2020 Integrated Resource Plan

WESTERN AREA POWER ADMINISTRATION (WAPA) APPROVED

Contract No. 15-RMR-2633; and
Contract No. 14-RMR-2554
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1. Overview on the City of Gillette

1.1. Background

The City of Gillette ("the City") is a municipal utility providing electric services to the retail customers located in the City of Gillette, Wyoming. The City's service area includes the residential, commercial, and industrial electric customers of the City of Gillette as well as City owned facilities that exist outside the City Limits. The City owns two generation facilities and purchases the remainder of its requirements through bilateral agreements from regional utility systems. The City's Electrical Services division operates and maintains the City's underground & overhead electric distribution system and the 69kV transmission line that supplies wholesale power purchased by the City for distribution to its retail customers. The division also operates & maintains the City's electrical substations and installs line extensions into new service territory.

1.2. Customer Information

The City of Gillette is in Campbell County, Wyoming. It is 23.19 square miles and located in the northeast portion of the state. The City is one of the more populated areas of the state with a population of 32,030 as of July 1, 2019 U.S. Census estimate. The City's municipal electric utility system serves 15,576 customers as of December 31, 2020 in the City of Gillette. It serves 13,081 residential customers and 2,495 commercial customers, as of December 31, 2020. In addition to end-use customers, the City also serves municipal requirements, such as Regional Water System Facilities.

1.3. Overview of the City's IRP Requirements

This IRP is intended to meet the Energy Planning and Management Planning (EPAMP) Final Rule published in the Federal Register (60 FRJ4151) Oct. 20, 1995, as amended; Section 13 of Contract No. 15-RMR-2633 between the City and The United States Department of Energy, Western Area Power Administration, Rocky Mountain Region (WAPA) dated March 9, 2015; and Section 15 of Contract No. 14-RMR-2554 between the City and WAPA dated July 20, 2015.

1.4. Purpose, Goals, and Objectives of the IRP

The purpose of this IRP is to develop a two and five-year implementation plan for best serving the City's power supply requirements while meeting the objectives of the IRP. The City has several goals and objectives for developing and implementing its IRP process.

1.4.1. Supply diversity;
1.4.2. Meet customer preferences;
1.4.3. Minimize total costs; and
1.4.4. Enhance reliability.

2. Customer Requirements

2.1. Historical Consumption

The City of Gillette is a summer peaking system, which experienced a peak demand of 77.8 MW and retail energy sales of 338,048 MWh in 2017. The City experienced an all-time high peak demand of 77.8 MW during the summer of 2017.

The City's requirements have leveled off over the last several years. Table 1 presents the City's peak demand and energy consumption over the 25-year period from 1996 through 2020.

