CLIMATE CABINET EDUCATION

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ELECTRIC MUNICIPAL UTILITIES AND THE TRANSITION TO A CLEAN ENERGY FUTURE

A Guide for Municipal Utility Leaders

Climate Cabinet Education combines data science with policy expertise, local partnerships and cross-state experience to support climate leadership in local governments across the US — working towards a clean energy economy that creates jobs, improves community health, and unlocks local opportunity and leadership.

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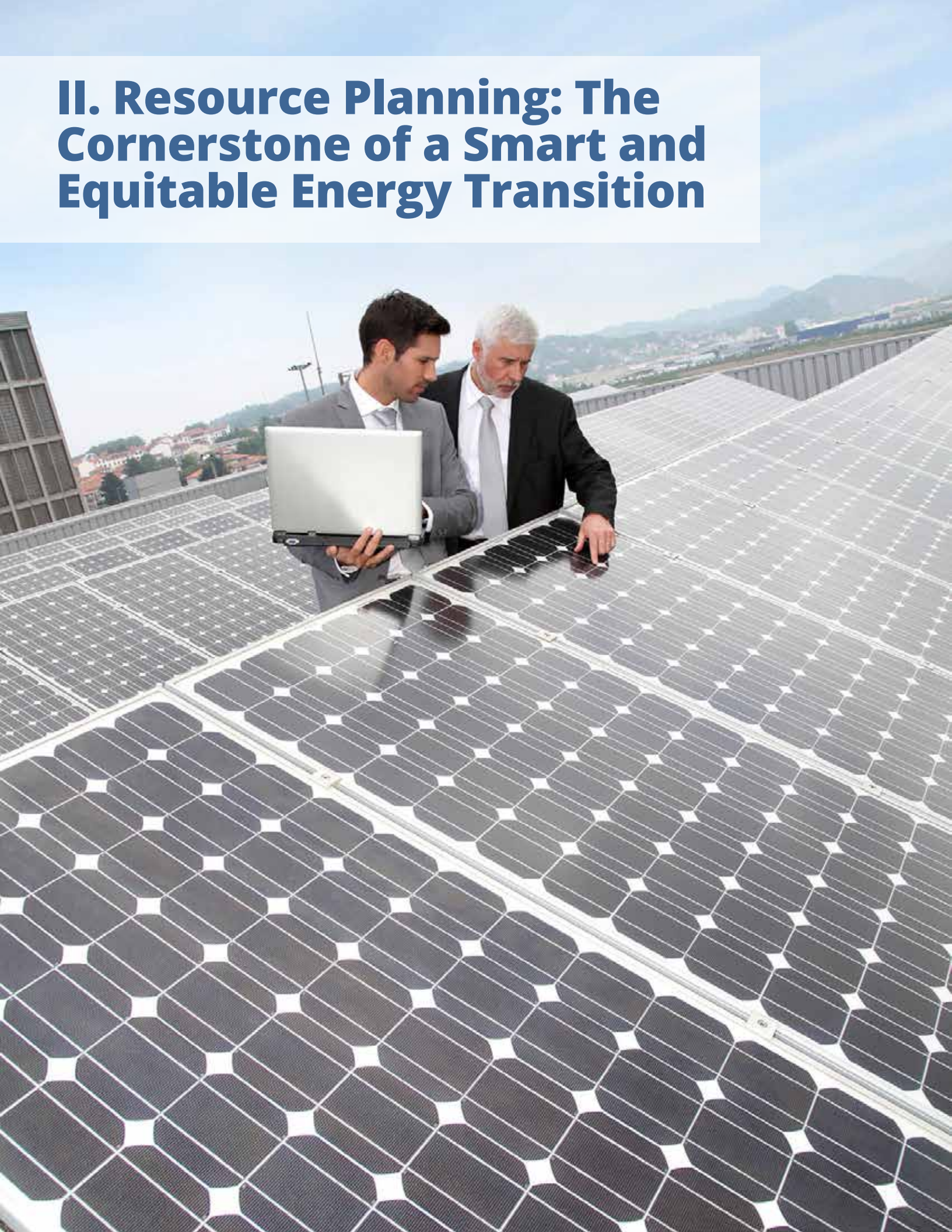
II. Resource Planning: The Cornerstone of a Smart and Equitable Energy Transition



