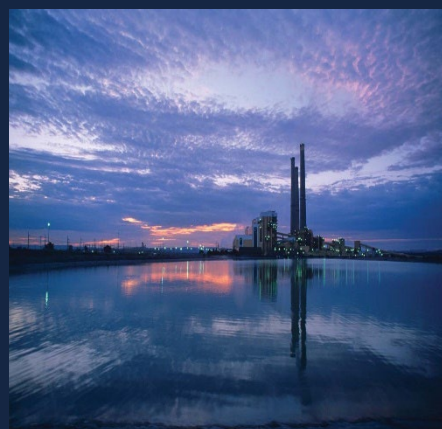
Develop

Provide



Involve

Sustain

Integrated Resource Plan

(FY2022 to FY2041)

Prepared by Utah Municipal Power Agency

Final Draft Plan: September 28, 2022

UTAH MUNICIPAL
POWER AGENCY

Contents

Executive Summary

Integrated Resource Planning guides the decision-making process regarding power supply resources and demand-side management programs. The Integrated Resource Plan (IRP) evaluates members' electrical system requirements, operating economic viability, generating plant capability, and environmental sustainability. Utah Municipal Power Agency (UMPA or Agency) prepared this IRP as a guide in their mission to provide reliable, sustainable, and least-cost electricity to UMPA member cities of Levan, Manti, Nephi, Provo, Salem, and Spanish Fork.

The 2022 UMPA IRP was submitted as required by the Energy Policy Act of 1992. UMPA prepared the IRP in accordance with the requirements of Western Area Power Administration (WAPA), an agency within the U.S. Department of Energy.

Key steps and elements in the IRP include:

1. An understanding of the planning environment,
2. Determination of future energy and capacity needs,
3. Examination of operating performance and accessibility of existing power resources,
4. Review of demand-side management (DSM) programs implemented by member cities,
5. Preparation of a plan of action to secure needed supply-side power resources,
6. Implementation of viable DSM programs.

The UMPA 2022 IRP included public participation through a public comment period as part of the IRP final process. A draft of the IRP was available to the public for review, and they were invited to offer comments within a thirty (30) day public comment period. The public comments are found in the appendix. After the public comment period, the UMPA Board of Directors reviewed the comments, considered appropriate changes, and approved the final IRP.

Purpose of the Integrated Resource Plan

This IRP is a guiding document to encompass four primary goals:

1. Identify sufficient generating resources to reliably serve the growing electrical demands of the member cities for the next 5-to-20-year planning period.
2. Ensure the selected generating resource portfolio balances costs, risk, reliability, environmental attributes, and business matters.
3. Give equal and fair treatment to supply-side resources and demand-side measures.
4. Involve the board, the member cities and the public in planning and setting the future energy policy for the Agency.

The actions taken by UMPA in accordance with the IRP will determine the diversity of energy resources to meet the obligations to the member cities. The IRP becomes a viable tool for both long-term and short-term planning. In the short-term, it provides monitoring and evaluation methods for the cost effectiveness of programs and resources. In the long-term, it forces an in depth look and consideration of emerging technologies, resources, and programs to meet the obligations of the Agency. It puts planning into a living document that is reviewed and updated to reflect the changes in the energy surroundings.

In the past, UMPA's member cities have enjoyed low electric rates because of the abundance of low-cost federally provided hydroelectric resources and locally available coal to power plants developed in the last century. However, there are no more opportunities to develop new hydroelectric projects, and climate change concerns and greenhouse gases make it impractical to develop new coal resources. The resources available today that meet future customer demand, focus primarily on natural gas resources for its capacity and dispatchability while adding intermittent renewable energy resources and battery storage.

As UMPA adds new generating resources to meet growing customer demand, costs are going to increase, either from participation in new generation construction, or from power purchase contracts. Through the integrated resource planning process, UMPA is responsibly planning the addition of new generating resources and managing the current power contracts and existing fleet to minimize the cost impact to customers.

UMPA's Mission Statement

UMPA, an interlocal political subdivision of the State of Utah, was established as a joint action agency in 1980. The Agency was created for the purpose of developing a reliable and economic power supply program to meet the "**all-requirements-obligation**" of electric power and energy needs of its member municipalities in Utah. UMPA serves the members by economically providing and scheduling power supply, creating energy load forecasts, ensuring interconnection and transmission service, supporting state and federal political action, and promoting demand-side management programs such as "RenewChoice."

The Agency is governed by a six-member Board of Directors, consisting of elected Mayors from each member city. In addition, an advisory UMPA Technical Committee consists of the electric manager from each of the member cities. The Technical Committee engages further into the operational reports, studies, and planning, and makes recommendations to assist the Board of Directors.

UMPA's long standing goals are to:

1. **Develop** a reliable, sustainable, and economical power supply program to meet the electrical power and energy needs as required by the members and their customers.
2. **Provide** the benefits of economies of scale through joint endeavors relating to generation, transmission and distribution of electric power and energy.
3. **Involve** each member in the planning, operation and developing stages it undertakes.

UMPA's History and IRP

UMPA was created pursuant to the Interlocal Co-operation Act, Title 11, Chapter 13, Utah Code Annotated 1953. UMPA was established on September 18, 1980, for the purpose of developing a reliable and economical power supply program to meet the electric power and energy needs of its member municipalities by acquiring, constructing, operating, maintaining, repairing, and administering power resources.

UMPA conducted reconnaissance power supply investigations in 1981, prepared and adopted a plan of development and obtained a $6 million loan for the Agency's development activities in 1982. These activities included acquiring water rights for a steam generation unit then under consideration and initiating engineering feasibility studies, legal investigations, and power pooling operations. Power supply screening studies, econometric load forecasts and a refined plan of development were accomplished in 1983. Pooling of existing member resources commenced in 1984. In November of 1985, UMPA developed into an All-Requirements Supplier for its member cities pursuant with the acquisition of a share the Bonanza coal-fired powerplant.

The Agency is governed by a Board of Directors represented by one director/representative from each member city. Each Director has one vote and decisions of the Board are made by a majority vote with public input.[1] This governing body is assisted by UMPA's Technical Committee. The technical committee was organized to be an advisory body to the Board of Directors.

The Board of Directors appoint the CEO/President of the Agency to oversee the day-to-day operations of the organization. The CEO/President is responsible for the staffing and directing the duties and tasks of the staff in meeting the needs of its members.

As a purchaser of power from the WAPA, UMPA is required to submit an IRP to WAPA under a provision of the Energy Policy Act of 1992. The Agency has had a least-cost plan since 1983 and is currently submitting this IRP for approval by the Board of Directors who regulate the actions and decisions of UMPA in evaluating and obtaining all available supply-side and demand side options. The purpose of the IRP is to help UMPA identify which resources to acquire, what amounts of resources to acquire, when to acquire them, and to acquire them at the lowest cost consistent with the guidelines the Agency has established relative to reliability, flexibility, economics, and other significant determinants discussed in the executive summary of this report. The initial IRP process included:

1. Examination of the power and energy requirements for the future.

[1] The Amended and Restated Interlocal Cooperation Agreement also allows for a call for a weighted vote on any matter, but automatically creates a weighted vote for approval of the annual budget, the addition of new power supply resources, the issuance of bonds, or other financial transactions in excess of $5 million.

2. Open and balanced consideration of a wide variety of supply-side and demand-side options within the existing resource mix.
3. Consideration of environmental impacts of providing energy services.
4. Involvement with the public and stakeholders through the member cities with the invitation to review and comment on the IRP, and its applicable criteria, for supply resources and demand-side programs.

Review of UMPA Goals, Strategies and Objectives

The following strategies are in place to support UMPA to fulfill its long-term goals to **develop**, **provide**, and **involve**.

a. UMPA must maintain an updated short-term and long-term load forecast and must monitor its load and load shape to assure that the basis for resource selection is well-grounded in terms of peaking, intermediate, and base resource needs in conjunction with intermittent and dispatchable characteristics.
b. The performance of existing resources that provide the framework within which a new resource is introduced must be monitored and optimized to deliver the full amount of power intended by economic dispatch procedures. This will assure the new resource will occupy a position appropriate to its characteristics which formed a major portion of the basis for its selection.
c. UMPA must continue to analyze potential demand-side and supply-side resources to determine that attractive options are fully considered as the IRP evolves in a dynamic process designed to continually enhance the economics, sustainability, reliability, and appropriateness of UMPA's resource mix. UMPA plans to provide a forum in its meetings where public participation plays a role in determining the preferred and economical resource.
d. The uncertainty in any scheme impacts UMPA load and resource plan as well. Therefore, an appropriate level of redundancy, or flexibility, should ideally be present among our resources so that a failure in one resource can be supported by increased performance from another. Conversely, loss of load can be addressed by the absence of a minimum requirement provision with our resources. For shorter term impacts, UMPA can rely on the availability of internal or contracted resources, spinning reserves, or the open market for energy.
e. If the economics and environmental attributes can be justified, UMPA must continue to consider environmental impacts with carbon-free, less regulated, and cleaner energy resources, as a priority. In FY2012, thirty-five percent (35%) of the Agency's supply-side resources came from renewable resources, primarily from the hydroelectric generation from WAPA. UMPA is keenly aware of the need and related expenses for clean air and water, and protecting sensitive surroundings, and has as a goal to be a minimal contributor to environmental degradation. In recent years, UMPA has added more renewable hydroelectric generation from the Olmsted project, the Sixmile hydro project and additional CRSP allocation, more solar energy from two projects – Clover Creek in Mona and the community solar project in Spanish Fork, and finally the energy from the BYU Cogeneration facility. These renewable efforts by UMPA are reducing on dependance on coal and reducing our carbon footprint. UMPA's largest member, Provo City, has adopted a goal of achieving 60%

renewable and clean power-supply by 2030.[2] UMPA is committed to work towards this and other goals for the reduction of greenhouse gasses, cleaner air along the Wasatch front and sustainable efforts by the public.

The types of demand-side programs depend on how much electricity the customers use and when they use it. UMPA's criteria for evaluation of demand-side options include the following attributes:

- Ease of Implementation
- Customer preference
- Costs
- Environmental impact
- Market potential and penetration ability
- Record keeping and documentation
- Reliability, durability, and commercial availability
- Capacity shaving and energy efficiency
- Credible operating statistics and measurable results
- Balance of load and resource integration

If a demand-side program scores well against the criteria listed above, and is recommended by the Technical Committee, then the program is evaluated by the staff in more detail. The priority in implementing any program is determined by the least cost and greatest benefit.

The criteria used for the supply-side options are similar to the criteria used in the demand-side evaluation. UMPA's criteria for the supply-side options include the following elements:

- Reliability/ Durability
- Location
- Costs
- Environmental attributes/benefits
- Diversity
- Dispatchability
- Capacity and energy capabilities
- Credibility of developer, contractor and operator, and their statistics and references
- Ability to meet the demand, follow the load and timely shape according to need
- Other operational or fuel risk factors

If the supply-side or demand-side options meet the respective criteria listed above, then UMPA will evaluate the project/program on the second level which includes:

- Economic considerations
- Environmental considerations
- Governance and control considerations

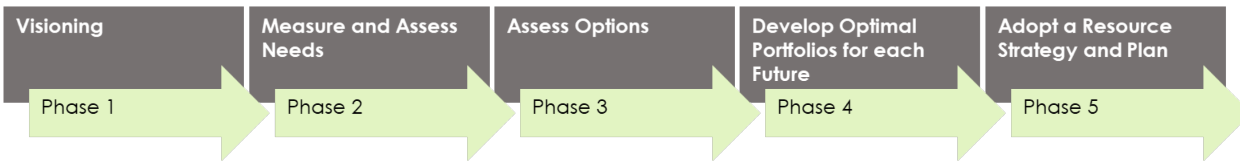
The intent of this IRP is to be a guide for evaluating, studying, and making power supply decisions according to the system requirements, economic viability, unit availability and environmental sustainability. If the assumptions and inputs of the IRP are set up incorrectly; it will likely produce erroneous and inaccurate results.

[2] Provo City's goal of renewable energy. (20-043) A motion to adopt into the Council Handbook, and refer to the Energy Board, a goal of achieving 60% green, renewable, and carbon-free power sources by 2030 was approved 7:0.

IRP Process

Description

The steps in preparing and updating the IRP are similar to any long-term planning strategy. The flowchart below describes the typical IRP process followed by a description of key steps.



Visioning

Identifying member cities' energy and power requirements in the future.

Measure and Assess Needs

Create a load forecast which accounts for historical loads, existing resources, and projects the need for additional resources.

Assess Options

Evaluate technologies and economics influencing supply, demand, transmission, distribution, and rates.

Develop Optimal Portfolios for each Future

Account for social and environmental factors which would produce alternate outcomes. Define suitable resource mixes and analyzes uncertainties.

Adopt a Resource Strategy and Plan

Incorporate a public review and ensure board approval of the IRP. Include action plans. Acquire needed resources. Continue to monitor factors that would impact the resource plan.

Electrical System Load Forecast

Forecast Methodologies and Key Assumptions
Historical Analysis
Electric System Load Forecast
Forecast Scenarios
Load Characteristics
Type of Power Generation

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Forecast Methodologies and Key Assumptions

UMPA is committed to serve the electrical growth of its member cities under all conditions. The timing of adding new supply resources depends on the rate of growth, required operating reserves, and targeted surpluses for adequate coverage.

The Agency developed annual forecasts by projecting total annual energy requirements using trending techniques. The Agency projected annual load factors based on history, known large new point-loads, and anticipated system maintenance. UMPA calculated annual peak demands using the annual energy requirements and load factor projections.

Careful evaluation of load data revealed no significant impact to projected power and energy loads from the COVID-19 pandemic.

The forecast operates under the following key assumptions:

1. Any new conservation and energy efficiency programs will not significantly impact the demand-side loads.
2. Normal weather and electricity consumption is forecasted for existing customers.
3. No adjustments are considered for climate change or weather-related conditions in this study.
4. No adjustments are considered for the all-electrification movement to reduce greenhouse gasses.

In general, the forecast methodologies used prior to presenting this report considered historical growth patterns, service area demographics, and service area economics. As a result, the annual forecasts reflect growth that is similar to that experienced historically. The forecasts also show what is anticipated to occur with the demographics and economies of the members' service areas.

The forecasts do isolate exceptionally large industrial customers (BYU, Owens-Corning, etc.) on the member systems and examines their usage and contribution to growth independent of the normal system growth. In this manner, relevant operating factors unique to the major customers will not be impacted by the system growth factor.

This base growth forecast does not include any new or unusual large load additions except known point-loads under construction, or highly probable to be constructed. Any new and significant large loads, or so-called point-loads, would be evaluated and considered independently of the planning in this study. UMPA wants to encourage the development of economic growth by its member cities, and yet note that new and significantly sized electrical users may have a negative fiscal impact to UMPA if not properly anticipated and impact mitigated.

Historical Analysis

UMPA and its members operate on a July 1st to June 30th fiscal year. The projections for the next twenty-year period from FY2022 to FY2041 were compared to actual member data over the past nine years. It was determined that some of member cities' growth should continue to be forecasted using linear and/or logarithmic regression techniques while reflecting recent growth trends.

The following table shows the composite historical fiscal year peak demand and energy requirements for UMPA. From FY2013 to FY2021, UMPA load has experienced growth in peak demand and energy requirements at compound annual growth rates (CAGR) of 1.33% and 0.65%, respectively.

Historical Non-Coincidental Load Growth

Fiscal Years 2013-2021

Year	Annual Peak (MW)	% Growth	Energy Requirements (MWH)	% Growth
2013	263.05		1,174,239.94	
2014	263.82	0.29%	1,159,893.67	-1.22%
2015	271.40	2.87%	1,169,701.89	0.85%
2016	269.76	-0.60%	1,181,566.79	1.01%
2017	268.32	-0.53%	1,180,216.21	-0.11%
2018	274.71	2.38%	1,210,224.89	2.54%
2019	277.93	1.17%	1,183,675.54	-2.19%
2020	288.71	3.88%	1,204,242.87	1.74%
2021	292.34	1.26%	1,236,978.33	2.72%
CAGR		1.33%		0.65%

Annual forecasts of peak demand and energy requirements for the next twenty-year period were developed for each of the six member cities within UMPA. The combination of these projections and results are presented herein for the Agency as a whole. Based on historical monthly load patterns, the annual forecasts were converted to monthly forecasts for planning purposes.