Table 1
Historical System Peak Demand and Annual Energy

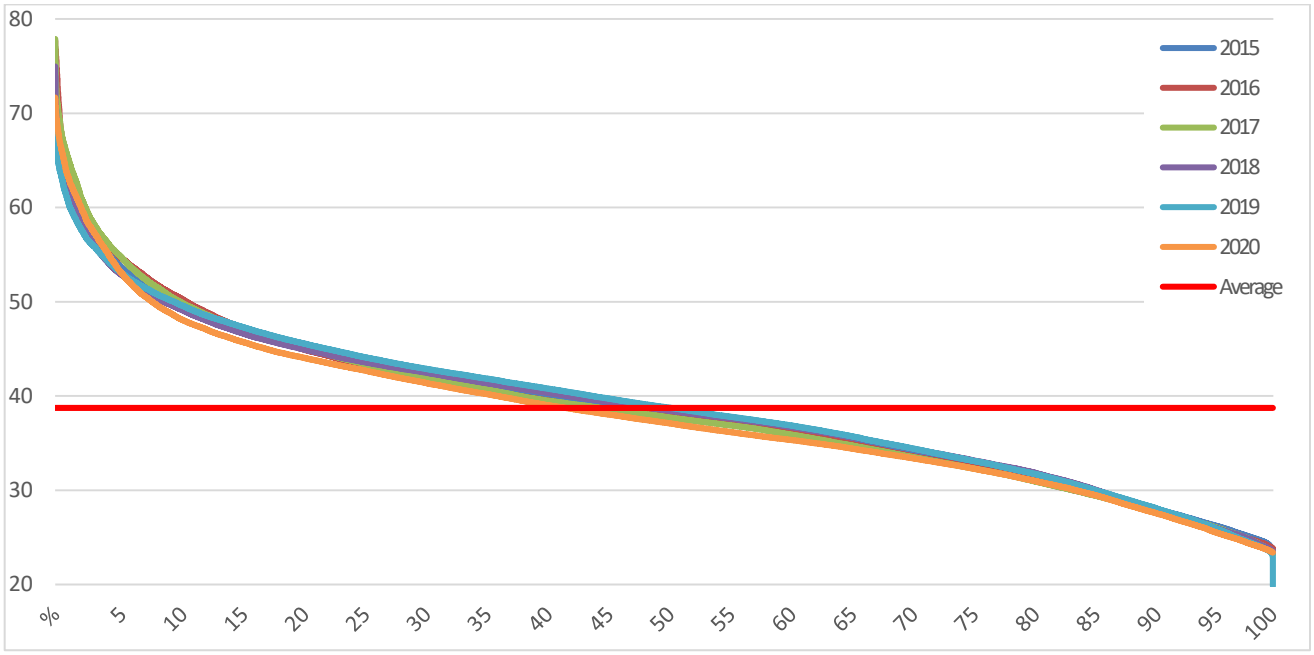
	Peak (MW)	Demand Growth	Annual Energy (GWh)	Energy Growth	Load Factor
1996	37.490		193.382		59%
1997	34.600	-8.35%	191.877	-0.78%	63%
1998	39.166	11.66%	200.173	4.14%	58%
1999	39.602	1.10%	203.497	1.63%	59%
2000	40.875	3.12%	217.406	6.40%	61%
2001	44.092	7.29%	223.013	2.51%	58%
2002	45.726	3.57%	232.005	3.88%	58%
2003	51.922	11.93%	244.597	5.15%	54%
2004	50.177	-3.48%	242.129	-1.02%	55%
2005	55.068	8.88%	265.706	8.87%	55%
2006	59.021	6.70%	287.494	7.58%	56%
2007	61.907	4.66%	303.565	5.29%	56%
2008	63.078	1.86%	313.439	3.15%	57%
2009	61.111	-3.22%	316.312	0.91%	59%
2010	65.029	6.03%	322.599	1.95%	57%
2011	68.471	5.03%	322.86	0.08%	54%
2012	71.600	4.37%	334.666	3.53%	53%
2013	66.919	-7.00%	335.572	0.27%	57%
2014	70.954	5.69%	335.277	-0.09%	54%
2015	72.144	1.65%	339.623	1.28%	54%
2016	77.670	7.11%	338.796	-0.24%	50%
2017	77.880	0.27%	338.641	-0.05%	50%
2018	74.000	-5.24%	340.674	0.60%	53%
2019	69.000	-7.25%	342.525	0.54%	57%
2020	71.665	3.72%	353.159	3.01%	52%

2.2. Load Shape

As part of its forecasting process, the City conducted a review of its hourly load shape in the form of a load duration curve to identify any anomalies or specific changes during the period from 2015 through 2020. Apart from peak demand growth, the City's peak load duration curve was found to be consistent over the last six years. Peak demand had been between 69 MW and 78 MW, with minimum demand consistently at approximately 24 MW, and an average demand of 38.7MW.

Figure 1 provides the City's hourly load duration curve. The higher loads are typically driven by extreme temperatures, therefore demand for the top 400 hours is driven by cooling load.

