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2019 Integrated Resource Plan

City of Mesa Energy Resources Department
Maricopa County
State of Arizona

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Section 1.0 – Executive Summary

The City of Mesa Energy Resources Department Electric Utility (Mesa) 2019 Integrated Resource Plan (IRP) addresses Mesa's resource requirements for the 2019 to 2028 planning horizon. Mesa issued wide-reaching competitive solicitations for both conventional and renewable market-based resources which allowed Mesa to compare all available supply options with Mesa-owned generation options, demand-side options and customer-owned generation options. Mesa's resource needs for this time frame are identified and plans to acquire the preferred resources are presented. This IRP will serve as a guide for Mesa to continue meeting current and future load requirements in a safe, reliable, economical and customer-responsive manner. Additionally, this Plan also addresses a number of other issues such as demand-side management (DSM) strategies and how to address requests for interconnection of customer-owned distributed generation.

1.1 Existing Operations and Resources

Mesa has developed a diverse resource portfolio comprised of long-term purchased power agreements, short-term purchased power agreements and "as needed" purchases from the regional energy market. Mesa contracts for power from a variety of entities to meets its customers' requirements, thus avoiding the issues of relying on a single supplier. Through participation in the Western Area Power

Administration's (Western) Resource Management Services (RMS) group, Mesa is able to gain access to the regional electric energy markets and acquires short-term (i.e., less than 12 months) firm, as-needed, resources to meet the customers' requirements that are not met through the acquisition of long-term agreements. Mesa relies upon a variety of firm transmission service, network transmission service and substation facilities agreements with Western to provide for the reliable import and delivery of Mesa's electric resources. Summarized below are the current power supply resources for Mesa as of 2019:

- **Western**

  Long-term, firm capacity, associated energy and associated transmission from the Parker-Davis Project (P-DP) and Colorado River Storage Project (CRSP) hydroelectric generation facilities amounting to a total of 14.7 MW of summer capacity and approximately 64,000 MWh of energy of per year. The P-DP contract terminates in 2028 and the CRSP contract terminates in 2024 but has been extended to 2057.

- **Shell Energy North America (SENA)**

  Mesa currently receives firm capacity and associated energy from one agreement with SENA. The agreement supplies 15 MW of 7x16 firm energy to Western's West Wing 500 kV substation from May through September which expires September of 2020. This agreement is fixed priced for the duration of its term.

- **Constellation, an Exelon Company (Constellation)**

  Mesa currently receives firm capacity and associated energy from one medium-term agreement with Constellation. The agreement is for 10 MW of 7x16, fixed priced, firm energy that is supplied to Western's Pinnacle Peak 230 kV substation from July through August which expires August of 2020. This is a fixed price agreement for the duration of its term.

- **CitiGroup Energy, Inc. (Citi)**

  Mesa recently executed an agreement with Citi for 15 MW of 7x24, fixed priced, firm energy that is supplied to Western's Pinnacle Peak 230 kV substation. This agreement began

delivering energy on October 1, 2018 and expires March 31, 2020. This is Mesa's "base load" contract which delivers energy every month of the year.

- **Resource Management Services**

  Mesa participates in Western's Resource Management Services program (RMS), which aggregates the loads and supply side resources of its members. Western dispatches and schedules the aggregated resources to minimize the costs to its members. Previously, the amount of excess resources available for sharing amongst participants was diminishing due to load growth in the participants' service areas, however, this trend has slowed, and resources have proven adequate to meet Mesa's needs.

1.2 Overview of the IRP Process

The planning process used by Mesa to develop this IRP is similar to the approaches used by many utilities. Mesa's planning process and the IRP have also been developed and will be administered to fully comply with the applicable federal regulations[1] and exceed prudent utility management practices. Mesa's objective is to develop an IRP that is robust, flexible and economical while complying with Western's requirements.

- The IRP is robust in that a number of scenarios for assumptions that significantly impact the resource choices are analyzed so that Mesa has confidence that the IRP will be a "least cost plan" under a wide variety of actual circumstances.
- The IRP is flexible in that the plan to acquire the selected resources can be accelerated or delayed based upon actual circumstances and conditions.
- The IRP prescribes the comparison of the costs of renewable resources to the costs conventional, long-term contractual resources that Mesa has historically utilized.
- The IRP is economical in that DSM resources have been evaluated and compared with alternative supply-side options with consideration for Mesa's staffing resources.

