarios to meet utility goals in line with any constraining factors. Finally, the utility and stakeholders weigh the pros and cons of those options to arrive at short- and long-term plans for utility operations.

The integrated resource plan itself usually outlines all of these parts of the planning process. Typical elements include the following.

1. Assess Current Operations and Financial Health

- **Planning environment.** How does the utility currently operate? Information needs to be gathered about the utility and the context of the planning process.
- **Financial health.** What are the utility's financial constraints? As not-for-profit corporations, municipal utilities have flexibility in reinvesting in their community but must reliably maintain their own financial health.
- **Current demand and supply.** To plan for the future, it is important to understand where the utility is today. What demand does it serve and what is the current generation portfolio? This assessment includes customer sources of generation, such as customer-sited distributed generation, and an assessment of increasing demand, such as electric vehicle penetration and future targets. Attention to changes in demand and in the supply resources over the planning horizon, such as plant retirements, are critical components.

2. Identify Goals and Regulatory Requirements

- **Utility goals.** At the start of the planning process, municipal utilities can set forth any relevant goals and benchmarks, which might include committing to clean energy or net-zero operations by a certain date, reducing energy bills, decreasing the low-income energy burden, supporting affected community members in the transition from fossil fuels, ensuring a transparent community-based planning process or other goals.
- **Regulatory requirements.** Depending upon the jurisdiction, municipal utilities may be responsible for meeting regulatory requirements set by city, state or federal agencies. These may include clean air and water provisions or clean energy benchmarks.
- **Values.** Underappreciated but helpful in the planning process is an articulation of the utility's values, such as a commitment to transparency, reliability, sustainability, equity, economic development or any number of other factors. Articulating values as part of the process can help with later decision-making, particularly when identifying trade-offs within scenarios.

3. Define Inputs for Resource Planning

There are multiple inputs into a robust scenario plan. During the planning process, it is important for a utility to share information about the assumptions, input and rationale for various scenarios. Those assumptions may be tested through stakeholder input and information. These inputs include:

- **Load forecast.** This predicts future customer demand for energy. Including more than one load forecast will enable the utility to consider how load may change in response to various factors such as energy efficiency programs, climate impacts, electric vehicle uptake, building electrification, population growth or decline, industrial development or customer adoption of solar photovoltaics (PV) and distributed generation.
- **Resource options.** Utilities should explore a full range of resources available to meet their goals. These resources include:
  - **Existing supply- and demand-side resources.** Current generation, including existing power purchase contracts, and demand-side resources. These options may continue to provide value, or the utility can consider whether they are no longer cost-effective.
  - **New demand-side programs.** Potential new demand-side resources or the expansion of current programs, such as energy efficiency potential, demand management programs, rate designs to influence behavior and customer-sited distributed resources.
  - **New supply.** New supply-side options, including new power purchase contracts, development of utility-owned resources in the service territory and possibilities for storage and microgrids as well as the development of customer-sided generation.
- **Distribution and transmission system interplay.** Some integrated resource plans may include an analysis of the interaction of the distribution and

transmission networks. Municipalities will largely be focusing on the distribution system, but an analysis of transmission available to serve the municipality may also be useful in considering available resources, especially if the municipality is buying generation from power plants located outside its service territory.

4. Develop Candidate Resource Portfolios

- **Resource portfolio creation.** These portfolios include a selection of existing and new resources that can meet customer needs during the planning period. By creating various portfolios of resources and accepting such portfolios from stakeholders, the utility can consider different ways that it can meet customer needs, utilizing different sets of resources or demand-side measures.
- **Resource portfolio modeling.** Typically, the utility then models the various scenarios so it can then compare the costs and impacts of the different scenarios to determine a preferred path forward.

5. Compare Portfolios

- **Scenario selection.** The municipal utility then compares the baseline scenario to one or more alternative scenarios. By considering several scenarios side by side, the utility can evaluate costs and benefits of several scenarios. This process is also an important time to stress-test different assumptions within the model to understand the effect of forecasted fuel prices, policy changes, demand fluctuations, operating conditions and other factors on each resource portfolio.
- **Analysis.** The core of the IRP process is to analyze the information gained through the process to determine a best path forward to meet customer needs. Stakeholder input at this stage is especially valuable to ensure that various perspectives are considered.

6. Select a Preferred Portfolio and Recommend an Action Plan

At the end of the IRP process, the utility can choose a preferred portfolio and then develop a plan to determine next steps needed to implement the portfolio. This plan can then guide priorities and next steps for the utility, including determining how to procure the resources or implement the programs that make up the preferred portfolio.

7. Submit the Preferred Portfolio to the Board or Commission for Authorization or Approval

Depending on state and municipal requirements, the municipal utility may then need to submit the plan to the municipal board and, in some states, to the state public utility commission for review or approval. In addition to approval of the plan, municipal board

Municipal utility jurisdiction and authority

Municipalities define the scope of authority of their municipal utilities differently. The authority to operate a municipal utility generally comes about through the legislative arm of the municipality (e.g., the city council), and as such, the municipal utility would have only the authority granted to it by the legislative branch. The scope of authority can allow the municipal utility to operate fairly independently to make all decisions regarding operations and energy procurement, for example. Other municipal utilities may have autonomy over the day-to-day operations but be required to seek approval for certain transactions involving procurement, increases in rates or energy policy from the city council or mayor. In some cases, elected officials may want to maintain oversight of finances, operations and decisions by requiring the municipal utility to present reports on its operations for review. Within these examples of the division of authority, there may be many hybrids, such as allowing the ability to decide and implement innovative rate designs or energy efficiency programs but requiring that increases in rates be subject to approval by elected officials. In any case, it is important to be clear about the jurisdictional divide between what lies within the purview of the mayor or city council and what is the responsibility of the utility.

It is imperative that each municipal utility recognize the parameters of its authority: what it can do independently, when it must seek approval and what is subject to review. Because of the distinctions in authority, we have in places used the term “municipality” generically such that the action should be taken in accordance with the lines of authority, whether it be the municipal utility or the elected officials of the municipality.

members may wish to participate throughout the planning process to provide input and weigh different options as the planning process proceeds. State law and regulation may mandate that the plan include certain elements, and the public utility commission may review solely for inclusion of those pieces, or it may take a broader look depending on state law, regulation and the practice of the commission.

D. Resource Development and Procurement

Once the utility has developed a plan to meet customer needs, the second step is to obtain the resources to meet those needs through resource development and procurement.[46]

In today's energy marketplace, utilities have tools to manage both supply and demand. Traditionally, utilities have managed the generation supply by estimating peak load demanded by the customer base and then building centralized generating plants to meet that load. These plants were large-scale and capital-intensive projects with long time frames for permitting and construction. In constructing them to meet demand, utilities took on sizable financial and project risk.

With changes in technology — particularly advancements in smart meters, connected household devices, beneficial electrification, demand management, storage and renewables — utilities now have tools that can shape demand as well as supply. In addition, these technologies are more modular, with lower average project cost. Using these distributed energy resources, utilities can develop a diverse, situation-specific blend of resources to meet their needs with less upfront financial outlay and far less financial, policy and project risk.

In today's energy sector, generation can be developed and owned by several different players:

- Municipal utilities can develop supply resources on their distribution grid.
- Municipal utilities can develop or contract to procure generation delivered via the transmission grid, such as from a utility-scale wind farm.
- Customer-owned distributed energy resources, such as residential solar systems, can contribute to supply and offer other services to the distribution grid, such as helping with power quality or voltage control.
- Municipal utilities can enter into power purchase agreements to purchase power generated by solar panels, wind turbines, or other forms of energy generation. Sometimes these agreements are part of a consortium in which several utilities own a portion of the plant.
- Municipal utilities can develop and engage demand-side flexibility through energy efficiency and demand management programs.

By combining resource planning with resource procurement, utilities can test their preferred scenarios to determine whether those resources can be acquired and meet demand consistent with what scenario modeling has shown. Municipal utilities can also use results from previous procurement, adjusted for changes in costs, to inform scenario planning and modeling. In short, resource planning and resource procurement are most effective when done in an iterative and integrated manner.

We explore these technologies in depth in the following section. One takeaway is that given the diverse options available to a contemporary utility, it is possible through good planning for a utility to lower bills in the long term, increase grid resiliency and flexibility, reduce emissions, work to minimize energy burden and create local jobs or any series of such benefits that a utility seeks to achieve.

Useful Resources on Planning and Procurement

Duncan, J., Eagles, J., Farnsworth, D., Shenot, J., & Shipley, J. (2021). *Participating in Power: How to Read and Respond to Integrated Resource Plans.* Regulatory Assistance Project and Institute for Market Transformation. https://www.raponline.org/knowledge-center/participating-in-power-how-to-read-and-respond-to-integrated-resource-plans/

Lazar, J. (2016). *Electricity Regulation in the US: A Guide* (Second Edition). Regulatory Assistance Project. https://www.raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/

Shwisberg, L., Dyson, M., Glazer, G., Linvill, C., & Anderson, M. (2020). *How to Build Clean Energy Portfolios: A Practical Guide to Next-Generation Procurement Practices.* RMI. https://rmi.org/how-to-build-ceps/

46 Of note, it can be advantageous to combine or otherwise link planning and procurement processes so that information about the availability and cost of different options to meet customer needs inform the utility's planning.

III. Building a Clean and Equitable Energy Future

One of the foundational electricity sector rules, that has operated for over a century, is that overall within a grid system, electricity generated must "equal" or balance the electricity consumed in the same amount at precisely the same time. Based on this rule, grid operators have determined load on a system and adjusted supply to meet it by adding available generation: first using the lowest-cost units, then adding more expensive ones until total electricity demand was satisfied. This is known as economic dispatch. Today, this basic rule has been modified to allow the entrance of new and economical technologies that are smaller and more flexible. New technologies on both the demand and supply side allow for system operators to balance demand and supply in new ways. On the demand side, technologies like controlled water heating and storage, as well as improved transmission capabilities and system operations, allow demand to become flexible. For example, EVs or water heaters can charge during the night when power costs are low or at midday when renewable generation is plentiful and may face curtailment. The customer's needs are met, whether water was heated or the car battery charged five minutes or five hours before it was needed. The flexibility to meet those demands over longer time periods creates new possibilities for grid operators to meet end-use needs while integrating more renewables, realizing cost savings and improved reliability and using existing grid resources more efficiently.

On the supply side, renewable energy resources, fast-ramping and fast-cycling generation, storage and distributed generation allow for generators to produce power more cleanly, closer to load, and matched more precisely to demand. These changes have opened up new opportunities to meet customer needs.

Electricity is an essential component of modern life. Yet at least 79.5 million American adults live in households that struggle to pay their usual household expenses, such as utility bills, rent, food and medicine, according to the latest U.S. Census Bureau Household Pulse Survey. That is 33% of the 249 million Americans over the age of 18.[49] In the United States in 2021, 13.4% of the national population was living below the poverty line. That rate represents more than approximately 42.5 million Americans.[50]

This shift in focus from large, central generating plants to a network of smaller, modular and economic resources on both the supply and demand side allows the electric system to operate reliably in a more nimble manner. It is also an opportunity to incorporate energy customers into the energy transition and to do so in an equitable manner. Increasingly, customers will buy distributed energy resources such as solar PV, storage and microwind or heat pumps and electric vehicles. Utility programs that reduce barriers to access to clean energy technologies for low-income customers and that provide robust and inclusive outreach programs to engage these customers are important both to ensure equitable access and to maximize community benefits. Program design will need to address the specific barriers low-income communities face to be successful. For instance, many low-income households rent rather than own their homes and therefore do not have the ability to make decisions about appliances like water heaters and stoves, or the installation of distributed energy resources. Landlords, meanwhile, have little or no incentive to spend money on equipment upgrades that would only benefit renters who pay the utility bills. Low-income households also tend to live in buildings that are in relatively greater need of weatherization and other basic upgrades and repairs, which can pose a challenge to electrifying their energy uses in ways that increase their home comfort and lower their bills. Successful utility clean energy transition programs will recognize these barriers along with other challenges, including language preferences and cultural barriers such as a lack of trust in government and utilities. These and other community-specific factors will affect the success of efforts to equitably electrify buildings.[48]

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48 Shipley, J., Hopkins, A., Takahashi, K., & Farnsworth, D. (2021). *Renovating regulation to electrify buildings: A guide for the handy regulator.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/renovating-regulation-electrify-buildings-guide-handy-regulator/

49 Lee, L. (2020, November 12). *An estimated 205 million Americans are at risk of utility disconnection. Here's how you can get help.* CNN. https://www.cnn.com/2020/11/12/us/utility-disconnection-help-covid-iyw-trnd/index.html; and U.S. Census Bureau. (2021, December 22). *Measuring household experiences during the coronavirus pandemic*. https://www.census.gov/data/experimental-data-products/household-pulse-survey.html

50 DePietro, A. (2021, November 4). U.S. poverty rate by state in 2021. *Forbes.* https://www.forbes.com/sites/andrewdepietro/2021/11/04/us-poverty-rate-by-state-in-2021/?sh=7e58250d1b38

With these changes to the rules of system operation, a utility can build an energy system that can flexibly rely on resources on the demand and supply side to meet customer needs. This section will discuss these building blocks. We highlight energy efficiency first because of its importance as the first and most cost-effective option. Additional opportunities to manage demand, including engaging customers through rate design, demand response and incentives for distributed energy development, are then explored. Next, we discuss beneficial electrification of end uses including buildings and vehicles, which will both affect load and create additional opportunities for flexibility. We then outline options for clean energy generation, including methods to procure and develop those resources. Because addressing energy burden is a critical part of ensuring that the clean energy transition benefits all members of a community, we include a discussion of policies and programs to reduce energy burden. Finally, this section includes a summary that discusses how all these pieces have roles to play in balancing a decarbonized system to meet customers' needs.

A. Put Energy Efficiency First

Energy efficiency is the first option for utilities to consider and implement. Energy efficiency is not only the least-cost resource option, it can also simultaneously provide savings to the electric system and to individual customers who participate in programs, including decreasing the risk of fluctuations in energy prices. In addition to monetary savings, energy efficiency programs can increase the quality of life for participants by creating tighter building shells that provide more comfortable indoor living environments. Energy efficiency programs are modular and flexible in that they can be scaled to budget, targeted to customer groups, and easily expanded. Energy efficiency programs can also create jobs within the local community.

To put this in perspective: Energy efficiency has become the nation's third-largest electricity resource. Without energy efficiency, an additional 313 large power plants would be needed to meet our energy needs.[51] With energy efficient appliances and home upgrades, customers can save anywhere from 5% to 30% on their utility bills, according to the U.S. Department of Energy.[52]

Despite these benefits, energy efficiency programs are often overlooked and underutilized. Programs can and should be evaluated to ensure they are cost-effective and to determine which programs provide the most savings. Industry tools are available to help the municipal utility determine which programs are best for its community. *The National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources* provides an excellent guide for how to screen programs, taking into account the goals of the municipal utility, as discussed in Section III-A-2 regarding cost-effectiveness screening.[53]

A key piece of making efficiency investments equitable is prioritizing lower-income members of

51 Beadle, R. (2019, May 8). *Benefits of energy efficiency go beyond saving energy and money.* Resource Innovations. https://www.resource-innovations.com/resources/benefits-energy-efficiency-go-beyond-saving-energy-and-money; and EnergySage (2021, August 30). *Why conserve energy: The top benefits of energy efficiency.* https://www.energysage.com/energy-efficiency/why-conserve-energy/

52 EnergySage, 2021.

53 National Energy Screening Project. (2020, August). *National standard practice manual for benefit-cost analysis of distributed energy resources.* https://www.nationalenergyscreeningproject.org/national-standard-practice-manual/

the community. Key to achieving this goal is better targeted outreach to low-income communities so that they are aware of the programs available. Further, greater flexibility is needed in providing people with the opportunity to participate in programs — for example, scheduling energy audits on a weekend so residents do not have to take off from work. Recognizing this, recent legislation in Colorado called for a task force to recommend improved access to state agencies and programs that schedule variable times of day and days of the week for public input and that use different methods of outreach, including language options.[54]

Growing the clean energy workforce

Partnerships between municipalities and community colleges to develop clean energy job training or retraining enable community members to build skills and attract clean energy employers or help community-based employers grow. Denver, while not a municipal utility city, has invested $2 million toward a clean energy workforce that will provide both a training pipeline and construction job opportunities prioritized for local residents and especially those from under-resourced communities.[55] These jobs and the workforce development programs that support them represent a unique opportunity to benefit the whole community while helping bridge the deep, persistent gaps in economic opportunity and access to education within the community. Already, over 2.3 million Americans work in energy efficiency jobs, including in heating, ventilation, air-conditioning, electrical work, insulation and plumbing.[56]

1. Financing Mechanisms

Energy efficiency programs can be funded in numerous ways. The most common method that investor-owned utilities use is to fund energy efficiency through a ratepayer charge. Municipal utilities can utilize this option or, depending on the size and scale of the programs, other approaches such as utility-financed programs, on-bill financing or property assessed clean energy programs or take advantage of federally funded weatherization programs.

a. Municipal-Utility-Financed Programs: Energy Audits and Rebates

The most common mechanism for financing customer energy efficiency programs is to absorb costs in rates, in the same way that purchasing power or building a new power plant would be. Typically, the utility receives cost recovery at the time the costs are incurred or shortly thereafter. If a municipal utility's energy efficiency program is financed in this way, the municipal utility would develop a portfolio of programs and a budget for implementation. For example, the Lansing Board of Water and Light Hometown Help program in Michigan serves income-qualified residential electric customers. Free products and services available under the program include a home energy assessment, a custom energy-saving kit with LED light bulbs, education on other ways to save, and water-saving measures for homes with an electric water heater. The program may also be able to provide financial assistance to replace older appliances including refrigerators, air conditioners, dehumidifiers and air purifiers.[57] Intentional outreach is important to ensure all customers are aware of programs like this when they exist.

54 General Assembly of the State of Colorado. (2021). *HB 21-1266.* https://leg.colorado.gov/sites/default/files/2021a_1266_signed.pdf

55 Denver Office of Climate Action, Sustainability & Resiliency. (2021, November 9). *Denver invests more than $2 million to create green workforce, providing career pathways in a growing clean energy industry.* Globe Newswire. https://www.globenewswire.com/news-release/2021/11/09/2331024/0/en/Denver-Invests-More-Than-2-Million-to-Create-Green-Workforce-Providing-Career-Pathways-in-a-Growing-Clean-Energy-Industry.html; and Community College of Denver. (2021, December 21). *Denver invests more than $2 million to create green workforce, providing career pathways in a growing clean energy industry.* https://www.ccd.edu/blog/press-room/denver-invests-more-2-million-create-green-workforce-providing-career-pathways&sa=D&source=docs&ust=1643130627889377&usg=AOvVaw2hGAZoIJuKg1_Z8coqvPgo

56 National Association of State Energy Officials. (2020). *2020 U.S. energy & employment report.* https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5ee78423c6fcc20e01b83896/1592230956175/USEER+2020+0615.pdf

57 Lansing Board of Water and Light. (n.d.). *Hometown Help.* https://www.lbwl.com/hometownhelp

b. On-Bill Financing

On-bill financing is a loan made to the utility customer to pay for energy efficiency improvements.[58] The utility collects the regular monthly payments through the utility bill until the loan is repaid. This mechanism can be designed to apply to one or more customer classes. In most cases, the loan funds are provided by the utility or a program administrator.[59] There are generally two kinds of on-bill financing: one in which the financing is a loan with debt repayment added to the customer's bill, and another that is tariff-based. With the Pay As You Save (PAYS) program, the costs of the energy efficiency are recovered through a tariff. The benefit of a tariff-based program is that all customers can be eligible for the program, reaching a larger group since many low- and moderate-income (LMI) customers are routinely disqualified from other debt-based on-bill financing programs.[60] The PAYS program can therefore serve typically hard-to-reach households such as single-family-home renters, mobile home residents, multifamily apartment renters and low-income customers.[61] Utilities with tariffed on-bill programs have reported estimated kWh savings of greater than 20%.[62]

Although there are differences between on-bill financing programs and tariffed-based programs, they essentially work in the same manner:

1. Energy savings are installed in a home or building with no upfront cost from the customer.
2. The municipal utility pays for it through low-cost financing. The utility recovers a monthly set amount in the customer's bill and remits it to the lender.
3. Once the costs are recovered, the payment ceases, and the customer enjoys larger bill savings.

