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ELECTRIC MUNICIPAL UTILITIES AND THE TRANSITION TO A CLEAN ENERGY FUTURE

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). *2030 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

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.

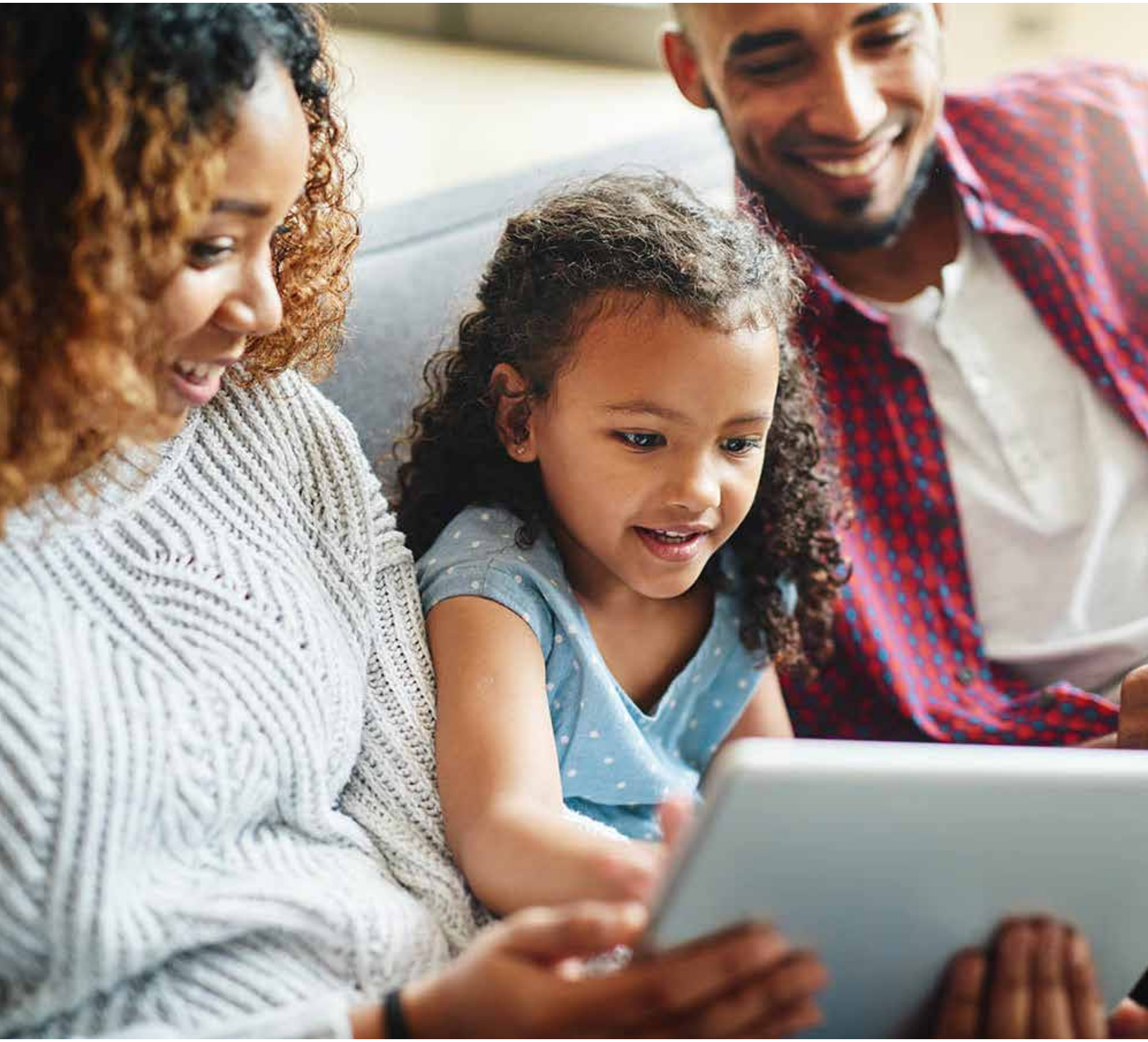
This transparency is critical for a publicly owned entity, particularly as it navigates changes driven by advancing technologies and the clean energy transition. Subject to sunshine laws and public records requests, utilities are encouraged to proactively make transparency a part of their operating culture 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.