[1] 10 CFR 905.11.(b)(4)(i) addresses this requirement. Part of WAPA's Energy Planning and Management Program of 1995 which was required by Section 114 of the EPACT of 1992

The IRP achieves these objectives and will increase Mesa's opportunities to enhance reliability by further diversifying its resource portfolio through the acquisition of resources from the competitive regional energy markets through competitive solicitation and the implementation of DSM programs that aim to increase customer interaction, reduce peak demand and leverage Mesa's Advanced Metering Infrastructure (AMI) project. Mesa also retains the ability to pursue the development of its own resources absent the availability of economically advantageous resources from the regional energy markets.

The main principles of Mesa's IRP approach are:

- Customer / community participation
- Resource requirements forecasted, planned & acquired in a timely & efficient manner
- Renewable & conventional supply-side options are identified through a competitive RFP process and are compared with DSM using industry standard techniques
- Resource options are selected & acquired based upon defined planning & selection criteria
- Compliance is achieved with requirement of power supply contracts and federal regulations administered by Western Area Power Administration (Western)

The IRP process for Mesa's 2019 IRP began long before 2019 with the development of an online survey which sought to evaluate Mesa's customers' appetite for renewable resources, appetite for alternative rate programs and tolerance for any associated rate increase as the result of acquiring those renewable resources.

In addition to surveying its customers, Mesa hosted two community meetings to discuss the IRP with its customer groups and pursuant to those meetings, launched a second survey to solicit additional customer input.

Mesa's customers show a continuing interest in renewable energy resources, however, there is also significant concern with ensuring that the implementation of renewable energy resources is done without drastically increasing the electric bills that they pay every month.

1.3 Industry Trends and Challenges

The electric utility industry is in a state of flux. The conventional model of a central, large utility supplying all the electricity to a collection of silent customers is shifting by the wayside towards a more decentralized, bi-directional grid with more interaction between the utility and the customers. Customers are making their voices heard that they want options and that some of those options should be low carbon, renewable resources. With renewable energy pricing falling to levels where renewable energy resources are now very competitive with conventional resources, utilities are now undertaking the challenge of determining how to provide customers with the energy that they want in a manner that is as inexpensive as possible while still maintaining overall grid reliability.

Mesa is taking this challenge very seriously and is an active participant in the renewable energy space; regularly speaking with renewable resource developers and other utilities in the area to come up with innovative solutions to implement renewable resources while also reducing the cost of power to its customers. Through this process, Mesa has found that there are three large challenges to providing more renewable resources to its customers:

1. **Size:** Renewable energy projects must be of appropriate size (100 MW or greater) to capture economies of scale, otherwise pricing increases significantly. Mesa is investigating creative approaches to overcoming this challenge.
2. **Location:** Any renewable energy project that Mesa wishes to participate in must be located in close proximity to Mesa's existing transmission rights. If not, additional transmission costs can make an otherwise economical project fall out of favor very quickly. Starting in October 2018, Mesa switched to Network Transmission Service with Western; greatly increasing Mesa's reach in terms of where it can procure power and so this will assist in overcoming this challenge.
3. **Timing:** Any renewable energy project that Mesa wishes to participate in must be scheduled to come online at a time that coincides with another one of Mesa's energy supplies expiring. Over the past 5 years Mesa has staggered its energy supplies so it is in a good position to overcome this challenge.

With the goal of economically integrating large amounts of renewable energy into its energy supply portfolio, Mesa is taking steps to move towards this worthwhile goal while still being sensitive to its customers' bottom lines.

Mesa is also taking steps to increase its customers' participation in reducing peak system demand and providing for the bi-directional communication that is becoming more common. Mesa's AMI Smart Grid project recently completed its investigational feasibility stage. Completion of this project will allow for Mesa to send price signaling to its customers via time-of-use rates, and open the door for things like demand response, customer prepay billing and other programs to increase utility-customer interaction.