Some key elements of on-bill financing include:

- All residential customers are eligible.
- There are no upfront costs.
- To make this work for low-income customers, there are no credit scores or debt-to-income ratios.
- An energy audit is performed to determine the most cost-effective measures.
- The cost-recovery charge is established to be less than the estimated savings from reduced use so that customers get a bill reduction benefit from the beginning.
- The customer is subject to disconnection for nonpayment.
- The charge for repayment remains with the dwelling should the customer move.

The benefit for customers is that it creates no loan debt that would occur if the customer procured energy efficiency installations or products independently, and it allows the customer to repay over time while still saving on energy bills. For utilities, it provides a mechanism to finance energy efficiency at the lowest-cost resource option without having to raise rates. The risk of nonpayment is reduced because if structured correctly, the customer's overall bill goes down. For society, it accelerates the adoption of clean energy options and improves the environment and the health and productivity of its citizens.

The City of Tallahassee Utilities offers financing for various energy-saving appliances, measures and systems including solar.[63] The city offers 5% interest financing for more than 25 energy efficiency measures. Loan payments are made on monthly utility bills. Financing terms are up to five years for most measures and up to 10 years for solar measures and for certain items in qualifying historic homes. Notes are secured with a property lien.

c. Property Assessed Clean Energy Program

A property assessed clean energy program allows customers to finance energy efficiency and renewable

58 For more information, see Energy Efficiency Institute Inc. (2021). *PAYS essential elements & minimum program requirements.* https://www.eeivt.com/pays-essential-elements-minimum-program-requirements-2/; Henderson, P. (2013, July). *On-bill financing overview and key considerations for program design.* National Resources Defense Council. https://www.nrdc.org/sites/default/files/on-bill-financing-IB.pdf; and Gardner, J. W. (2017, February 12). *On-bill financing with tariffed on-bill program in Kentucky: How$martKY* [Presentation]. National Association of Regulatory Utility Commissioners Winter Committee Meetings. https://pubs.naruc.org/pub/0BCFCDDC-DDA6-7D08-AE1D-A077B87835D3

59 A program administrator can be an independent nongovernmental entity; a utility administrator, in this case a specialized group within the municipally owned utility; a governmental administrator; or a hybrid of the above.

60 Hummel, H., & Lachman, H. (2018). *What is inclusive financing for energy efficiency, and why are some of the largest states in the country calling for it now?* ACEEE Summer Study on Energy Efficiency in Buildings. https://www.aceee.org/files/proceedings/2018/assets/attachments/0194_0286_000158.pdf

61 Hummel & Lachman, 2017.

62 Hummel & Lachman, 2017.

63 City of Tallahassee. (n.d.). *Energy-efficiency loans — Residential customers.* https://www.talgov.com/you/you-products-home-loans.aspx

energy improvements through a tax assessment that runs with the property.[64] The advantage of the program is a lower interest rate, but this needs to be balanced with the cost to the customer of the overall payment. The downside is that in contrast to on-bill financing, these programs can lead to higher risks for consumers due to credit score considerations and instances of predatory loan structures.[65] It should be noted that this becomes a debt payable with taxes, so affordability of the loan is important.

2. Cost-Effectiveness Screening for Energy Efficiency Programs

Energy efficiency programs decrease the demand on the system and can reduce the need for new, more expensive supply-side resources. To maximize the benefits of energy efficiency, programs should be screened through a cost-effectiveness test to determine which programs provide the most savings. The *National Standard Practice Manual* provides an excellent guide for how to screen programs taking into account the goals of the municipal utility as the energy efficiency provider.[66] The manual does not prescribe one test but rather creates parameters for jurisdictions to include their own inputs in accordance with their needs. It includes a five-step process: articulating goals, including utility system impacts, deciding which nonutility system impacts to include (such as improvements in air quality and health), ensuring that benefits and costs are properly addressed and establishing comprehensive and transparent documentation.

A secondary test can also be deployed for discrete purposes, such as to ensure program availability for low-income customers by reallocating program costs so that the bulk, if not all, of the costs are borne by the utility and its customers instead of the low-income customer, who would otherwise not be able to participate. These programs may include measuring the societal benefits of reducing trips to the hospital, absenteeism from work or school and service disconnections.

The *National Standard Practice Manual* also includes a list of potential impacts from the utility, customer and societal perspective that can be very helpful in cataloging the full benefits to be included in the benefit-cost analysis.

3. Weatherization for Low-Income Customers

Energy affordability is a significant problem for low-income customers, who typically pay 13.9% of their income on energy, compared with the 3% that other households pay.[67] Energy efficiency targeted for low-income households can therefore have a significant positive impact on monthly household energy expenditures. A big efficiency opportunity is weatherization, or weather-proofing buildings to limit leaking of air-conditioning or heating.

One of the main sources of weatherization is the U.S. Department of Energy Home Weatherization Assistance Program, which provides funding to all 50 states, the District of Columbia, Native American tribes and U.S. territories through an allocation formula.[68] The funds can be used for specific mechanical, building shell, energy and water, and health and safety measures as well as client education.[69] This program is able to fund approximately 35,000 homes per year and helps save approximately $283 in energy costs per year per dwelling. (The average weatherization cost is $4,695 per unit.) Thus, this program alone is not sufficient to cover the energy efficiency needs of low-income customers and needs to be supplemented with state and local programs as well as programs offered by the utility in

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64 For state-by-state status of these programs, see PACENation. (n.d.) *PACE programs.* https://www.pacenation.org/pace-programs/

65 Burns, R. (2021, April 6). *The subprime solar trap for low-income homeowners.* Bloomberg Green. https://www.bloomberg.com/news/features/2021-04-06/the-subprime-solar-trap-for-low-income-homeowners

66 "The *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources (NSPM for DERs)* provides a comprehensive framework for cost-effectiveness assessment of DERs. The manual offers a set of policy-neutral, non-biased, and economically-sound principles, concepts, and methodologies to support single- and multi-DER benefit-cost analysis (BCA) for: energy efficiency (EE), demand response (DR), distributed generation (DG), distributed storage (DS), and (building and vehicle) electrification. It is intended for use by jurisdictions to help inform which resources to acquire to meet their specific policy goals and objectives." National Energy Screening Project. (n.d.) *National Standard Practice Manual (NSPM).* https://www.nationalenergyscreeningproject.org/national-standard-practice-manual/

67 U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. (n.d.). *About the Weatherization Assistance Program.* https://www.energy.gov/eere/wap/about-weatherization-assistance-program

68 U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. (2021, January). *Weatherization Assistance Program* [Factsheet]. https://www.energy.gov/sites/default/files/2021/01/f82/WAP-fact-sheet_2021_0.pdf

69 U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, 2021.

order to reach a larger portion of the population.

Municipal utilities can work with the community action agencies or local groups that provide weatherization programs for low-income customers by offering additional funding to expand programs or to provide specific weatherization measures. This is an efficient way to reach more customers with minimal use of utility staff and resources. For example, Knoxville Utilities Board offers the Home Uplift program, which provides weatherization and energy efficiency upgrades to low-income customers. The program is funded by the Tennessee Valley Authority, the Tennessee Department of Environment and Conservation, and Knoxville Utilities Board. In fiscal 2021, the utilities board committed to an annual contribution of $1 million for low-income home weatherization, which will be used in conjunction with the Tennessee Valley Authority's Home Uplift funds, customer contributions and other sources.[70]

Useful Resources on Energy Efficiency

U.S. Environmental Protection Agency. (2011). *Energy Efficiency in Local Government Operations.* https://www.epa.gov/sites/default/files/2015-08/documents/ee_municipal_operations.pdf

70 Knoxville Utilities Board. (n.d.). *KUB weatherization programs*. https://www.kub.org/uploads/Round_It_Up_Program_Handout_1.pdf

B. Capture Demand-Side Flexibility[71]

Municipal utilities are required to provide customers with reliable energy around the clock. To do so, the utility matches energy supply with the highest expected energy demand that may be needed at a given time. The need for supply at these high demand times means that at times of low demand, typically nighttime hours, excess energy is available. It also means that there are times of high demand on the grid each day, similar to rush-hour traffic. High-traffic energy times occur predictably in the late afternoon and early evening when people start returning home and using air conditioners, cooking, watching TV and doing laundry, while commercial buildings and offices are still open and industry is operating.[72]

In addition to daily peaks of energy usage, there are also extreme events, usually due to weather, such as very hot summer days or extreme winter storms, that can stress the grid, causing customers to use more energy than usual to heat or cool their buildings. These events can lead to demand that exceeds the utility's available energy supply. Unresolved, this mismatch between energy supply and demand can lead to brownouts and blackouts.

Different options are available to utilities to fill both daily peak demand and these periodic, unexpected shortfalls of energy supply. Historically, utilities built excess generation that could be called upon during times of grid stress. Many utilities have built (or kept old) power plants known as peaker plants, which are rarely called upon but are available when the grid approaches maximum capacity. Using peaker plants is a costly option, both in terms of finances and environmental impacts; peaker plants have high fuel costs when operated, so the power they supply can be very expensive. Additionally, if they are older plants that are mothballed and kept mainly to meet periodic

71 See Budhiraja, D. (2019, January 24). *Demand response 101: Understanding how utilities balance energy supply & demand.* GridPoint. https://www.gridpoint.com/understanding-demand-response/ and Linvill et al., 2019.

72 See Budhiraja, D. (2019, January 24). *Demand response 101: Understanding how utilities balance energy supply & demand.* GridPoint. https://www.gridpoint.com/understanding-demand-response/ and Linvill et al., 2019.

energy shortfalls, they may not meet current emissions requirements but are nevertheless allowed to run in emergency situations.[73] An alternative supply option is for a utility to purchase power if it is in a regulated market.

A more efficient approach involves managing demand to more fully utilize existing grid capacity and to effectively integrate interconnected devices to create a smart two-way grid. In short, to meet these variations in supply and demand, utilities can engage customers. Customers can be encouraged to change or shift the time they use energy through time-varying pricing and demand management programs, which are discussed below. The pricing policy can also encourage customers to invest in distributed energy resources, which municipal utilities can encourage by providing net metering. Pricing and demand management programs can also shift energy use for customers' electric vehicles or space or water heaters to absorb excess renewable energy. Further, municipalities can offer energy efficiency programs — the most effective option to decrease peaks and manage demand.

Policies that are used to engage customers to capture demand-side flexibility include:

- Demand management programs.
- Time-varying pricing.
- Net energy metering and interconnection policies.

These policies are not meant to be used in isolation, and they work well together. For example, time-of-use (TOU) pricing is a rate design that may be incorporated in demand management and beneficial electrification programs.

1. Managing Demand to Realize Utility and Customer Benefits

A key to realizing system flexibility is to successfully engage customers. Because shaping energy demand previously was not technologically possible, utilities have not focused on methods to engage customers or communicate grid needs. Now, changes in technology allow the customer to save money and the utility to make the most effective use of grid assets through demand management.

Demand management[74] occurs when customers intentionally reduce or shift their electricity usage in response to a signal from the utility, usually with financial incentives to do so. Historically, the technology has not been available to store energy or shift energy

Benefits of demand management

- Reduces peak demand by an average of at least 10%.[75] This reduction:
  - Saves customers money.
  - Enables the municipal utility to avoid or defer the need to build or purchase additional generation capacity, which also leads to savings for customers.
  - Provides environmental benefits through reduced emissions, particularly if demand is able to be shifted to times when cleaner generating sources are abundant.[76]
- Helps integrate zero-emissions electric generation and end uses.
  - The flexibility of demand management enables the integration of variable energy resources like wind and solar by shifting electric vehicle charging and appliance use to times when these resources are abundant.
- Reduces greenhouse gas emissions.
  - When demand management programs reduce peak load, they also help to reduce air pollutants from existing fossil-fueled generating sources.
  - Demand management programs can provide flexibility to support growth of zero-emissions generation.[77]

73 This practice is known as "reliability must run" exceptions.

74 Demand management has been known by various terms over the decades, including demand response and demand-side management. "Demand response" is a historical term used when such programs were used to provide cost-effective energy and capacity resources to help defer the need for new sources of power, including generating facilities, power purchases and transmission and distribution capacity additions. However, due to changes that are occurring within the industry, electric utilities are also using demand management or demand-side management as a way to enhance customer service. See U.S. Energy Information Administration. (n.d.). *Electric utility demand side management.* https://www.eia.gov/electricity/data/eia861/dsm/

75 Nadel, 2017.

76 Hurley, D., Peterson, P., & Whited, M. (2013). *Demand response as a power system resource.* Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2016/05/synapse-hurley-demandresponseasapowersystemresource-2013-may-31.pdf

77 National Association of Clean Air Agencies. (2014). Improve demand response policies and programs. Chapter 23 in *Implementing EPA's clean power plan: A menu of options.* https://www.4cleanair.org/wp-content/uploads/Documents/Chapter_23.pdf

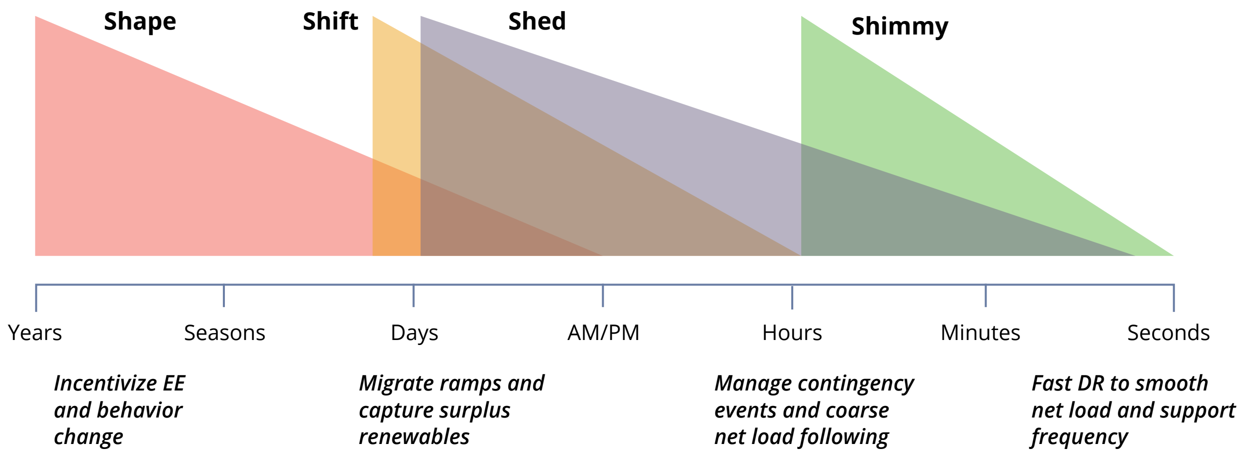
use. Consequently, management of the grid was largely a one-way option — namely, to build more power generation to meet peak load requirements. Today, rather than dispatching supply to meet uncontrolled demand, technology advances allow management of the demand side to meet available supply. Demand management is not new, but traditional demand response programs focused on simply shedding load during periods of grid stress. Today, demand management includes the ability to respond to other grid needs. Now, average residential customers are increasingly able to control their energy usage through efficiency upgrades and energy management tools and even to become grid resources themselves through behind-the-meter solar or storage. The ability for demand to play a role in balancing grid operations is a fundamental shift from the 20th-century era of large, centrally operated generating plants.

Managing the demand for electricity is now an option that can be utilized to make more efficient use of the grid, reduce customer costs and reduce environmental harm. Demand management programs are common and are fairly simple to implement. They rely on two types of mechanisms: (1) sending quantity signals to customer appliances and devices (direct load control programs); and (2) sending price signals to customers to alter their consumption habits (time-varying rates). Utilities, municipalities and electric cooperatives have used these types of programs for decades.

Demand management programs today can provide load flexibility over different time frames, as illustrated in Figure 5.[78] It is useful to think about these types of flexibility within the time frames they can operate, moving from the longest span of years and days for shaping down to time frames of minutes and even seconds for shimmying.

In practical terms, this means demand management can shape load away from expensive peaks. It can then shift load and grow load at times when renewable energy is available and energy is less expensive. It can shed load in a controlled manner during critical energy events, and it can shimmy load back and forth to meet short-term grid needs. EV charging is an example of a technology that can shimmy because it can occur all at once or can be turned on and off as the need arises.[79]

Figure 5. **Shape, shift, shed and shimmy — time frames of flexibility**



Source: Alstone, P., Potter, J., Piette, M. A., Schwartz, P., Berger, M. A., Dunn, L. N., Smith, S. J., Sohn, M. D., Aghajanzadeh, A., Stensson, S., Szinai, J., Walter, T., McKenzie, L., Lavin, L., Schneiderman, B., Mileva, A., Cutter, E., Olson, A., Bode, J., … Jain, A. (2017). *2025 California Demand Response Potential Study — Charting California's Demand Response Future: Final Report on Phase 2 Results*

78 Alstone, P., Potter, J., Piette, M. A., Schwartz, P., Berger, M. A., Dunn, L. N., Smith, S. J., Sohn, M. D., Aghajanzadeh, A., Stensson, S., Szinai, J., Walter, T., McKenzie, L., Lavin, L., Schneiderman, B., Mileva, A., Cutter, E., Olson, A., Bode, J., … Jain, A. (2017). 2025 *California demand response potential study — Charting California's demand response future: Final report on Phase 2 results* (LBNL-2001113), Figure 19. Lawrence Berkeley National Laboratory. https://eta.lbl.gov/publications/2025-california-demand-response

79 Linvill et al., 2019.

a. Methods to Obtain Flexibility

Encourage customers to shift load through time-based rates.

Methods of engaging customers in demand management efforts include offering **time-based rates**. Customers are able to see the cost savings they can achieve if they reduce air-conditioning load, turn off lights or program their dishwasher or washing machine to less expensive, off-peak times of day. Examples of demand management in response to price signals include dynamic pricing programs, peak-time rebates, smart EV charging and smart thermostat programs. (For more detail, see Section B-1-b-ii, "Time-varying pricing.")

Encourage customers to control load through smart devices that can respond to smart rates.

Controllable load, often electrified load, means that virtually all major household electricity uses can be at least partly shifted away from peak periods using smart, responsive technologies. Smart thermostats make it possible for heating and cooling uses to participate in programs like Google Nest's Rush Hour Rewards, which provide incentives to customers that let their thermostat automatically be turned down by a very small amount during peak times.[80] Electric vehicles are a controllable load and can be set to charge at certain times or price points. Grid-integrated water heaters can respond to signals from the utility or demand-side aggregator, and major appliances, such as the refrigerator, dishwasher, washer and dryer, can be grid interactive or scheduled.[81] Smart customer systems such as in-home displays or home area networks can make it easier for customers to change behavior and reduce peak period consumption. These programs also have the potential to help the utility save money through reductions in peak demand, which in turn enables the utility to defer construction of new power plants.[82] The load avoided for a single home may be small, but when many customers participate, it creates a large reduction in energy demand for the utility.[83]

Advanced metering infrastructure (smart meters) expands the types of time-based rate programs that can be offered to customers. The ability to institute various types of time-varying pricing is somewhat dependent on the types of meters used. Retail electricity meters are now available in a spectrum of complexity and capability. Simple conventional meters measure only kWh consumption and are read at intervals, such as monthly, to note the customer's consumption since the last reading. These meters are not able to provide time-of-use price signals. Somewhat more complex meters are capable of not only recording kWh consumption but also of dividing that usage between two or a few preset time periods (a TOU meter), recording the peak load since the previous reading (a demand meter) or both.