Figure 1
Load Duration Curve 2015 - 2020



2.3. Background on Forecasting Process

Black Hills Energy prepares an energy and peak demand forecast on an annual basis on behalf of the City. The purpose of this forecast is the basis for conducting resource planning studies, transmission reservation planning, and other related planning activities. The forecasting methodology is based on a time series methodology over 25-years of monthly metered consumption data. The City's most recent forecast, conducted in January 2021, projects average annual peak demand and energy growth of 1.3 percent for the next 10 years. Table 2 provides the City's annual peak demand and energy forecast for the 2021-2035 period.

Table 2
Peak Demand and Annual Energy Forecast

	Peak (MW)	Demand Growth	Annual Energy (GWh)	Energy Growth	Load Factor
2021	78	8.24%	357.080	1.10%	52%
2022	79	1.32%	361.335	1.18%	52%
2023	80	1.32%	365.916	1.25%	52%
2024	81	1.31%	370.665	1.28%	52%
2025	82	1.30%	375.531	1.30%	52%
2026	83	1.29%	380.543	1.32%	52%
2027	85	1.28%	385.542	1.30%	52%
2028	86	1.28%	390.606	1.30%	52%
2029	87	1.27%	395.743	1.30%	52%
2030	88	1.26%	400.855	1.28%	52%
2031	89	1.26%	405.868	1.24%	52%
2032	90	1.25%	410.819	1.21%	52%
2033	91	1.24%	415.819	1.20%	52%
2034	92	1.24%	420.973	1.22%	52%
2035	93	1.23%	426.231	1.23%	52%

3. Existing Supply-Side Resources

The City's existing generation supply portfolio includes two municipally-owned resources as well as several short-term purchases. The City's facilities consist of partial ownership of a 100 MW coal plant and full ownership of a 40 MW combustion turbine. These facilities are further described below.

3.1. WyGen III Facility

In 2010 the City acquired a 23 percent ownership interest in the 100 MW Wygen III plant. Wygen III is an efficient mine-mouth coal power plant located at the Wyodak Energy Complex, near Gillette, Wyoming. Wygen III began commercial operation on April 1, 2010 and employs state-of-the-art emissions control technology, including mercury emissions reduction. It also features air-cooled steam condensing. The ownership interest provides the City with approximately 23 MW of capacity for the life of the plant.

3.2. Combustion Turbine No. 2

In 2014 the City acquired a 40 MW simple-cycle gas-fired combustion turbine for meeting its peaking requirements. The unit, referred to as CT2, entered commercial operation in 2009 and is also located at the Wyodak Energy Complex. The city purchased the plant from Black Hills Electric Generation, LLC

("BHEG"). During the acquisition of CT2, the City entered into an agreement with BHEG for the purchase of economy energy. While not attributed to any one resource, the agreement allows the City to take advantage of non-firm energy that is priced lower than the cost of producing energy from CT2.

3.3. Purchase Power Agreement (PPA)

In 2019 the City entered a PPA with Black Hills Wyoming to purchase 5 MW from Wygen I. This coal fired plant is located at the Wyodak Energy Complex east of Gillette. The City will start receiving the energy from this agreement in January 2023.

3.4. Western Area Power Administration Loveland Area Projects

The City purchases firm capacity and energy under long-term contract from Western. The Agreement provides for the continued delivery of 3-4 MW purchase of power from Western Loveland Area Projects.

3.5. Peaking Energy Contract

This agreement provides the remainder of the capacity and energy required for the City of Gillette. Below is peak energy used for the 6-year period from 2015 through 2020.

Table 3
Peaking Energy

	2015	2016	2017	2018	2019	2020
Peaking Energy (MWh)	76	259	34	52	1	67
Peaking Hours	23	59	16	15	1	34

3.6. Supply-Side Resources Summary

Table 4 summarizes the City's resources for meeting its future requirements.