1.4 Plan and Scenarios Considered

Mesa developed an action plan and two alternative scenarios for this IRP. All of the scenarios share the following common traits:

- Mesa's hydroelectric allocations will be retained for flexibility and economics; and
- The customer-owned solar program (including net metering and dollar-per-watt incentives and caps on size and total new participants) will be reviewed annually and adjusted if appropriate. With the implementation of AMI, additional rate structures would help retain the value of those resources for all customers; and
- Renewable generation at City Buildings would be implemented as deemed economical to provide other benefits that market based resources do not provide (e.g. shade and community development) alongside the benefit of local power generation.

Preferred Scenario: Least Cost Mix of Conventional and Renewables Portfolio

Mesa will focus on replacing its expiring conventional, wholesale-market-based term contracts with a mixture of similar, conventional resource-based term contracts or renewable resource contracts based on economics as measured by the present worth of costs and applicability. Renewable resource acquisitions will be timed to maximize the benefits of tax advantages and drops in market pricing. Demand side management programs will be developed based on industry standard benefit-cost tests including consideration of resources needed to effectively and efficiently implement the programs. Internal generation (natural gas, renewable, energy storage or some combination of those) will be added to help provide additional reliability for critical infrastructure, hedge against market fluctuations and support renewable resources. Internal demand will grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new

transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.

Alternative Scenario 1: Conventional Resources Portfolio

Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with similar contracts using the competitive procurement processes (RFPs) that have been used historically. The distribution of the RFPs will be extended to potential developers and marketers of both distributed and utility scale renewable resources. The acquisition of distributed and utility scale renewable resources would be restricted to those resources whose terms and conditions (including pricing) will be at or below the costs of conventional resources on a **current cost** basis. Energy efficiency programs would be limited to pricing/rate-oriented initiatives such as time of use rates that become feasible with Mesa's conversion to AMI. Internal natural gas generation may be installed if justified by significant, currently unforeseeable changes in market conditions. Mesa would begin moving towards installing a new substation and second transmission feed in order to meet forecasted customer demands more than 100 MW.

Alternative Scenario 2: Solar/Renewable Centered Portfolio

Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with competitively sourced, renewable energy resource contracts. The amount of renewable resources to be acquired would be a function of i) the resources' "fit" into the utility's supply portfolio, ii) their costs (and, to the extent the costs of renewable energy resource contracts are more than conventional resource options) and iii) their impact on the electric utility's total costs of service. The renewable energy resource goal would be to acquire renewable resources over time up to an amount that increases costs to a level that causes ERD's customers' rates/bills to be in parity with SRP's equivalent rates. Demand side management programs, including AMI enabled rate structures, that reduce peak demand and whose benefits reliably exceed costs, on a present value basis using industry standard benefit-cost tests would be developed and implemented. To help provide additional reliability and hedge against market volatility and support renewable resources, Mesa will pursue options such as thermal and battery energy storage, internal combustion generation using renewable natural gas and other non-carbon technologies.