At the other end of the metering spectrum, advances in communications and digital technology are bringing down the costs of advanced metering infrastructure and smart meters for the mass market. These innovations are increasing opportunities to send not only long-term average price signals (already possible using conventional meters) but also price signals that reflect weekly, daily, hourly or even real-time variability in system costs and conditions and to record customer usage over time intervals as short as five minutes. Today, just over half of the public power meters installed in the United States are smart meters.[84] Installation of smart meters is just the start, as merely installing smart meters does not alone facilitate advanced pricing; meter data management systems investments, billing engine modifications and rate studies are needed to develop advanced pricing.

Manage customer load for them through utility direct load control.

Demand management also includes **direct load control programs** that allow the utility or private aggregators to directly alter a customer's energy consumption during periods of peak demand in exchange for a financial incentive and lower electric bills for the customer.[85] Radio or internet-controlled switches on residential air conditioners or electric water heaters are but one of many methods used.[86]

80 Linvill et al., 2019.

81 Linvill et al., 2019.

82 U.S. Department of Energy, Office of Electricity. (n.d.-a). *Demand response.* https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid/demand-response

83 Budhiraja, D. (2019, January 24). Demand response 101: *Understanding how utilities balance energy supply & demand.* GridPoint. https://www.gridpoint.com/understanding-demand-response/

84 Zummo, P. (n.d.). *Moving public power forward.* American Public Power Association. https://www.publicpower.org/system/files/documents/Moving-Public-Power-Forward-Community-Driven-Solutions-for-Industry-Transformation_0.pdf

85 U.S. Department of Energy, Office of Electricity, n.d.-a.

86 U.S. Department of Energy, Office of Electricity. (n.d.-b). *Demand response — Policy.* https://www.energy.gov/oe/services/electricity-policy-coordination-and-implementation/state-and-regional-policy-assistanc-4

Direct load control programs represent some of the initial approaches to demand management that existed prior to much of the technology that is available today. These programs result in overall savings for the municipal utility and an incentive payment for participating customers.[87] The majority of direct load control programs are for residential central air-conditioning switches, but some offer a credit for each controlled electric appliance the customer registers with the utility. Electric water heaters and pool pumps are also commonly incentivized with fixed bill credits and cycled by the utility in a similar manner. With air-conditioning, when the utility expects a high peak load day due to very warm weather forecasts, it will notify the customer in advance. When energy demand peaks, the utility will send a signal to a customer's air conditioner (or other appliance) that causes it to operate for a shorter period of time.

A common feature among direct load control programs is that customers have a choice between the level of service interruption they will accept and the amount of an incentive they receive. Typically, these are directly variable: The more interruption a customer will tolerate, the higher the incentive. Residential direct load control programs with cycling options and fixed monthly bill credits offer a simple and understandable method for customers to reduce their addition to peak load without tying the benefit to abstract concepts like kW demand charges or kWh shifting. Until recently, utility direct load control programs have been enabled by a control switch installed on an individual appliance, but with advances in technology, utilities are now able to use programmable communicating thermostats to control household energy use.

Obtain flexibility through regional markets.

Planning and market processes are another tool for adding flexibility to the power system. In regions with a regulated market, more innovative uses of demand management are able to bid into the market to maintain reliability by providing capacity or energy reductions or to reduce wholesale electricity prices and provide economic benefits.[88] Municipal utilities may also be able to work with demand management aggregators to bid demand management programs into a regulated market and provide further economic benefit to municipal customers.[89]

b. Important Elements of Successful Demand Management Programs[90]

Experience reveals several key elements to successful demand management program design and implementation, which include the following.

- **Customer education.** Not only does education through effective marketing enable meaningful demand reduction, it also leads to improved customer satisfaction in both the program and the utility. Customer education is key toward ensuring that demand response mechanisms are properly used by customers to optimize the results. Utilities should prepare a budget specifically for customer education.
- **Incentives and tools.** The utility must provide customers with incentives to participate and the tools needed to achieve savings. Customers are more likely to participate when:
    - They earn a reward, so it is important to show them their measurable savings.
    - The utility provides physical hardware such as thermostats and switches, as well as reliable communication of peak events and tips on how and when to conserve energy.
    - The utility provides immediate feedback on how much customers saved following a peak event.
    - The utility shows customers their savings on their monthly bill.
        - For direct load control programs, a set monthly bill credit (i.e., $4 during summer months) rather than a varying rate discount gives the customer confidence in future savings.
        - For TOU rates, the utility should use historical customer data to calculate the potential impact.
    - Multiple demand management programs are marketed together (i.e., a direct load control switch and TOU rate) rather than in separate marketing campaigns, which can reduce program costs.
    - Third-party demand management program administrators participate, which provides greater

87 Customers respond to utility signals, often with very limited notice, and most often using preheated or cooled water.

88 National Association of Clean Air Agencies, 2014.

89 National Association of Clean Air Agencies, 2014.

90 State of Michigan. (n.d.). *Common demand response practices and program designs.* https://www.michigan.gov/documents/energy/Common_Practices_Feb22_522983_7.pdf

variety in program design and limits the utility's exposure to program-related risks, such as marketing, hardware and software updating costs.
- TOU rates are the default rate for eligible customers (i.e., smart-metered customers); this leads to very high participation.

There are some important considerations beyond reflecting costs when designing demand management programs and TOU rates. Usually, demand management programs decrease emissions. However, demand management based on price signals can shift usage from one time period that has generation with lower emissions to another time period when generation has higher emissions. Utilities can design the program to avoid this result by considering not only peak periods but also to send price signals to shift demand to times when generation is cleaner, such as when wind or solar resources are plentiful. Awareness of the generation resources available during certain periods of the day and night and providing demand management signals to customers to shift load to beneficial times will yield both economic and environmental benefits.

Demand management programs can provide an excellent opportunity to reduce peak demand and cut costs by avoiding the need for expensive peaking capacity. Mansfield Municipal Electric Department in Massachusetts offers monthly rewards for customers that purchase or own certain smart devices, including batteries, EV chargers, electric water heaters, mini split controller and Wi-Fi thermostats, through its HELPS Connected Homes Program. The program helps the utility and the city to reduce their carbon footprint, stabilize the electric load and keep electric rates low.[91] An additional benefit of such programs is added reliability; the Mansfield Municipal Electric Department was nationally recognized for exceptional reliability in 2021 by the American Public Power Association.[92]

Program administration: The third-party option

Third-party administrators can be a valuable resource for municipal utilities that do not have the specific expertise or staff resources to take on new projects. The third party can be a contractor hired by the municipality to administer energy efficiency or demand management programs, or it can be an independent company that is authorized to perform the services. Payment can be made by the municipality's including this cost in its budget, or payment can be made based on the administrator keeping a percentage of the savings or some combination thereof, such as payment of the cost for the service with the profit or return coming from a percentage of the savings. For a third-party administrator under contract and paid directly, the municipality can add requirements such as using a local workforce to implement the program. Where it is an independent company that provides the services, it will be important for the municipal utility to work with the company to provide it with the data it needs. The municipal utility will need to develop protocols for addressing customer privacy; many utilities have done this already. In fact, the U.S. Department of Energy launched in 2012 its Smart Grid Data Privacy Voluntary Code of Conduct, which provides guidance on balancing data needs and customer privacy.

Useful Resources on Customer Data

Navigant Consulting. (2015). *Value of Customer Data Access: Market Trends, Challenges, and Opportunities.* National Association of Regulatory Utility Commissioners. https://pubs.naruc.org/pub/536E2D7C-2354-D714-5129-435231D889E0

U.S. Department of Energy & Office of Electricity. (n.d.). *DataGuard Energy Data Privacy Program.* https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid/dataguard-energy-data-privacy

91 Mansfield Municipal Electric Department. (n.d.). *3 reasons to enroll in the HELPS Connected Homes Program*. https://www.mansfieldelectric.com/sites/g/files/vyhlif836/f/uploads/mansfield_connected_homes_2.pdf

92 Mansfield Municipal Electric Department. (2021, May 4). *Mansfield Electric nationally recognized for exceptional reliability.* https://www.mansfieldelectric.com/home/news/mansfield-electric-nationally-recognized-exceptional-reliability

Useful Resources on Demand Management

Alstone, P. Potter, J., Piette, M. A., Schwartz, P., Berger, M. A., Dunn, L. N., Smith, S. J., Sohn, M. D., Aghajanzadeh, A., Stensson, S., & Szinai, J. (2016). 2015 *California Demand Response Potential Study – Charting California's Demand Response Future: Interim Report on Phase 1 Results.* Lawrence Berkeley National Laboratory (LBNL-2001115). https://eta.lbl.gov/publications/2015-california-demand-response

Hurley, D., Peterson, P., & Whited, M. (2013). *Demand Response as a Power System Resource.* Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2016/05/synapse-hurley-demandresponseasapowersystemresource-2013-may-31.pdf

Linvill, C., Lazar, J., Littell, D., Shipley, J., & Farnsworth, D. (2019). *Flexibility for the 21st Century Power System.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/flexibility-for-the-21st-century-power-system/

Michigan New Energy Policy. (n.d.). *Common Demand Response Practices and Program Designs.* https://www.michigan.gov/documents/energy/Common_Practices_Feb22_522983_7.pdf

National Association of Clean Air Agencies. (2014). Improve Demand Response Policies and Programs. Chapter 23 in *Implementing EPA's Clean Power Plan: A Menu of Options.* https://www.4cleanair.org/wp-content/uploads/Documents/Chapter_23.pdf

Examples of municipal demand management programs

- City Utilities. *City Utilities Demand Response Program.* https://www.publicpower.org/system/files/documents/SAMPLE%20-%20EEMCP%20Business%20Plan.pdf
- Northern Municipal Power Agency. *Demand Response Program.* https://www.nmpagency.com/demand-response
- Massachusetts Municipal Association. *MunEnergy.* https://www.mma.org/about-mma/services/munenergy/

2. Time-Varying Pricing

Rate design refers to the elements of electricity prices that form the basis of the retail customer bills. For most retail and small commercial customers, the designed rate typically appears on a monthly utility bill as a fixed monthly customer charge and a usage component, which is generally a per-kWh charge.[93] Most residential customer rates are still flat rates, meaning that the amount customers pay does not vary across the day, and customers pay the same price per kWh no matter how much electricity they use during peak times. A flat rate does not accurately reflect the changes in cost that the utility faces to serve customers over the course of the day.

Time-of-use electricity pricing, one of many types of time-varying pricing options, provides better price signals to customers by more accurately aligning rates to utility costs. It gives customers the opportunity to take control of their energy use and electricity bills. TOU pricing enables people to choose when they power up appliances or electric vehicles based on electricity prices and to make decisions that can both save them money and reduce harmful pollution. In contrast to rates that do not change with the time of day, TOU rates give customers a view of varying electricity costs so they can plan ahead to avoid expensive time periods. By paying more attention to the timing of energy use, or programming charging devices to do so, customers could have a new means of lowering energy bills and reducing the strain on the electric grid, while the municipality gains flexibility in supply options to serve customers.

The municipal utility in Fort Collins, Colorado, adopted a residential rate that is well designed because it allows customers to achieve bill savings through shifting their load. The utility moved all residential customers to TOU rates that have a very low off-peak rate and a peak rate that is three times as high as the off-peak rate. This incentivizes energy usage in off-peak hours. It also has a tier charge that applies to all usage over 700 kWh per month, which also provides an energy conservation incentive (see Table 2).[94]

93 Lazar, J. (2013). *Rate design where advanced metering infrastructure has not been fully deployed.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/rate-design-where-advanced-metering-infrastructure-has-not-been-fully-deployed/

94 City of Fort Collins. (n.d.). *Residential electric rates.* https://www.fcgov.com/utilities/residential/rates/electric/. The Fort Collins rate is beneficial for several reasons. First, by moving all customers onto the TOU rate as a default, the utility maximizes the benefits but still allows those who want to opt out the ability to do so. The rate is useful because, first, the low customer charge increases the amount that a customer can change the bill. Second, the very low off-peak rate creates noticeable bill savings for switching usage to that period. Third, setting the peak rate at three times the off-peak rate signals the extra costs to the utility during peak hours. See Linvill et al., 2019.

Table 2. **Fort Collins, Colorado, residential time-of-use rate**

Customer charge	$6.78	
	Summer	**Winter**
Off-peak	$0.069	$0.067
On-peak	$0.241	$0.216
Tier charge (0ver 700 kWh)	+0.0194/kWh	

Source: City of Fort Collins. (n.d.). *Residential Electric Rates*

a. Customers and TOU

What does TOU pricing mean for the customer? When Sacramento Municipal Utility District implemented TOU pricing, people reported greater satisfaction with this plan compared to existing electricity rates, noting that TOU provides “fairer pricing” and “more opportunities to save money.”[95] However, some customers are unable to shift demand as much as other customers to realize lower rates, particularly the elderly, those with disabilities and low-income households. Low-income customers still saved money under TOU rates but less than average customers. TOU rates have the potential to achieve big system benefits and many customer benefits, but for those living in leaky homes with old, inefficient appliances, those benefits are far harder to realize. Utilities build into their rates the risk of recovering their costs for procuring power during periods of high peak usage. TOU rates help mitigate that risk and can reduce the price customers pay.

With strong supporting policies, TOU rates can be implemented and ensure that all communities can participate in the benefits. These supporting implementation procedures include the following.[96]

Prioritize vulnerable customers for energy efficiency, electrification and appliance upgrade programs. Vulnerable populations, such as low-income customers, elderly people and people with disabilities, may find TOU rates to be more expensive because of leaky, inefficient homes and old appliances. Municipalities should specifically reach out to these customers with weatherization and appliance upgrade programs and prioritize these customers for energy efficiency and electrification programs. Note also that upgraded appliances may include timers, which allow customers to set an appliance, such as a washing machine or dishwasher, to operate after they have gone to bed. This is especially useful for disabled people and older adults.

Provide bill protection for up to one year. Municipalities may want to implement bill protection, whereby customers will not face bill increases under a TOU rate for a period of time, preferably up to a year. This allows customers to benefit from TOU savings if they are able but will not harm those who find themselves unable to adequately shift consumption during peak hours. This lead time enables customers to see if they are able to shift their usage. If they are not, they have time to opt out of the program. A variant on this approach is shadow billing, where the customer remains in the non-TOU program but receives a shadow bill showing what they would have paid using TOU rates. The municipality could allow customers to opt in to the program sooner, and then make the program mandatory after a period of time.

Start with opt-in TOU policies with customer education. Most TOU policies are voluntary and apply only to customers who opt in. Customer education about TOU policies and the effect of the policies is incredibly important to help customers understand their current bill and the effect of TOU rates. Shadow billing, discussed above, is an effective tool to help customers see the effect on them of TOU rates. Education on behavioral changes to receive more benefits under TOU rates is also important.

Allow TOU policies to be opt-out. As noted above, most TOU programs are opt-in. However, few customers do, particularly where customer education on the benefits of TOU is poor. Thus, education about how the program works is the most critical step to encouraging more customer participation and ensuring that customers understand how to use the program to their advantage. Putting customers on TOU without them understanding how it works can have adverse consequences when customers start getting bills that are higher because they did not properly use the TOU rate. Allowing customers to opt out provides an important option to ensure equitable outcomes from more advanced electricity pricing, particularly for low-

95 Environmental Defense Fund. (n.d.). *Time-of-use electricity pricing: Savings when they matter* [Factsheet] https://www.edf.org/sites/default/files/ca_tou_fact_sheet_091514.pdf

96 For more information on the suggestions referenced here, see Spiller, B. (2020, March 9). *How we can make time of use pricing work for everyone.* Environmental Defense Fund. http://blogs.edf.org/markets/2020/03/09/how-we-can-make-time-of-use-pricing-work-for-everyone/

income renters. Opt-out provisions are preferable from a system benefits and cost-savings perspective because they drive cost-effective behavior, and customers tend to change their behavior rather than opt out.

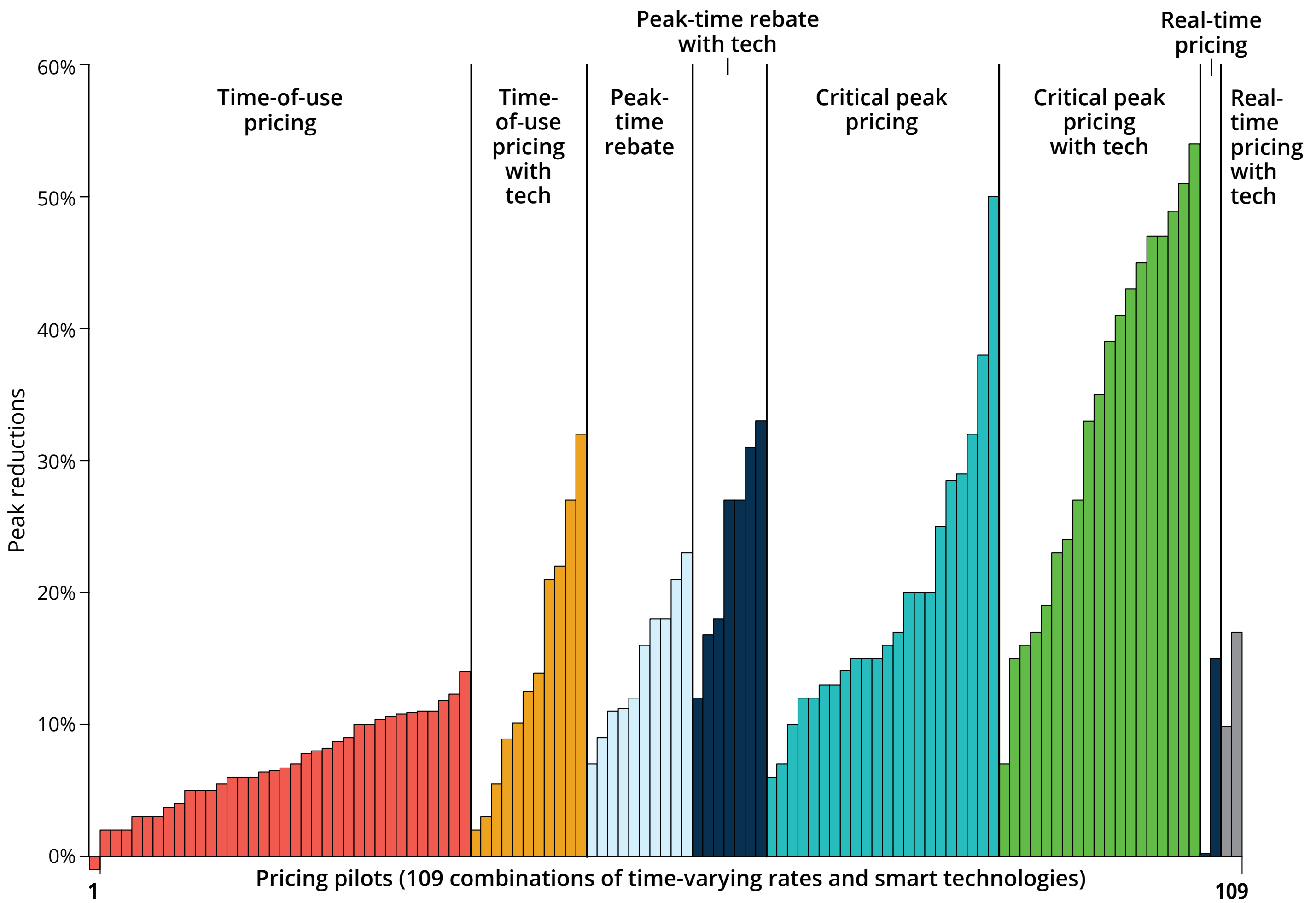
Ensure TOU rates are actionable. For TOU rates to be most effective at reducing consumption during peak hours, the price difference of peak to off-peak needs to be significant and the length of the peak hours manageable.[97] For example, peak hours cannot be so long that customers find it difficult to comply, and customers must see real financial benefit to switching to off-peak hours. TOU time blocks should provide ample space for customers to shift away from peak times and benefit from a greater number of low-cost hours.

b. Forms of Time-Based Rate Programs

The options for electricity pricing based on time of use include the following.[98]

- **Time-of-use pricing.** This pricing typically applies to usage over broad blocks of hours (e.g., on-peak equals six hours for summer weekday afternoon; off-peak equals all other hours in the summer months) where the price for each period is predetermined and constant. Rough time-varying blocks can be accomplished with traditional meters.
- **Real-time pricing.** These rates fluctuate hourly based on the hourly price of electricity.
- **Variable peak pricing.** This pricing is a hybrid of time-of-use and real-time where the different periods for pricing are defined in advance (e.g., on-peak equals six hours for summer weekday afternoon; off-peak equals all other hours in the summer months), but the price established for the on-peak period varies.
- **Critical peak pricing.** These substantially increased prices occur during periods when municipalities

Figure 6. **Average peak reduction under time-varying rate pilot programs**



Source: Faruqui, A., Hledik, R., & Palmer, J. (2012). *Time-Varying and Dynamic Rate Design*

97 Spiller, 2020.

98 Smart Grid. (n.d.). *Recovery act: Time based rate programs.* https://www.smartgrid.gov/recovery_act/time_based_rate_programs.html

observe or anticipate power system emergency conditions or a specific critical time period (e.g., 3 p.m. to 6 p.m. on a hot summer weekday). Two variants of this type of rate design exist: one where the time and duration of the price increase are predetermined when events are called and another where the time and duration of the price increase may vary based on the electric grid's need to have loads reduced.