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

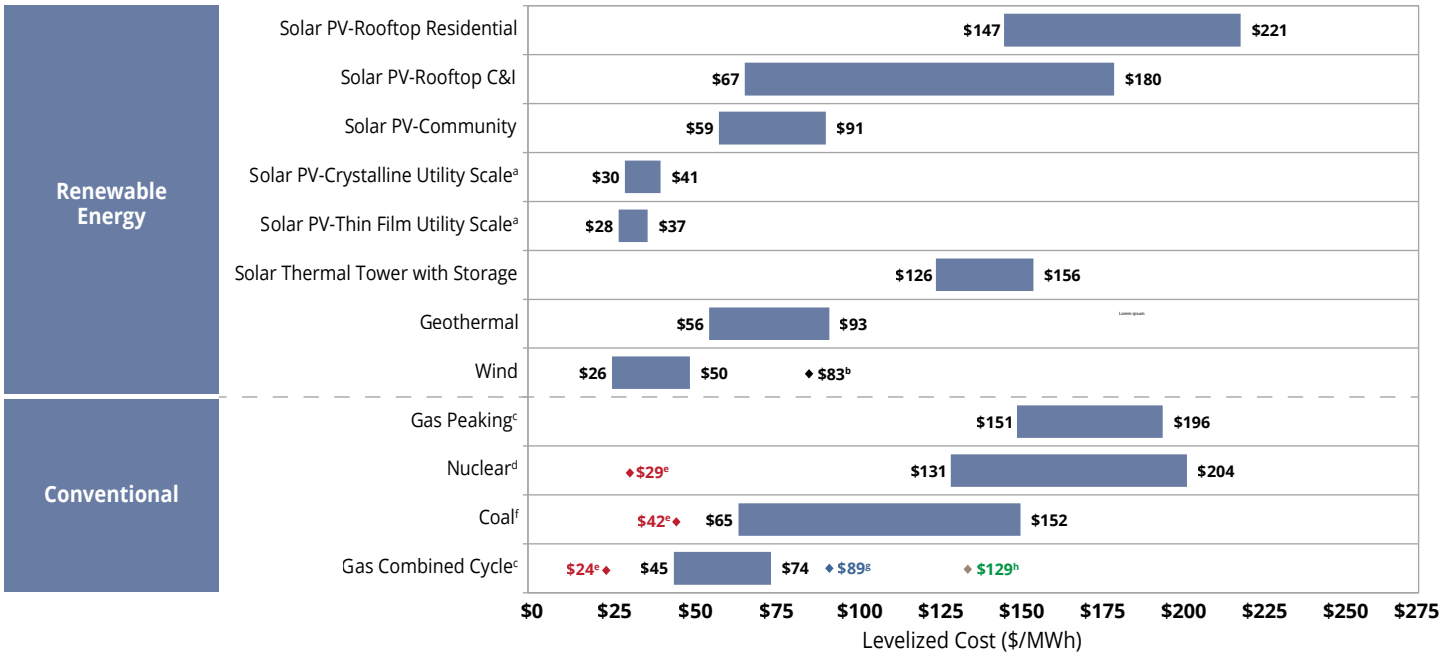
The costs of clean energy resources have dropped exponentially in recent years, and they are now the least-cost resources in many situations. As a result, utilities are no longer procuring these resources solely in response to renewable energy targets. As the analysis below demonstrates, clean energy 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.