Table 1) Three scenarios developed for this IRP

Portfolio Metric	Preferred Scenario: Least Cost Mix of Conventional & Renewables Portfolio	Alternative Scenario 1: Conventional Resources Portfolio	Alternative Scenario 2: Solar/Renewable Focused Portfolio
Contract Replacement Strategy	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with a mixture of similar, conventional resource-based term contracts or renewable resource contracts based on economics as measured by the present worth of costs and applicability. Renewable resource acquisitions would be timed to maximize the benefits of tax advantages and drops in market pricing.	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with similar contracts using the competitive procurement processes (RFPs) that have used historically. The distribution of the RFPs will be extended to potential developers and marketers of both distributed and utility scale renewable resources. The acquisition of distributed and utility scale renewable resources would be restricted to those resources whose terms and conditions (including pricing) will be at or below the costs of conventional resources on a current cost basis	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with competitively sourced, renewable energy resource contracts. The amount of renewable resources to be acquired would be a function of i) the resources' "fit" into the utility's supply portfolio, ii) their costs (and, to the extent the costs of renewable energy resource contracts are more than conventional resource options) and iii) their impact on the electric utility's total costs of service. The renewable energy resource goal would be to acquire renewable resources over time up to an amount that increases costs to a level that causes ERD's customers' rates/bills to be in parity with SRP's equivalent rates.
Energy Efficiency	Demand side management programs would be developed based on industry standard benefit-cost tests including consideration of resources needed to effectively and efficiently implement the programs	Energy efficiency programs would be limited to pricing/rate-oriented initiatives such as time of use rates that become feasible with Mesa's conversion to AMI	Demand side management programs, including AMI enabled rate structures, that reduce peak demand and whose benefits reliably exceed costs, on a present value basis using industry standard benefit-cost tests would be developed and implemented.
Internal, Utility-Owned Generation	Internal generation (natural gas, renewable, storage based or some combination of those) would be added to help provide additional reliability for critical infrastructure, hedge against market fluctuations and support renewable resources.	Internal natural gas generation may be installed if justified by significant, currently unforeseeable, market conditions change	To help provide additional reliability, hedge against market resources and support renewable resources, Mesa will pursue options such as thermal and battery energy storage, internal combustion generation using renewable natural gas and other non-carbon technologies.
Requirement for Substation	Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.	Mesa would begin moving towards installing a new substation and second transmission feed in order to meet forecasted customer demands more than 100 MW	Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.
Customer owned solar	The customer-owned solar program (including net metering and dollar-per-watt incentives and caps on size and total new participants) will be reviewed annually and adjusted if appropriate. With the implementation of AMI, additional rate structures would help retain the value of those resources for all customers		
Hydro Electric Power	Mesa's hydroelectric allocations will be retained for flexibility and economics		

Renewable Generation at City Buildings	Renewable generation at City Buildings would be implemented as deemed economical to provide other benefits that market based resources do not provide (e.g. shade and community development) alongside the benefit of local power generation.

1.5 Recommended Action Plan

The 2019 IRP's Recommended Action Plan identifies the following path forward for the next five years as analyzed through the Preferred Scenario:

- 2019:
    - Evaluate the replacement of the expired SENA Sculpted Base and Constellation Dispatchable resources with a competitive request for proposal that includes the option for replacement using renewable resources. If the winning proposal is for conventional resources, then replacement agreements will be for shorter terms (1-3 year instead of 3-5 year) in order to give Mesa more flexibility to respond to low priced resource offers (renewable or conventional)
    - Implement the following Demand Side Management Programs:
        - Municipal Energy Efficiency Program
        - Multi-family Energy Efficiency Program
        - Shade Tree Partnership
        - Municipal Electric Vehicle Program
    - Investigate the potential to implement Voluntary Residential Pre-Pay rates
    - Implement a Green Tariff program for launch in the 2019/2020 fiscal year
    - Begin evaluation of thermal energy storage and/or battery storage opportunities within Mesa's ESA
    - Investigate utility scale solar opportunities with the intent to purchase 10 MW of utility scale solar by 2021 at a price that will not negatively impact customers' bills. This deal would ideally need to be executed by mid-2019 to capture the existing solar tax incentives
    - Begin evaluating City parking lots, roofs and other properties for the potential of up to 3 MW of distributed solar by 2023

- Begin evaluating Mesa's distribution system for the optimal placement of internal natural gas generation with the intent of installing 4 MW of internal natural gas generation by 2023
- Initiate conversations with SRP regarding the potential for expanding capacity at Rogers in the event of the addition of a large customer to Mesa's ESA

- Early 2020
  - Evaluate the replacement of the Citi Base resource with a competitive request for proposal that includes the option for replacement using renewable resources. Replacement agreement will be for shorter terms (1-3 year instead of 3-5 year) in order to give Mesa more flexibility to respond to low priced resource offers (renewable or conventional)
- Mid 2020
  - After the full deployment of Mesa's AMI project (forecasted for 2020), implement:
    - Voluntary residential Time of Use rates
    - Voluntary commercial Time of Use rates
    - Voluntary Electric Vehicle Charging rates
- Early 2021
  - Evaluate the replacement of the Constellation July-August Peak resource and Shell Summer Peak resource with a competitive request for proposal that includes the option for replacement using renewable resources. If the winning proposal is for conventional resources, then the replacement agreements will be for shorter terms (1-3 year instead of 3-5 year) in order to give Mesa more flexibility to respond to low priced resource offers (renewable or conventional)
  - Investigate utility scale solar opportunities with the intent to purchase 10 MW of utility scale solar with storage by 2023 at a price that will not negatively impact customers' bills.
- Throughout the 5-year period, Mesa will:
  - Continue seeking competitive counterparties
  - Evaluate alternative transmission paths