- **Critical peak rebates (also known as peak-time rebates).** These refunds are made to the customer at a single, predetermined value for any reduction in consumption during a utility-declared critical event, relative to what the utility deemed the customer was expected to consume. The price for electricity during these time periods remains the same.

Figure 6 shows the average peak reduction from various pricing models in pilot programs.[99]

Among variable rate pricing options, TOU pricing is the most common and the easiest to implement. Studies have found that TOU rates can lead to demand reductions of 16% and average reductions in consumption of 2.1%, which can also provide customer savings.[100]

Useful Resources on Time-Varying Pricing

American Public Power Association. (n.d.). *Moving Ahead with Time of Use Rates.* https://www.publicpower.org/system/files/documents/Moving-Ahead-Time-of-Use-Rates.pdf

Colgan, J., Delattre, A., Fanshaw, B., Gilliam, R., Hawiger, M., Howat, J., Jester, D., LeBel, M., & Zuckerman, E. (2017). *Guidance for Utilities Commissions on Time of Use Rates.* https://votesolar.org/wp-content/uploads/2020/12/TOU-Paper-7.17.17.pdf

Huber, L. (n.d.). *TOU Pilot Strategies and Lessons.* Strategen Consulting. https://e21initiative.org/wp-content/uploads/2018/01/e21_Forum_TOUPilotBestPractices_5.05.17.pdf

Lazar, J., & Gonzales, W. (2015) *Smart Rate Design for a Smart Future.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/smart-rate-design-for-a-smart-future/

U.S. Department of Energy. (2016, November 16). *Final Report on Customer Acceptance, Retention and Response to Time-Based Rates from the Consumer Behavior Studies.* https://www.smartgrid.gov/document/CBS_Results_Time_Based_Rate_Studies.html

3. Net Metering

Net metering is a policy that allows electricity customers with their own on-site generation capacity (e.g., rooftop solar) to be financially compensated by their utility or municipality for the energy they produce. Net metering, also called net energy metering, is widely regarded as having an important role in deployment of distributed generation, especially solar energy. Depending upon state law, local governments may have the authority to establish net-metering policies. Net metering has been very successful at increasing the amount of distributed resources, but as it has increased and as utilities develop more and more of their own renewable resources, it has also posed challenges for some municipal utilities. Planning processes will help the utility to prepare for the increase in customer generation (whether through residential solar rooftops or through larger distributed generation facilities) and to determine the amount and location of additional distributed generation resources that could be useful to the distribution grid.

Net metering allows utility customers with on-site generation sources, such as solar PV, to offset the electricity they draw from the grid. The utility customer pays for the net energy consumed from the utility grid. If the amount of electricity the customer's system produces is more than the amount of electricity that customer can use, the excess amount is exported to the utility's electric grid. If the net-metering customer uses more electricity than the distributed generation system produces, the customer Imports electricity from the grid and pays the full retail rate for that electricity, just like a traditional utility customer.[102]

Net metering requires either a single bidirectional meter (with an optional export validation meter, if

99 Faruqui, A., Hledik, R., & Palmer, J. (2012). *Time-varying and dynamic rate design.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/time-varying-and-dynamic-rate-design/

100 Baatz, B. (2017, March). *Rate design matters: The intersection of residential rate design and energy efficiency.* American Council for an Energy-Efficient Economy. https://www.aceee.org/sites/default/files/publications/researchreports/u1703.pdf

101 Congressional Research Service. (2019, November 14). *Net metering: In brief.* https://sgp.fas.org/crs/misc/R46010.pdf

102 National Renewable Energy Laboratory. (n.d.). *Net metering.* https://www.nrel.gov/state-local-tribal/basics-net-metering.html

Net metering benefits and challenges

Utilities in the United States first began offering net-metering tariffs in the early 1980s. In those early days, digital smart meters were not available. Limitations in metering capabilities, paired with billing system challenges and the desire to keep tariffs simple enough for customers to easily understand, led to the design of what we will call traditional net-metering tariffs. Many U.S. utilities still offer traditional tariffs today. However, smart meters are now widely available that are capable of monitoring net exports and net imports of energy in small time intervals for use in a variety of distributed generation tariff designs, including those relying on time-varying rates. A growing number of utilities (and the public utility commissions and legislatures that regulate them) are considering alternatives to traditional net metering. Net metering has successfully encouraged more customers to install distributed generation. Net-metering experience in states with high distributed energy adoption indicates that adding large amounts of these resources will cause system demand to shift, which can in turn shift peak periods and periods with significant ramping. Time-of-use rates and the redefinition of the peak period have proven to be important tools to fully utilize the higher solar production. A number of higher-adoption states, such as California, are implementing these tools. Other strategies can create more manageable load profiles, such as the robust demand management programs discussed above.[103]

gross generation measurements are desired) or two unidirectional meters. Today, net metering is the most commonly used tariff design for customers who have solar PV or any other customer-owned generation resources.[104]

Net-metering policies commonly vary with regard to the following elements:

- **Eligible technologies.** Specified renewable energy technologies may include solar PV, wind, geothermal electric, biomass and fuel cells.
- **System size caps.** A system size cap is the maximum individual system size that can be net metered. Caps can be capacity (e.g., kW) or percentage based (e.g., 120% of maximum daily load).
- **Program size caps.** These caps are the total amount of net-metering systems installed in a region or utility service territory. Net-metering program caps can be calculated in many ways, including percent of peak demand or load and capacity. Some states have no program caps, and some states have trigger mechanisms that require net-metering policies to be reevaluated when certain thresholds are met.
- **Customer type.** Eligible customer classes for net metering include residential and commercial.
- **Net excess generation**. Customers are credited for net excess generation. This varies by:
  - The rate (e.g., full retail, less than retail, no compensation) paid for excess generation to the customer. Rates should reflect the value to the utility of distributed generation.
  - The term for using credits for excess generation in a particular billing cycle and whether the credits expire. It is common for them to expire after a finite number of billing cycles (e.g., 12 months) or at the end of a calendar year, after which they are either forfeited or credited at a predetermined net excess generation rate, usually between zero and the full retail electricity rate.

Interconnection policies, the process through which customers with distributed generation connect to the grid, have an impact on the number of distributed generation customers there are in a utility district. Typical barriers to interconnection are the costs and the lack of specified timelines in the utility approval process, which can cause excessive delays. If the policies are cumbersome and difficult to figure out, customers with distributed generation may not interconnect to the grid. In some cases, customers may even disconnect or defect from the grid. The decreased cost of residential distributed generation resources and improved technology of storage systems makes defection more possible. What was a theoretical risk for utilities may

103 For more on net metering evolution, see LeBel, M., Shipley, J., Linvill, C., & Kadoch, C. (2021). *Smart rate design for distributed energy resources.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/smart-rate-design-distributed-energy-resources-2/

104 Zinaman, O., Aznar, A., Linvill, C., Darghouth, N., Dubbeling, T., & Bianco, E. (n.d.). *Grid-connected distributed generation: Compensation mechanism basics.* National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/68469.pdf

105 National Renewable Energy Laboratory, n.d.

become an issue that municipal utilities need to address as defection deprives the utility of the distributed resource and the revenues it would have collected from that customer. If the utility instead considers how distributed generation resources can serve both the customer and the utility and streamlines interconnection policies to encourage resource development in that vein, more distributed generation options, such as solar PV or customer-owned or -sited storage, will contribute as system resources.

Useful Resources on Net Metering

Lawson, A. (2019). *Net Metering: In Brief. Congressional Research Service.* https://sgp.fas.org/crs/misc/R46010.pdf

LeBel, M., Shipley, J., Linvill, C., & Kadoch, C. (2021). *Smart Rate Design for Distributed Energy Resources.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/smart-rate-design-distributed-energy-resources-2/

Institute for Local Self-Reliance. (n.d.). *Municipal Financing for Renewables and Efficiency.* https://ilsr.org/rule/municipal-financing-for-renewables-and-efficiency/

Institute for Local Self-Reliance. (n.d.). *Net Metering*. https://ilsr.org/rule/net-metering/

National Renewable Energy Laboratory. (n.d.). *Interconnection Standards.* https://www.nrel.gov/state-local-tribal/basics-interconnection-standards.html

National Renewable Energy Laboratory. (n.d.). *Net Metering.* https://www.nrel.gov/state-local-tribal/basics-net-metering.html

Office of the New York State Comptroller. (2008, April). *Green Best Practices: How Local Governments Can Reduce Energy Cost and Minimize Impact on Global Climate Change.* https://www.osc.state.ny.us/files/local-government/publications/pdf/researchbrief_green.pdf

Zinaman, O., Anzar, A., Linvill, C., Darghouth, N., Dubbeling, T., & Bianco, E. (2017). *Grid-Connected Distributed Generation Compensation Mechanism Basics.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/grid-connected-distributed-generation-compensation-mechanism-basics/

C. Promote Beneficial Electrification for Buildings and Transportation

Among the wide-ranging changes taking place in the power sector, one of the more striking is the opportunity for beneficial electrification: electrifying end uses historically powered by gas or oil. Beneficial electrification provides one of the biggest opportunities in the power sector today to connect customers with more affordable and cleaner resources and to improve management of the grid and reduce harm to the environment and public health. Beneficial electrification can reduce customers' costs in the long run and help make more effective and efficient use of the electric grid and is a necessary prerequisite to eliminating carbon emissions from the power and transportation sectors by replacing oil and gas combustion, especially when utilizing generation from renewable sources. For electrification to be considered beneficial, it must provide a net benefit that (1) saves customers money over the long run, (2) enables better grid management or (3) reduces negative environmental impacts.

First, electrifying end uses can reduce customers' long-run costs because most forms of electrification are more efficient than their fossil-fueled counterparts. These efficiencies decrease overall energy use and operating costs. Additionally, depending on the level of adoption of these end uses, all electricity ratepayers can enjoy these benefits through the associated system benefits, not just those who installed these innovative technologies.

Due to the flexibility of many forms of electrification in buildings — including water heating, some forms of space heating and transportation electrification via EVs — these end uses can help increase grid flexibility. Because EVs and electric water heaters are flexible in when they draw power and are used, they can function like batteries. This flexibility enables a shift in load to times when there is less demand for electricity, when electricity is cheaper or when renewable energy generation is abundant and away from times when there is greater demand and the need to draw upon more expensive and often more polluting generation resources. With the electrification of EVs and space and water heating, utilities are in a position to improve their ability to manage loads and share cost savings with ratepayers.

Beneficial electrification can help reduce environmental impacts by using less energy than fossil-fueled alternatives, by providing the ability to reduce reliance on often dirtier resources used to serve electric system peaks and by adding the flexibility that can make the grid more capable of accommodating variable generation resources like wind and solar. A key point here is that as long as we are reducing the carbon intensity of the grid, as we have been since 1990, every electrical device powered by the grid is getting cleaner throughout its life.[106]

All of the electrification options below may benefit from incentives to encourage customer adoption. Financial incentive programs for customer adoption of EVs, electric heat pumps and electric water heaters are widely used around the country. Incentives can come from the municipal utility (typically through rebates), third-party energy efficiency providers or governmental agencies or programs (through rebates, loans or tax incentives).

One way municipal utilities can incentivize electrification is through rebates for more efficient appliances. Hutchinson Utilities Commission in Minnesota has a joint website with Bright Energy Solutions that provides information for their many rebate programs, both residential and commercial, covering multiple Energy Star appliances, air conditioning, and more — all in one convenient place.[107]

Municipality- or utility-financed early appliance retirement programs (aka “cash for clunkers”) can also motivate customers to make more reasoned decisions about water heater or space heater replacement. Rather than having to make a purchase decision under duress when an appliance breaks down, customers can consider replacing aged appliances in a more thoughtful and reasoned manner. Early retirement programs can identify appliances that are nearing the end of their useful lives, and then work with customers to replace them before an emergency purchase is required.[108]

Electrification of buildings, through space and water heating, and transportation offers municipal utilities a lot of flexible load that can be shifted to accommodate renewable energy and to decrease peak load. It is also an opportunity for customers to save money on more efficient appliances and vehicles and is an important step in meeting clean energy goals and achieving the clean energy transition. Below are some options municipal utilities may consider for beneficial electrification of buildings and transportation.

1. Building Electrification Components

While we tend to think of buildings as stationary, inflexible structures, they have the potential to dynamically interact with the electric grid. Electrification of space and water heating is key to this flexibility.

a. Electrification of Space Heating

Because space heating represents such a sizable proportion of energy use in the average home, it is a key focus for electrification efforts. Electric space heating, especially with new heat pump technology, will reduce customer costs, enable better grid management and lessen environmental impact. Most space heating currently relies on fossil fuels, such as home heating oil, propane and gas. Beneficial electrification of space heating represents multiple opportunities for customers to save on their total energy bills by switching to a more efficient heating technology (depending on the housing type and region); for municipalities and grid operators to secure valuable grid management benefits; and for a significant reduction of greenhouse gas emissions.[109]

b. Electrification of Water Heating

Water heating accounts for almost 20% of residential energy bills, and put simply, today it can take far less energy to heat a gallon of water with electricity than directly with fossil fuel. Transitioning from fossil-fueled water heaters to electric resistance and heat pump water heaters is an important step in achieving a low-carbon economy. Electric water heaters also enable improved grid management through control of their energy use or charging. Electrification load is often relatively flexible for when it draws power from the grid. Generally, as long as customers can take a hot shower when desired, they do not care about when their water heater is drawing power. As a result, water heaters can

106 Roberts, D. (2017, October 27). *The key to tackling climate change: Electrify everything.* Vox. https://www.vox.com/2016/9/19/12938086/electrify-everything. For more information on beneficial electrification, see Farnsworth et al., 2018.

107 Bright Energy Solutions. (n.d.). *Hutchinson Utilities Commission.* https://www.brightenergysolutions.com/municipalities-container/mn/hutchinson-utilities-commission/

108 Farnsworth et al., 2018.

109 Shipley, J., Lazar, J., Farnsworth, D., & Kadoch, C. (2018). *Beneficial electrification of space heating*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/beneficial-electrification-of-space-heating/

serve as thermal storage of energy supplied at other times of the day, helping to balance the grid.[110] For example, the Maui Electric Company utilizes connected water heaters to prevent the curtailment of wind power.[111]

2. Activating a Grid-Interactive Building

Buildings can be made into a valuable grid resource by focusing their energy demand reductions at high-cost times or shifting load to times of day when excess renewable energy is being produced. For buildings to be grid interactive and provide value to the grid, space and water heating needs to be electrified. However, electrification alone doesn't automatically yield grid benefits. Building electrification could adversely impact the grid if those new loads are exacerbating peaks.[112] Conversely, if electrified buildings are also grid interactive through controlled technology and policy programs, they can be part of a strategy to increase energy savings, manage grid resources and integrate more renewable energy, reduce system costs and improve customer economics and productivity.

Incorporating building electrification as a valuable resource to municipal utility actions involves many of the strategies we have discussed above, including energy efficiency, demand management and rate design. A fundamental first step, however, is to ensure that building electrification programs are able to reach all utility customers. This will first require an understanding of all of the communities being served and the barriers different communities may face.

All building electrification programs face challenges such as the upfront costs of appliances, electrical upgrades and other building modifications, depending on local circumstances. One of the issues that needs to be addressed is assuring that the conversion from gas to electric will save customers money. This can be determined by comparing the total cost of an electric and gas bill with the cost of an all-electric bill. Low-income and environmental justice communities often face additional challenges.[113] As noted in *Renovating Regulation to Electrify Buildings*, "many low-income households rent rather than own their homes and therefore do not have the ability to make decisions about appliances like water heaters and stoves. Landlords, meanwhile, have little or no incentive to spend money on equipment upgrades that would only benefit renters who pay the utility bills. Therefore, creating programs that allow landlords to replace gas appliances with electric appliance and providing the landlord with the cost differential if there is one or providing a rebate could be helpful to incentivize landlords. Low-income households also tend to live in buildings that are in relatively greater need of weatherization and other basic upgrades and repairs, which can pose a challenge to electrifying their energy uses in ways that increase their home comforts and lower their bills. But without electrification, these households will potentially be left behind, relying on an increasingly unaffordable fossil gas system and bearing a larger and larger share of that system's fixed cost — while wealthier customers electrify and disconnect from fossil gas."[114] Addressing these barriers will take explicit focus.

As not-for-profit, community-owned entities, municipal utilities are uniquely situated to address many of the challenges of building electrification by working with municipal governments and without the bias toward capital investments that for-profit utilities face. To electrify buildings, municipal utilities can take the following steps:

- Ensure building electrification benefits reach everyone, including low-income customers and environmental justice communities. Doing so will require an affirmative effort to reach out to affected communities to ensure that solutions will address the specific barriers to electrification that they are facing. Working with the municipal government to target financial incentives and address coordinated efforts on energy efficiency and weatherization along with electrification may be useful.

110 Farnsworth, D., Lazar, J., & Shipley, J. (2019). *Beneficial electrification of water heating.* Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2019/01/rap-farnsworth-lazar-shipley-beneficial-electrification-water-heating-2019-january-final.pdf

111 Lazar, J. (2016, February). *Teaching the "duck" to fly — 2nd edition.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/teaching-the-duck-to-fly-second-edition/

112 Shipley et al., 2021.

113 Environmental justice communities are communities that are disproportionately affected by pollution and other environmental hazards. Their residents are more likely to be people of color. See Mikati, I., Benson A. F., Luben, T. J., Sacks, J. D., & Richmond-Bryant, J. (2018, March 7). Disparities in distribution of particulate matter emission sources by race and poverty status. *American Journal of Public Health*. https://ajph.aphapublications.org/doi/10.2105/AJPH.2017.304297

114 Shipley et al., 2021.

- Illuminate and reveal the value that demand flexibility can provide. Because all utility systems are different due to various factors — generation mix, climate and weather, customer base and economics, among others — it is important to understand the value that electrified grid-interactive buildings can provide for a specific utility. Pilots or programs starting with municipal buildings can help illuminate the various value streams produced by demand flexibility from reducing things like peak demand, grid congestion and renewable curtailment.
- Structure rate design to communicate the system value of flexible load so customers are able to respond and receive benefits if they reduce demand at times of system stress and help utilities avoid associated costs (see Section II-B: Capture Demand Side Flexibility).
- Reassess programs and goals. Incorporating review opportunities into programs and policies can allow for reassessment and improvements in the future.