Table 4
Summary of Existing Power Supply Resources

Resource Name	Primary Fuel	Rated Capacity (MW)	Term of Purchase
Wygen III	Coal	23	Life of Unit
Combustion Turbine 2	Natural Gas	40	Life of Unit
WAPA	Hydro	3-4	Sept. 30, 2024 Contract #2633 Sept. 30, 2054 Contract # 2554
Peaking Energy Supply	System Mix	Up to peak requirement	Until terminated
Wygen I PPA	Coal	5	Start in 2023 20-year Term

4. Existing Demand-Side Resources

4.1. Existing Customer Programs

Wyoming has consistently ranked within the top four states for having the lowest average electricity costs in the country. These low costs are a result of a regionally abundant supply of low cost coal generation. The low electricity costs along with excess capacity in the region have historically made conservation and demand-side management programs cost-prohibitive. As a result, the City currently does not offer any specific demand-side management programs to its retail residential and commercial customers. Although it has participated in the demand resource research and evaluation process in prior years, the City, has not elected to implement any specific end-use programs due to a sudden and prolonged downturn in the local economy that started in 2016.

4.2. Energy Efficiency Codes and Requirements

In 2009, the City adopted the use of energy efficiency codes and requirements for residential and commercial buildings. These requirements include:

4.2.1. **Chapter 11 of the 2006 Edition International Residential Code (Residential):** The stand-alone residential code contained in this document establishes minimum regulations for one- and two- family dwellings and townhouses. Chapter 11 regulates the energy efficiency for the design and construction of buildings regulated by this code.

4.2.2. **2006 Edition International Energy Conservation Code (Commercial):** This comprehensive energy conservation code establishes minimum regulations for energy efficient buildings using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new energy efficient designs.

4.2.3. Net Metering – This section of the City code allows residents to return excess energy to the City's grid. Below is an excerpt from Chapter 17 of the City code regarding Net Metering:

4.2.3.1 This rate is applicable for customer owned parallel electrical generation facilities of less than 25 kW. Generation equipment will be designed to be compatible with the characteristics of the service that the customer receives from the City electrical utility.

4.2.3.2 For each month, the City will record both the energy delivered to the customer and the energy received from the customer. If the energy delivered to the customer is greater than the energy received from the customer, the customer will be billed for the difference under the rate applicable to the customer.

4.2.3.3 If the energy delivered by the City electrical system is less than the energy received from the customer, the customer will not be billed for energy in that billing period and the surplus energy will be carried forward to the next billing period.

4.2.3.4 In the first billing period of each year, if the customer's account has a credit for energy received from that customer, the customer will be compensated for the surplus at a rate not less than the City's average avoided cost for energy for the previous calendar year**.**

4.2.3.5 The City will supply and install an electric meter that will record the power flow delivered to and received from the customer. The customer will supply all other equipment necessary to ensure operation of customer owned generation. A separate lockable disconnect is required for all service applicable to this rate. The disconnect shall be accessible to City electrical utility personnel at all times.

4.2.3.6 The customer will install and maintain a separate disconnecting means for the generator(s). This disconnect must be accessible to City electrical utility personnel. The disconnect shall have provisions to be padlocked in the open position and provisions to allow its use in the utility's energy control plans. The disconnect shall be labeled. If the generator disconnect is not located within sight of the utility supply disconnect, a plaque showing the location of all disconnects shall be placed at each disconnect serving the facility.

4.2.3.7 The Customer will maintain a Power Factor for the generation equipment between .9 leading and .9 lagging at all times. For purposes of this requirement, the Power Factor for the generator will be measured at the generation disconnect. If the customer fails to maintain the Power Factor

within this range, the City may require the customer to disconnect the generation equipment from the City's system until the customer can demonstrate compliance.