20-Year Electric System Load Forecast

Using the methods described, UMPA forecasts the "base-growth scenario" for peak demand and energy requirements to increase at a compound annual growth rate (CAGR) of 1.93% for demand, and 2.22% for energy, throughout fiscal years 2022 to 2041 as shown on the following table:

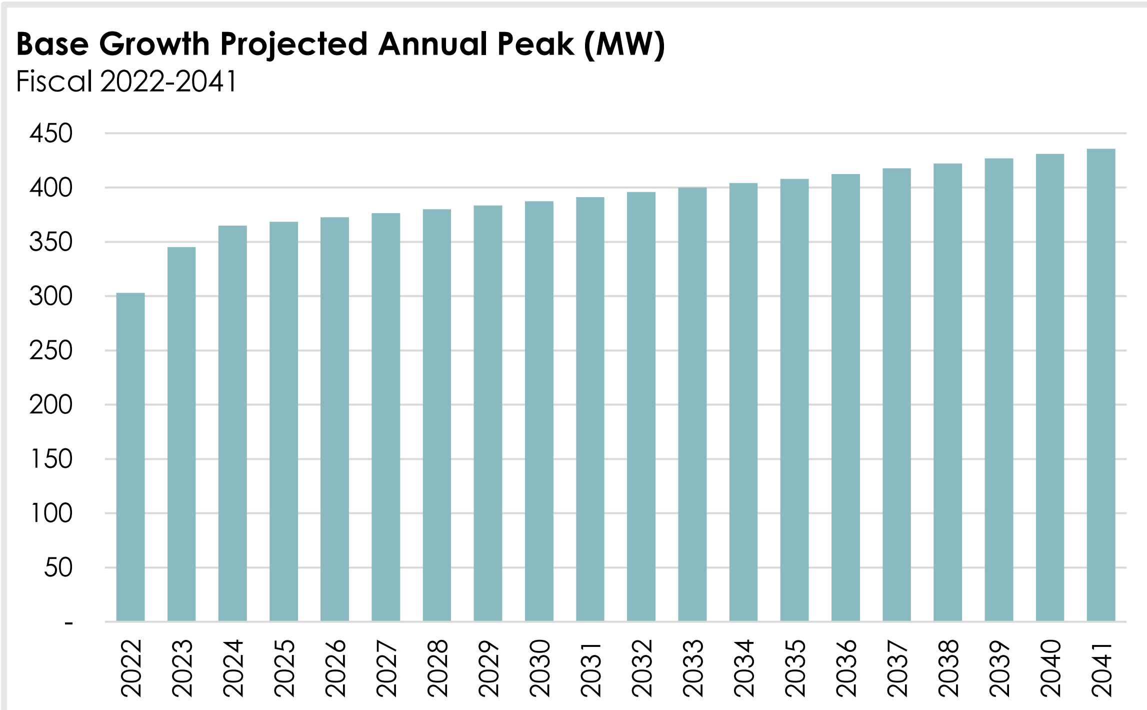
UMPA 20 Year Load Forecast

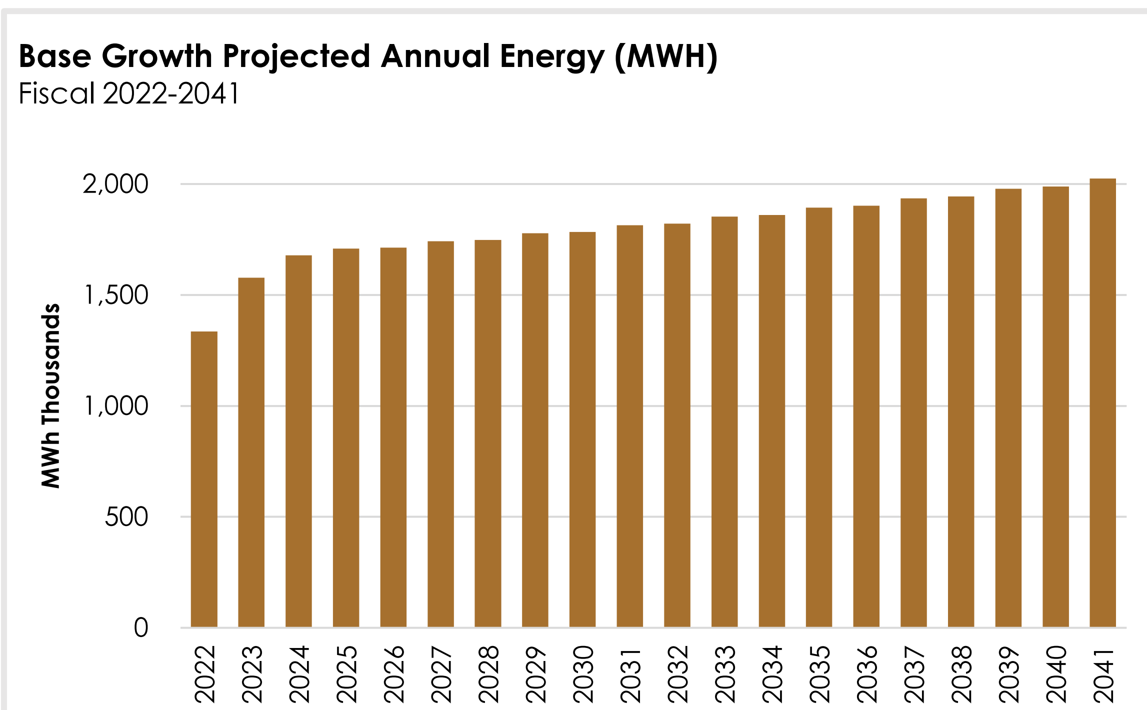
Year	Annual Peak (MW)[3]	% Growth	Energy Requirements (MWH)	% Growth
2022	302.82		1,335,046.60	
2023	345.03	13.94%	1,577,940.19	18.19%
2024	364.99	5.78%	1,679,368.94	6.43%
2025	368.45	0.95%	1,708,378.54	1.73%
2026	372.65	1.14%	1,712,732.01	0.25%
2027	376.33	0.99%	1,742,436.85	1.73%
2028	380.01	0.98%	1,747,500.96	0.29%
2029	383.42	0.90%	1,777,932.62	1.74%
2030	387.21	0.99%	1,783,739.59	0.33%
2031	391.12	1.01%	1,814,930.19	1.75%
2032	395.89	1.22%	1,821,513.21	0.36%
2033	400.04	1.05%	1,853,496.43	1.76%
2034	404.21	1.04%	1,860,890.20	0.40%
2035	408.05	0.95%	1,893,702.29	1.76%
2036	412.27	1.03%	1,901,942.57	0.44%
2037	417.57	1.29%	1,935,620.61	1.77%
2038	422.19	1.11%	1,944,746.20	0.47%
2039	426.89	1.11%	1,979,328.57	1.78%
2040	431.06	0.98%	1,989,379.06	0.51%
2041	435.81	1.10%	2,024,906.68	1.79%

Peak Demand		Energy Requirements	
5 Year CAGR	5.32%	5 Year CAGR	6.43%
10 Year CAGR	2.88%	10 Year CAGR	3.47%
20 Year CAGR	1.93%	20 Year CAGR	2.22%

[3] Energy in kilowatt-hours is equal to the megawatt-hours multiplied by 1,000. For example, one MWH is equal to 1,000 kWh and one MW is equal to 1,000 kW.

Applying the assumption in forecasting collected from the member cities, the following two graphs show the forecasted power and energy requirements for UMPA using the base-growth scenario:





Forecast Scenarios

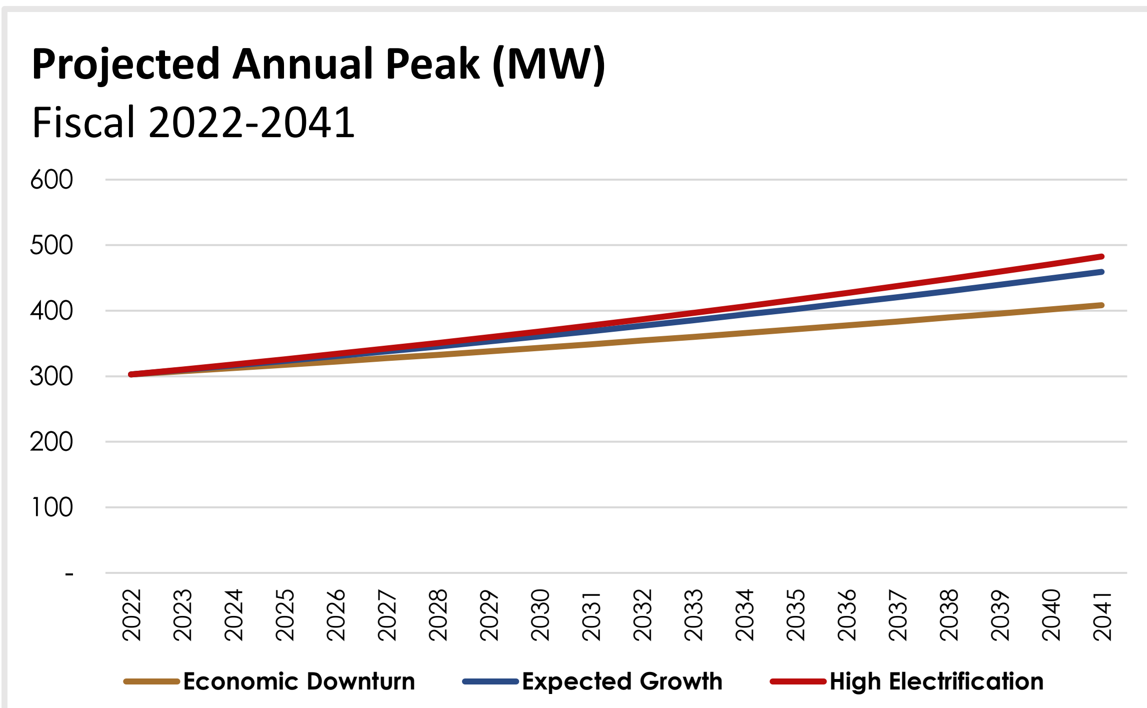
The "base-growth scenario" represents the projected electrical load growth for UMPA with the highest probability. In addition to the expected growth scenario, UMPA examined and projected two other sensitivity scenarios:

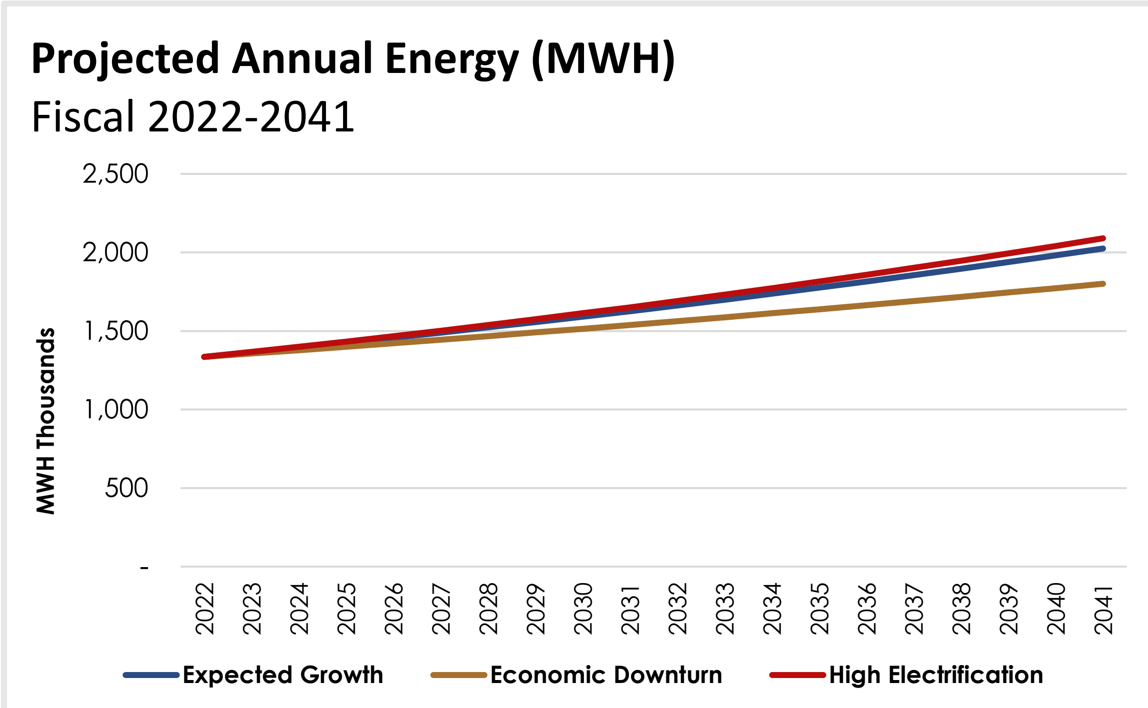
- Economic Downturn: low-growth rate of 1.68%
- High Electrification: high-growth rate of 2.48%

The following table shows the average annual compound growth rates:

Forecast Scenario	Peak Demand	Energy Requirements
Expected-Growth	1.93%	2.22%
Economic Downturn	1.68%	1.68%
High Electrification	2.48%	2.48%

The following three-line graphs for annual peak, capacity and energy requirements show the forecasted power and energy requirements for UMPA considering the three different growth scenarios as described:





The study period for this IRP is 20 years, thus providing a long-term horizon for UMPA to the upcoming challenges in planning. However, in meeting the submittal requirements for WAPA, a specific five-year forecast has been prepared.

As shown, UMPA's load will continue to grow as cities expand with new housing and economic development along with increases in consumer's usage. The expansion and growth will be different for each member city and UMPA will monitor closely the development patterns and types of construction to respond appropriately to the planning function in this IRP.

In forecasting the next 20-year horizon, UMPA does not expect the robust growth it experienced in the past 20 years. The system expansion is not only affected by the slow growth in the economy, but retail rates also increasing due to higher production costs and more energy efficient products are likely contributors.

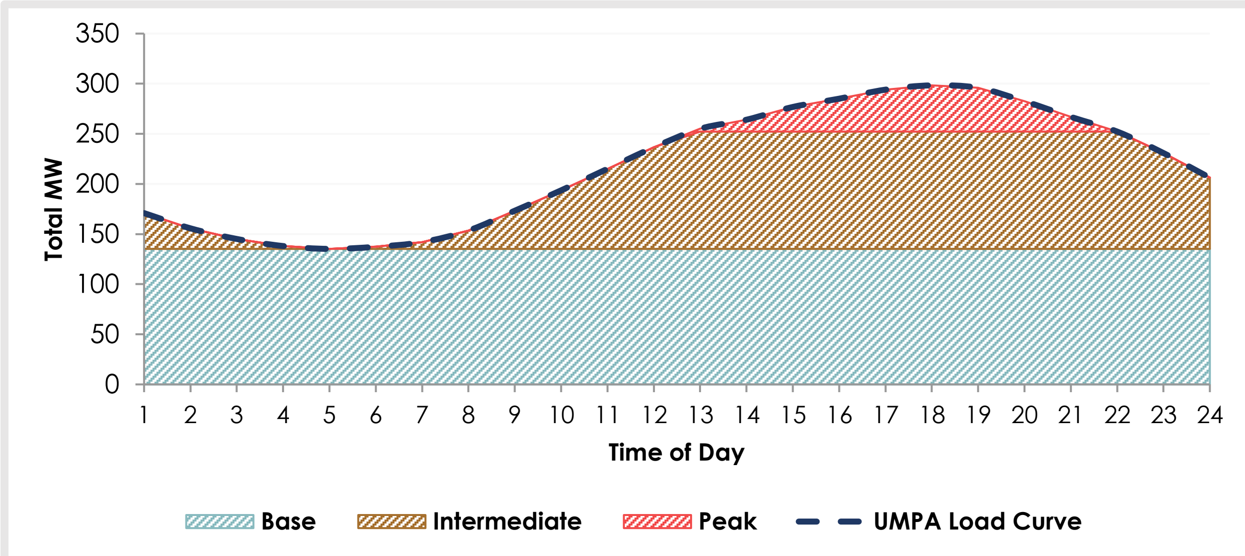
The Agency will continue to investigate and monitor the key drivers in growth in the member cities such as:

- New and planned housing developments
- Business and economic development
- Open space growth along the I-15 corridor

Load Characteristics

UMPA expects the daily load curves and duration statistics to grow in a comparable fashion as in the past with no major change in the consumer requirements. The impact from demand side management programs in reshaping load curves are considered insignificant for planning purposes.