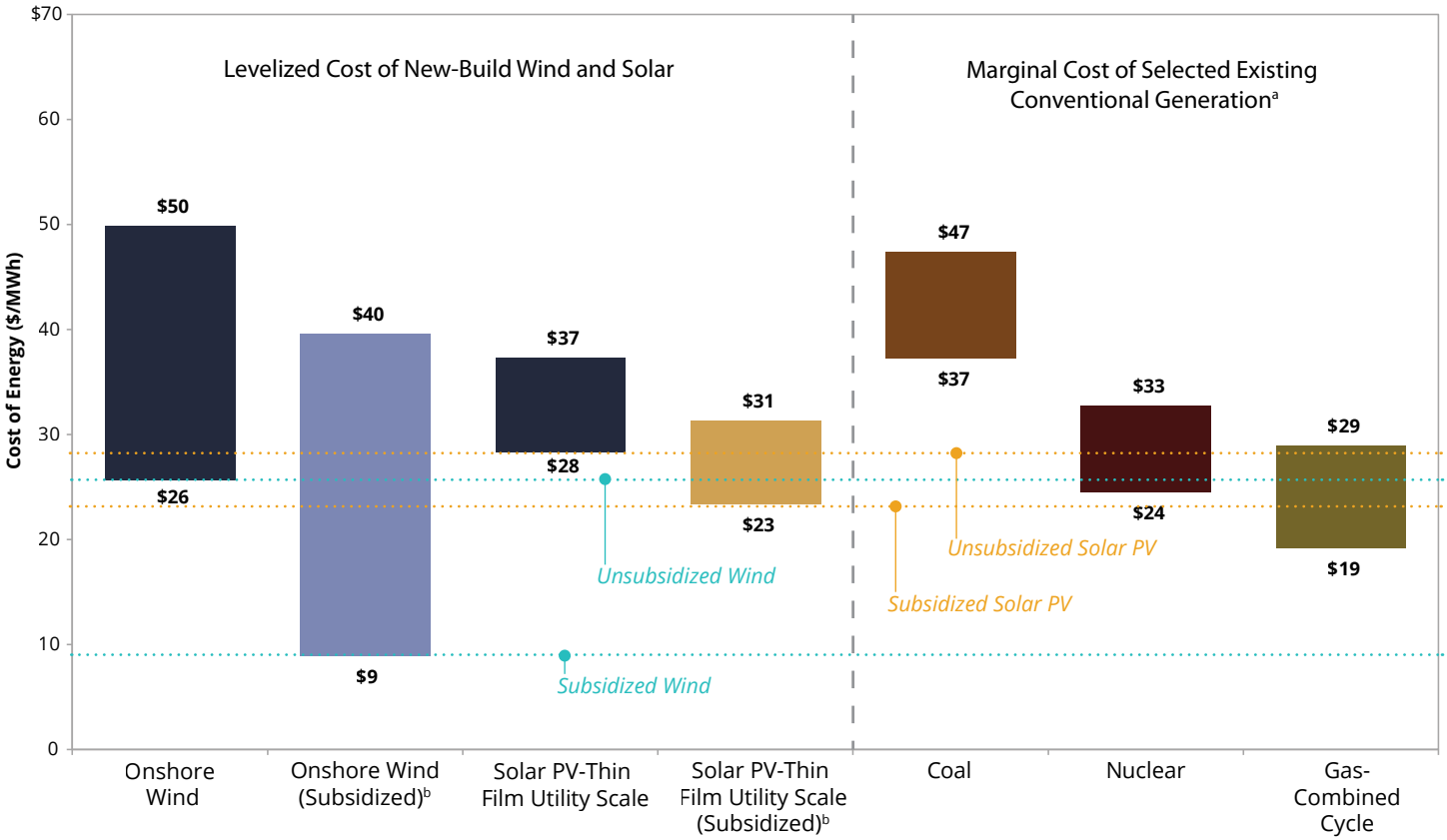
g Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Blue" hydrogen, (i.e., hydrogen produced from a steam-methane reformer, using natural gas as a feedstock, and sequestering the resulting CO2 in a nearby saline aquifer). No plant modifications are assumed 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.

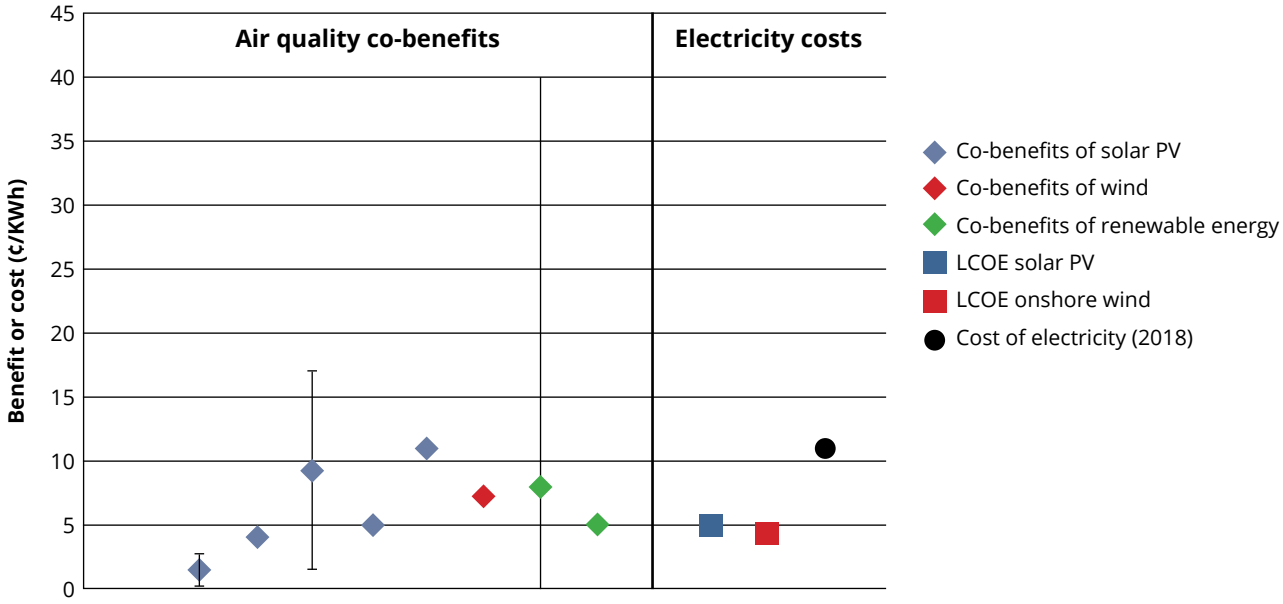
Source: Lazard. (2021, October). *Lazard's Levelized Cost of Energy Analysis — Version 15*