4.2.3.8 The Customer is responsible for compliance with all applicable codes and standards, including but not limited to the National Electrical Code, the National Electric Safety Code, IEEE standard 1547, and the City of Gillette's Electrical Distribution Standards. The Electrical Services Division will review the generation equipment and its installation to ensure that it will be compatible with the City electrical distribution system and their approval is required before the generation equipment is connected to the City electrical distribution system and energized. The Customer will allow utility access to the generator's disconnecting means to allow utility staff to perform measurements to independently verify compliance with the above referenced codes and standards.

4.2.3.9 In accordance with IEEE Standard 1547, the generation equipment shall automatically disconnect from the utility's system in the event of loss of utility supply to the customer's meter.

As of December 31, 2020, five (5) customers are participating in the City's Net metering program.

4.3. Conservation Measures Installed in City Facilities

Although the City currently does not offer energy savings programs to its retail customers, it has undertaken several energy conservation measures. These are highlighted below:

4.3.1. The City recently implemented the city-wide replacement of street lights, converting traditional high-pressure sodium ("HPS") street lights fixtures to LED fixtures throughout the City. The LED streetlight replacement program continues and is 92% complete. Of the 3,523 City street lights, there are approximately 260 street lights remaining to upgrade to LED fixtures.

4.3.2. Variable Frequency Drives ("VFD"): Installed VFD's in one of its administrative buildings, installing six VFD's on two chilled water pumps, two hot water pumps, and two condenser water pumps at City Hall. All pumped water facilities in the City's water and wastewater system also have VFD's installed.

4.3.3. Lighting: As indoor and outdoor lighting needs replacement, LED bulbs are utilized.

4.3.4. HVAC: Each thermostat is equipped with a sensor; if a room is not occupied the temperature moves to a default setting from the manual setting to save energy.

4.3.5. Installed motion detectors in conference rooms, rest rooms and other areas to control lighting in City buildings.

4.3.6. Water Division shuts down pump stations during peak power demands when required.

4.3.7. Donkey Creek II pump station has been upgraded, operating higher efficiency pumps lowering power usage.

4.3.8. Motor/Pump delay start sequencing starts large pumps and equipment to reduce the overall peak of the system.

4.3.9. Irrigation Smart Controllers reduce the overall water usage for commercial and residential customers, this reduces the energy needed to pump water.

4.3.10. Advanced Metering Infrastructure (AMI) when complete this will allow for electrical customer education to aide in the management of the City's demand curve.