A load curve is a graph used to show how the use of electricity (demand) rises and falls during a given period of time. UMPA's current 24-hour energy requirements and daily load curve for a typical summer peak period are shown below:



Base Load – The minimum constant level of electric demand that is being supplied 24 hours each day.

Intermediate Load – The portion of electric demand between a utility's Base Load and Peaking Load occurring between mid-morning and evening hours.

Peak Load – The portion of electric demand that is above a utility's Intermediate Load, which typically occurs between the early afternoon and early evening hours.

Type of Power Generation

As shown above, UMPA needs to identify, secure, supply, and schedule the most economical energy in sufficient quantities to meet the needs of the member cities considering the type of power supply defined as:

Base Load Generation – Plants are designed to a maximum operating efficiency at continuous operation such as coal and nuclear. Typically, the plant investment is higher but through continuously running of the units the overall economics are lower. Base load units operate at plant availability factor greater than 65% in order to achieve optimal efficiency.

Immediate Load Generation – An intermediate unit is designed to operate at maximum load through the day and easily adjust to minimum load at night, or when there is little to no demand for electricity. Generation cost from immediate units, such as a combined cycle gas turbine, is between that of peaking and base load generation. Intermediate units operate efficiently at a plant availability factor between 20% and 65%.

Peak Load Generation – A peaking unit is designed to operate infrequently and typically the initial capital costs are greatly reduced. A peaking unit cycles on and off daily, and even on an hourly basis, with a design for quick start up and a wide range for performance. An example of a peaking unit is simple cycle gas turbine or reciprocating engine. Fuel and operating costs are the most expensive. A peaking unit typically has a designed annual plant availability factor of less than 20%.

Intermittent Generation – This is any source of energy that is not continuously available due to some factor outside direct control. The intermittent source may be somewhat unpredictable. For example, solar power or wind generation cannot be controlled nor dispatched to meet the hourly demand of a power system, and solely relies on the forces of nature. Effective use of intermittent sources in meeting electrical load usually relies on the intermittent sources to displace fuel that would otherwise be consumed in generating power to the grid. The use of small amounts of intermittent power has negligible effect on grid operations; however, larger amounts may require a redesign of the grid infrastructure. Intermittent units operate at a plant availability factor of 20% to 35%.

UMPA will continue to promote the implementation of energy efficiency and DSM programs, however; the Agency does not expect proposed DSM programs to have a significant impact on current daily and load duration curves. UMPA will respond appropriately to changes in power and energy requirements and shifts in the implementation phase.

Existing Resources and Attributes

Energy Resource Portfolio
Owned Supply Resources
Contracted Supply Resources
Rated Capacity and Retirement
Resource Retirement Risk
Transmission Facilities and Contracts
Dispatch Application of Power Resources

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Energy Resource Portfolio

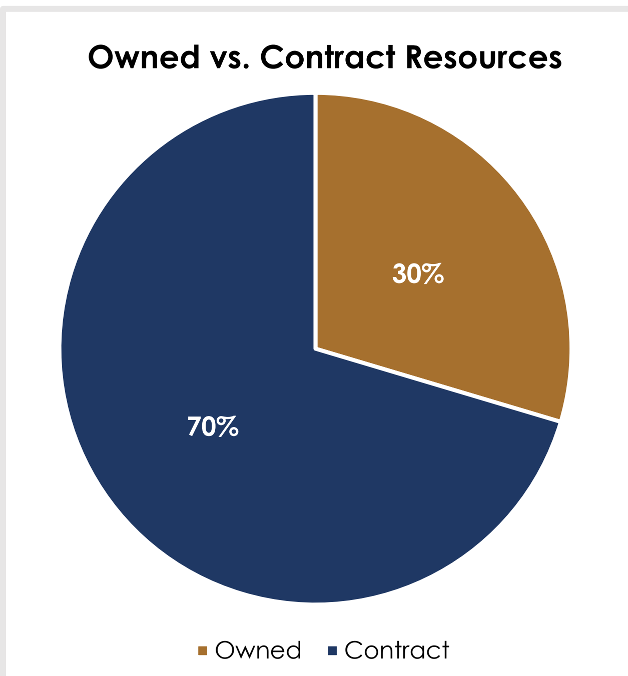
To quantify future resource requirements, UMPA first determines how much power it can produce from its existing resources. The term "existing resources" refers to UMPA resources that are available through sole ownership, joint participation or through a power sale agreement within the IRP study period.

In evaluating the fit of a particular resource, UMPA considers cost, load requirements, environmental attributes, availability, timing, and operations (e.g., flexibility and dispatchability). UMPA also considers the fit of each resource to the existing system, fuel type, location, and ability to enhance the system.

The Agency has a number of alternatives to meet future power needs. These alternatives include options on both the demand-side and supply-side. With the existing system, the supply and demand-side options constitute the agency's portfolio of resources for the future. However, the demand-side alternatives alone will not be sufficient to satisfy UMPA's future load requirements.

This section discusses UMPA's diversified mix of existing resources, firm and non-firm contracts, and existing transmission agreements. It also compares the forecasted loads with existing generation resources at the 138 kV bus-bar delivery and interconnection.

There are significant differences in resource ownership versus power purchase agreements, or contracts for existing resources.



Both approaches have many benefits and challenges in best managing and scheduling the resources to meet the demands of the utility. This requires managing the risks and rewards to determine the appropriate ratio mix of the two approaches.

Ownership

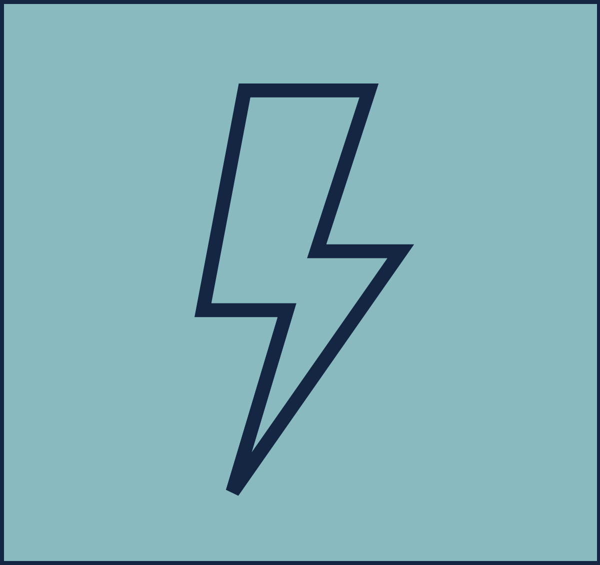
- Capital costs
- Operating costs
- Financing – bonding 30 years
- Environmental challenges
- Operating flexibility

Contract

- Length – term (5 to 15 years)
- Pricing
- Operating flexibility
- Little or no control

The 2013 IRP pie graph above reflects the ratio between ownership and contract of the existing energy resource portfolio. Since the publication of the 2013 IRP, UMPA increased the ratio of ownership to contract resources by 4%. The Agency continues to work toward a balanced equity position between contract and owned resources. UMPA aims to secure more ownership in future resources to achieve an appropriate balance.






Owned Supply Resources

Existing supply-side resources owned by UMPA including member city owned resources.

Hunter Unit I

Features of System Operation

Resource Type: Coal **Generation Type:** Base

Year Acquired: 1980 **Estimated Retirement:** 2042

Hunter Unit No.1 is a coal-fired generating plant with a rated capacity of 446,000 kW located near Castle Dale, in Emery County, Utah. In 1980, prior to forming UMPA, Provo purchased a 6.25% undivided ownership interest in the plant and common facilities from Utah Power and Light (PacifiCorp). Provo's capacity from this plant was dedicated to the Agency under a capacity purchase agreement. In 2017, Provo assigned and transferred their undivided ownership interest in Hunter 1 to UMPA.

PacifiCorp is responsible for the administration, construction, operation, and maintenance of the Hunter Unit 1. PacifiCorp and the Agency share the cost of operation, maintenance, capital additions, repairs, improvements, and replacements for Hunter Unit 1 according to ownership interest. Costs related to energy production are shared in accordance with the percentage of scheduled generation.

Hunter Unit No. 1 acts as a base load resource and provides a stable energy source for the overall UMPA portfolio.

In 2013 PacifiCorp upgraded the emission control equipment (baghouse) to satisfy new environmental regulations. However, the coal-fired unit continues to pose challenges for air quality and the United States Environmental Protection Agency (EPA). A current legal challenge is the EPA's effort to satisfy the State's regional haze obligations under the Clean Air Act. UMPA and other joint owners of the Hunter facility support PacifiCorp's effort to operate the facility within these EPA standards without installing an SCR. We expect other permitting and operating challenges in the future.

Bonanza Unit

Features of System Operation

Resource Type: Coal **Generation Type:** Base

Year Acquired: 1985 **Estimated Retirement:** 2030+

The Bonanza Unit No.1 is a 458,000-kW coal-fired generating plant located south of Vernal in Uintah County, Utah. UMPA owns a 3.75% undivided ownership interest and a 1.875% undivided ownership interest in common facilities, plus a contract that expires in 2025 for an additional 3.5% from Deseret Generation and Transmission (Deseret). The power contract mirrors the terms of ownership including actual fuel costs. By acquiring the ownership plus the contract, UMPA is able to receive the benefits of resource maximization.

As an element in the acquisition of the Bonanza resource, UMPA acquired a 6.25% ownership to capacity on the Bonanza Project Transmission System. This line allows UMPA to move its Bonanza resource to PacifiCorp or WAPA at the Mona Substation for delivery to load, as well as for off-system sales to the west.

Bonanza Unit No.1 also acts as a base load resource and provides a stable energy source for the overall UMPA portfolio.

In 2015, Deseret entered into a settlement agreement with the U.S. Environmental Protection Agency (the "EPA") and certain environmental groups, pursuant to which Deseret must limit coal consumption and emissions at the Bonanza Unit. Shortly after 2030 (estimated), the Bonanza Plant will shut down under current emission limitations. An evaluation to install selective catalytic reduction (SCR) technology, carbon sequestration, or other innovative technology at the plant is being considered for future operations.

Six Member Hydroelectric Plants

Features of System Operation

Resource Type: Hydro **Generation Type:** Seasonal/Run-of-the-River

Year Acquired: 1985 **Estimated Retirement:** 2045+

Three of UMPA's member cities have run-of-the-river hydroelectric generation units which output is committed to UMPA. These cities and UMPA maintain and operate the generating units.

The town of Levan has two hydroelectric generating units, Pigeon Creek, and Cobble Rock. Manti City has two hydroelectric plants which consist of two generating units in the Upper Plant, and two generators in the Lower Plant. Nephi City also has two hydroelectric generating plants named the Bradley Plant and the Salt Creek Plant. The table below summarizes the average capacity and energy for each of the hydroelectric plants over the last five years.

Plant Name	Capacity (kw)	Annual Energy (kwh)
Pigeon Creek	210	154,727
Cobble Rock	110	151,302
Upper	1,000	1,823,545
Lower	1,200	1,502,391
Bradley	200	834,561

With a combined rated capacity of 3.42 MWs, these six small hydro facilities represent a minor portion of the Agency's total generation resources. All six of the hydrogeneration facilities are undergoing major improvements.

West Valley Plant

Features of System Operation

Resource Type: Natural Gas **Generation Type: Intermediate/**Peak

Year Acquired: 2016 **Estimated Retirement:** 2045+

The West Valley Plant is a natural gas-fired electricity generating plant located in West Valley City, Utah. The West Valley Plant consists of five General Electric LM6000 simple-cycle gas turbine generating units, each with a nominal electric power output rating of 43.4 MW, for a plant total of 217 MW. Winter capacity of the West Valley Plant is 200 MW net total, and summer capacity is 185 MW net total.

The West Valley Plant is used as a peaking power resource and provides efficiency and reliability to the UMPA portfolio. Under the current maintenance and repair program, the West Valley Plant is expected to be operational for the next twenty plus years.

Provo Plant

Features of System Operation

Resource Type: Natural Gas **Generation Type:** Intermediate/Peak

Year Acquired: 2018 **Estimated Retirement:** 2048+

The Provo Power Plant consists of five reciprocating Caterpillar G32520H natural gas generators with an aggregate nominal electric power output rating of 12 MW. The Agency's Provo Power Plant replaced a 10 MW power plant owned by Provo City, the capacity and energy of which Provo had dedicated to the Agency pursuant to a Capacity Purchase Agreement.

Provo's prior plant was taken out of service in June 2016. The Agency's Provo Power Plant is located on the site of the original power plant. The new Provo Power Plant is constructed with the latest emission controls and selective catalytic reduction (SCR) technology on the engines.

The Provo Power Plant is also used as a peaking power resource and provides efficiency and reliability to the UMPA portfolio.

SharedSolar (Community Solar Facility)

Features of System Operation

Resource Type: Solar **Generation Type:** Intermittent

Year Acquired: 2021 **Estimated Retirement:** 2046

The SharedSolar, or Community Solar project, is located in Spanish Fork, Utah. There are over 11,900 solar panels on steel racks located on top of the city's old landfill.

The 4MW Community Solar project offers customers in member cities the opportunity to gain the benefits of solar without installing solar panels on their home or business. The average home uses about 750 kwh of energy per month. Customers can subscribe for one kilowatt blocks. Each block will generate 200-kilowatt-hours (kwh) of energy. Customers can keep their subscriptions for up to twenty years.

Contracted Supply Resources

The following are existing resources of UMPA under contract through power purchase agreements:

Colorado River Storage Project

Features of System Operation

Resource Type: Federal Hydro **Generation Type:** Base/Intermediate

Year Acquired: 1963 **Contract Term:** 2056

A sizeable portion of the Agency's power and energy comes from hydroelectric generation by the Colorado River Storage Project (CRSP) which is owned and operated by the United States government and marketed by WAPA. CRSP has been and continues to be a low-cost power and energy resource for the Agency. The amounts of CRSP power and energy available for purchase are subject to seasonal and annual hydrologic variations in the watershed of the Colorado River Basin.

WAPA is responsible for the marketing and transmission of Federal power in fifteen western and central states, generated by fifty-five hydropower plants operated by the Bureau of Reclamation and Corp of Engineers entered into a firm allocation of CRSP capacity and energy pursuant to a contract which has been amended from time to time. The current contract ends in 2056 and the project life extends beyond the contract term.

Due to the extended drought, the U.S. Bureau of Reclamation projects a 23% chance that Glen Canyon could cease power production by 2024 (Colorado River Projections, 2022). UMPA expects that drought conditions will continue to impact power allocations and energy rates. Effects of the drought will lead several utilities to the wholesale energy market until drought conditions stabilize.