3. Transportation Electrification

Electrification of the transportation sector (cars, trucks, buses, taxis, ports, etc.) provides an opportunity to save citizens money on transport, increase local jobs and businesses, address national security concerns, improve public health and combat climate change. Real-world experience and studies show that these benefits can be achieved, but proactive policies are needed to realize the full magnitude of these benefits. Without an early and comprehensive approach, potential benefits will be lost. High levels of EV adoption with smart charging can provide benefits to all of society — not just EV owners — and the grid. The converse is also true. Inaction in this area could lead to slow penetration of EVs, problems with uncontrolled EV charging, sporadic access and forgone societal benefit.

a. Understand the Federal and State Context

Experience shows that government policies can accelerate the transition to EVs. By early 2019, 48 states plus the District of Columbia had taken action on regulation, financial incentives or market development initiatives related to electric vehicles.[115] Municipalities should maintain awareness of federal and state activities that can augment or support municipal actions on EVs, including checking:

- **Federal and state goals.** Federal funding requires certain state plans. If a state has set EV goals, municipalities may have specific EV procurement requirements or targets to build into municipal plans. If not, municipalities can take steps to create a plan of their own. If a municipality has adopted EV goals, these goals may affect the utility, both for vehicles used and the amount of vehicle charging the utility should provide and plan to provide in the future. If federal and state goals have not explicitly addressed EVs and charging infrastructure for low-income and rural communities, specific municipality and utility focus on this may compensate for gaps in state goals.
- **Federal and state incentives**. Municipalities should become familiar with state and federal incentives, both for purchase of electric vehicles and EV charging infrastructure. Municipalities can then assess gaps in incentive structure and determine in which areas to offer municipal incentives. Municipalities and the municipal utility should ensure transportation benefits are shared equally, which may require incentives particularly focused on low-income communities.
- **State building code provisions**. Updating building codes to support EV charging is important to adoption of EVs. Codes can require that new buildings be EV-ready — that is, have the infrastructure to enable installation of EV charging. Some municipalities will be able to adopt EV-ready building codes on their own if they are in a home rule state wherein the state's constitution grants municipalities the ability to pass laws or, in this case, building codes to govern themselves as they see fit, within the bounds of the state and federal constitutions. Other states only allow limited authority to local governments, and they are not able to set their own building codes. In these states, municipalities may need to work with a state building codes body to ensure adoption of EV-ready building codes. Municipalities and municipal utilities can also focus specifically on the needs of low-income communities to ensure renters and multi-unit dwellings are addressed in building code electrification plans.
- **State and third-party private EV plans**. Some states are creating statewide EV plans that may include purchase goals, infrastructure plans, and incentives.

115 Carr, A., Lips, B., Proudlove, A., & Sarkisian, D. (2019, May). *50 states of electric vehicles: Q1 2019 quarterly report.* North Carolina Clean Energy Technology Center. https://nccleantech.ncsu.edu/wp-content/uploads/2019/05/Q1-19_EV_execsummary_Final.pdf

Municipalities should also determine if any third-party private infrastructure plans would impact the municipality. Understanding state level and private EV plans, and intra-state or regional plans, particularly for EV infrastructure, can help municipalities determine the most effective EV investments for them, such as buses or light-duty vehicles. Municipalities and municipal utilities, with a better focus and understanding of their community, will also be able to assess the electrification needs that will most effectively meet the needs of low-income and rural community members.

- **Public utility commission or public service commission requirements**. Regulatory commission requirements for utility programs and EV pricing programs and any requirements on municipalities need to be ascertained. The regulatory commission authority over municipalities varies by state. In some states, the commission may have authority over all municipal utility rates; in others, the commission may regulate rates only outside municipal limits or under specific conditions, such as if there is a vote of municipal members, direct competition with another utility and so on.[116]

Understanding of the federal and state context for EV goals, planning and incentives will help municipalities determine the most effective steps they can take to support EVs that augment and expand state efforts.

Municipal governments have opportunities to take significant action on EVs and may provide leadership in advance of federal and state goals. Municipal actions can also provide guidance to customers to enable the benefits of transportation electrification. Key actions in the following areas are necessary to achieve this:

- Setting municipal goals and plans for low-income, rural, urban and heavy-duty transport.
- Electrifying municipal fleets.
- Planning for EV infrastructure development for low-income, rural, urban and heavy-duty transport.
- Ensuring benefits reach all segments of society, including low-income communities.

b. Set Municipal Goals and Plans

After determining how state goals and policies will affect them, the first step for local governments committing to EVs is to make a plan for transportation electrification. For municipalities focused on rapid decarbonization, the International Council on Clean Transportation recommends 100% EV sales for light-duty vehicles by 2035 and medium- and heavy-duty vehicles by 2040. Municipal goals and financial incentives that help make this transition happen sooner will enable faster decarbonization. Articulating a transportation electrification commitment in a local law or ordinance is optimal, but progress can be made even if initial local political support for a comprehensive plan or commitment is lacking at the start. For example, some municipalities may set EV fleet goals to meet decarbonization targets, while others may start with planning local infrastructure to enable EV parking. Local laws can mandate the development of a comprehensive municipal fleet electrification transition plan that starts with an assessment of the existing fleet and sets EV procurement schedules by vehicle class, special considerations for emergency and heavy-duty vehicles and infrastructure and maintenance investments. These outcomes can be achieved through a resolution, a statement of support or the adoption of a local law directing a transition to an all-electric municipal fleet by a certain date.[118]

Rural transportation electrification

Rural America is home to 20% of the population but almost 70% of the country's road miles. This makes electrification both hugely challenging and attractive. As noted by the U.S. Department of Transportation, "Rural residents drive more than their urban counterparts, spend more on vehicle fuel and maintenance, and often have fewer alternatives to driving to meet their transportation needs. Over the long run, EVs will help residents of rural areas reduce those costs and minimize the environmental impact of transportation in their communities."[119] But ensuring charging is available to meet rural driving needs is a challenge that coordinated policy planning among federal, state and local government will need to address. Once realized, however, rural electrification can offer individual residents lower maintenance and fuel costs and a source of power and resilience. It can also offer rural communities opportunities for economic growth, cleaner air and climate benefits.

118 Electrify NY. (n.d.). *EV municipal toolkit.* https://electrifyny.org/ev-municipal-toolkit/#1595974225040-92bfb940-320e

119 U.S. Department of Transportation. (2022, February 10). *Charging forward: A toolkit for planning and funding rural electric mobility infrastructure.* https://www.transportation.gov/rural/ev/toolkit

Comprehensive plans and goals also need to ensure equitable access to electrified transportation. Municipalities will need to work with low-income and rural communities to identify barriers and develop solutions that deliver on inclusivity goals specific to each municipality. Major barriers to electrification for low- and moderate-income communities include the higher upfront cost, lack of access to EV infrastructure or payment mechanisms and lack of outreach and education. The Greenlining Institute's Equity Toolkit articulates some of the barriers these communities face:[120]

- **Cost**. EVs have a higher upfront cost than internal combustion engine vehicles but a lower total cost of ownership over the life of the vehicle. Incentives such as sales tax exemptions, after-purchase rebates and tax credits are more difficult for low-income communities to access; however, vouchers and instant rebates that reduce upfront cost are more likely to enable a low-income household to purchase an EV. It's also important to make used electric vehicles more available to the many households that cannot afford new vehicles.[121] To ensure equitable access to electric vehicles, municipalities may want to focus first on LMI communities with fewer economic resources to ensure these communities are incorporated in the transportation electrification evolution.
- **Lack of access to charging infrastructure**. Municipalities and municipal utilities can overcome this barrier by working to ensure charger access in low- and moderate-income communities. Additionally, many LMI customers may not have smartphones or be able to afford subscription fees, common components of private charging network applications, which can constitute an additional barrier.[122]
- **Lack of awareness and customer education**. A general lack of awareness about the benefits of EVs and available vehicle purchase incentives also create barriers to adoption among lower-income households, rural populations and disadvantaged communities. Education and outreach strategies by the municipality or utility that are specifically targeted to meeting the needs of underserved communities signal a strong commitment to ensuring they are prioritized in efforts to expand access to electric mobility.
- **Specific mobility needs**. Low-income rural residents may rely more on vehicle ownership or informal ride sharing because of bad public transportation services and access. Conversely, low-income residents in densely populated cities may have less of a need to own a car to get to work or complete daily tasks but may need robust public transportation.

As noted in the last point above, transport electrification will also have different implications in rural communities. Rural communities differ in significant ways from cities, and their transportation needs differ as well. In general, rural communities have significantly less EV charging infrastructure, which is largely concentrated in major cities.[123] While other factors such as limited EV models for trucks and limited dealership networks[124] are outside municipalities' scope of influence, municipalities and municipal utilities can help increase EV charging in rural areas. Rural residents may be more likely to be physically or financially dependent on shared transit rather than private car ownership.[125] Broad and ongoing stakeholder engagement and specific outreach to these communities will help municipalities develop EV plans that meet the needs of all municipal customers.

c. Electrify Municipal Fleet Vehicles

Municipalities will need to consider their particular needs, the scope of state fleet electrification and the type of provision that will work best for their particular municipality. Fleet electrification can be achieved through various actions at the state or local level. Some jurisdictions have set goals to electrify a certain

120 The Greenlining Institute. (n.d.). *Electric vehicles for all: An equity toolkit*. https://greenlining.org/resources/electric-vehicles-for-all/

121 The Greenlining Institute, n.d.

122 Northeast States for Coordinated Air Use Management. (2020, September 21). *Expanding equitable access to electric vehicle mobility: Examples of innovative policies and programs.* https://www.nescaum.org/documents/expanding-equitable-access-to-ev-mobility-examples_9-21-20.pdf/

123 Tolbert, J. (2021, October 22). *Beyond cities: Breaking through barriers to rural electric vehicle adoption.* Environmental and Energy Study Institute. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption

124 Northeast States for Coordinated Air Use Management, 2021.

125 Kadoch, C. (2020). R*oadmap for electric transportation: Policy guide.* Regulatory Assistance Project. www.raponline.org/EV-roadmap

percentage of fleet vehicles by a certain date. A variation of this type is to specify a rate of purchase of electric, hybrid or alternative fuel vehicles — for example, 5% of all new motor vehicles per year.[126] Others require the purchase of an electric vehicle if the total cost of ownership is less than that of a comparable internal combustion engine vehicle. The total cost of ownership of electric versus internal combustion vehicles will vary depending upon the financial incentives for EVs, but as technology costs decrease, the total cost of EVs will also decrease. Others simply require the purchase of electric and hybrid vehicles "to the maximum extent feasible." This approach allows more discretion in determining which vehicles should be electric or hybrid and which can be internal combustion.

Burlington Electric: EV charging incentives for landlords

The Burlington, Vermont, municipal utility launched a program that gives apartment building owners a financial incentive to install chargers and make them available to the public. The primary purpose of the program is to benefit renters or residents of multi-family condo buildings. Building owners who install a smart charger receive a $1,200 incentive to cover installing. Buildings that serve low-income residents receive an extra $250, and if the charger is made accessible to the public, they receive an extra $300. In total, the incentives cover 75% of the installation cost for each charger.[127]

d. Plan for EV Infrastructure

Customer concern about the lack of available charging infrastructure is a significant barrier to electrification of the light-duty transport sector. The lack of widespread charging stations leads to a chicken-and-egg problem for EV adoption. Federal funding may provide an opportunity to promote more widespread EV infrastructure. Optimally, states would facilitate a coordinated planning process on provision of EV infrastructure among state agencies, investor-owned utilities, third-party providers, private interests and municipalities. Some states are in the process of starting or planning for this type of coordinated plan, and municipalities should check with state energy offices or other state agencies to determine whether a process exists or suggest implementing one. Regardless of whether a statewide effort exists, municipalities can plan for their own EV charging infrastructure needs and may incorporate or consult many of the stakeholders listed above.

Particular attention must be paid to low-income communities for EV charging infrastructure planning. Low- and moderate-income communities may have fewer EVs due to higher upfront cost. The state or municipality may also create policies aimed at lowering the cost for LMI customers through rebates at the time of sale that directly reduce the cost of the EV. Lack of charging infrastructure in LMI areas, perhaps as a result of there being fewer EVs per capita, would lock in the status quo and provide a significant barrier to transportation electrification. A specifically coordinated effort on the part of the municipality and utility is necessary to ensure that LMI communities have equitable access to electric vehicles and the charging infrastructure to support them. The utility also needs to be sensitive to the impact that utility-built infrastructure may have on electric rates for LMI customers. With good planning, a municipal utility can ensure that all customers receive the benefits and that costs are shared equitably, which may mean LMI customers do not pay for EV infrastructure because it would prohibitively increase costs on the customers that can least afford it. Electrification has the opportunity to provide LMI customers with clean, reliable and affordable transportation. Proactive planning now can make this a reality.

Municipalities' goals will likely guide EV infrastructure planning and needs, along with identification of gaps between what state, utility or third-party providers are planning. Municipalities may also want to think of EV infrastructure planning in phases, recognizing that EV adoption will increase. The resources at the end of this chapter provide more information on developing EV infrastructure plans, but a few considerations will help development of an EV infrastructure plan:

- Develop a plan to switch municipal internal combustion engine vehicles to EVs by a certain date.
- Develop plans for EV-powered public transportation and school buses.

126 An act relative to green communities, Chapter 169, 191st General Court, (Mass. 2008). https://malegislature.gov/laws/sessionlaws/acts/2008/chapter169

127 Thill, D. (2022, March 1). Burlington expands program that gives renters and public access to EV chargers. Energy News Network. https://energynews.us/2022/03/01/burlington-expands-program-that-gives-renters-and-public-access-to-ev-chargers/

- Assess municipality needs. Understanding EV driver and municipal demographics and existing needs will help municipalities prioritize EV charging needs. This includes specific outreach to diverse residents of a municipality. Ensuring that the benefits of transportation electrification are shared equitably will require states to consider the degree to which all customers have access to electricity as a transportation fuel, regardless of their economic and geographic circumstances.
- Plan for steady growth in EV charging infrastructure needs. State and municipal goals could spur EV growth. Although EVs are currently 2% of global sales, they are projected to grow to 24% of global sales or higher by 2030, even absent specific EV goals.[128]
- Assess gaps in existing EV charging infrastructure, ideally after consultation with state agencies, commercial third-party providers and utilities. Municipalities should also engage EV drivers, local councils, low-income communities, rural communities, public and private fleet owners and EV advocates to identify barriers and opportunities and specifically prioritize equitable access to EV charging.[129]
- Assess grid infrastructure to determine the sites with the greatest grid capacity for installing EV charging infrastructure, particularly direct-current fast chargers.
- Streamline permitting processes and identify preapproved sites. Streamlining and expediting permitting and installation of charging infrastructure can improve the business case for private EV infrastructure construction.[130] This can be further expedited by identification of preapproved sites, which may also encourage charging in locations that are ideal from a municipal grid perspective.
- Secure investment from local businesses. Communities and businesses that host public charging stations may also see economic benefits as EV drivers eat or shop while their vehicles charge.[131] Municipalities can engage local coalitions of businesses to install EV charging at their businesses and promote awareness of the business case for their investment. Strategic use of incentives can also increase charging infrastructure.[132]

e. Empower Customers Through Rate Design

Because electric vehicles do not need to be charged at the same time they will be used, they are inherently flexible and can serve as energy storage. As a result, the power system can serve this new load at cleaner and less expensive times of the day. This flexibility means that EVs can actually improve the utilization of the transmission and distribution system, shifting loads that would otherwise add to system peaks, which ultimately drive grid investment and increase cost. The need for system upgrades can be minimized if EVs are charged during off-peak periods, either through smart charging, time-of-use pricing or some combination of both.

Shifting the load to less expensive times can produce savings that customers can share in through appropriately designed electricity rates. Municipalities can develop smart charging programs and rate designs to encourage customers to charge their EVs at lower-emissions and lower-cost times of the day and year. Given that customers will typically charge their cars overnight after they get home, the customer charging time is compatible with taking advantage of off-peak pricing. (See Section III-B's discussion of rate design.)

f. Financing and Incentives

Federal funding under the National Electric Vehicle Infrastructure Formula Program is available to build out national EV infrastructure.[133] Electrification of

128 Shepardson, D. (2021, August 4). *U.S. automakers to say they aspire to up to 50% of EV sales by 2030-sources.* Reuters. https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/

129 The International Council on Clean Transportation & C40 Cities Climate Leadership Group. (n.d.). *Electric vehicle charging infrastructure: A quick guide for cities* [Factsheet]. https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000Mp2p/2r2iFhMbXlgoqFFnxWsycjub2dEp.PKxHbs0_tFHhyI

130 Hall, D., & Lutsey, N. (2020). *Electric vehicle charging guide for cities.* The International Council on Clean Transportation. https://theicct.org/sites/default/files/publications/EV_charging_guide_03162020.pdf

131 Crotty, F., Jordan, B., McFarlane, D., Sexton, T., & Simons, S. (2019). *Accelerating electric vehicle adoption: A vision for Minnesota.* Minnesota Department of Transportation, Minnesota Pollution Control Agency and Great Plains Institute. http://www.dot.state.mn.us/ sustainability/docs/mn-ev-vision.pdf

132 C40 Cities Climate Leadership Group. (2021, August). *How to build an electric vehicle city: Deploying charging infrastructure.* https://www.c40knowledgehub.org/s/article/How-to-build-an-electric-vehicle-city-deploying-charging-infrastructure?language=en_US. In Berlin, small- and medium-sized businesses can get a 50% subsidy for building public charging stations.

133 U.S. Department of Transportation. (2022, February 10). *President Biden, USDOT and USDOE Announce $5 Billion over Five Years for National EV Charging Network, Made Possible by Bipartisan Infrastructure Law.* https://highways.dot.gov/newsroom/president-biden-usdot-and-usdoe-announce-5-billion-over-five-years-national-ev-charging#:~:text=The%20program%20will%20provide%20nearly,Formula%20Program%20is%20%24615%20million

transportation is a multisectoral effort and provides benefits across the energy, transport and building sectors, as well as environmental and health benefits. Municipalities can think broadly in terms of how these costs and benefits are paid for and shared. Although transportation electrification is often thought of as an expense that is worthwhile to support because of the public benefits it can yield, municipalities can also think of targeted use of electrification (transportation and otherwise) as a means to reduce costs they would otherwise face. Targeting is possible in a number of areas:[134]

- Air quality is a significant concern in many regions, and transportation-related emissions are a main contributor to regional pollution. Targeted transportation electrification in these areas can address air quality issues, often at a lower cost than other options. Federal funding is also available for air quality improvement through transportation projects. The Congestion Mitigation and Air Quality Improvement Program is one element of the Federal-Aid Highway Program that provides a funding source for states, local governments and transit agencies to fund transportation projects and programs that help meet the requirements of the Clean Air Act and help reduce regional congestion in transportation networks.[135]
- State efforts to spur job growth generally focus on building things for public benefit, such as hospitals and roads that provide construction jobs and tax breaks for corporations relocating to a state. In cooperation with states, municipalities can provide EV incentives and infrastructure as a method to increase local jobs or focus on encouraging EV manufacturing and related industry jobs throughout the state.
- Private investment is a largely untapped source of funding for EV charging infrastructure. Installing charging infrastructure at retail locations allows EV owners to power up while shopping, eating and resting, as well as providing local business owners with an additional marketing tool and a revenue source.
- Additional federal funding may also become available through further efforts on infrastructure. Local governments with existing EV plans may be better situated to apply for and receive federal money when it becomes available.[136]

Recognizing the wide range of benefits that EVs can provide, jurisdictions around the world have provided direct financial support to encourage the electrification of transportation. Municipalities with specific EV goals may wish to provide financial incentives to encourage equitable EV adoption. Best practices for structuring EV incentives include:

- Applying incentives at the point of purchase.
- Making incentives simple, transparent and understandable.
- Making incentive programs durable.