- Evaluate the addition of internal generation (solar and/or natural gas) subject to the conditions established in this IRP
- In the instance that peak demand unexpectedly grows towards 100 MW, evaluate methods (using the same techniques and criteria within this IRP) for:
  - Reducing internal demand; and/or
  - Expediting the installation of internal generation to offset demand at Rogers; and/or
  - Securing additional electric transmission and/or substation capacity

By 2023, Mesa's resource portfolio will consist of the following:

Table 2) Mesa's expected energy supply portfolio by the year 2023.

YEAR		2019	2020	2021	2022	2023
LOAD (MW)		**91.3**	**92.6**	**93.8**	**95.1**	**96.3**
Demand Side and Distributed Resources	Energy Efficiency	0.1	0.1	0.5	0.9	1.3
	Dist. Utility Solar	0.0	0.3	0.5	0.8	1.1
	Customer-Owned Solar	0.5	0.6	0.6	0.7	0.8
	Thermal Storage	0.0	0.7	0.7	0.7	0.7
Net Demand at Rogers		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
Supply Side Resources	SENA	14.1	14.1	0	0	0
	Citi	14.1	0	0	0	0
	Constellation	9.7	9.7	0	0	0
	Utility Scale Solar	0.0	0.0	0.0	0.0	0.0
	Utility Scale Solar with Storage	0.0	0.0	9.7	19.4	19.4
	Parker- Davis	10.4	10.4	10.4	10.4	10.4
	CRSP	4.3	4.3	4.3	4.3	4.3
	New Competitively Sourced Market Purchases	19.6	33.7	47.8	38.1	38.1
	RMS Market Purch.	18.5	18.8	19.2	19.8	20.3
TOTAL SUPPLY (MW)		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
(NEED) (MW)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