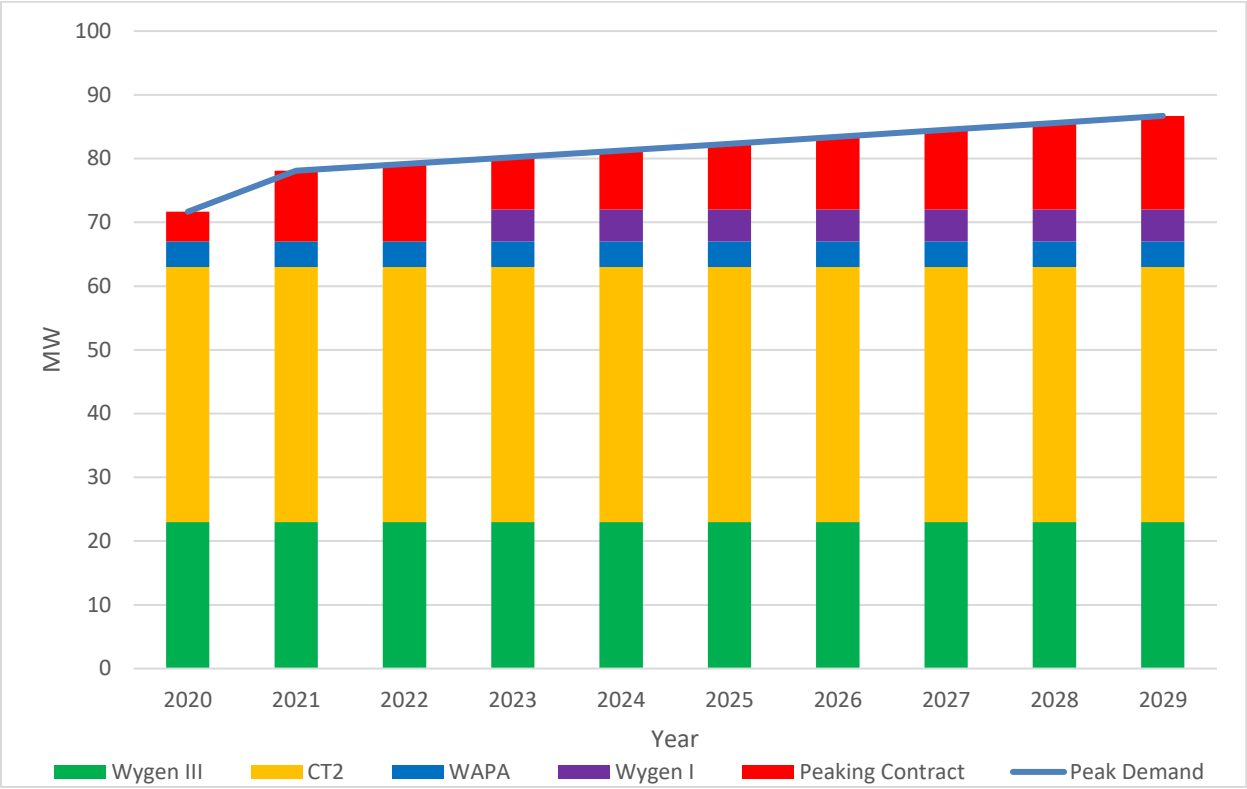
4.3.11. Solid Waste community drive and drop allows residents to dispose of less efficient appliances that have exceeded their useful life. Landfill disposal fees are waived as part of this annual program.

As discussed more fully in the next section, energy efficiency and demand-side management programs for the City's retail customers will continually be evaluated and examined for future implementation.

5. Future Resource Requirements

This section of the IRP compares the City's peak demand and reserve requirements to existing resources to determine the timing and need for additional resources. The City's peak demand requirement includes projected peak demand and estimated capacity reserves. Based on the comparison of peak demand requirements and existing resources, the City has appropriate supply-side resources to meet its peak demand and reserve requirement. Figure 2 summarizes the capacity position of the City and Table 5 provides the same information in a tabular format.

Figure 2
Comparison of Peak Demand and Resources



1) 2020 uses actual Peak Demand numbers

2) WAPA's allocation varies from 3-4 MW and is scheduled to deliver 4MW during system peak hours

Table 5
Comparison of Summer Peak Requirements and Resources

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Peak Demand	72	78.1	79.15	80.2	81.27	82.34	83.42	84.5	85.59	86.7
Resources										
Wygen III	23	23	23	23	23	23	23	23	23	23
CT2	40	40	40	40	40	40	40	40	40	40
WAPA	5	5	5	5	5	5	5	5	5	5
Wygen I	0	0	0	5	5	5	5	5	5	5
Total	68	68	68	73	73	73	73	73	73	73
Peaking Contract	4	12.1	13.15	9.202	10.27	11.34	12.42	13.5	14.59	15.7

1) 2020 uses actual Peak Demand numbers

2) WAPA's allocation varies from 2-5MW and is scheduled to deliver 5MW during system peak hours

6. Future Supply-Side Resource Options

6.1. Resource Solicitation

Based on the City's need for additional capacity, the City has secured a Purchase Power Agreement (PPA) with Black Hills Power for 5 Megawatts from their Wygen I coal generation facility. This PPA begins January 1, 2023.

The utility has identified utility systems that are in a surplus situation for the next several years. These systems are generally located on the Black Hills, Western, or MEAN transmission systems.