134 Kadoch, 2020.

135 U.S. Department of Energy & U.S. Department of Transportation. (2016). *Guide to federal funding, financing, and technical assistance for plug-in electric vehicles and charging stations.* https://www.energy.gov/eere/vehicles/downloads/guide-federal-funding-financing-and-technical-assistance-plug-electric

136 See Electrification Coalition. (n.d.). *Federal funding guidance for cities.* https://www.electrificationcoalition.org/work/federal-ev-policy/federal-funding-guidance-for-cities/

Useful Resources on Transportation Electrification

Atlas Public Policy. (2021, November). *Dashboard for Rapid Vehicle Electrification (DRVE).* https://atlaspolicy.com/dashboard-for-rapid-vehicle-electrification-drve/. DRVE is a powerful tool that equips users with decision-relevant information on the financial viability and environmental impact of light-, medium-, and heavy-duty vehicle fleet procurements across an entire fleet.

American Public Power Association. (n.d.). *Exploring Electric Vehicle Rates for Public Power*. https://www.publicpower.org/topic/electric-vehicles

Brinker, C. (2019, June 20). *A New Model of Energy Codes in Home Rule States.* Southwest Energy Efficiency Project. https://www.swenergy.org/a-new-model-for-energy-codes-in-home-rule-states.

Electrification Coalition. (n.d.). *Federal Funding Guidance for Cities.* https://www.electrificationcoalition.org/work/federal-ev-policy/federal-funding-guidance-for-cities/

ElectrifyNY. (n.d.). *Appendix 1: Sample Ordinance.* https://electrifyny.org/ev-municipal-toolkit/#1565755774604-d3373363-c491. Sample ordinances and policy guidance for local policies related to electric vehicles. Some of the templates may be from state legislation but can be amended to apply to a municipality.

The Greenlining Institute. (n.d.). *Electric Vehicles for All: An Equity Toolkit.* https://greenlining.org/resources/electric-vehicles-for-all/

Hall, D., & Lutsey, N. (2020). *Electric Vehicle Charging Guide for Cities.* The International Council on Clean Transportation. https://theicct.org/sites/default/files/publications/EV_charging_guide_03162020.pdf

Kadoch, C. (2020, February). *Roadmap for Electric Transportation: Legislative Options.* Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2020/03/rap-roadmap-electric-transportation-legislative-options-2020-february.pdf. This guide and legislative kit contains state legislation, all of which can be amended to apply to a municipality.

Northeast States for Coordinated Air Use Management. (2020, September 21). *Expanding Equitable Access to Electric Vehicle Mobility: Examples of Innovative Policies and Programs.* https://www.nescaum.org/documents/expanding-equitable-access-to-ev-mobility-examples_9-21-20.pdf/

Office of Energy Efficiency & Renewable Energy. (n.d.). *Energy Standard and Code Determinations.* https://www.energycodes.gov/

U.S. Department of Transportation. (2022, February 10). *Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure.* https://www.transportation.gov/rural/ev/toolkit

D. Expand Clean Energy Generation

As load is changing due to energy efficiency and electrification and becoming more flexible through demand management, supply options are also changing and possess different characteristics than traditional sources. Municipal utilities have numerous options to procure and develop supply. Ultimately, they will be able to match these sources of supply with energy efficiency and demand-side approaches. This section will first discuss how policies to procure or build clean energy sources may act as a threshold consideration for municipal utility decisions. Next, this section will outline various options that municipal utilities have to develop or procure clean energy generation.

1. Policies to Procure or Build Municipal Clean Energy

There are a number of ways utilities can develop and procure clean energy to meet policy goals and as a least-cost option to meet demand.

Municipalities may:

- Procure clean energy through all-source competitive bidding.
- Build or contract a third party to build their own renewable generation, such as solar, wind and storage.
- Engage customers to procure flexibility from energy efficiency, demand management and time-varying rates and obtain distributed resources on the distribution grid through net metering, user-friendly interconnection regulations and electrification tariffs.

Determining which method or mix of methods to use can be daunting. The process outlined in Table 3 may help.

Table 3. **Steps to help municipalities choose procurement methods**

Internal assessment	The utility should assess resource needs, including determining the optimum procurement of resources in front of and behind the meter. The utility should also assess whether other municipal goals for customer involvement or other goals would have a bearing on the types of resources selected beyond cost considerations. Many of these steps will take place in the planning processes we have discussed.
Issue a request for proposals for competitive all-source procurement	This process will provide municipalities with an assessment of the variety of resources available to meet their needs and the cost of procuring it.
Get bids for self-build	Obtain bids for creating on-site renewable or clean energy.
Weigh and assess the results	The information obtained in this process will help municipal utilities determine which option or mix of options is right for them.

a. Competitive Bidding of All Sources to Serve Load

Historically, energy generating sources were mainly coal, nuclear or gas, resource types that require large, central generating plants. Given the cost of these large plants, they were usually owned by utilities. Today, generation sources include renewable energy, either utility scale or distributed generation, and grid resources such as demand response and storage, all of which can be provided by third-party providers in addition to utilities. Renewable energy purchases by local governments are growing rapidly. In 2018 and again in 2019, renewable energy purchases made by local governments were over three times those made in 2017.[137] According to research by the World Resources Institute, the vast majority of renewable energy procured by local governments between 2015 and 2020 was obtained through off-site procurement versus on-site renewable energy generation.[138] As municipal utilities begin to take more control of their generation, this trend may change.

As municipal utilities have more choices for energy needs, they can adjust their energy purchasing practices to allow for this diversity. All-source procurement means that whenever a municipal utility believes it is time to acquire new generation resources, it may conduct a unified resource acquisition process. In that process, the requirements for capacity or generation resources are neutral with respect to the full range of potential resources or combinations of resources available in the market. A competitive procurement process is usually accomplished through requests for proposals (RFPs) as part of the process of selecting adequate generation resources. In an RFP, the municipal utility describes the resources it wishes to procure.[139]

Competitive bidding is not a new concept for municipal utilities, as many types of contracts may have competitive bidding requirements pursuant to state law. Experience offers some best practices to follow for competitive procurement.[140]

- **Ensure that the need for new resources is well defined, transparent and linked to findings from a well-vetted resource planning process.** A need for new resources may arise from emerging electric system reliability requirements, from changing economics of resource options, or from policy goals that reflect environmental, equity, economic development and resource priorities. Modeling assumptions and tools should be as transparent as reasonably possible and accessible to all stakeholders. Resource planning scenarios should be specified and evaluated in consultation with a diverse

137 Gonçalves, T., & Liu, Y. (2020, June 24). *How US cities and counties are getting renewable energy.* World Resources Institute. https://www.wri.org/insights/how-us-cities-and-counties-are-getting-renewable-energy

138 Gonçalves & Liu, 2020. Note this data includes cities and other forms of municipal government in addition to municipal utilities.

139 Shwisberg, L., Dyson, M., Glazer, G., Linvill, C., & Anderson, M. (2021, March). *How to build clean energy portfolios.* RMI. https://rmi.org/how-to-build-ceps/; and Wilson, J. D., O'Boyle, M., Lehr R., & Detsky, M. (2020, April). *Making the most of the power plant market: Best practices for all-source electric generation procurement.* Energy Innovation Policy & Technology and Southern Alliance for Clean Energy. https://energyinnovation.org/wp-content/uploads/2020/04/All-Source-Utility-Electricity-Generation-Procurement-Best-Practices.pdf

140 Adapted for municipal utilities from Shwisberg et al., 2021.

group of stakeholders so that those needs are well understood and validated.

- **Ensure that all resource providers have opportunities to offer all capabilities from each of the resource options they bid.** Bidding should be open to all resource providers that meet reasonable bidding requirements, and bidders should be allowed to submit bids that include all resource types to enable portfolios that use combinations of supply- and demand-side resources.
- **Work with bidders prior to, during and after solicitations to understand what data they need to give their best bids.** Supporting bidders to deliver diverse and competitive solutions requires municipal utility contacts to be available to answer questions. In the interests of transparency and to ensure a level playing field, the municipality should document and publish all bidder questions and municipality answers and be open to modifying the solicitation and proposed contract terms if that can expand the field of competitive solutions.
- **Ensure that the bidding process is open, transparent and evaluated fairly.** Evaluation criteria used to select bids should be transparent and communicated clearly to bidders prior to bid submission deadlines. A third-party, independent evaluator could be used to supervise the utility bid evaluation to ensure that it follows published criteria. Municipalities should consider trade-offs among bids and additional modeling of resource options if no one portfolio among finalists is clearly superior to the others.
- **Consider whether evaluation criteria for selecting the optimal resource portfolio are aligned with public policy outcomes.** Stakeholders are increasingly concerned about alignment between procurement and public policy objectives, including resilience, equity and decarbonization. Municipalities should carefully evaluate how well their solicitation processes support municipal goals.

Three foundational improvements in competitive all-source procurement practices support the achievement of outcomes that are aligned with objectives and ensure the least regrets outcomes:[141]

1. **Increase transparency.** Bidders obtain the information they need to propose competitive solutions that meet solicitation objectives and reduce the likelihood of bids falling through.
2. **Engage stakeholders and customers.**
   - Stakeholders may propose alternative specifications of the need or portfolio options that the municipal utility did not consider.
   - Stakeholders can provide feedback about whether state and local policy objectives are adequately reflected in a solicitation's scope and evaluation criteria and build public support for outcomes.
   - Stakeholders and bidders can identify barriers that may limit participation in the solicitation.
   - Consistent engagement with bidders can reduce perceived risk, result in more competitive bids from a diverse set of resources and support market maturation.
3. **Link planning and procurement.**
   - Consider all resource options holistically, including distributed energy resources and nonprocurement pathways (i.e., energy efficiency measures or other options that could achieve resource needs without procuring new energy) to save money and reduce environmental impact. Assess the need for procurement of a resource in the context of longer-term planning objectives and risks.
   - Actual price and operational capability information from bids is used to inform planning decisions.

b. Build and Own Municipal Clean Energy

Some municipal utilities have decided to pursue utility-built and -owned clean energy. These projects can include large-scale or utility-scale renewable energy developments on municipal land. They can also include on-site solar PV systems, often installed on rooftops or parking lots or on land at the same location where electricity is consumed. These systems are directly tied to a facility's electrical system and can reduce the facility's need for electricity from the grid.[142] Increasingly, energy storage is co-located with renewable energy systems and may be built or procured along with renewable energy.

Municipal government and municipal utility goals, as well as cost comparisons learned from an all-source RFP, will help inform whether to procure clean energy through third parties, build and own clean energy on-site or a combination of both. Figure 7 breaks down how local governments get their renewable energy.[143]

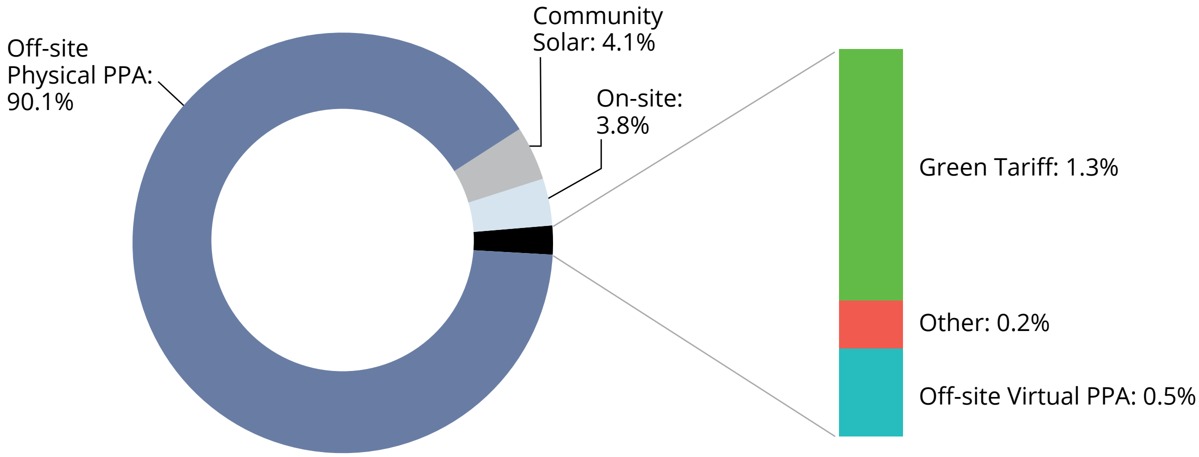
Utility-scale clean energy projects require

141 Adapted for municipal utilities from Shwisberg et al., 2021.

142 American Cities Climate Challenge Renewables Accelerator. (n.d.). *Procurement guidance: On-site solar.* https://cityrenewables.org/on-site-solar/

143 Gonçalves & Liu, 2020.

Figure 7. **Types of renewable energy procured by U.S. local governments, (2015 through first quarter of 2020)**



Source: Gonçalves, T., & Liu, Y. (2020, June 24). *How US Cities and Counties Are Getting Renewable Energy*

coordination and alignment between municipal government officials and municipal utility board and staff. Municipal officials (government and utility) will need to:

- Ensure alignment on goals and priorities.
- Perform or oversee on-site solar siting assessment.
- Analyze and decide on ownership model.
- Run the transaction process — that is, issue an RFP using the process outlined above, select a contractor and negotiate a contract.[144]

On-site clean energy can also offer visibility and educational opportunities, lower costs and — when paired with energy storage — enhance resilience. It also has the potential to provide local jobs and economic development.[145]

"Community solar" refers to projects in which members of the community can subscribe to get the benefits from a solar facility. It is especially useful for renters who cannot install PV units and for low-income customers who can't afford to purchase a PV unit but can benefit from a reduced rate by having a portion of their electricity needs come from solar energy. Community solar programs are another option for municipal government and utilities to procure clean energy, and they can be owned and operated by the municipal utility or can be owned by a developer and subject to the competitive solicitation elements outlined above. Community solar programs can be generally grouped in one of three categories: utility owned, member owned or third-party (developer) owned. Being more flexible and responsive to customer demand allows municipal utilities to occupy a unique space within the community solar market. Some of the first community solar projects in the nation were initiated by municipal utilities. Sacramento Municipal Utility District in California, for example, launched its SolarShares program in 2008 with a 1-MW installation. Sacramento and other municipal utilities have expanded to offer many more community solar programs over the past decade plus. Research indicates that direct interactions between municipal utilities and their customer bases often precipitate the decision to offer a community solar option.[146]

Additionally, community solar can be a way for utilities to extend the benefits of solar to low-income customers by waiving or discounting upfront costs, termination fees and subscription fees that may otherwise be prohibitive, as well as guaranteeing savings on the energy bill of income-qualified customers. In states that have legislation allocating funds for low-income community solar, utilities have a great opportunity to link their customers to those funds and help address energy burden in their communities while they expand their renewable portfolio.[147] (The following section further discusses policies that address energy burden.)

Use of energy storage is rapidly increasing as storage

144 American Cities Climate Challenge Renewables Accelerator, n.d.

145 American Cities Climate Challenge Renewables Accelerator, n.d.

146 National Renewable Energy Laboratory. (2016, December). *Lessons learned: Community solar for municipal utilities.* https://www.nrel.gov/docs/fy17osti/67442.pdf

147 Examples are Massachusetts and Washington, D.C., as shown in this report: Heeter, J., Xu, K., & Chan, G. (2021, July). *Sharing the sun: Community solar deployment, subscription savings, and energy burden reduction.* National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy21osti/80246.pdf

technology is rapidly becoming cost-effective. Storage can be implemented either in front of the meter, typically utility-scale storage, or behind the meter as a customer resource, depending on the desired application. Municipal utilities are increasingly pairing intermittent generation resources, such as solar PV, with energy storage to allow them to capture electricity as it is produced and discharge when it is needed, thus enabling further large-scale solar and wind development.[148] Energy storage can be built and owned by a municipal utility or by a third-party developer.

Working with municipal government on clean energy

Municipal utilities can work with the mayor and city council to assess permitting options that can attract renewable energy or clean energy developers. The municipality can incentivize and control where renewable generation is allowed through zoning and local permitting, leveraging its oversight to influence investment in renewable energy. Some towns have allowed renewable energy development on municipal land and used the associated land lease payments to invest in other infrastructure, such as roads, municipal facilities and schools, to reduce local property taxes.[149]

Community land use plans are an ideal starting point for municipalities wishing to pursue renewable energy objectives. This plan should identify elements that allow for community priorities around renewable energy objectives. Once a community plan is in place outlining renewable energy objectives, local governments with the authority to regulate zoning should include renewable energy development in zoning codes. Finally, providing a clear and predictable permitting process saves time and money for both contractors and municipalities.[150]

148 SolSmart & Cadmus Group. (2019). *Solar + storage: A guide for local governments.* https://solsmart.org/wp-content/uploads/SolSmart_SolarPlusStorage_Guide_06-25-2019.pdf

149 Office of the New York State Comptroller. (2008, April). *Green best practices: How local governments can reduce energy cost and minimize impact on global climate change*. https://www.osc.state.ny.us/files/local-government/publications/pdf/researchbrief_green.pdf

150 Grow Solar. (2017). *Local government solar toolkit: Planning, zoning, and permitting — Wisconsin*. https://www.growsolar.org/wp-content/uploads/2017/10/WisconsinSolarToolkitOCT2017.pdf

Useful Resources on Renewable Energy Procurement

American Cities Climate Challenge Renewables Accelerator. (n.d.). *Procurement Guidance: Form Your Teams and Goals.* https://cityrenewables.org/on-site-solar/teams-and-goals/

Borneo, D., Olinsky-Paul, T., Costello, M., Galbraith, S., Misas, H., & Turchak, N. (2016). *Energy Storage Procurement Guidance Documents for Municipalities.* Sandia National Laboratories. https://www.cesa.org/wp-content/uploads/Energy-Storage-Procurement-Guidance-Document.pdf

National Renewable Energy Laboratory. (2017). *Lessons Learned: Community Solar for Municipal Utilities.* https://www.nrel.gov/docs/fy17osti/67442.pdf

SolSmart. (2019). *Solar + Storage: A Guide for Local Governments.* https://solsmart.org/wp-content/uploads/SolSmart_SolarPlusStorage_Guide_06-25-2019.pdf

Shwisberg, L., Dyson, M., Glazer, G., Linvill, C., & Anderson, M. (2020). *How to Build Clean Energy Portfolios: A Practical Guide to Next-Generation Procurement Practices.* RMI. https://rmi.org/how-to-build-ceps/

Grow Solar. (2017). *Local Government Solar Toolkit: Planning, Zoning, and Permitting — Wisconsin.* https://www.growsolar.org/wp-content/uploads/2017/10/WisconsinSolarToolkitOCT2017.pdf

U.S. Environmental Protection Agency. (n.d.). *Local Government Solar Project Portal.* https://www.epa.gov/repowertoolbox/local-government-solar-project-portal

U.S. Environmental Protection Agency. (2008, October 21). *Renewable Energy Certificates: Background & Resources.* https://www.epa.gov/sites/default/files/2016-03/documents/background_paper_3.pdf

U.S. Environmental Protection Agency Green Power Partnership. (2015, April 15). *Understanding Renewable Energy Certificates (RECs) and the Green Power Procurement Process.* https://www.epa.gov/sites/default/files/2016-01/documents/webinar_20150415_critchfield.pdf

Wilson, J. D., O'Boyle, M., Lehar, R., & Detsky, M. (2020, April). *Making the Most of the Power Plant Market: Best Practices for All-Source Electric Generation Procurement.* Energy Innovation Policy & Technology and Southern Alliance for Clean Energy. https://energyinnovation.org/wp-content/uploads/2020/04/All-Source-Utility-Electricity-Generation-Procurement-Best-Practices.pdf

E. Address Energy Burden With Programs and Policies

Access to electricity is a prerequisite for many aspects of our lives, including refrigeration, heating and cooling and health equipment, as well as internet-based necessities that connect people to employment, education, support services and resources and even health care. In modern-day life, electricity is not optional; it is a necessity, regardless of income. The ratio of the energy bill amount to income is called the energy burden.[151] Energy burdens are typically far higher for low-income people because they have less opportunity to reduce their energy consumption in relation to income and face barriers to utilizing advances in energy efficiency. In other words, when low-income customers pay their energy bills, they have much less money left for other necessities than the average customer. Additionally, people of color, renters and adults 65 and older have disproportionately high energy burdens compared with customers who do not fall into those categories.[152]

The following section discusses policies municipal utilities can adopt to help customers facing high energy burdens pay their bills. Of course, payment plans and financial mechanisms discussed in this section are not a complete solution to dealing with the problem of energy burden. Targeted energy efficiency, weatherization and distributed energy programs are critical for lowering energy usage and costs in the first place. Taking a multi-solution targeted approach that combines energy

151 More than 6% of income spent on energy costs is considered a high energy burden. Drehobl, A., Ross, L., & Ayala, R. (2020, September). *How high are household energy burdens? An assessment of national and metropolitan energy burden across the United States.* American Council for an Energy-Efficient Economy. https://www.aceee.org/sites/default/files/pdfs/u2006.pdf

152 Drehobl et al., 2020.

efficiency, bill assistance and payment plans can be useful, as many utilities are doing. See Section III-A for a discussion of energy efficiency and Section III-D for a discussion of community solar.