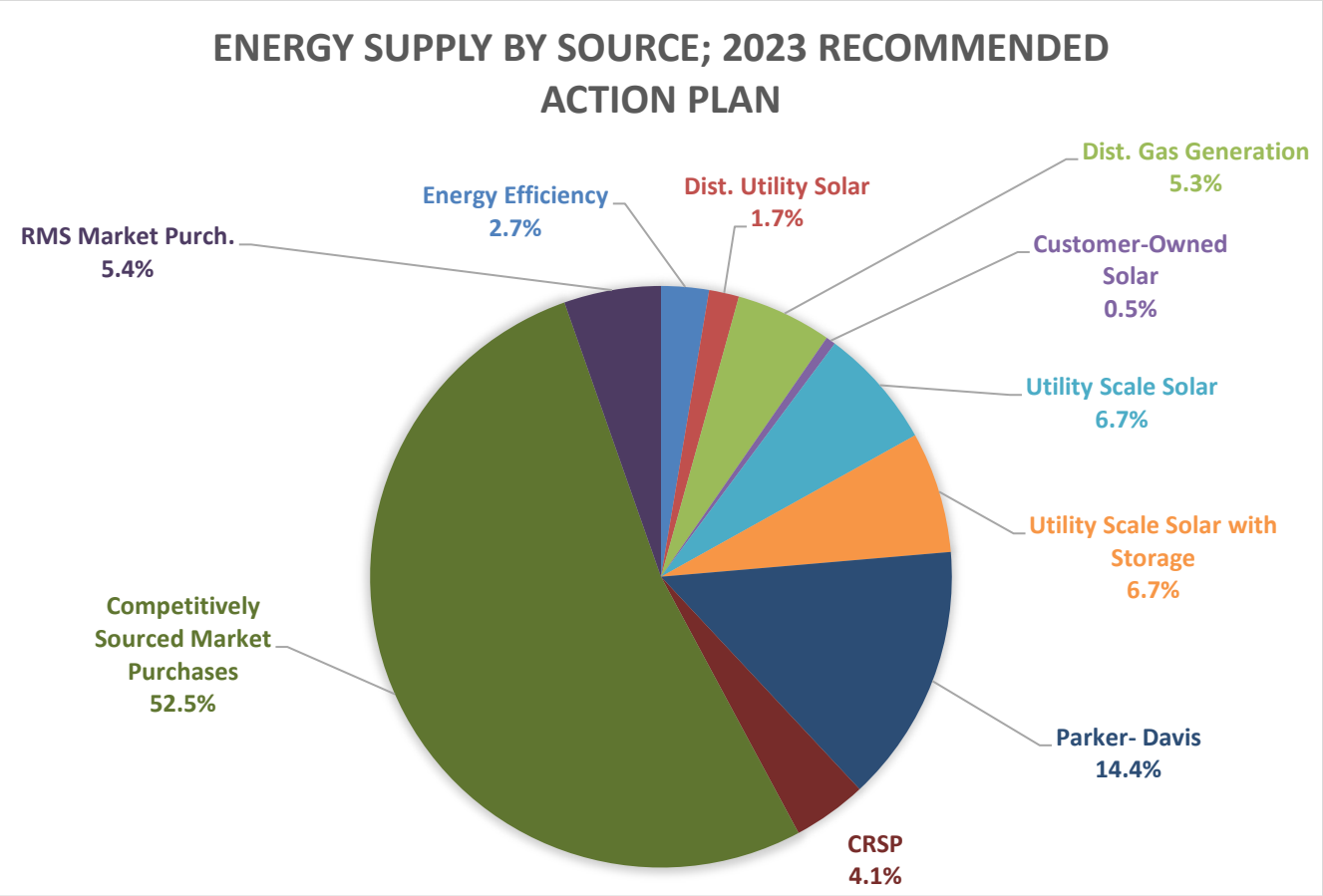

Figure 1) Mesa's energy supply by source in 2023 for the recommended action plan

Section 2.0 City of Mesa – Electric Service Area Information

2.1 Electric Service Area Description

The City of Mesa is a full-service Arizona municipality initially settled by pioneers in the 1870's and incorporated in 1883. Mesa is the State of Arizona's third largest city by population and has operated its own electric utility since 1917. The current electric service area (ESA) was established by the Arizona Supreme Court on September 15, 1954 and approximates the incorporated city limits as they were at that time. Mesa's ESA is approximately 5.5 square miles and encompasses the heart of the city, including the original town site. As of April, 2019, service within this area was provided to 16,846 customers of whom 14,278 were residential customers, 2,350 were commercial and the remaining 218 were the City itself or other governmental entities. There are no industrial customers in the ESA.