Deer Creek

Features of System Operation

Resource Type: Federal Hydro **Generation Type:** Seasonal/Run-of-the-River

Year Acquired: 1998 **Contract Term:** 2024

UMPA executed a purchase contract for electric service with WAPA to purchase power and energy from the Deer Creek Power Plant of the Provo River Project. The capacity of the Deer Creek plant is 4,950 kW and UMPA purchases 70% of the output of the Project. The contract for Deer Creek expires in 2024.

WAPA will be issuing a new marketing plan for Deer Creek in the coming months. UMPA will make an application and urge the renewal of a contract with WAPA. UMPA expects to receive an equal or slightly less allocation and a new contract for an additional 20 years.

Windward

Features of System Operation

Resource Type: Wind **Generation Type:** Intermittent

Year Acquired: 2013 **Contract Term:** Year to Year

In January 2015, UMPA contracted with Windward Engineering LLC to purchase renewable wind generation from a wind farm at the mouth of Spanish Fork Canyon. The number of small operating wind turbines with various turbine capacities operated by Windward Engineering for testing and electricity production varies from time to time. The purpose for these wind facility tests is to assist in the design of small wind turbines that may be used in more isolated areas where large wind turbines are not practical. The electricity is delivered at distribution voltage to Spanish Fork's distribution system. There is no cost for wheeling services. The contract is for three years and will automatically renew unless notice is given to terminate by either party.

BMB Hydroelectric Plant

Features of System Operation

Resource Type: Hydro **Generation Type:** Seasonal/Run-of-the-River

Year Acquired: 2015 **Contract Term: Feb** 2023

In February 2016, the Agency contracted with BMB Enterprises, Inc. to purchase renewable hydroelectric generation from a new power plant located in Six Mile Canyon approximately ten miles south of Manti, Utah. The plant consists of three small turbines with a combined capacity of 1.36 MW and is expected to generate approximately 4,440 MWH annually. Production is based on the run-of-the river water supply. The electricity is delivered at distribution voltage to Manti City's distribution system about nine miles from the project. The UMPA contract with the BMB hydro facility terminates June 2022; however, UMPA desires to renegotiate and continue to purchase power from the BMB hydro facility. Discussions to renew the contract with the owner are ongoing.

Olmsted

Features of System Operation

Resource Type: Federal Hydro **Generation Type:** Seasonal/Run-of-the-River

Year Acquired: 2017 **Contract Term:** 2024

The Olmsted Hydroelectric Power Plant is located at the mouth of Provo Canyon in Utah County. Olmsted is one of the oldest hydroelectric power plants in the western United States and has undergone several changes. Most recently, Olmsted underwent a rehabilitation project in 2016. The new Olmsted plant is a "run of the river" plant. As a Federal facility, Olmsted is operated and maintained by the Central Utah Water Conservancy District. Olmstead serves several local customers including UMPA. The contract for Olmsted expires in 2024.

WAPA will be issuing a new marketing plan for Olmstead in the coming months. UMPA will make an application and urge the renewal of a contract with WAPA. UMPA expects to receive an equal or slightly less allocation and a new contract for an additional 20 years.

BYU Cogeneration

Resource Type: Natural Gas **Generation Type:** Base

Year Acquired: 2019 **Contract Term:** 2025

The BYU Cogeneration system replaced the campus coal boilers with a natural gas-powered turbine to generate heat and electricity. The BYU central heating plant is considered a Critical Infrastructure (CI) facility. The BYU Cogeneration facility has a 20-to-30-year life. UMPA entered into an agreement with BYU to purchase the power generated from their cogeneration system. The BYU Cogeneration project is considered a stable baseload resource for UMPA. The contract will automatically renew unless notice is given to terminate by either party.

CRSP White Mountain Apache Tribe

Features of System Operation

Resource Type: Federal Hydro **Generation Type:** Base/Intermediate

Year Acquired: 2020 **Contract Term:** 2040

Through an agreement with the U.S. Department of Energy, the White Mountain Apache Tribe (WMAT) began receiving a hydroelectric allocation from the Colorado River Storage Project (CRSP) in 2004. Over the years the WMAT partnered with different entities by offering the WMAT CRSP hydroelectric allocation in exchange for a benefit payment or credit. In 2020 UMPA entered into an agreement with the WMAT to purchase the WMAT CRSP hydroelectric allocation. The contract terms extend 20 years with opportunity to renew.

Clover Creek

Resource Type: Solar **Generation Type:** Intermittent

Year Acquired: 2021 **Contract Term:** 2046

Clover Creek is an 80 MW solar project located approximately ten miles northwest of Nephi, UT. The owner and operator of the facility is sPower, an AES and AIMCo Company, located in Salt Lake City, UT. UMPA signed a 25-year agreement with sPower's Clover Creek facility to provide power to UMPA member cities through 2046.

The project is interconnected into the Mona Substation and power and energy are delivered to UMPA over PacifiCorp's Transmission System. The project was completed in 2021 and energy was first provided in November 2021. The project is expected to produce over 200,000 MWHs annually. All renewable energy credits (RECs) are transferred to UMPA.

Wholesale Energy Market

UMPA incorporates short term contracts and real-time transactions to meet supply shortages or provide sales in times of surplus resources. UMPA monitors the market and elects to purchase lower-cost energy from a counterparty rather than using owned, higher-cost resource, for any given hour.

Rated Capacity and Retirement

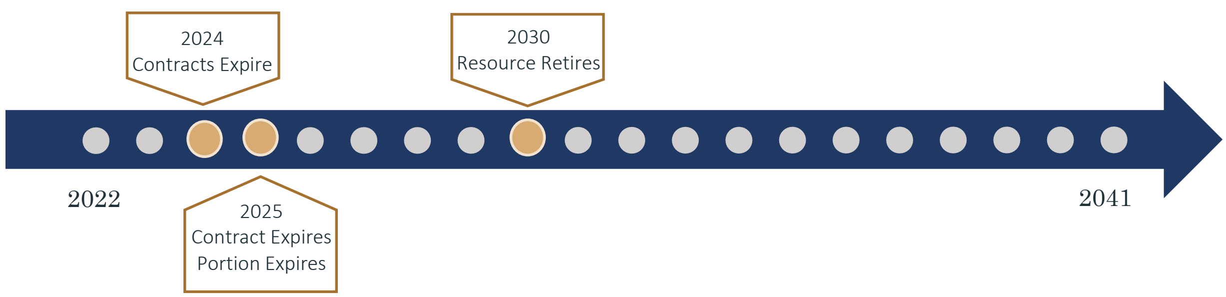
The following tables summarize the existing resources owned and contracted by UMPA along with the rated capacity for supply side operations:

Owned Resources	Fuel	Capacity (kW)		Actual 2021	
		Winter	Summer	Peak (kW)	Energy (kWh)
Hunter	Coal	27,000	32,000	32,000	229,034,000
Bonanza	Coal	34,000	34,000	34,000	228,230,000
West Valley	Natural Gas	200,000	185,000	-	-
Provo Plant	Natural Gas	12,000	12,000	12,570	7,574,380
Member Hydro	Hydro	3,170	3,170	1,620	2,890,030
SharedSolar	Solar	4,000	4,000	3,910	3,886,190

Contract Resources	Fuel	Capacity (kW)		Actual 2021	
		Winter	Summer	Peak (kW)	Energy (kWh)
CRSP	Hydro	40,000	33,000	58,000	295,318,000
WMAT CRSP	Hydro	3,000	3,000	4,000	19,050,000
Deer Creek	Hydro	-	4,000	4,000	14,329,000
Olmsted	Hydro	3,550	3,550	9,900	11,221,850
Windward	Wind	50	50	-	-
BMB Hydro	Hydro	1,360	1,360	1,000	1,573,500
BYU Cogen	Natural Gas	16,200	16,200	14,950	115,372,760
Clover Creek	Solar	80,000	80,000	77,100	17,142,800
Market Purchases	Variety	-	-	432,000	646,814,000

Resource Retirement Risk

Approximately 60 MW of resource capacity could retire or expire within the next ten years. UMPA will work to replace by building or negotiate future power resources.



2024

Deer Creek and Olmsted contracts expire. WAPA will initiate the process of reallocating these two resources in 2022. UMPA should know by 2023 the future allocations of these facilities. UMPA has high expectations of renewing these resources. However, production levels may be reduced slightly. The contract should be for another 10 to 20 years or till 2043.

2025

BYU Cogeneration contract expires. UMPA expects that the contract will be renewed with BYU at its current production levels. Pricing will be updated in the new contract. UMPA could plan on the facility being there beyond 2045.

UMPA anticipates the 3.5% contract portion of the Bonanza coal-fired plant to expire with Deseret Generation and Transmission in 2025.

2030

Shortly after 2030, the Bonanza Plant will shut down under current emission limitations. The Bonanza Plant could continue to run with the implementation of carbon sequestration or other technology. However, the likelihood that the facility extends beyond 2030 is low.

In addition to the replacement of supply resources, UMPA must plan for meeting future power and energy growth on the system. The action plan for supply-side resources is to investigate and find replacements for the expiring contracts and the added requirements from growth based on the criteria identified in this IRP.

Transmission Facilities and Contracts

The Agency's acquisition of the Bonanza Project included a 6.25% interest in Deseret's transmission system which enables the Agency to deliver power to the Mona Substation in Utah and the Rangely Substation in Colorado. This provides access to WAPA's transmission system in Utah and in other western states.

CRSP electricity is wheeled on behalf of WAPA over transmission facilities owned by PacifiCorp, pursuant to a transmission wheeling contract between WAPA and PacifiCorp for the life of the CRSP contract. UMPA has a transmission service agreement with PacifiCorp whereby PacifiCorp transmits UMPA's power across PacifiCorp's transmission system to member cities loads and contract loads. The contract has an indefinite life such that it cannot be cancelled by PacifiCorp unless a replacement contract has been negotiated. The Federal Energy Regulatory Commission (FERC) regulates the rates charged for transmission and ancillary services. Monthly, UMPA pays for its usage of the transmission system on the amount of UMPA power being transmitted on the system at the time of the maximum hourly peak by all users on PacifiCorp's system. The transmission rate is set annually using an updated cost-of-service formula.

Dispatch Application of Power Resources

Scheduling of UMPA's power resources is done on an economic dispatch basis, i.e., lowest cost to highest priced. Base load resources are utilized first to meet the demands and needs of the member cities; followed by intermediate resources; and finally, by the peaking resources. UMPA attempts to market and sell to other utilities all and any surplus power in the power market pool. Operating history has shown that UMPA has been highly successful in managing and dispatching the power resources.

Future Resources and Attributes

Future Supply Resources
Energy Generation and Storage Technologies
Criteria and Considerations
Supply-Side Action Plan

Future Supply Resources

The U.S. Energy Information Administration (EIA) projects that renewable energy will make up nearly 60% of added electric generation capacity from 2020-2050. Natural gas generation is projected to make-up most of the remaining 40% of added electric generation through 2050. Large quantities of coal-fired generation units continue to decline and retire (Annual Energy Outlook 2021, 2021).

The shift to renewable energy technologies is supported by the Net-Zero Initiative launched by the United States. The Net-Zero Initiative is a partnership between countries to enhance clean energy investment and deployment (U.S. Launches Net-Zero World Initiative to Accelerate Global Energy System Decarbonization, 2021). UMPA remains apprised of local, state, federal, and world-wide energy initiatives to operate in compliance with government regulations and deliver the best quality services to member cities.

This Future Resources and Attributes section examines energy alternatives of potential power resources to meet our growing demands and replace retiring facilities. All standard power resources are described in general terms and compared in terms of their viability for UMPA.

Many energy technologies are developing but are not ready for commercial deployment. The developing technologies will likely play a role in filling future energy needs. Although the Agency will continue to monitor the advancement of these power sources, we have limited the scope to sources that are proven and established as mature power supplies.

Energy Generation and Storage Technologies

This section describes each resource type with key attributes. Technologies and research advancements are portrayed following the attributes.

Coal Fired Generation

In most coal fired power plants, chunks of coal are crushed into fine powder and fed into a combustion unit where it is burned. Heat from the burning coal is used to generate steam that is used to spin one or more turbines to generate electricity.

Attributes

Environmental Impact

Coal mining may cause erosion and leaching of toxic chemicals. Coal burning results in the emission of fine particulate matter into the atmosphere. Current EPA regulations limit the amount of CO2 emissions into the atmosphere by mandating new coal plants to the same emission level as a combined-cycle gas turbine. On an energy basis, coal fired plants emit twice the amount of CO2 as a gas turbine. Any additional CO2 must be sequestered underground. The impacts CO2 emissions encourages the development direct air capture (DAC) technologies and other carbon capture technologies.

Costs

Levelized cost of energy (LCOE) is driven by five main factors: upfront capital costs, project performance, financing and tax assumptions, operating costs, and project life. The average 2020 unweighted and unsubsidized levelized cost of ultra-supercritical coal energy is approximately $79/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022). Ultra-supercritical coal plants are typically used in more modern designs.

Dispatchability

Coal plants are limited in their dispatchability to follow load curves given the heat rates and efficiency curves. Coal works best as a base load resource.

Technologies and Advancements

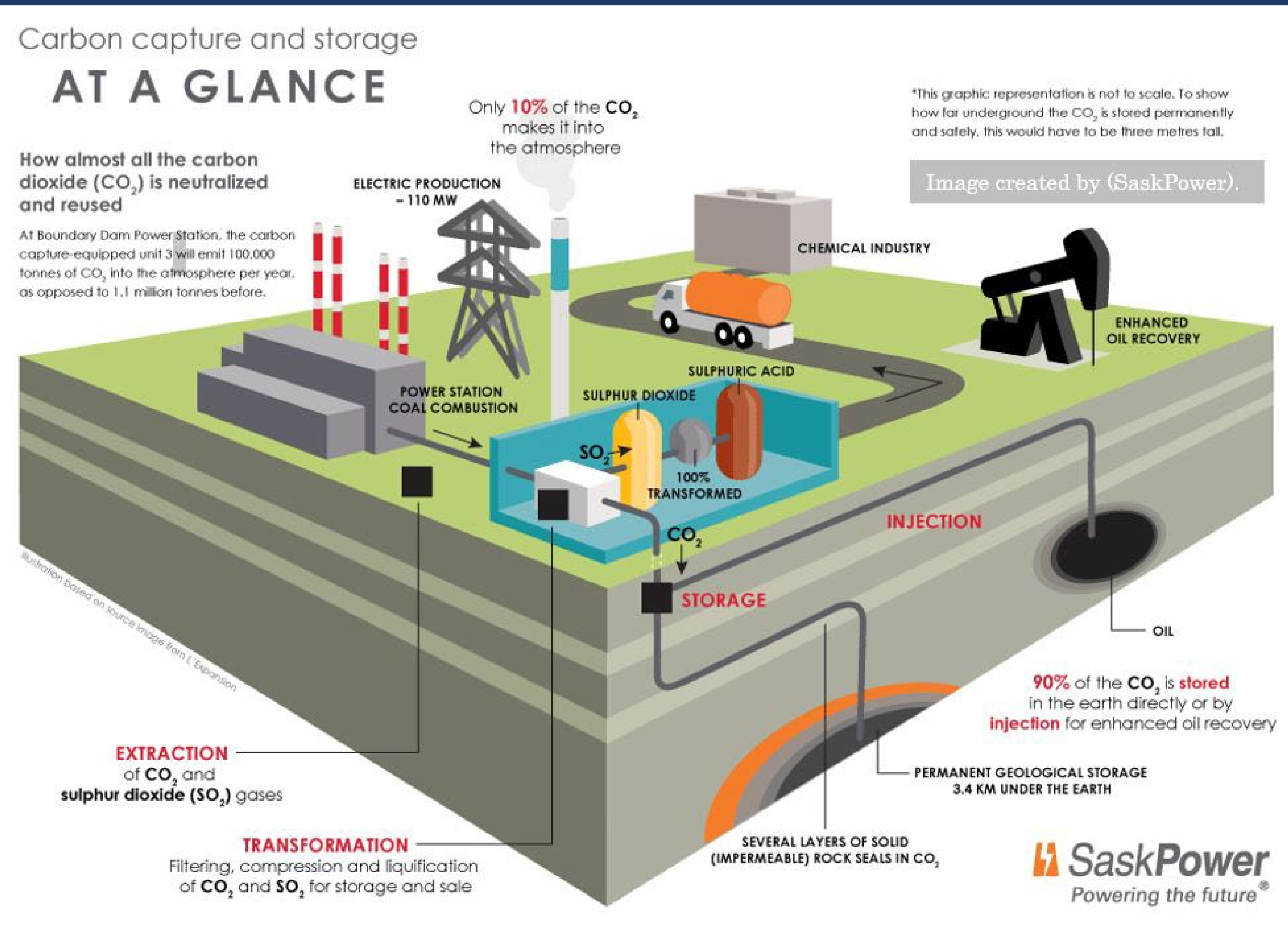
Carbon Sequestration

Carbon capture, utilization, and sequestration is process that captures carbon dioxide emissions from sources like coal-fired power plants and either reuses or stores it so it will not enter the atmosphere. There are two types of carbon sequestration, geologic and biologic. Geologic carbon sequestration stores carbon dioxide underground and biologic carbon sequestration stores atmospheric carbon in vegetation. Carbon capture can occur post combustion or pre-combustion (Legislating for Results: Policy and Performance Analysis, 2022).