1. Bill Assistance Programs

For people with low income, managing the various costs associated with living, including energy, is a persistent struggle. Although a utility's available funds can be limited, there are various ways that municipal utilities can help reduce the bill that customers receive each month, which can afford the customer a chance to keep up with the obligations the municipality sets.

a. Low Income Home Energy Assistance Program

The Low Income Home Energy Assistance Program (LIHEAP) is a federal program that allocates funds for bill assistance on a yearly basis. In 2021, $3.36 billion was allocated among the states, territories and Native American tribes.[153] Each state determines the amount of the customer benefit, which can be used for winter heating, summer cooling, crisis and weatherization as determined by the state.[154] Municipal utilities can and should ensure that their customers are included in the state allocation of funds for LIHEAP. This is an existing program that mainly requires outreach on the part of the utility.

b. Income-Based Discounts

California utilities with 100,000 customers or more are eligible for the California Alternative Rates for Energy program. Customers who are enrolled receive a 30% to 35% discount on their electric bill and a 20% discount on their natural gas bill based on income eligibility criteria, established at up to 200% of the federal poverty guideline.[155] Municipal utilities implement these kinds of discounts themselves, too. Seattle City Light has a program providing a 60% discount retroactive to the date of the application for income-qualifying customers, which shows up as a 2% impact on rates as a whole.[156] Flathead Electric Cooperative in Montana has a basic charge waiver program, under which eligible members receive a credit equal to half the basic charge on their bill each month. In most cases this credit is $11.36 per month.[157] Some programs offer additional support to customers who qualify for LIHEAP. For example, Fort Collins Utilities in Colorado has an income-qualified assistance program that provides a 23% discount on certain elements of service. The program also offers educational resources on energy efficiency and conservation. Households that receive LIHEAP are eligible. North Attleborough Electric Department in Massachusetts offers a discount rate to customers eligible for LIHEAP.[158] Other utilities have multiple discount tiers for different incomes, which have been designed to address energy burden as it occurs in their communities.

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153 U.S. Department of Health & Human Services, Office of Community Services. (n.d.). *Low Income Home Energy Assistance Program (LIHEAP).* https://www.acf.hhs.gov/ocs/low-income-home-energy-assistance-program-liheap. For information on your state's allocation, see Initial FY 2021 funding release of LIHEAP Block Grant Funds to states and territories under the *Continuing Appropriations Act, 2021 and Other Extension Act* (Public Law 116-159) [Table]. https://web.archive.org/web/20210327103312/https://www.acf.hhs.gov/sites/default/files/documents/ocs/corr_liheap_crfundingdclattachment_1_fy2021_110520.pdf

154 U.S. Department of Health and Human Services. (2021, March). *State low-income energy assistance snapshots*. https://web.archive.org/web/20210318001028/https://liheapch.acf.hhs.gov/snapshots.htm. This webpage has additional information on various state or utility programs and some charitable bill assistance options.

155 California Public Utilities Commission. (n.d.). *California Alternate Rates for Energy (CARE).* https://www.cpuc.ca.gov/care/. Also of critical concern are those households whose income is just above the 200% threshold and who also are struggling to make ends meet and pay utility bills. To address this concern, California created the Family Electric Rate Assistance program for households with three or more people in which the total household income is at or below 250% of the federal poverty guideline. These households receive a 12% rate discount. This program highlights the need to create discounts that help more than just the lowest income customers.

156 Seattle City Light. (n.d.). *Residential rates.* City of Seattle. https://www.seattle.gov/city-light/residential-services/billing-information/rates

157 Residential members must qualify as low income according to the guidelines set by LIHEAP (150% of the federal poverty level). Members qualifying for LIHEAP after October 1 will automatically be eligible. Flathead Electric Cooperative. (n.d.). *Low income assistance.* https://www.flatheadelectric.com/account/low-income-assistance/. Flint Energy in Georgia has a similar program that provides a $15.50 discount off the $31 customer charge. Flint Energies. (n.d.). *Residential rates.* https://www.flintenergies.com/residential-rates

158 North Attleborough Electric Department. (2018, October 1). *Rates — tariff — Rate 5, 9-18* [Rate sheet]. http://www.naelectric.com/images/TARRIF-Rate_5_10-1-2018.pdf

c. Usage-Based Discounts

There are also programs that have differentiated rates based on the amount of energy used. For example, the rate for up to 500 kWh per billing period could be discounted. This reduction gives extra incentive for customers to reduce usage. This approach pairs well with energy efficiency and weatherization programs, especially those designed to benefit low-income residents.

d. Percentage of Income Payment Plan

The percentage of income payment plan (PIPP) used by investor-owned utilities in Ohio, Pennsylvania and Illinois as well as a few other jurisdictions allows income-eligible customers[159] to pay a percentage of their income instead of the full bill every month to keep service connected. Ohio set the percentage of income at 6% each for gas and electric service, for a total of 12%. In Illinois, 3% is used as the percentage of income, which better matches the energy burden for customers who are not categorized as low income. The unrecovered portion of the low-income customer's bill is recovered from all customers (residential, commercial and industrial) through a rider on monthly bills that is reconciled periodically. The utilities track the unpaid bill amounts as arrears for the customer that they are required to pay back once they are no longer eligible for the program due to increased income. Depending on how long the customer was on PIPP and the size of the monthly bill, these arrearage amounts can prove to be insurmountable obstacles to a sustainable debt-free life. Therefore, a critical component of the PIPP program is the arrearage forgiveness program whereby for every month the customer pays the current bill plus a portion of the arrearage, the utility writes off one month of arrearage. In Ohio, this allows the customer to be debt free after two years.

Table 4. **Traditional percentage of income payment plan mechanism**

Customer monthly income	$1,500
Customer payment (6% of income)	$90
Customer bill [$10 customer charge + (1,000 kWh x $.12/kWh)]	$130
Customer arrearage amount collected through surcharge (bill amount of $130 minus customer payment of $90)	$40

Source: Migden-Ostrander, J. (2021, April 13). *Use Less, Save More: Adding a Conservation Incentive to Percentage of Income Payment Programs*

The significant upside of this program is that it addresses head-on the energy burden and tries to make bills more affordable. The downside is that there is no incentive to conserve, as the utility bill is based on income and not usage. Table 4 demonstrates how the traditional PIPP program works using Ohio's 6% of income.[160]

Under the above scenario, the customer pays $90 of a $130 bill, with the remainder going into the PIPP rider account. Under the conservation incentive, if the customer does not conserve, the customer continues to pay the same amount as under the traditional PIPP mechanism. There is no penalty for not conserving. However, if the customer can reduce energy consumption, the savings from that reduction are split between the customer and the utility. This means customers pay a lower energy bill for the month in which they conserved, and the utility PIPP rider account increases by a lower amount. It creates a win-win scenario as illustrated in Table 5,[161] using the same numbers as in Table 4.

159 Eligibility in Ohio is set at 150% of the federal poverty guideline. The community action agencies that provide multiple services to low-income customers determine a customer's eligibility and certify it to the utility. The utility pays the agencies a small fee for their services.

160 Migden-Ostrander, J. (2021, April 13). *Use less, save more: Adding a conservation incentive to percentage of income payment programs.* Regulatory Assistance Project. https://www.raponline.org/blog/use-less-save-more-adding-a-conservation-incentive-to-percentage-of-income-payment-programs/

161 Migden-Ostrander, 2021.

Table 5. **Percentage of income payment plan mechanism with conservation incentive**

Customer monthly income	$1,500
Customer payment (6% of income)	$90
Customer historical bill [$10 customer charge + (1,000 kWh x $.12/kWh)]	$130
Customer current bill with incentive mechanism [$10 customer charge + (900 kWh x $.12)]	$118
Value of savings due to conservation (1,000 kWh minus 900 kWh = 100 kWh x $.12)	$12
Customer share of savings on bill ($12 x $.50)	$6
Customer total bill ($90 minus $6)	$84
Customer arrearage amount collected through surcharge (bill amount of $118 minus ustomer payment of $84)	$34
Reduction in PIPP collection account ($40 minus $34)	$6

Source: Migden-Ostrander, J. (2021, April 13). *Use Less, Save More: Adding a Conservation Incentive to Percentage of Income Payment Programs*

In the example in Table 4, the customer reduced their monthly consumption by 100 kWh, which reduced the monthly bill by $12. That $12 is shared 50-50 with the customer so that the monthly bill amount goes from $90 to $84. The amount that goes into the PIPP rider account decreases from $40 to $34.

e. State and Local Community Programs

Many states as well as municipal utilities and community organizations have programs for bill assistance. For example, HeatShare, a program of the Salvation Army, raises private money that elderly, disabled and low-income customers can apply toward heating and air-conditioning bills. When sufficient funds are available, HeatShare grants can cover emergency repairs to energy-related equipment as well as broken windows and doors. Decatur Utilities in Alabama has Operation: Warm, which provides assistance to people who don't qualify for LIHEAP. The community action agency that administers Operation: Warm decides who receives funds based on income and necessary expenses, such as medications. The program runs from December 1 through May 31, during which applicants are eligible for assistance only once.[162] Donation-based programs can be helpful but should not be relied upon as the primary way to address energy burden. Thus, in addition to facilitating charitable donations, the utility should also employ some of the other mechanisms discussed in this section that lower the affordability threshold for low-income customers through discounted rates and significant energy efficiency, which lowers consumption and thus bills.

f. Extended Payment Plans

An extended payment plan is the key element to avert a disconnection, but it only works if the plan is flexible and realistic in terms of what a customer can afford to pay each month. Plans can be designed so the customer pays the current bill plus a percentage of the arrearage over a period of months (e.g., the current bill plus 10% of the arrearage) or pays a percentage of the total bill plus the arrearage over a period of months (e.g., 25% of the combined total of the current bill and arrearage, until the arrearage is paid off). Putting a customer on a budget bill also helps manage the seasonal highs and lows by having the customer pay one-twelfth of the estimated annual usage each month. However, it is important to provide the customer with information on actual usage and energy efficiency savings to help the customer keep the overall bill low and to avoid the surprise of a high reconciliation payment amount at the end of the year if actual usage exceeds estimated budget usage.

g. Moratoriums, Arrearage Management Plans and Debt Forgiveness

Disconnection moratoriums have been used in the past to avert tragedy due to disconnections during events with significant health impacts, such as cold weather. Due to the COVID-19 pandemic, an unprecedented number of customers found themselves with significant unpaid utility balances. Moratoriums on disconnections protected these customers who lost their incomes, but arrears still grew. This reinforced the need for better and more flexible arrearage management plans than utilities may have traditionally offered. Some customers received automatic grants, but those who saw the most debt relief were customers who entered into agreements, similar to extended payment plans, in which they make certain payment amounts per month

162 Decatur Utilities. (n.d.). Residential — *Bill assistance & energy efficiency.* https://www.decaturutilities.com/bill-assistance-efficiency

related to their arrears, and the utility waives a portion of their balances each time. Maine's Versant Power forgives one-twelfth of the outstanding balance, with a cap of $300, per bill, so long as the eligible customer meets the payment conditions.[163] For customers whose arrearages had grown to insurmountable levels, a significant amount of forgiveness was the only practical way to move forward for both the utility and the customer.

2. Late Fees and Reconnection Fees

Late fees are meant to operate as a disincentive for being delinquent on bills. But when a customer is delinquent on a bill because they do not have the money to pay when it is due, either because they have not received their paycheck yet or because they live on a fixed income, this is not a viable disincentive. Late fees and reconnection fees levied against low-income customers only make payment plans harder to manage and further reduce their means to cover their cost of living. Municipal utilities should either eliminate these charges and incorporate them into the general rate that all customers pay or waive these charges for low-income customers.

3. Disconnection Policy

Electricity is an essential service, and establishing policies to keep customers connected is vital. By prioritizing cost-saving access to energy efficiency upgrades and distributed energy for low-income customers, employing a combination of the programs listed above and fostering trust with customers through clear communication and robust community engagement, a utility can avoid having customers face disconnection in many cases.

If a customer does end up facing disconnection, clear communication is vital, and certain protections should be guaranteed. Utilities should provide 30 days' notice for disconnection with ample communications to ensure the customer is aware of their options and knows the utility is there to help them stay connected. Minimal partial payments should be set at a small percentage of the outstanding debt (e.g., 10%) while the customer sets up an extended payment plan.

Some customers should be protected from disconnection regardless of payment status:

- Those that have a physician's note or medical certificate that states that access to electricity is vital for the health of a household member. These policies exist in all 50 states for all investor-owned utilities,[164] and many municipal utilities have adopted similar protections. Allowing for self-certification in emergencies or short-notice situations is recommended.
- Customers who are already working to get assistance or take advantage of one of the utility's programs.
- All customers during periods of unsafe weather conditions, including when the forecast high temperature is 32 degrees Fahrenheit or below, during a dangerous heat index and when the air quality index is at unhealthy levels.
- All customers during public health emergencies, following the precedent of utility shutoff moratoriums during the COVID-19 pandemic,[165] as appropriate considering local circumstances.

Ultimately, utility service is a necessity like food and shelter. Disconnection removes access to that necessity, and all steps should be taken to work and communicate with the customer to avoid that outcome. Unfortunately, customers are often afraid to be proactive in addressing an inability to pay, so it is incumbent for the utility to reach out to those customers with clear communications as to options that can help the customer stay connected. This is not only in the best interests of the customer, but it is good for society as a whole and helps the utility by mitigating against lost revenues from lost service.

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163 Versant Power. (n.d.). *Arrearage Management Program (AMP).* https://www.versantpower.com/residential/programs-and-services/arrearage-management-program/

164 For state-specific criteria, see National Consumer Law Center. (2021). *Protecting seriously ill consumers from utility disconnections; Appendix A: Serious illness criteria in each of the 50 states and D.C.* https://www.nclc.org/images/pdf/energy_utility_telecom/consumer_protection_and_regulatory_issues/Serious_Illness_Ap_A.pdf. In some states where the utility commission has capacity to regulate municipal utilities these may apply, but individual municipal utilities should make sure their policy is not allowing customers to fall through the cracks.

165 For a list of states that issued moratoriums applicable to investor-owned utilities, see National Association of Regulatory Utility Commissioners. (2021, September 9). *Map of disconnection moratoria*. https://www.naruc.org/compilation-of-covid-19-news-resources/map-of-disconnection-moratoria/. Many, but not most, public power entities issued their own moratoriums.

Tracking progress on energy burden with performance incentive metrics

Performance incentive metrics are a useful tool to measure progress on issues that have been identified as public policy priorities. Reporting on metrics is a transparent way to inform the public of a municipal utility's actions and progress in meeting those metrics. In Hawaii, for example, performance incentive metrics were established. which required the utility to report on:

- Energy burden in terms of the typical and average annual bill as a percentage of average income for low-income households.
- Percent of customers entering into a payment arrangement.
- Percentage of disconnections due to nonpayment.

Puerto Rico has also established performance metrics to address low-income issues. The metrics include the number of:

- Disconnections by customer class.
- Customers enrolled in a payment plan by class.
- Customers defaulting from a payment plan by class.
- Customers completing a payment plan by class.

The latter two are especially important to ensure that the payment plans the utility establishes are flexible, realistic and achievable.[166]

Useful Resources on Energy Burden

Heeter, J., Xu, K., & Chan, G. (July 2021). *Sharing the Sun: Community Solar Deployment, Subscription Savings, and Energy Burden Reduction.* National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy21osti/80246.pdf

U.S. Department of Health and Human Services. (2021, March). *State Low-Income Energy Assistance Snapshots.* https://web.archive.org/web/20210318001028/https://liheapch.acf.hhs.gov/snapshots.htm

166 Puerto Rico Energy Bureau, Case No. NEPR-MI-2019-007, Resolution and Order on May 14, 2019. https://energia.pr.gov/wp-content/uploads/sites/7/2019/06/MI20190007-Resolution-and-Order.pdf

F. Summary: Putting the Pieces Together to Build a Clean and Equitable Energy Future

In this section, we have examined ways municipal utilities can implement energy efficiency programs, demand management, electrification and development of clean energy resources to meet customer end uses in a manner that takes into account a changing energy landscape and, in particular, a need to address climate targets. These building blocks are best thought of as a suite of tools and resources that a municipal utility can use to realize an equitable, clean and cost-effective energy transition. Therefore, the utility will need to consider all of these resources and likely deploy all of them to meet municipality and municipal utility goals. Combinations of resources and policies can result in savings of costs and emissions and create new value streams that may not exist where just one option is deployed.[167]

An example of using a suite of tools, programs and resources can be found in the Oakland Clean Energy Initiative, a program of Pacific Gas and Electric Co. and East Bay Community Energy, which replaced an aging 165-MW fossil-fueled peaking plant and avoided the need for new transmission. The resulting project is a mix of energy efficiency, demand management and photovoltaic distributed generation, electric storage, substation upgrades and line reratings. This strategy saved ratepayers money and reduced air emissions, avoiding transmission and generation solutions totaling $300 million to $600 million with a combination of distributed energy resources costing only $102 million (see Figure 8).[168]

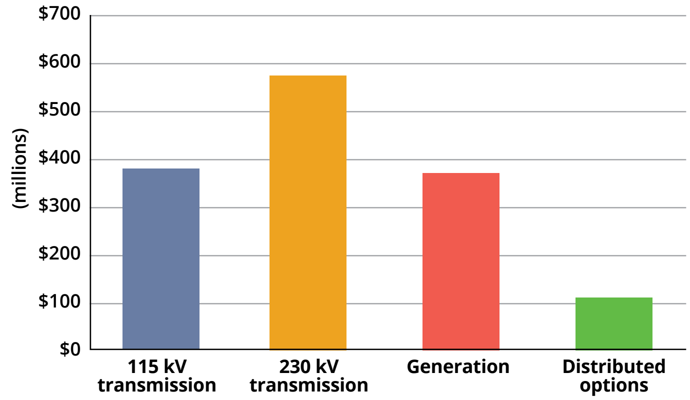
167 Shenot, J., Linvill, C., Dupuy, M., & Brutkoski, D. (2019, August). *Capturing more value from combinations of PV and other distributed energy resources.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/capturing-more-value-from-combinations-of-pv-and-other-distributed-energy-resources/

168 Linvill et al., 2019. See also East Bay Community Energy. (n.d.). *The East Bay's public power agency.* https://ebce.org/about/; and Pacific Gas & Electric. (2018). *Oakland Clean Energy Initiative (OCEI): 2018 Oakland Clean Energy Initiative RFO.* https://www.pge.com/en_US/for-our-business-partners/energy-supply/electric-rfo/wholesale-electric-power-procurement/2018-oakland-clean-energy-initiative-rfo.page?WT.mc_id=Vanity_rfo-ocei&ctx=large-business

In contrast to the traditional model that relied on large, central generation, a modern energy system can offer many paths to meet customer needs that create resilience and flexibility within the system.