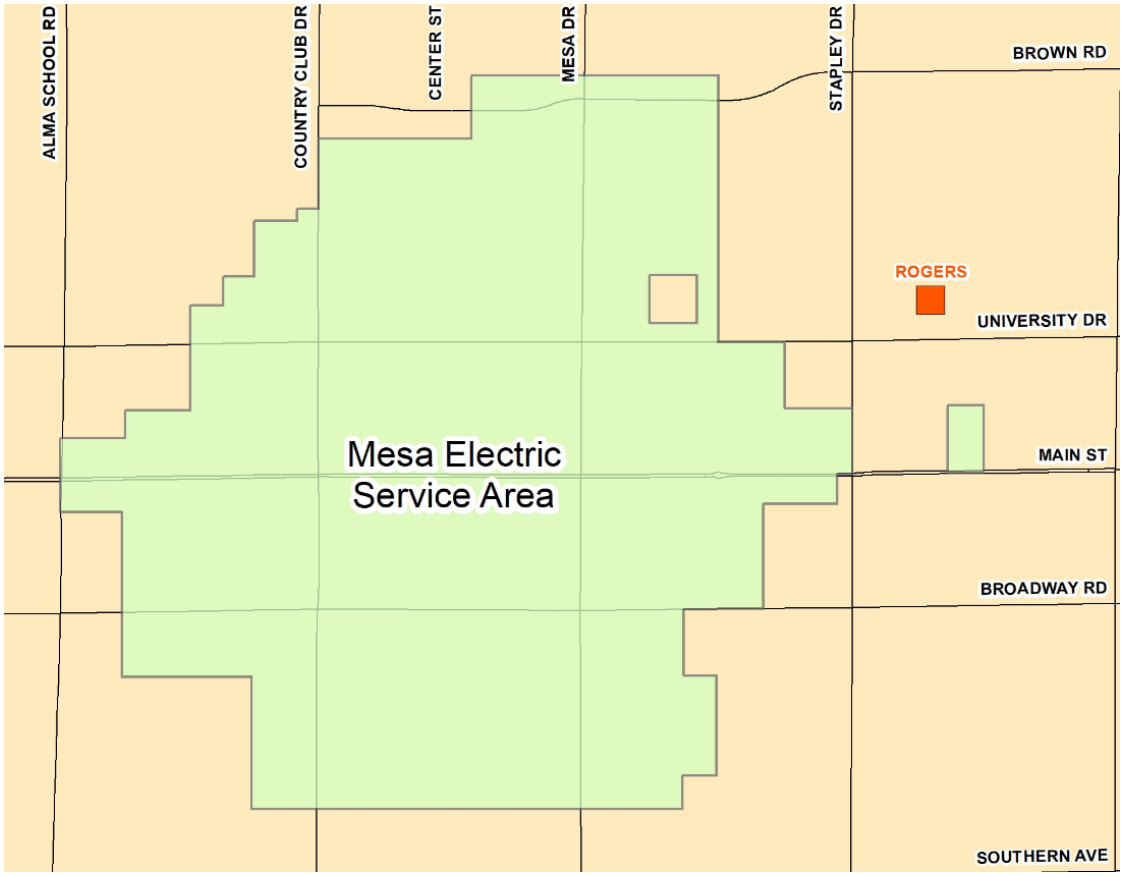

Figure 2) City of Mesa Electric Service Area (ESA)

The Salt River Project Agricultural Improvement and Power District (SRP) serves the areas surrounding Mesa's ESA. Mesa's service territory has minimal vacant land for new development and so the customer growth that is forecasted is attributed to in-fill residential growth trends and specific commercial and educational developments and their related electric requirements.

2.2 Mesa City Council

The City's electric rates are established by ordinance and adopted by the City Council. Mesa's City Council is comprised of six council members and the mayor. Each councilmember is elected from one of six voting districts in Mesa, with the mayor being elected at large. The current City Council members are listed below:

City Council

John Giles – Mayor
Mark Freeman – Vice Mayor, Councilmember, District 1
Jeremy Whittaker – Councilmember, District 2
Francisco Heredia – Councilmember, District 3
Jen Duff – Councilmember, District 4
David Luna – Councilmember, District 5
Kevin Thompson –Councilmember, District 6

2.3 IRP Responsibility

Mesa's Energy Resources Department is responsible for planning and acquiring the electric power resources required to meet the electrical service needs of its customers. Under the direction of the Energy Resources Department Director, the Energy Resources Department is specifically charged with this task. Additionally, the Energy Resources Department is charged with monitoring and updating Mesa's IRP. Mesa personnel responsible for the IRP are listed below.

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Section 3.0 City of Mesa Energy Resources Department Electric Utility Integrated Resources Plan Goals and Objectives

This IRP represents Mesa's response to Western's Energy Planning and Management Program rules delineated by 10 CFR Part 905. In addition to complying with federal regulations, the primary objectives of this project are to develop an IRP that is robust, flexible and economical:

- The IRP is robust in that will still be an appropriate plan under a variety of diverse scenarios. Thus, the IRP will be a "least cost plan" under wide variety of actual circumstances.

- The IRP is flexible in that the plan to acquire the selected resources can be accelerated or delayed if actual circumstances and conditions are materially different than those assumed in the development of this plan.
- The IRP provides an economical approach in that the supply side resources will be acquired through a competitive solicitation process ensuring that the least cost source of supply (without compromising reliability) will be acquired. Mesa will use present worth and system optimization techniques to compare the various options to determine "least cost".