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/

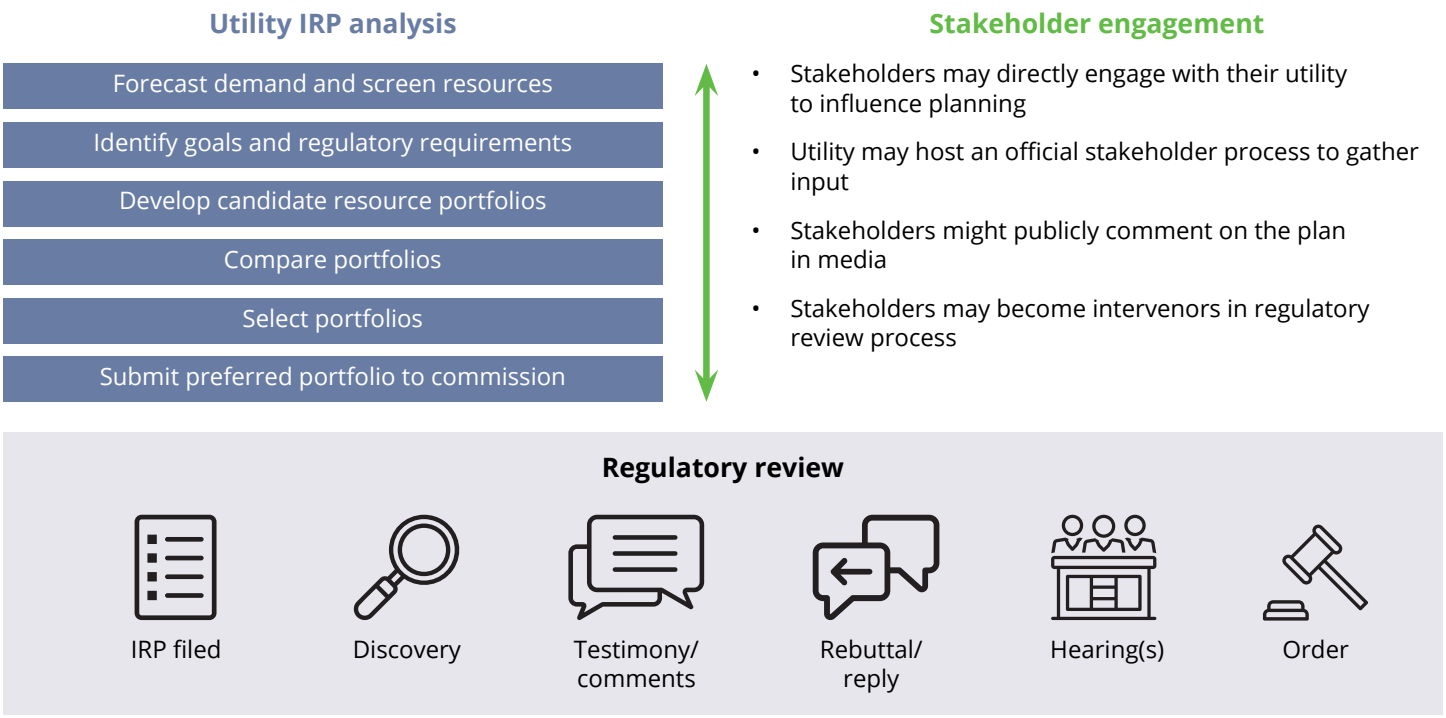
side, can be evaluated in an integrated fashion, with the participation of stakeholders, to arrive at a plan with the least overall cost, within whatever constraints are imposed. For simplicity, and because it is the most recognized term, we will use the term "integrated resource planning" (IRP) to describe 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.