In a post-combustion capture system, carbon dioxide is captured from a flue (combustion exhaust) gas generated by burning a carbon-based fuel, such as coal or natural gas. Pre-combustion carbon capture removes carbon dioxide from fossil fuels to create a synthesis gas ("syngas") that can be converted into a clean energy source. Rather than burning fossil fuels and attempting to separate carbon dioxide from the resulting flue gas, a carbon-based fuel is reacted with steam and oxygen to form syngas, which undergoes a subsequent reaction to produce hydrogen and carbon dioxide. The carbon dioxide is sequestered, and the hydrogen can be used as fuel for energy production.

Assessment

There are no new coal plants being built. In order to reduce its carbon footprint, UMPA is not considering participation in any coal facilities.



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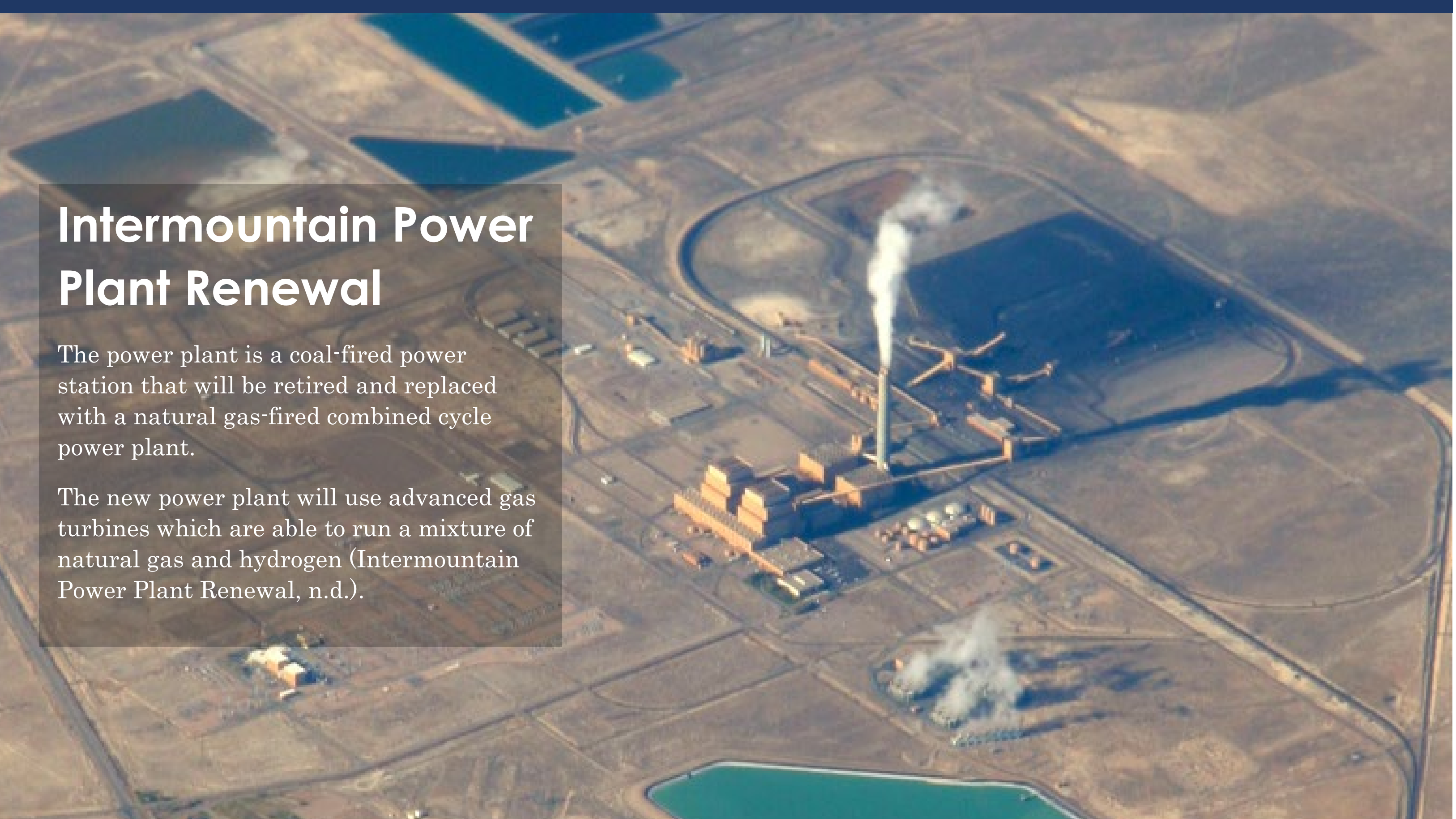


Intermountain Power Plant Renewal

The power plant is a coal-fired power station that will be retired and replaced with a natural gas-fired combined cycle power plant.

The new power plant will use advanced gas turbines which are able to run a mixture of natural gas and hydrogen (Intermountain Power Plant Renewal, n.d.).

Natural Gas Fired Generation

A common method for energy production using natural gas is steam generation. Natural gas is used as a boiler fuel to make steam for use by a steam/generator set. These plants were commonly used for base-load applications until the advent of the newer and higher-efficiency combined cycle turbine technology became available.

Attributes

Environmental Impact

Natural gas plants use less fuel per kWh and produces less carbon dioxide emissions than coal fired power plants. However, combustion releases methane which reduces air quality.

Costs

The average 2020 unweighted and unsubsidized levelized cost of natural gas energy by combustion turbine is approximately $122/MWH versus $44/MWH by combined cycle technology (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Natural gas generation offers reliable and flexible service. It is cost effective as a base and intermediate resource, and the most effective resource in responding to shortages from an intermittent supply-side project.

Technologies and Advancements

Simple Cycle Combustion Turbines

Simple Cycle Combustion Turbines (SCCT) technology is essentially a jet engine turning a generator. It is typically used for peak load service during high price market conditions and for meeting load variations from intermittent resources. The main advantage of a SCCT is the ability for it to be turned on and off within minutes.

A combustion turbine is a type of internal combustion engine. It has an upstream rotating compressor coupled to a downstream turbine, and a combustion chamber in-between. Energy is added to the gas stream in the combustor, where fuel is mixed with air and ignited. In the high-pressure environment of the combustor, combustion of the fuel increases the temperature. The products of the combustion are forced into the turbine section. There, the high velocity, and volume of the gas flow is directed through a nozzle over the turbine's blades, spinning the turbine which powers the compressor. The energy given up to the turbine comes from the reduction in the temperature and pressure of the exhaust gas.

Combined-Cycle

This plant design adds a boiler system and steam generator unit to the simple cycle gas technology. The jet engine turns a generator and the waste heat from the process is used to generate steam for a turbine/generator set. This generation type has been the technology of choice for meeting base and intermediate loads due to its relatively low capital cost, quick construction lead-time and high fuel efficiency.

Stationary Reciprocating Internal Combustion Engines (RICE)

Reciprocating combustion engine, like the Provo Power Plant, is any internal combustion engine which uses reciprocating motion to convert heat energy into mechanical work. There are two basic types of stationary reciprocating engines - spark ignition and compression ignition. Spark ignition engines use a spark (across a spark plug) to ignite a compressed fuel air mixture. Compression ignition engines compress air to a high pressure, heating the air to the ignition temperature of the fuel, which then is injected. The high compression ratio used for compression ignition engines results in a higher efficiency than is possible with spark ignition engines.

Assessment

UMPA continues to investigate this resource as a bridge technology for the future. UMPA will need additional dispatchable capacity to manage the intermittent nature of renewables.

Nuclear Generation

Nuclear energy is produced by a controlled atomic chain reaction. When a neutron strikes a relatively large fissionable atomic nucleus, it forms two or more smaller nuclei as fission products, releasing energy and neutrons in a process called nuclear fission. The released neutrons trigger further fission, and so on. The nuclear power plant uses nuclear fission inside the reactor to create heat for generating electricity. The heat is then used to boil water, produce steam, and drive a steam turbine.

Attributes

Environmental Impact

Nuclear generation is the largest source of clean energy in the United States. Environmental impacts depend largely on design and location of the reactor; however, SMRs provide site flexibility when compared to larger plants.

Costs

The average 2020 unweighted and unsubsidized levelized cost of nuclear energy is approximately $77/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Nuclear generation is a viable base load resource. Nuclear energy is considered reliable with a capacity factor of 92.5% (Infographic: Five Fast Facts about Nuclear Energy, 2021).

Technologies and Advancements

Molten Chloride Fast Reactor

A molten chloride fast reactor (MCFR) is a type of molten salt reactor (MSR) which focuses on a fast neutron spectrum rather than the thermal neutron spectrum. Molten chloride salt fuel acts as both the fuel and the coolant (TerraPower's Molten Chloride Fast Reactor Technology: Retooling Nuclear for a Changing Energy Sector, 2021).

Small Modular Reactors

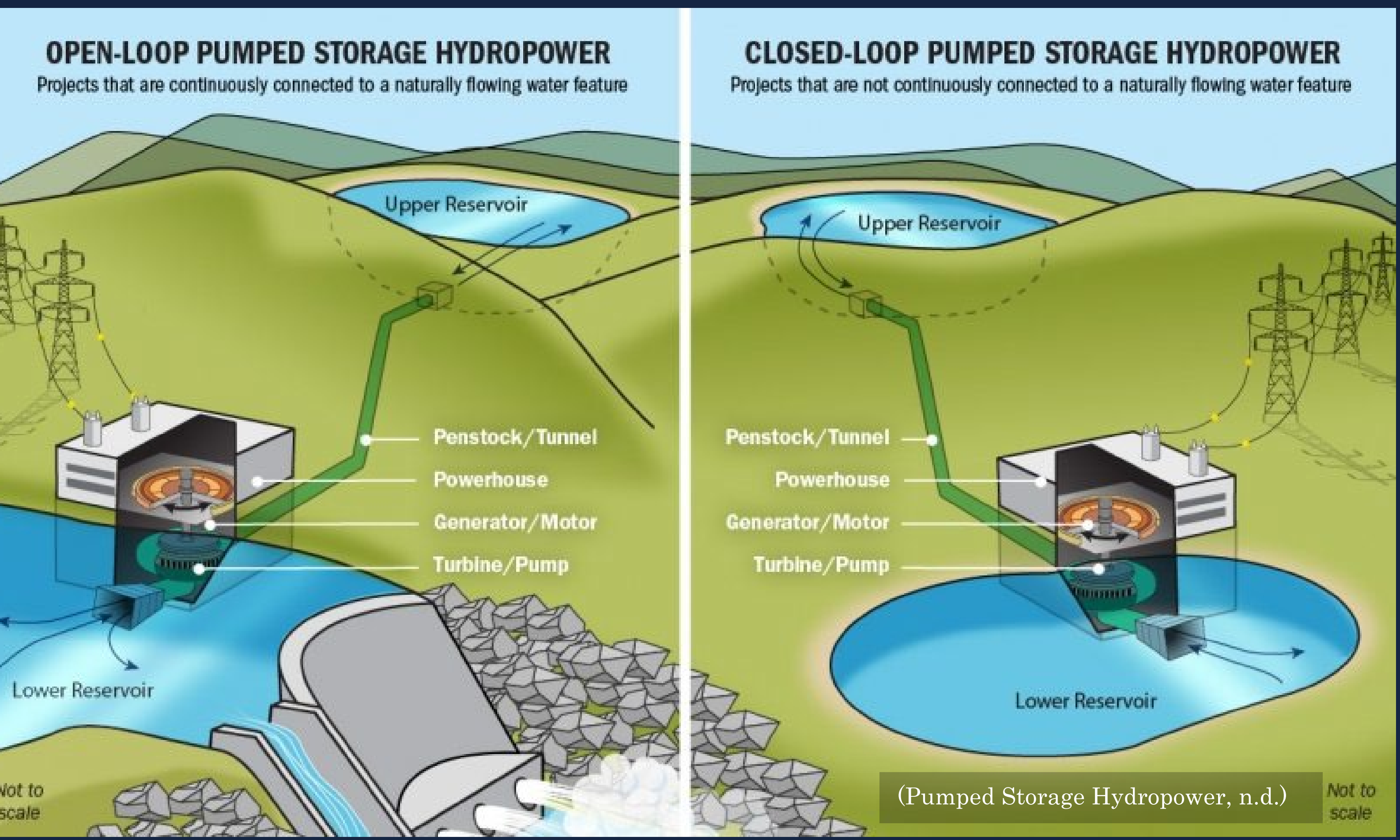
Small modular reactors (SMRs) are nuclear fission reactors that vary in size from tens of megawatts up to hundreds of megawatts. SMRs can be used for power generation, process heat, desalination, or other industrial uses. SMR designs may employ light water as a coolant or other non-light water coolants such as a gas, liquid metal, or molten salt (Advanced Small Modular Reactors, n.d.).

Assessment

UMPA will investigate and support nuclear energy technology. The electric industry needs a dependable and affordable base load resource to meet the future growth and demand for electricity. Although the SMR is the first design of its kind, emerging nuclear technology may be the most viable solution to meet energy demands.

Small Modular Reactor (SMR) Plant

Utah Associated Municipal Power Systems (UAMPS) plans to build a NuScale SMR plant at the Idaho National Laboratory. Fluor Enterprises is managing the combined license application (COLA) process. The COLA will be submitted to the US Nuclear Regulatory Commission (NRC). Startup operation of the plant is projected for 2029 (Fieldwork completed in milestone for UAMPS SMR, 2022).



(Pumped Storage Hydropower, n.d.)

Hydroelectric Generation

Hydropower plants are located near a water source. The available energy depends on the volume of water flow and the change in elevation from one point to another. Water flows through a pipe and then spins the blades in a turbine, which, in turn, spins a generator that ultimately produces electricity (How Hydropower Works, n.d.).

Attributes

Environmental Impact

Hydroelectric generation is a renewable power source and environmentally friendly with no pollutants and emissions. However, additional projects may impact fishery and water supply.

Costs

The average 2020 unweighted and unsubsidized levelized cost of hydroelectric energy is approximately $55/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Depending on the site and storage, the generation profiles will likely not peak during the summer requirements of the Agency. Run-of-the-river plants are not dispatchable. There is an operational risk due to seasonal droughts causing low or no production periods, requiring an alternative power source.

Technologies and Advancements

Pumped Storage

Pumped storage hydropower (PSH) is a configuration of two water reservoirs at different elevations that can generate power as water moves down from one to the other (discharge), passing through a turbine. The system also requires power as it pumps water back into the upper reservoir (recharge). PSH acts similarly to a giant battery because it can store power and then release it when needed (Pumped Storage Hydropower, n.d.).