The evaluation criteria established to identify, evaluate, and select firm power supply resource options include the following:

- Availability to meet the City's resource timing needs,
- Reliability of the resources (or portfolio of resources),
- Transmission requirements for delivery (cost and availability),
- Environmental impacts and compliance costs of the resource, and
- Total delivered cost of the resource.

6.2. Renewable Power

A portion of the City's current supply portfolio is energy from the purchase of renewable energy credits. Purchases of “green” energy credits are a voluntary way for retail customers to support the environment and to promote the development of renewable energy in conjunction with conventional fuels such as coal and natural gas. Below is an excerpt from Chapter 17 of the Gillette City Code which provides retail customers the opportunity to purchase these “green” energy credits.

6.2.1. Renewable Energy Rate:

6.2.1.1 This rate is applicable to all customers that support the use of renewable energy sources in the City’s wholesale electrical energy portfolio.

6.2.1.2 In addition to electrical energy purchased under any of the above rates, customers may purchase “green power” in units of 100 kWh per month. Green power purchased is over and above the energy metered for the customer’s use.

6.2.1.3 Each 100 kWh block billed under this rate will be bill at a rate of $.0020 per kilowatt hour.

6.2.1.4 Participation in this rate is limited by the City’s projected renewable energy purchases.

The City also purchases 3-4MW monthly from WAPA which is generated from hydro-power facilities in the Western Loveland Area Projects in Colorado.

7. Future Demand-Side Options

7.1. Overview of Load Shape Objectives of DSM Programs

Demand Side Management ("DSM") options are evaluated as a means of deferring capacity acquisitions. DSM options modify the end use load shape. Provided below in Table 6 is a brief description of six industry accepted load shape objectives as developed by the Electric Power Research Institute ("EPRI").

Table 6
Load Shape Objectives

Load Shape Objective	Description
Strategic Load Growth	Strategic Load Growth involves promoting increase in loads of any kind. This is typically for utilities with surplus low cost base load generation.
Peak Clipping	Peak Clipping is the reduction of system peak loads in order to reduce the reliance on peaking units with high fuel costs. Air conditioning load cycling is an example of a peak clipping program.
Strategic Conservation	Strategic conservation is directed at reducing end-use consumption for selected time periods. Strategic conservation has a levelized effect on end-use consumption, and may have a lesser reduction to peak load. An example of strategic conservation is promoting purchases of efficient appliances.
Valley Filling	Valley filling is a program that promotes increasing off-peak loads. Promotion of night lighting is an example of a program that may build evening loads, and promotion of electric heat pumps is a program that builds off-season loads.
Load Shifting	Load shifting moves load from peak to off-peak periods. Irrigation load control and thermal energy storage systems are examples of load shifting.
Flexible Load Shape	Flexible load shape programs modify the load shape with daily calls to reduce loads when necessary. Interruptible load programs and time-of-day rates are an example of flexible load shape.

The City selected two primary load shape objectives from the six listed above. These are 1) Strategic Conservation and 2) Peak Clipping. DSM options that satisfy these load shape objectives were selected for further evaluation. While other load shape objectives could be implemented, the two objectives identified above offer many options that encourage activities which otherwise may not occur for economic reasons.

7.2. DSM Program Evaluations

In the 2015 Integrated Resource Plan it was concluded the Demand Side options on both the residential and commercial side were not deemed economical due to the City's competitive power supply costs. Upon review of the 2015 analysis, this continues to be the case. Refer to section 7 and Appendix A of the 2015 IRP for a comprehensive analysis.

8. Environmental Effects

The City complies with all applicable provisions of the state and federal environmental regulations at its existing power plants and substation facilities. The City has considered impacts on the environment when developing this IRP. Any new power supply resources developed by the City as part of this IRP will comply with the Clean Air Act and Clean Water Act, and will include emissions control technologies as may be required to help reduce the impacts of the emissions on the environment.

The City has also implemented conservation programs and measures at City owned facilities and water supply locations. These conservation programs are designed to reduce energy usage and associated environmental impacts.