The options outlined in this section can offer significant benefits by themselves, but the power of a transition is combining numerous resources to meet customer end needs at least cost to the customers and the community and environment supporting those customers.

Figure 8. **Replacement alternatives for a gas peaking plant in Oakland, California**



Source: Linvill, C., Lazar, J., Littell, D., Shipley, J., & Farnsworth, D. (2019, October). *Flexibility for the 21st Century Power System*

IV. Good Governance

A. Foundations of Good Governance

As characterized by the American Public Power Association, public power is an expression of the American ideal of local people working together to meet local needs. It is a manifestation of local control. What makes municipal utilities unique is that their local nature enables them to reflect hometown characteristics and values.[169] Realizing these virtues and benefits requires adherence to principles of good governance to ensure the public interest is met.

The Organisation for Economic Co-operation and Development defines governance as the formal and informal arrangements that determine how public decisions are made and how public actions are carried out. The principal elements of good governance include accountability, transparency, efficiency, effectiveness, responsiveness and the rule of law.[170] Some of these elements are already articulated for municipal utilities in enabling statutes and ordinances. But principles of transparency and public engagement are usually less clearly spelled out in governance structures. We explore them more fully here.

Important elements of good governance for municipal utilities include:

- Clear governance and operations structures.
- Clear notice of public meetings.
- Opportunities to take advantage of community resources and interest.
- Transparent policymaking processes.

1. Clear Governance and Operations Structures

According to data from the American Public Power Association, most public power utilities are owned by cities and towns, but many are owned by counties, public utility districts and even states.[171] The types of municipal utility governance structures can vary greatly within a state, such as the following categories in Florida:[172]

- Utility services are provided by a department under the city, town or local government (in a council-manager form of government) or a division under a department head. The utility still has a designated top manager (e.g., an assistant city manager or director/supervisor), and it retains some degree of autonomy.
- Utilities are separate entities that answer directly to the city council or mayor. In this model, elected officials define policies and utility managers implement them. Typically, there is no difference between utility employees and city employees.
- Utilities are governed by an independent commission. The utility top manager (chief executive officer or general manager) does not interact directly with city officials but rather with an independent commission (utility authority) composed of specialists or citizens with broad public experience. Usually, the city mayor chairs this commission but is not allowed to vote.

Given the variety of governance structures among municipal utilities, it is important for each municipality to clarify for community members how the utility is governed and functions. Municipalities should make the following utility information accessible on their website and upon request.

- **Statutory mandate.** Generally, states define a public or municipal utility in statute or code. This statute also generally sets the governance structure, oversight and functions the utility must perform.
- **Oversight structure.** Utilities should publicize information about the oversight authority, which could be a board of directors, governing committee, government office or division of government. Information should also be included on the terms of the individuals involved in governance, if any, and roles, responsibilities and duties of the oversight body. Any governing principles for the board of directors or commission, typically articulated by the city, town or municipality through an ordinance, should also be publicly available.
- **Utility management.** Information on the utility manager, chief executive officer or executive management of the utility and major utility departments should be publicly available, along with contact information, including mail, telephone or internet.

169 American Public Power Association, n.d.

170 Organisation for Economic Co-operation and Development. (2015). *The Policy Framework for Investment (PFI).* http://www.oecd.org/investment/pfi.htm

171 American Public Power Association, n.d.

172 da Cruz, N. F., Berg, S. V., & Marques, R. C. (2013). Managing public utilities: Lessons from Florida. *Lex Localis, 11(2),* 101-118. https://bear.warrington.ufl.edu/centers/purc/docs/papers/1101_Cruz_Managing_Public_Utilities.pdf

- **Utility financial information.** Because they are public entities, public power utilities do not pay federal income taxes or most state taxes, but they support the local government through payments in lieu of taxes or transfers to the general fund. Unlike with investor-owned utilities, excess revenues stay in the local community and are invested in system improvements and utility reserves, shared with the local government, or returned to the customer in the form of lower rates. Public power utilities also generally have access to lower-cost tax-exempt financing and generally have stronger credit ratings than privately owned utilities.[173] Financial information about the municipal utility — including payments to the municipality, the amount and use of excess revenues and credit rating — should all be publicly available. General and nonconfidential financial information of the utility should also be publicly accessible, including compensation of top utility executives and federal 990 forms.
- **Public records and reports.** Sunshine laws — also known as open records laws, public records laws or FOIA laws, for the federal Freedom of Information Act — govern public access to governmental records. Municipal utilities should make public any meeting minutes of the board of directors, oversight committee and public utility meetings and any annual reports or other information provided by the utility.
- **Municipal goals, resource plans and strategic direction.** Section II discusses setting municipal goals, strategic direction and resource plans. General and non-confidential information on municipal goals, plans and strategic direction should be accessible to the public.
- **Customer program information and tariffs.** Section III discusses energy efficiency, weatherization programs and low-income bill assistance programs. It also covers the benefits of customer interactive tariffs, demand management programs and beneficial electrification, including electric vehicles, renewable energy and distributed generation programs. Information on these programs, including customer eligibility, benefits to the customer and program details, should also be clearly accessible for municipal utility customers.

2. Clear Notice of Public Meetings

Public power utilities are owned by and operated for the citizens they serve and therefore are accountable to their local owners. As articulated by the American Public Power Association, this local, independent regulation and governance gives utility policymakers greater agility in decision-making and protects the long-term viability of the utility, while permitting customer involvement in the process. Customer involvement ensures decisions reflect the values of the community,[174] so these benefits

Examples of good governance

- **Hutchinson Utilities Commission in Hutchinson, Minnesota**, has a very navigable website (https://www.hutchinsonutilities.com/about-huc/) that includes many documents outlining policies and procedures for cogeneration, interconnection, storage and so on, as well as details about the commission, including a link to commission minutes. It also has a joint website with Bright Energy Solutions (https://www.brightenergysolutions.com/municipalities-container/mn/hutchinson-utilities-commission/) that provides information on their many rebate programs, both residential and commercial.
- **Colorado Springs Utilities** (https://www.csu.org/Pages/default.aspx) is an example of a utility that is transparent in its governance and operations. The roles of the leadership figures are clearly identified by their elected or appointed status and their governing or advisory nature. The site even has information on how customers can engage with the utility's governing process and has community outreach programs that customers can participate in. Financial reports and planning, meeting agendas and minutes, energy portfolios and integrated resource plans are all readily available on the website, making it a transparent and educational resource for customers.
- **The Grand Rapids Public Utility Commission** (https://www.grpuc.org/) in Minnesota serves a town of almost 11,000 people. Despite the utility's modest size, its website is a comprehensive resource for its customers. It features an organizational chart, financial reports, plans, meeting minutes and a plethora of programs available to customers.

173 American Public Power Association, n.d.

174 American Public Power Association, n.d.

won't be realized unless municipal utility meetings are open, accessible and transparent.

As noted in the section above, information included on the municipal utility website and made available to municipal customers must include meeting minutes and public records. Information should also be made accessible on the following:

- **Notice of meetings.** Notices of regular and special meetings should be posted in accordance with public records and meeting laws. However, extra effort may be necessary to ensure that a diverse population is able to participate. Meetings during the day may be inaccessible to customers of a municipality. Therefore, utility managers should take steps to ensure that the location, timing and language of notices and materials supports the engagement of residents, including those with disabilities. Notices for meetings should be made in the languages spoken in the community and should be publicly posted at local community centers, libraries, faith organizations, clubs, community organizations, medical facilities, schools or other places where people commonly gather. Municipal utilities should also ensure that participants have relevant information on the topic or issue at hand that is written in commonly understandable language.
- **Decisions made in public meetings.** Decisions beyond day-to-day operational decisions should be made in public meetings. This enables municipal customers to participate in and understand utility processes and operations. All meetings should provide an opportunity for public comment.

3. Opportunities to Utilize Community Resources and Customer Interest

As community-owned enterprises, public power utilities have the ability to focus on specific customer needs and local priorities, which may include new technologies, environmental concerns or advanced communications.[175] The municipal governance structure also typically allows greater agility in decision-making and the ability to try new programs and sources of supply and more effective utilization of local resources than investor-owned utilities can muster. Municipal utilities should take steps to realize these unique resources and opportunities. Methods to do this include the following.

a. Public Meetings About Potential New Programs and Resources

Public power utilities have a history of innovation and have "been leaders in every new technology that reduces emissions, enhances reliability, and increases efficiency for customers. Many of those efforts have been 'incubated' in our small communities and then extrapolated to larger communities."[176] Familiar concepts that were first trialed in public power settings include wind generation, landfill-gas-to-energy projects, community solar, energy efficiency programs, electric vehicle infrastructure early adoption and hydroelectricity.[177] Earlier in the report we have described various methods to achieve municipal goals through energy efficiency and clean energy programs, which offer a starting point for introducing new programs and resources to municipal utilities. Meetings, either general or special, are an excellent venue to educate community members about these programs and new opportunities that municipalities may pursue. Municipalities are also able to utilize municipal land for renewable energy development opportunities or community solar gardens (see Section III-D).

b. Direct Public Involvement

In addition to a history of innovation, public power utilities also have a valuable resource in engaged municipal customers. The public can be included in general meetings and through specific public engagements on big municipal decisions. But active customers of the municipality can also be engaged in other ways, including on specific topics or in outreach to other customers.

One important tool for engaging and utilizing municipal customers is a volunteer task force to study specific issues and make recommendations. Some issues before a municipal utility may require technical expertise and require the use of paid consultants. Others, particularly at early stages of exploration, may be more suited to community-sourced research. With a clear directional charge, timeline and sufficiently detailed expectations, volunteer task forces made up of interested members of the public can provide

175 American Public Power Association, n.d.

176 American Public Power Association. (2021b, May 14). *Public power: At the forefront of innovation.* https://www.publicpower.org/blog/public-power-forefront-innovation

177 American Public Power Association, 2021b.

analysis of specific issues and make recommendations. Issues particularly suited for this approach could be determined in a public participation process, such as researching innovative resource options.

4. Transparent Policymaking Processes

Public power utilities, like investor-owned utilities and cooperatives, engage in policymaking through the planning processes explored in Section II. These include integrated resource plans, energy efficiency strategies, electrification plans, renewable portfolios and distribution system plans, among others. Many of these planning processes can benefit from public engagement in some form as further discussed in Section IV-B below.

Lessons learned on transparency and good governance

Transparency and good governance practices are valuable tools that not only provide better outcomes for the municipal utility and individual customers but also help ensure that these public bodies are free from corruption and regulatory capture.[178] Sharing information and inviting participation in decision-making processes provides the public a greater understanding about how and why the utility is making certain decisions. Where stakeholders do not agree with the assumptions or data upon which those decisions are based, open processes also provide an avenue to secure additional information or ideas. Without such good governance practices, customers and stakeholders may feel that the municipal utility's decisions are not well grounded, and without any means by which to review or contest those decisions, they may grow skeptical and distrustful, possibly leading to more costly challenges such as court challenges.

Clear explanation of the specific planning processes, their schedule and the reasons for them will help the public and stakeholders participate. Additionally, current planning documents should be available to the public.

B. Ensuring Public Participation in the Clean Energy Future

Energy customers increasingly desire clean energy sources. In 2019, 40% of surveyed customers wanted renewable generation, up from 25% the prior year.179 Given the increased customer interest in clean energy resources and desire for input into the process, a strategy to engage in robust public engagement will enable municipal utilities to incorporate members of the public in an effective and efficient manner. The International Association for Public Participation notes that the idea of public participation is based upon the "belief that those who are affected by a decision have a right to be involved in the decision-making process." This sentiment is especially applicable to municipal utilities and public power agencies.

The International Association for Public Power defines five levels of public participation that are particularly applicable to public power utilities. These include duties to:[180]

1. **Inform.** Provide the public with balanced and objective information to assist them in understanding the problem, alternatives and/or solutions.
2. **Consult.** Obtain public feedback on analysis, alternatives and/or decisions.
3. **Involve.** Work directly with the public throughout the process to ensure public issues and concerns are consistently understood and considered.
4. **Collaborate.** Partner with the public in each aspect of the decision-making, including the development of alternatives and the identification of the preferred solution.
5. **Empower.** Place the final decision-making in the hands of the public.

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178 Regulatory capture occurs when a regulatory body that is charged with protecting the public interest instead advances the political or commercial interests of the companies or entities it is supposed to be regulating. For more information on regulatory capture, see such resources as Carpenter, D., & Moss, D., (2014). *Preventing regulatory capture: Special interest influence and how to limit it.* Harvard University. https://www.tobinproject.org/sites/tobinproject.org/files/assets/Introduction%20from%20Preventing%20Regulatory%20Capture.pdf; and Nash, B. J. (2010). Regulatory capture. Richmond Federal Reserve. https://www.richmondfed.org/publications/research/econ_focus/2010/q3/~/media/26F9F09B51BF43BFB25FCCCB4BCFC909.ashx#:~:text=The%20ICC%20is%20now%20regarded,not%20just%20maximum%2C%20shipping%20rates

179 Escalent. (2019, April 22). *Consumer demand for clean energy significantly increases.* https://escalent.co/news/consumer-demand-for-clean-energy-significantly-increases/

180 American Public Power Association. (2007, April). *Public participation for community-owned utilities.* http://courses.washington.edu/bse190b/data/6a_i.pdf

These steps are important for municipal utilities to implement, particularly when facing decisions on building or procuring new resources or setting municipal climate and conservation goals.

Typical public power decisions that warrant specialized effort for public participation include, but are not limited to:

- Acquiring or procuring new generation.
- Expanding service territory.
- Siting a power plant.
- Adding a substation.
- Restructuring rates or new tariff designs.
- Designing energy efficiency, demand management, distributed generation or electrification programs.
- Revising or expanding low-income programs.
- Starting or revising green power programs.
- Building a transmission line.
- Expanding services beyond power supply.
- Selecting a general manager or other important executive position.
- Setting or revising municipal goals for the utility.[181]

Public engagement and input is also useful as a regularly recurring strategic planning effort. The following principles of public engagement can help municipal utilities gather meaningful input into decisions from a variety of public perspectives.[182]

Inclusive Planning and Preparation

Robust public engagement activities take planning to ensure that the goals of the engagement are accomplished and that the affected members of the community are present. This means that the planning process for the public engagement itself also requires inclusive planning. Inclusive planning ensures that the design, organization and convening of the public engagement process serves the defined municipal purpose and the needs of the participants. Developing the plan will require input from appropriate local officials, as well as representative members of the community. This early planning enables municipalities to equitably incorporate diverse people, voices, ideas and information to lay the groundwork for a good outcome.

Transparency

Clear statements of the purpose of the public engagement process, the steps in the process and how the municipality will incorporate results of the public engagement process will provide transparency. Readily available information on where customers can find out more details on the topic at issue, the process and contact information is also helpful.

Authentic Intent

The primary purpose of public engagement activities is to solicit views and ideas from municipal customers that will help shape the policy discussion. As noted by the Institute for Local Government, the purpose should not be to persuade customers to accept a decision already made.[183] Consequently, the planning and preparation step is important to ensure that diverse viewpoints are presented and heard so that a variety of options may be considered.

Broad, Informed and Accessible Participation

Robust public engagement processes include people and viewpoints that are broadly reflective of the municipal utility's population. Extra effort may be necessary to ensure that a diverse population is able to participate. This includes taking steps to ensure that the public engagement process is broadly accessible in terms of location, time and language and that it supports the engagement of residents with disabilities.

Clear and Engaging Public Process

Public engagement processes that utilize discussion formats that are responsive to the needs of municipal customers and encourage full, effective and equitable participation work well. Municipal engagement leaders should be clear about the public engagement process and the steps involved at each stage. They should provide a public record of the organizers, topics, range of views and ideas expressed and outcomes.

181 American Public Power Association, 2007. Additional items added to this list.

182 These principles of public engagement are derived from the best practices identified in National Coalition for Dialogue & Discussion. (2010). *Resource guide on public engagement.* https://www.ncdd.org/uploads/1/3/5/5/135559674/ncdd2010_resource_guide.pdf; and Institute for Local Government. (2015). *Principles of local government public engagement.* https://www.ca-ilg.org/sites/main/files/file-attachments/principles_of_public_engagement_jan_2015.pdf?1497552327

183 Institute for Local Government, 2015.

Sustained Engagement and Participatory Culture

Utilizing public engagement as a regular part of municipal utility governance decisions helps to promote a culture of participation from and with the community. Consequently, participation in utility programs will be more robust, and community value from and appreciation for municipal utility services will be high.

Useful Resources on Public Engagement

American Public Power Association. (2007). *Public Participation for Community-Owned Utilities: An Implementation Guide.* http://courses.washington.edu/bse190b/data/6a_i.pdf

Institute for Local Government. (2015). *Principles of Local Government Public Engagement.* https://www.ca-ilg.org/sites/main/files/file-attachments/principles_of_public_engagement_jan_2015.pdf?1497552327

National Coalition for Dialogue & Discussion. (2010). *Resource Guide on Public Engagement.* https://www.ncdd.org/uploads/1/3/5/5/135559674/ncdd2010_resource_guide.pdf

V. Conclusion

This document presents a great deal of information for municipal utility leadership to consider. Ultimately, many of these options may be useful to a municipal utility and its customers, but they cannot all be implemented at once, and it can be overwhelming to think about the transformation as a whole. Instead, we recommend that municipal utility leaders identify some first steps to begin the process (many of which echo first steps in a planning process) and then use this document as a reference in developing solutions for their community and its needs.

1. Consider where your utility is now. Do you have the information you need to determine what is working well and what needs to be changed? If not, how can you get that information?
2. What are your utility's goals and plans for the energy transition now underway?
3. What is an area where momentum, circumstances and political will enable immediate action? What areas may take longer? In other words, consider opportunities for immediate, mid-term and long-term planning.
4. Use the planning process to dig deeper into and develop these first steps and to involve stakeholders in planning and possibly implementation.

The utility industry is in the midst of a transformational change. Utilities can now balance demand and supply using more customer-centric, modular and distributed resources to create more flexible and resilient systems. Municipal utilities are well situated to engage in this transition to realize benefits for their customers, the communities they serve and their own operations. By doing so, municipal utilities can also align their operations to be consistent with new technologies, customer preferences, the changing climate, and at the same time benefit from more efficient operations.

These opportunities require a utility to embrace new approaches and methods of operations. These changes are not always easy, and proactive leadership of municipal utilities is therefore critical to ensure that municipal utilities position themselves effectively to take advantage of the energy transition. This guide is intended to facilitate initial steps and to provide additional resources for utilities wishing to engage further.

We wish you great success in your endeavors and are glad to serve as a resource as your utility embarks on the clean energy transition.