Assessment

UMPA desires more hydroelectric generation. With higher market prices, it may change the future viability and UMPA will continue to monitor and pursue feasible options. However, any potential hydroelectric sites are currently unfeasible.

Wind Generation

Wind turbines use wind to make electricity. Traditionally, wind turns the propeller-like blades of a turbine around a rotor, which spins a generator, which creates electricity (How Do Wind Turbines Work?, n.d.).

Attributes

Environmental Impact

Wind generation is environmentally friendly with no pollutants and emissions. However, there are other environmental challenges as (1) certain locations may impact birds and migration paths, (2) certain locations may be unsightly and a visual impact, and (3) the use of significant land for equivalent generation production as compared with other generating sources.

Costs

The average 2020 unweighted and unsubsidized levelized cost of onshore wind energy is approximately $37/MWH and about $121/MWH for offshore wind energy (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Depending on the site, generation will likely not peak during daily or seasonal requirements of the Agency. Wind generation is not dispatchable, predictable or controllable. It can only operate within a range under certain windy conditions, which creates an operational risk. Wind generation is best used to offset the fuel costs of other supply-side resources. However, emerging battery storage technology increases the reliability of wind energy.

Technologies and Advancements

Big Adaptive Rotors

Multiple technologies are undergoing testing in order to enable the use of larger rotors. Trends show that as rotor diameter increased so has nameplate capacity (U.S. Department of Energy 2021). The Big Adaptive Rotor (BAR) Program identified highly flexible rail-transportable blades and distributed aerodynamic controls (DAC) as favorable options to reduce the LCOE of future wind energy projects (Johnson, et al., 2021).

Bladeless Wind Turbines

The bladeless wind turbine technology harnesses wind energy from a phenomenon of vorticity called vortex shedding. Essentially, bladeless technology consists of a cylinder fixed vertically with an elastic rod. The cylinder oscillates on a wind range, which then generates electricity through an alternator system (Bladeless Wind Energy, n.d.).

Hybrid Wind Power Plants

According to the U.S. Department of Energy, the most common type of wind hybrid project combines wind and storage technology. Other combinations may include solar and gas. The number of the hybrid plants continues to grow year-to-year.

Offshore Wind Turbines

Offshore wind turbines work similar to traditional wind turbines; however, offshore wind turbines require costly installation and transmission infrastructure. Offshore wind turbines are installed with either a fixed bottom or floating bottom.

Assessment

UMPA would like to add wind energy generation into its portfolio. However, UMPA will only pursue affordable projects.

Wind Energy Innovation

The Office of Wind Energy Technologies office supports national efforts to further develop wind technologies. Several of the efforts originate from Utah.

In 2020 Sequent Logic LLC out of Logan, Utah received funding to study the feasibility of fiber-optic sensing technologies for offshore wind turbines ((Wind Energy Technologies Office Projects Map, n.d.).

Solar Farm in Tooele County

The 80-megawatt solar farm in Tooele County is called Elektron Solar. The Elektron Solar project is similar to the Clover Creek solar project in Mona, UT.

Elektron Solar is estimated to provide 80% of energy used by the city of Salt Lake and bring the UVU campus to its carbon neutral goal. The solar farm is projected to connect to Utah's power grid in 2023 ((Mesch, 2021).

Solar Generation

Solar cells or photovoltaic (PV) devices change sunlight directly into electricity. A single PV device is known as a cell. To boost the power output of PV cells, they are connected together in chains to form larger units known as modules or panels. Modules can be used individually, or several can be connected to form arrays. One or more arrays is then connected to the electrical grid as part of a complete PV system (Solar Energy Technologies Office).

Attributes

Environmental Impact

Solar generation is considered environmentally friendly with no pollutants and emissions. However, common environmental concerns are (1) visual impacts, (2) wild-life effects, (3) large land-use, and (4) end-of-life management (Solar Energy Technologies Office 2021; Buchanan et al. 2021).

Costs

In 2010 the LCOE for utility-scale PV projects averaged $305/MWH. However, in 2019 the average LCOE dropped to $51/MWH. While the reductions to LCOE is mainly attributed to capital costs, technological advancements have also led to lower operational costs and increased project life expectancy (Wise, Bolinger, & Seel, 2020).

Dispatchability

Solar generation is an intermittent renewable source. Depending on the site, the generation profiles will likely not peak during the daily or seasonal requirements. However, advancing concentrating solar-thermal power (CSP) technology increases the time a solar power plant can generate energy. Dispatchability of solar generation grows more possible with the use of thermal energy storage. Such storage would reduce the operational risk of solar generation based on its availability.

Technologies and Advancements

Concentrating Solar-Thermal Power

The U.S. Department of Energy explains that Concentrating Solar-Thermal Power (CSP) technologies use mirrors to reflect and concentrate sunlight onto a receiver. The energy from the concentrated sunlight heats a high temperature fluid in the receiver. This heat - also known as thermal energy - can be used to spin a turbine or power an engine to generate electricity. Utility-scale CSP plant configurations include power tower and linear systems (Concentratine Solar-Thermal Power Basics, n.d.).

Assessment

UMPA will continue to add solar resources when viable.

Biomass Generation

Biomass is burned in a boiler to produce high-pressure steam. This steam flows over a series of turbine blades, causing them to rotate. The rotation of the turbine drives a generator, producing electricity (Bioenergy Technologies Office, n.d.).

Attributes

Environmental Impact

Typically, with biomass generation, the environmental impacts are offset by the ongoing adverse impact and costs of managing the biomass waste. The environmental impacts from converting the waste stream into electricity are an enhancement over the alternative of either storing or destroying the waste by-product.

Costs

The average 2020 unweighted and unsubsidized levelized cost of biomass energy is approximately $89/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Depending on the site, the generation may or may not be controllable depending on the biomass fuel source.

Technologies and Advancements

Anaerobic Digester

Organic waste material, such as animal dung or human sewage, is collected in oxygen-free tanks called digesters. Here, the material is decomposed by anaerobic bacteria that produce methane and other byproducts to form a renewable natural gas, which can then be purified and used to generate electricity (Bioenergy Technologies Office, n.d.).

Rotating Algae Biofilm Reactor

The Rotating Algae Biofilm Reactor (RABR) spins a flat disk that contains a film of microalgae. The disk rotates slowly, exposing the organisms to a mix of nutrient-rich wastewater, carbon dioxide and sunshine. The result is a thick film of biomass that can be easily harvested and converted into bio-based products including fuel, fertilizer, and plastics. The RABR project is led by Utah State University's Sustainable Waste to Bioproducts Engineering Center (SWBEC).

Assessment

UMPA is interested in pursuing biomass energy generation; however, no projects are currently proposed.

Utah's First Anaerobic Digester

Wasatch Resource Recovery is a anaerobic digester used for food waste diversion to biogas and bio-based fertilizer. The facility can process food waste from restaurants, food processing manufacturing plants, bottles beverage sellers, etc.

Located in North Salt Lake, Wasatch Resource Recovery operates under a public-private partnership with ALPRO Energy & Water and South Davis Sewer District. This image is of the gas conditioning system, where raw biogas is filtered and compressed to pipeline-grade renewable natural gas (About Wasatch Resource Recovery, n.d.).

The Utah FORGE Project

Utah Frontier Observatory for Research in Geothermal Energy (FORGE) is dedicated to discovering advancements in Enhance Geothermal Systems (EGS). The field research site is located just outside Milford, Utah (A New Future For Geothermal: The Utah FORGE Project, 2019).

Geothermal Generation

Electricity is generated from geothermal water or steam sources. Technologies in use include dry steam power plants, flash steam power plants and binary cycle power plants. Geothermal power uses steam or hot fluids in underground rock formations to run steam turbine generators. Viable geothermal reservoirs are those that have adequate heat, rock permeability, and hot water or steam, and site accessibility.

Attributes

Environmental Impact

Geothermal power plants life cycle greenhouse gas emissions are lower than both natural gas and solar PV. Projects are compact and use less land than coal, wind, and solar PV (Geothermal Baiscs, n.d.).

Costs

The average 2020 unweighted and unsubsidized levelized cost of geothermal energy is approximately $36/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Geothermal generation is a renewable resource for base loads.

Technologies and Advancements

Enhanced Geothermal Systems

The potential for geothermal energy is limited to regions with fluid to carry heat from rocks through pathways to conduct fluid through hot rocks. Enhanced Geothermal Systems (EGS) creates permeable pathways by injecting fluids from the surface. EGS technologies are projected to be commercially viable by 2030.

Assessment

UMPA is investigating two geothermal opportunities. Geothermal energy generation would be a great solution to our base power needs; however, projected costs are much higher than shown in the EIA reports.

Hydrogen and Fuel Cells

Fuel cells work like batteries, but they do not run down or need recharging. They produce electricity and heat as long as fuel is supplied. A fuel cell consists of two electrodes—a negative electrode (or anode) and a positive electrode (or cathode)—sandwiched around an electrolyte. A fuel, such as hydrogen, is fed to the anode, and air is fed to the cathode. Hydrogen fuel can be produced from a variety of domestic resources, such as natural gas, nuclear power, biomass, and renewable power like solar and wind.

Attributes

Environmental Impact

Fuel cells have lower, or zero emissions compared to combustion engines. Hydrogen fuel cells emit only water, addressing critical climate challenges as there are no carbon dioxide emissions. Fuel cells do not create noise pollution during operation as they have few moving parts.

Costs

The U.S. Department of Energy (DOE) is focused on developing technologies that can produce hydrogen at $2/kg by 2025 and $1/kg by 2030 via net-zero-carbon pathways. Currently, most hydrogen in the United States is produced by large-scale natural gas reforming without carbon capture and storage. This established technology has been shown to be able to reach the cost targets; however, the goal is to reach the cost target via low-carbon pathways (Hydrogen Production Pathways, n.d.).

Dispatchability

Hydrogen is an energy carrier that can be used to store, move, and deliver energy produced from other sources.

Technologies and Advancements

Electrolysis

Electrolysis is a process where water can be separated into oxygen and hydrogen. Electrolytic processes take place in an electrolyzer, which functions much like a fuel cell in reverse—instead of using the energy of a hydrogen molecule, like a fuel cell does, an electrolyzer creates hydrogen from water molecules (Hydrogen Fuel Basics, n.d.).

Steam Reforming

Thermal processes for hydrogen production typically involve steam reforming, a high-temperature process in which steam reacts with a hydrocarbon fuel to produce hydrogen. Many hydrocarbon fuels can be reformed to produce hydrogen, including natural gas, diesel, renewable liquid fuels, gasified coal, or gasified biomass.

Assessment

No hydrogen and fuel cell projects are currently under development; however, UMPA will continue to monitor these emerging technologies.

Battery and Energy Storage

Battery storage systems can be charged by electricity generated from renewable energy, like solar and wind power.

Attributes

Environmental Impact

Storing electricity can be used to integrate more renewable energy to the grid. Impacts of electricity storage depend on the type and efficiency of the storage technology.

Costs

The average 2020 unweighted and unsubsidized levelized cost of battery storage is approximately $120/MWH (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022, 2022).

Dispatchability

Battery storage helps to mitigate operational risks associated with intermittent energy sources.

Technologies and Advancements

Compressed Air Energy Storage

Compressed air energy storage systems use surplus power to compress and store air. When energy is needed, the compressed air passes through an air turbine to generate electricity.

Flow Batteries

In flow batteries, which are essentially rechargeable fuel cells; chemical energy is provided by two chemical components dissolved in liquids contained within the system and separated by a membrane. Electric current flows through the membrane while the liquid circulates (Energy Explained, 2022).

Flywheel Energy Storage

Flywheel energy storage (FES) works by accelerating a flywheel at an extremely high rotational velocity in order to store energy in the form of rotational kinetic energy. This energy is discharged as the rotational velocity of the flywheel lessens and can be harnessed to create electricity (2021 Integrated Resource Plan, 2021).

Lithium-ion Batteries

Lithium is a lightweight metal that an electric current can easily pass through. Lithium ions make a battery rechargeable because their chemical reactions are reversible, allowing them to absorb power and discharge it later (Solar-Plus-Storage 101, 2019).

Mechanical Gravity Energy Storage

An example of mechanical gravity storage is when energy lifts concrete blocks up a tower. When the energy is needed, the pull of gravity is used to lower the concrete blocks back down.

Assessment

UMPA is pursuing a pilot program for the development of two small battery storage projects in Provo and Spanish Fork. UMPA hopes to obtain grant monies to help offset the capital cost of these projects. This program would enable UMPA to understand the operations of battery storage technology and its viability.

The Agency is likely to continue to add battery storage as its solar and wind resource mix grows and costs continue to decrease.

Criteria And Considerations

UMPA monitors and investigates potential generation resources in the region which may be considered for inclusion in UMPA's supply-side portfolio. In reviewing the American Public Power Association's report on "New Generating Capacity for 2021", it indicates that the near-term trend favors wind and solar as shown in the table below:

Fuel Mix of New Plant - Under Construction

Primary Fuel Type	Capacity (MW)	% of Total
Wind	21,539.56	38.65%
Solar	18,386.94	32.99%
Natural Gas	13,299.17	23.86%
Nuclear	2,200.00	3.95%
Other*	178.02	0.32%
Hydro	126.70	0.23%
Total	**55,730.39**	

*Fuel types that make up the 'Other' category includes the following: agriculture byproduct, biomass gases, biomass solids, waste heat, distillate fuel oil, landfill gas, and waste (Zummo, 2021).

With each new supply-side opportunity, UMPA will be prudent and careful in the review and investigation according to the IRP process. Factors to be considered in the selection of any supply-side resources include:

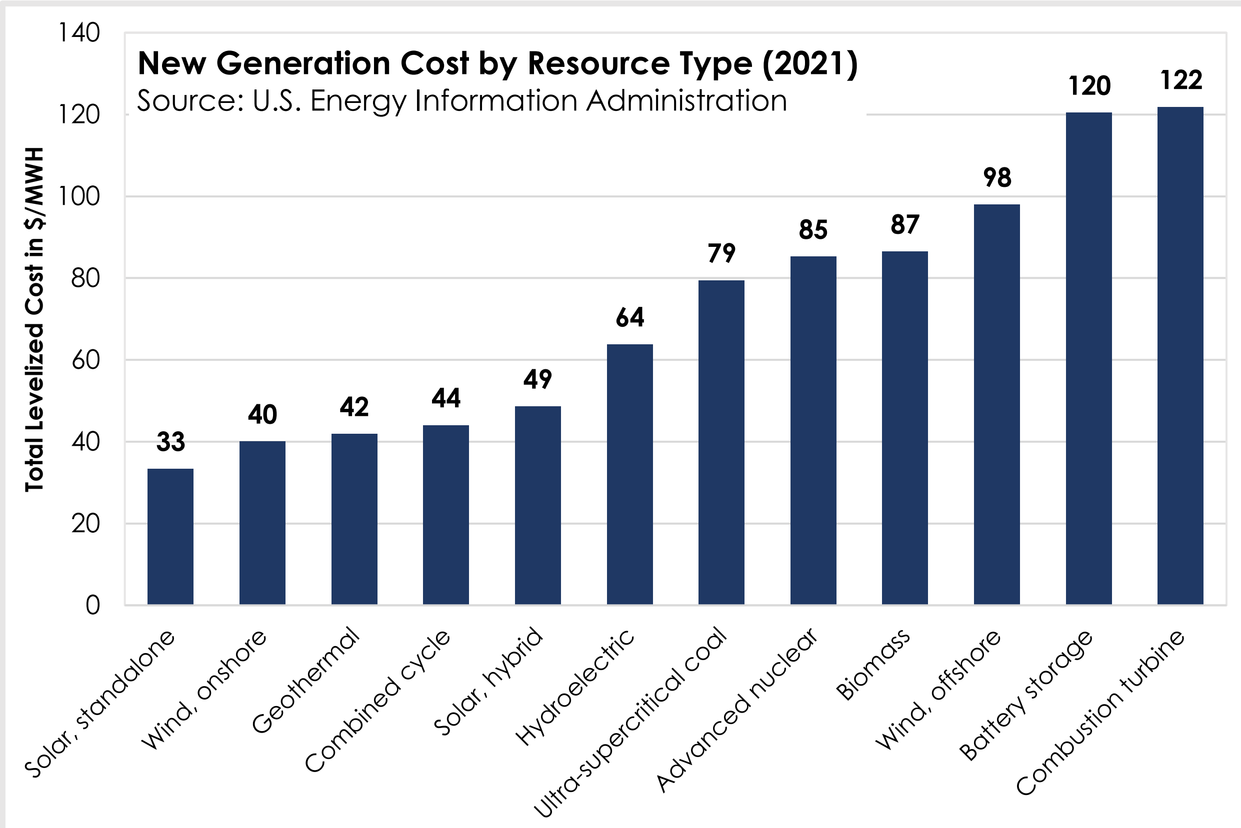
- Balance between ownership and purchase agreements
- Size in capacity and energy output
- Associated costs including capital, operating, fuel, transmission, and financing.
- Anticipated environmental impacts

- Operating criteria, scheduling flexibility, and ability to dispatch for load
- Location, reliability, efficiency, and durability
- Diversity, fuel options, and other risk factors
- Transmission network constraints

If the supply-side meets the respective criteria listed above, then UMPA will evaluate it on the second level which includes:

- Economic considerations
- Environmental considerations
- Governance and control considerations

The following graph illustrates the levelized cost of electricity (LCOE) for the diverse types of supply-side resources and storage under consideration.