9. Public Participation

An important part of the IRP development process is the City's comprehensive approach for including public participation in the plan. As described below, the City encouraged and welcomed public participation, developed a process for collecting the comments of its stakeholders, and has incorporated public comments into the plan as appropriate. Provided below is a description of the public participation process as implemented by the City.

9.1. On July 1, 2021, the City posted an announcement on its public website providing notice that the draft IRP would be presented to the public for stakeholder comment. The notice included the date, time, and location of the public presentation, and included instructions for providing written comments prior to the public participation process. The website also included access to the draft IRP document for the public to view and download. (The Public Hearing Notice is included as an Exhibit.)

9.2. Representatives from the City made a presentation summarizing this IRP as part of the City's regularly scheduled City Council work session. The work session was held on Tuesday, July 13, 2021, and was noticed in advance on the Council's agenda and advertised in the Gillette News-Record Public Notice Section. The City Council work sessions are open to the public, generally well attended, and provide a great opportunity for public dialog.

9.3. During the City Council meeting on July 20, 2021, a public hearing was conducted and a Resolution adopting the IRP was approved by the Governing Body. The Resolution and meeting minutes are included as an Exhibit. The City did not receive any Public Comments regarding the IRP during this process.

9.4. The City video records City Council meetings and work sessions to accurately capture and collect any comments provided by the public. The video recording can be accessed via the City's Gillette Public Access website.

10. Action Plan and Measurement Strategies

Provided below is the City's short-term and long-term action plan.

10.1. Two-Year Action Plan

The City's research has identified a surplus power supply is available in the region. Moreover, there are several utilities in the region that are interested in making a short-term power supply sale to the City should the need arise. The following is the City's short-term action plan.

- Program all City owned facilities with demand and power considerations to optimize power requirements.
- Continue to replace low efficiency streetlights with high efficiency LED streetlights, with the goal being 100% LED streetlights in Gillette.
- Begin to develop a framework and collect necessary information on the energy consumption of the City's customers with the anticipation of developing a more detailed peak demand forecast. The AMI roll out will aide in this and should be completed prior to the next IRP update.
- Continue to evaluate and screen conservation programs. More detailed and customer specific conservation measure cost information should be developed for a more rigorous evaluation. As such, the City will continue to research and analyze economically viable DSM programs.
- Continue to provide the drive and drop program which allows residents to deliver old appliances to be disposed.

10.2. Five-Year Action Plan

The longer-term action plan includes analyzing the development and procurement of power supply options along with economically viable DSM programs. Based on the City's research of the economically valuable DSM programs and power supply options available in the market, provided below is the City's five-year action plan.

- Continue to develop and refine a more detailed methodology for forecasting the City's peak demand and energy requirements.
- Research the capital and operating costs of new combustion turbine, combined cycle, and renewable resources that could be developed and owned by the City. These cost estimates will provide a "backstop" solution for the City and provide an estimate for comparing and evaluating any potential generation acquisition opportunities.
- Identify potential generation resources that may provide an opportunity for full or partial acquisition and ownership by the City. Consistent with this IRP process, the environmental

impacts of any power supply acquisition should be considered as part of the analysis.

The City should review and modify the above action plans if there are significant changes to peak demand growth, or DSM program and power supply costs estimates.

10.3. Maintain System Reliability

The City has been striving for decades to increase its reliability to its customers. In 1988, the City started installing all its primary and secondary lines in underground conduit. Currently, we have 346 miles of primary distribution line, or 88% of this system installed underground. Of this 88%, 93.6% of our primary distribution system is in conduit. These efforts have greatly increased the reliability to our customers. In 2011, the City developed an Avian Protection Plan. Since 2011, City crews have increased spacing between phases to meet the 60" rule and isolated phases where adequate spacing was not possible. These efforts have reduced outages due to wildlife contact and have greatly increased our system reliability.