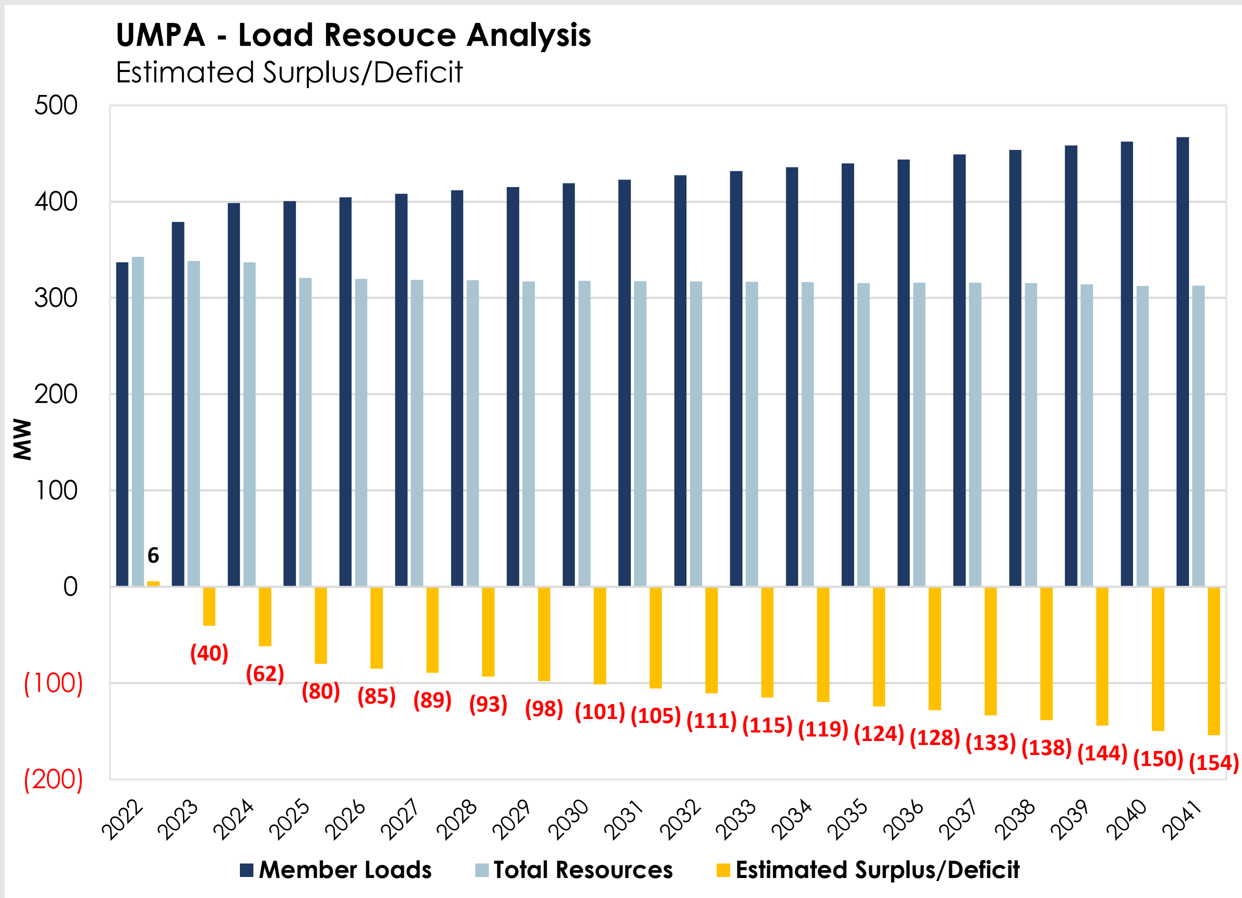


Supply-Side Action Plan

Supply-side resources for planning and further consideration are as follows:

- Add additional **renewable energy** sources
    - Intermittent Options:
        - Community solar projects at 3-6 MW within five years
            - Possible locations: Manti, Nephi, and Provo
        - A utility grade solar project at 40-100 MW within three to five years
        - The Agency will continue to consider additional solar and wind projects as needed within the portfolio and when economically viable.
    - Baseline Options:
        - A geothermal project at 10-40 MW is under consideration.
- Add additional **energy storage** options
    - Pumped Storage:
        - UMPA plans to identify viable sites and conduct an economic analysis.
    - Batteries:
        - Within the next 2 years, UMPA plans to install 2-10 MWH batteries.
            - Possible locations: Provo and Spanish Fork
        - UMPA will install energy storage as needed within the portfolio.
- Add additional **natural gas capacity** options
    - Reciprocating Power Plant:
        - (Similar to Provo Plant) UMPA considers a plant in Nephi to support capacity in the future within the next five years
    - Simple Cycle Natural Gas:
        - (Similar to the West Valley Plant) UMPA investigates the addition of a simple cycle natural gas power plant in the next 5 to 10 years. The Agency also explores converting to hydrogen as a fuel source with the economics driving the conversion
- Plan for additional **carbon free energy** sources to replace coal-fired facilities
    - UMPA is interested in SMR development. UMPA monitors two projects, NuScale developed by UAMPS and TerraPower project developed by PacifiCorp. UMPA plans to add some level of nuclear power 10-30 MW in the long term.
    - UMPA is interested in carbon sequestration and storage with UMPA's ownership of coal facilities. The Agency hopes that the carbon capture technology will extend the life of existing UMPA resources

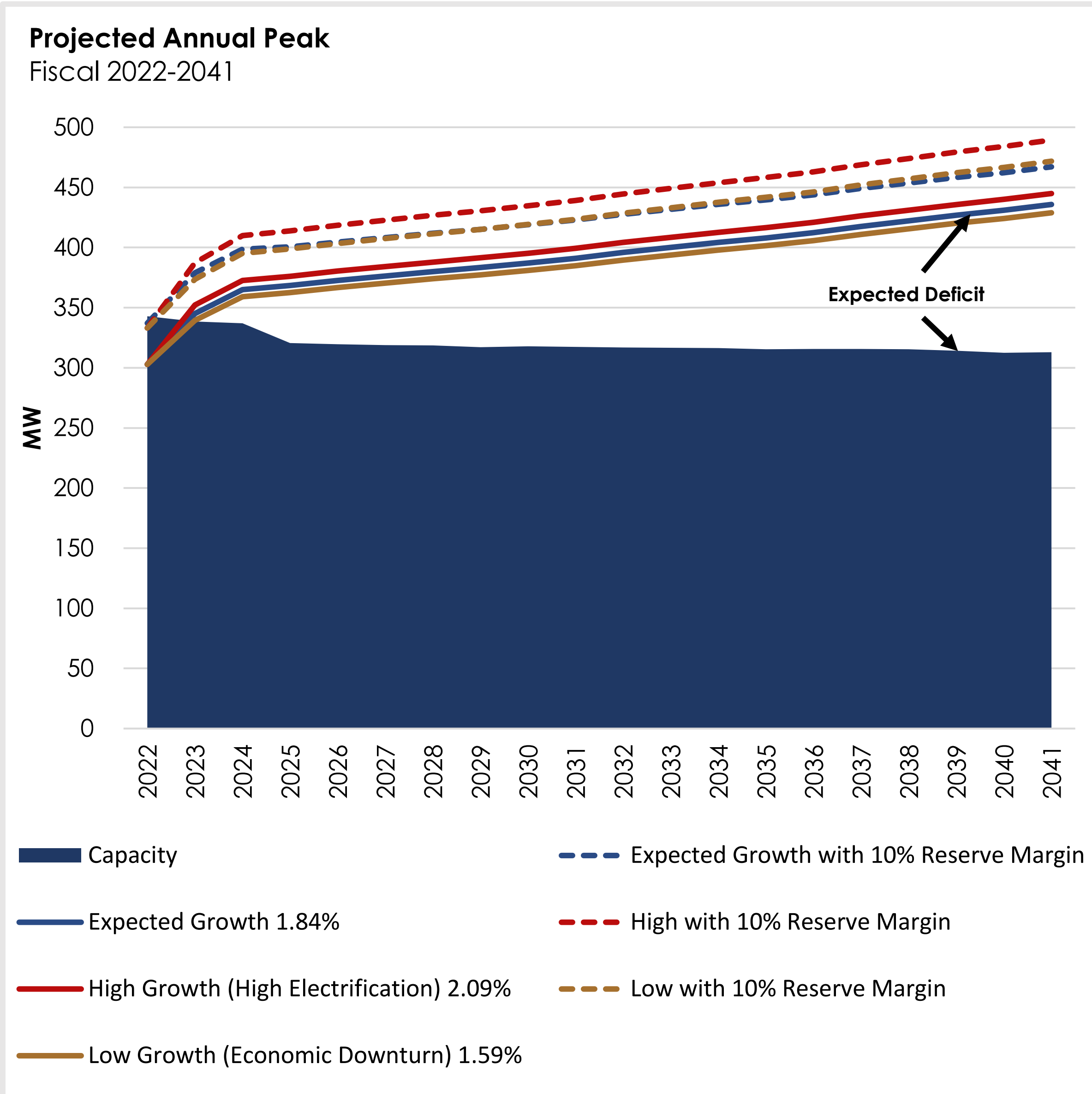
The following graph depicts the forecast loads, available supply-side resources, and the surplus or deficit for the coming years:



In summary, UMPA's members have enjoyed low electric rates because of the coal fired resources developed in the region and the access to Federal developed hydroelectric generation. The opportunity to develop large hydroelectric projects no longer exists. Concerns with climate change and regulatory uncertainty make it impractical to develop new coal resources as a future alternative, even with the abundance of coal supply in the region. Clean coal technology may still be a resource possibility with further advances in design. With the RPS, renewable power will continue to play a significant role in meeting the demands for future resources.

For the future, UMPA must find base and intermediate load resource to replace the energy deficit created by expiring power purchase contracts and continued growth on the system. The primary replacement source available today comes from natural gas. UMPA will explore the development and participation in a natural gas fired plant.

The following graph shows the deficit in meeting forecasted loads with current supply-side resources into the future years:



Demand-Side Management

Demand-Side Resource Portfolio
Programs by Priority Group
Demand-Side Action Plan

UTAH MUNICIPAL
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Demand-Side Resource Portfolio

Demand-Side Management (DSM) practices have expanded from being focused on adjusting consumer usage to also promoting clean energy consumption. In support of the Utah Energy Resource and Carbon Emission Reduction Initiative, the UMPA DSM portfolio includes programs that promote clean energy consumption.

The Agency DSM resource portfolio is represented by four priority groups: (1) Energy Efficiency, (2) Outreach, (3) Renewables and Decarbonization, and (4) Demand Response. Each DSM program falls into a dominant priority group, however, there is some overlap depending on the nature of the program. The priority groups are defined as follows:

1. Energy Efficiency: Programs which anticipate savings in energy and capacity through advancements in technology, equipment, and/or management.
2. Outreach: Communication and education efforts which lead to energy savings through knowledge based behavioral changes.
3. Renewables and Decarbonization: Programs and opportunities to increase renewable energy and reduce the emissions of carbon dioxide.
4. Demand Response: Programs which create capacity savings from advanced scheduling or active control.

UMPA DSM programs are outlined by priority group in the table below.

Energy Efficiency	Outreach
• Energy Star Appliance Rebates • Refrigerator Disposal • Streetlights • Weatherization Rebates • Heat Pump Rebate	• Conserve • National Energy Foundation (NEF) • Public Meetings and Media
Renewables and Decarbonization	**Demand Response**
• BizSolar • GreenXchange • NatureShade • Net Metering • SelectGreen • SharedSolar	• Load Control for Central A/C • Restructuring of Rates • Smart Gird • System Infra-red Scanning • Voltage Control Regulator

Programs by Priority Group

DSM programs are grouped by priority and described below. Descriptions include program objectives, assessed viability, status (e.g., suspended, current, etc.), and target consumer (e.g., industrial, residential, etc.). Completed programs are included to illustrate the shift in the DSM model and as a method of accountability.

Energy Efficiency

Energy Star Appliance Rebates

Status: Suspended **Target Consumer:** All

The appliance rebate program offered an incentive for the purchase of new qualified energy star rated appliance in our customer's homes including refrigerators, dishwashers, clothes washers, lighting fixtures and ceiling fans.

Assessment

UMPA member, Provo City, shifted the focus from the Energy Star Appliance Rebates to RenewChoice rebate programs. Provo implemented the program in 2010 with strong public interest.

However, due to diminishing public interest in buying energy efficiency appliances, Provo elected to financially support other rebate programs and suspended the appliance rebate program. However, the program may resume depending on funding and interest.

Refrigerator Disposal

Status: Suspended **Target Consumer:** All

UMPA member, Provo City, offered customers an avenue and resource to properly dispose and recycle old and inefficient equipment.

Assessment

UMPA member, Provo City, shifted the focus from the Refrigerator Disposal program to RenewChoice exchange programs.

The program started with strong public interest; however, due to diminishing public interest, Provo elected to financially support other programs and suspended the Refrigerator Disposal program. The program may resume depending on funding and interest.

Streetlights

Status: Current **Target Consumer:** Internal

UMPA member cities are committed to replacing old street lighting with new efficient LED lights. Spanish Fork City is working toward replacing lights around the city that are also dark sky compliant. Dark Sky compliant light fixtures do not create as much light pollution by forcing light downward.

Assessment

UMPA is committed to reducing energy by replacing older, less efficient streetlamps with more efficient lights. UMPA member cities will invest capital funds to replace streetlights with highly efficient LED lights.

Weatherization Rebates

Status: Suspended **Target Consumer:** Residential

UMPA member, Provo City, promoted conservation and energy efficiency through a residential weatherization rebate program. The program offered a rebate for the installation of qualifying efficient windows, insulation, and central air conditioning.

Assessment

Provo City shifted the focus from the Weatherization Rebates to RenewChoice rebate and Conservation programs.

The program started with strong public interest; however, due to diminishing public interest, Provo elected to financially support other programs and suspended the Weatherization Rebate program. The program may resume depending on funding and interest.

Heat Pump Rebates

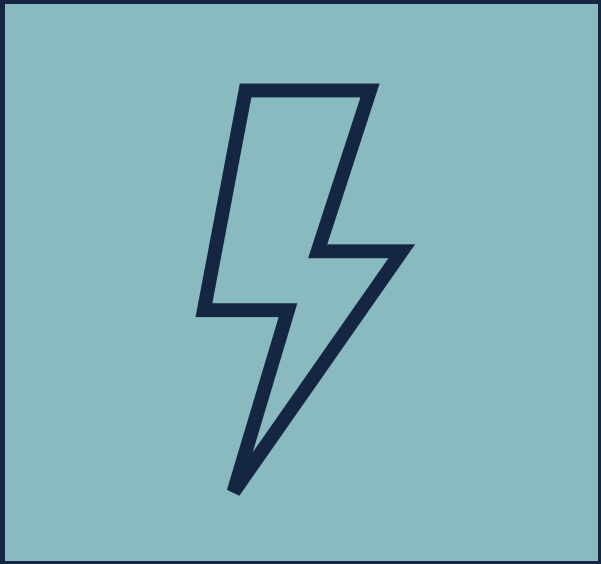
Status: Current **Target Consumer:** Residential

UMPA member, Provo City, offers a rebate of $500.00 as an incentive if a highly efficient heat pump conversion is completed. A rebate of $1,000.00 will be offered as an incentive if a dual fuel heat pump conversion is completed.

Assessment

The Heat Pump rebate program is not mandatory, however, UMPA encourages consumers to take advantage of the program where feasible. Other UMPA member cities are considering participating in this program.






Outreach

Conserve

Status: Current **Target Consumer:** All

The RenewChoice Conserve Program objective is to expand and promote energy usage awareness through knowledge and information on the website. The website provides information on how to reduce energy consumption and conduct a home energy audit.

In addition to the educational program, rebates for energy-efficient upgrades may also be offered in member cities. Find out more information about this program at www.renewchoice.com/conserve-rebates/.

Assessment

The RenewChoice Conserve program offers customer information to manage their energy usage. Customers may choose to apply these proven methods and techniques.

National Energy Foundation

Status: Current **Target Consumer:** All

Since 2002, UMPA has engaged the National Energy Foundation (NEF) to provide formal education regarding energy saving ideas and methods in the public school system. The program offers a variety of energy saving devices to the students along with emphasis on improving behavior in better utilizing electricity.

Each year, the NEF focuses its program at a specific grade (typically 4th, 5th or 6th grade) and teaches their energy conservation program at a number of schools within the UMPA member service territory.

Assessment

UMPA is committed to the education of energy efficiency in the schools and plans to fund the NEF in coming years.

Public Meetings and Media

Status: Current **Target Consumer:** All

Member cities conduct public meetings and events throughout the year where energy conservation and efficiency are promoted and marketed. Many of the cities' websites offer conservation tips and advice. Cities use monthly newsletters as another communication tool to educate and inform the public.

Assessment

Member cities will continue to sponsor and host events for promoting the message of conservation and wise energy use. The combination of monthly utility bills and city newsletters will continue to offer energy saving tips.

Renewables and Decarbonization

BizSolar

Status: Current **Target Consumer:** Commercial and Industrial

The BizSolar program gives customers the opportunity to sell solar power to UMPA under a long-term power sales contract. This solar program gives customers the opportunity to tap into the potential of solar generation and help supply a portion of the demand with the support of UMPA and the local member electric utility.

An organization would need to build and operate a solar generating facility (greater than 25 kW and less than 750 kW) and be willing to comply with the terms and conditions of the program. Find out more information about this program at www.renewchoice.com/biz_solar/.

Assessment

UMPA is committed to finding renewable energy solutions. UMPA encourages customers to participate in BizSolar.

GreenXchange

Status: Current **Target Consumer:** Residential

GreenXchange began operating in 2019. The program is designed to reduce air emissions produced by gas-powered yard equipment and improve air quality. Residential electric utility customer can receive a rebate up to $300 for exchanging their gas-powered yard equipment for new electric-powered equipment. Find out more information about this program at www.renewchoice.com/exchange-program/.

Assessment

Member cities are committed to reducing air pollution in our communities and encouraging more clean air for the future. UMPA members funded this rebate program and encourage all customers to participate in GreenXchange when feasible.

NatureShade

Status: Current **Target Consumer:** All

NatureShade is a free shade tree program offered by Provo City. Eligible electric utility customers within Provo can apply for a free shade tree to plant on their property in Provo. The NatureShade program provides long-term benefits for the community as shade trees are highly effective at sequestering carbon.

DSM-related planting of trees will not account for any capacity and energy savings for the first 15 years in order to allow the planted trees to mature. Once they reach maturity, a savings is estimated of 0.14 kW and 210 kWh per year per tree. Find out more information about this program at www.renewchoice.com/natureshade-2/.

Assessment

UMPA member, Provo City, is committed to continuing this program with the target of 250 trees planted each year. The overall goal is to move towards one tree planted per customer having central (refrigerated) air conditioning. Although trees are donated by the utilities from time-to-time, the member cities are considering participating in this program.

Net Metering

Status: Current **Target Consumer:** All

Net Metering is a utility billing method available in Utah that offers a credit to residential and business customers who are making excess electricity with their solar panel systems and sending it back to the local power grid. Find out more information about this program at www.renewchoice.com/net_metering/.

Assessment

UMPA member cities are committed to continuing this program and promoting the benefits to the consumers through its members. There are no targeted energy and demand reductions at this time. UMPA's promotion of a Net Metering program will reduce overall system loads by generating electricity at the point of use, thereby reducing the cost of future generation and system capacity.

SelectGreen

Status: Current **Target Consumer:** All

Energy consumers are able to purchase 100 kWh blocks of power that are from renewable sources. The program allows flexibility for how much of a customer's energy portfolio comes from clean energy. Customers may opt in or out at any time (allowing for about 30 days of processing time). Find out more information about this program at www.renewchoice.com/select_green/.

Assessment

UMPA supports the SelectGreen program and its efforts to create energy conscience consumers.

SharedSolar

Status: Current **Target Consumer:** Residential and Commercial

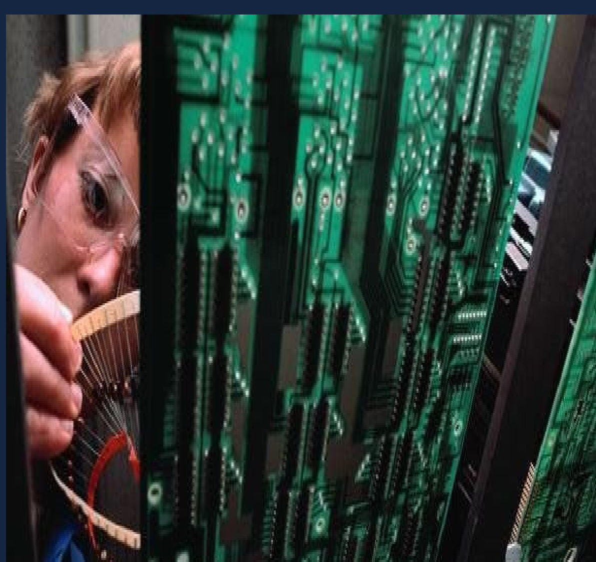
SharedSolar power provides clean, renewable energy to those who otherwise cannot access traditional rooftop solar panels. Around 12,000 solar panels were installed to provide clean, renewable energy to hundreds of households within UMPA member cities.

Customers can subscribe for one kilowatt (kw) blocks. Each will generate 200-kilowatt-hours (kwh) of energy. Customers can keep their subscriptions for up to 20 years. If they move to another city within RenewChoice service territory, their solar blocks go with them. Find out more information about this program at www.renewchoice.com/shared_solar/.

Assessment

UMPA member cities are committed to finding renewable energy solutions for their customers and encourages customers to participate in SharedSolar. Customers can elect to take 100% renewable, clean energy for their business or home. This program allows customers to reduce their carbon footprint and help in the reduction of carbon emissions.





Demand Response

Load Control for Central Air Conditioning

Status: Future **Target Consumer:** Residential

A load control device is a unit installed near the central air conditioning unit that allows utilities to interrupt power to the condenser on the air conditioner during peak energy usage while allowing the fan to continue circulating cool air inside the home.

Assessment

UMPA will work in the coming years with the members to study and determine the value of this program. This program needs to be compatible with the supply-side resources and costs.

Restructuring of Rates

Status: Future **Target Consumer:** All

Member cities are encouraged to study and evaluate the implementation of new retail rate designs that will promote energy conservation such as an inclining energy block or time of use design.

Assessment

UMPA will support member cities in their efforts to promote energy conservation through careful study and evaluation.

Smart Grid Programs

Status: Current **Target Consumer:** Internal

It has been stated that a modernization of the national grid system expects to reduce demand by 20% in the nation and enough to eliminate hundreds of power plants. Most UMPA members have implemented AMI (automated metering integration) for improved system monitoring and accuracy of system losses.

Assessment

UMPA and its members will continue to investigate innovative technology and implement it based on the DSM criteria.

System Infrared Scanning

Status: Current **Target Consumer:** Internal

The loss of energy through excessive heat in connections and electrical equipment is another area of concern for the member cities. System losses are monitored and are benchmarked against other utilities. To reduce losses, infra-red scanning of major equipment, identifies problems before they become catastrophic.

Assessment

UMPA's members plan to continue using this tool for reducing system losses caused by poor connections and equipment performance. There is no targeted kW reduction at this time. UMPA will track the cost and labor time committed to this program.

Voltage Control Regulator

Status: Future **Target Consumer:** All

This program may allow UMPA and member cities to save as much as 2% of its peak load during critical periods. For those members with remote voltage control, this program could be activated during the monthly system peak and result in significant kW reductions.

Additional studies, system improvements, and added controls are necessary before the program is ready to deploy. The program will likely be used during periods of operational necessity when UMPA's loads are the highest.

Assessment

UMPA is not ready to implement this program and will continue to study for future consideration.

Demand-Side Action Plan

Demand-side resources for planning and further consideration are as follows:

- Enhance energy efficiency programs through outreach
    - Technology Options:
        - Determine the viability of the following programs:
            - Wi-Fi Controlled Thermostat Rewards program
            - Solar/Electric Water Heater Rebate
            - Free HVAC Tune-Up
    - Education Options:
        - Share the benefits of technology enhancement with the consumer. Encourage consumers to make changes without a rewards or rebate in place.
        - Continue to fund NEF for schools
        - Promote energy efficiency in city newsletters
- Shift energy usage to renewables and decarbonization options
    - Consumer Options:
        - Track consumer participation in the following programs:
            - BizSolar
            - GreenXchange
            - NatureShade
            - Net Metering
            - SelectGreen
            - SharedSolar
- Demand Response
    - Load Control Options:
        - Determine the viability of the following:
            - Water Heater Controls
            - Space Heating Switch
            - Smart Thermostat
    - Time-Varying Prices:
        - Encourage members to adjust rates with the following options:

- Time of Use Rates[4]
- Critical Peak Pricing
- Time of Use + Critical Peak Pricing

Each UMPA member has devised operating procedures for implementing programs as described in the IRP. UMPA will implement innovative programs that support our DSM priorities explained in the IRP. UMPA considers this a dynamic process and desires to enhance services to its members and consumers. UMPA welcomes demand-side alternative and energy efficiency programs to meet the growing needs of its members.

[4] Provo City Power has adopted a pilot program for TOU.

IRP Approval Process

The initial drafting of the IRP and preparation of the document were performed by Treana Solomon (UMPA Consultant) and UMPA staff – Kevin Garlick. The forecasting and modeling information for the IRP were performed by UMPA staff – McKay Murphy. Other UMPA staff members are contributors to the IRP as noted below. Member cities contributed with information on their communities. The demand-side management and energy efficiency activities were reported through an annual survey and collection process.

The final draft of the IRP will be presented by staff to the UMPA Board of Directors and the Technical Committee. The presentation will occur during a regularly scheduled Board meeting open to the public. The staff seeks acceptance of the final draft IRP by the Board and approval of the notice for a 30-day public comment period.

After Board approval of the final draft, the report will be available to the public on the UMPA website. Member cities and the public are invited to submit comments for the 30-day public comment period. UMPA will email the final draft report to interested parties inviting them to submit comments.

Each member city should consider holding a public work session with their city leaders and staff and invite the public to participate in the review of the report. UMPA staff will be available if asked to participate in these public events to assist in educating the public on the purpose and findings of the report.

All comments to the final draft of the IRP during the comment period are to be submitted to:

Email: 2022IRP@umpa.energy
Mail: 696 W 100 S Spanish Fork, UT 84660
Phone: (801) 803-5476

Upon closing of the comment period, the UMPA staff will organize all public comments. The staff will prepare a report that will analyze each comment and offer suggested changes to the final IRP to be considered by the UMPA Board.

The final IRP will be submitted to the UMPA Board of Directors for adoption. This item will be conducted during a regularly scheduled Board meeting and open to the public.

Timeline

The following represents key dates and the timeline in the IRP approval process:

Date	Milestone
September 28, 2022	Final Draft IRP presented to Board of Directors and Technical Committee.
October 1, 2022	Start of Public Comment Period.
October 30, 2022	End of the Public Comment Period
November 20, 2022	Staff prepared response document of public comments and submits report with recommended changes to IRP for review by UMPA Board of Directors and Technical Committee.
November 30, 2022	Board Directors reviews and adopts the IRP by resolution (see UMPA Resolution of the FY 2022 IRP in Appendix C).
December 2022	Post the 2022 IRP on UMPA's website.
December 2022	Submit 2022 IRP to WAPA.

Public Comments

The comments submitted by the public and associated response from the Agency are filed under Appendix D, Public Comments and UMPA Response. The IRP was modified to reflect those comments offered and approved by the UMPA Board of Directors.

Acknowledgement

UMPA expresses appreciation to many contributors of the IRP:

The UMPA Board of Directors:

- Levan – Mayor Bruce Rowley
- Manti – Mayor Chuck Bigelow
- Nephi – Mayor Justin Seely
- Provo – Mayor Michelle Kaufusi, Chair
- Salem – City Council Kurt Christensen, Secretary Treasurer
- Spanish Fork – Mayor Mike Mendenhall, Vice Chair

The Technical Committee:

- Levan – Jason Worwood, Chair
- Manti – Blake DeMill
- Nephi – Rust Finlinson
- Provo – Travis Ball, Vice Chair
- Salem – Adam Clements
- Spanish Fork – Jake Theurer

The IRP UMPA Staff:

- Layne Burningham, CEO/President
- Kevin Garlick, SVP Generation
- Jake Chrisman, VP Energy Operations
- Marianne Shepherd, VP Finance
- Kelly Baker, VP Information
- McKay Murphy, Senior Power Analyst
- Jerame Blevins, West Valley Plant Manager
- Talon Doucette, Energy Marketing Manager
- and other UMPA employees as contributors

The Consulting and Drafting service:

- Treana Solomon, Project Consultant

Reporting Action Plan and Measurement Process

UMPA will continue to report its findings and data to WAPA on an annual basis in accordance with the IRP. The report will update WAPA as to progress, measured success, and decisions made toward both supply-side resources and demand-side management programs. Every year at the end of the fiscal year, UMPA plans to follow the steps in collecting and reporting the data:

1. Prepare a detail survey and submit to all the member cities.
2. Collect the data including the DSM activities and related energy reductions from member cities.
3. Prepare an annual report on DSM activities with performance measurements on each program described within.
4. Submit this DSM report to WAPA in accordance with guidelines.
5. Update the load forecasts.
6. Investigate and secure new supply-side resources in accordance with the IRP standards.
7. Submit historical energy and power supply data to WAPA.
8. Update the timeline and progress on adding new supply resources to the existing resource mix.
9. Post supply resources and DSM progress data on UMPA's website for public review.

List of Appendices

Appendix A – Member City Information

To be added in the final

Appendix B - References

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Appendix C – UMPA Resolution of the FY 2022 IRP

To be added in the final

Appendix D – Public Comments and Responses

To be added in the final

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