Other objectives integral to this IRP are:

- Enhance Mesa's ability to provide electric utility services to its customers in a safe, reliable and least cost manner, consistent with sound utility business principles;
- Contribute to customer financial stability by providing electric power at rates that allow for continued long-term enhancement in property and asset values;
- Identify the need and timing of new resources and develop an optimal planning strategy that responds to the inherent risks in the energy marketplace.
- Provide a resource portfolio that accounts for the desires of Mesa's customers and Council in terms of renewable resources and DSM programs.
- Actively attempt to acquire renewable resources without causing negative bill impacts to those customers who cannot or are not willing to absorb the impact from those acquisitions.

Section 4.0 Existing Resources

4.1 Power Supply Overview

Mesa's existing supply side resources portfolio is comprised of long-term (Over 5 years), medium-term (3-5 years) and short-term (less than 3 year) purchased power agreements. Mesa contracts for power from a variety of entities to supply its total load without relying on a single supplier. As a member in Western's Resource Management Services program (RMS), Mesa has access to the wholesale power supply market and the ability to engage in short-term firm and non-firm transactions. Mesa relies upon

a variety of firm transmission service and substation facilities agreements with Western to provide the reliable delivery of the capacity and associated energy Mesa is entitled to in these agreements.

RMS aggregates the loads and supply side resources (electric generation and transmission) of its members and dispatches and schedules the resources to minimize the costs to its members. Additionally, RMS markets any excess resources of the members and acquires its members' short-term supplemental and incremental needs. Western's aggregation of RMS members' loads and resources allows Western to meet Mesa's needs by acquiring standard sized market products which are typically lower in cost than non-standard products. Mesa has accrued significant benefits from its membership in RMS.

4.2 Existing Supply Resources Description

Mesa currently purchases firm power from Western Area Power Administration (Western), Shell Energy North America (SENA), Citigroup Energy Inc (Citi), and Constellation, an Exelon Company (Constellation) under firm purchased power contracts. Mesa also participates in the Parker-Davis Resources Exchange Program, along with similarly situated utilities, to integrate and exchange federal hydroelectric resources purchased from Western. The power and energy purchased from all of Mesa's resources are transmitted over Western's Parker-Davis and Pacific Intertie transmission systems to Western's 500kV and 230kV Pinnacle Substations and then to the 230/69 kV Rogers Substation, jointly owned by SRP, Western and Mesa. Beginning in October of 2018, Mesa's electric transmission service switched to Network Integrated Transmission Service and as a result Mesa will also gain access to the Western 230 kV Mead Substation. The power and energy are then transmitted via Mesa's two 69 kV lines to the electrical distribution facilities where the power and energy are then distributed to Mesa's ESA customers. Detailed below are the power supply resources for the City of Mesa Energy Resources Department that delivered power in 2018:

- **Western Area Power Administration**

  The agreements with Western are for firm capacity and associated energy from the Parker-Davis Project (P-DP) and Colorado River Storage Project (CRSP) hydroelectric generation facilities as detailed below:

- **Parker-Davis Project Generation**: 10.379 MW Capacity (March – September); 7.95 MW Capacity (October – February); 49,252 MWH Annual Energy. Energy from the Parker-Davis Project provided ~15% of the energy at Rogers in fiscal year 17/18.
    - Expires September 2028.

- **Colorado River Storage Project Generation**: 4.312 MW Capacity (April – September); 3.407 MW Capacity (October – March); 14,095 MWH Annual Energy. Energy from CRSP provided ~4% of the energy at Rogers in fiscal year 17/18.
    - Expires September 2057.

- **Western Replacement Power (WRP)**

  WRP Power is a market-based resource that is available to Mesa as needed, within certain capacity constraints. With its CRSP power, Mesa pays for the full transmission allocation all month long in each month, but only uses energy up to the amount available from the hydrology. This leaves time during the month where the CRSP transmission capacity is available to schedule more energy deliveries from the wholesale energy market without having to incur any transmission charges. As such, Western schedules WRP power to take advantage of these transmission savings. WRP is not hydropower, rather, it is market-based power that is scheduled on Mesa's transmission which is more typically used for its CRSP hydropower. Energy from WRP Power provided ~2% of the energy at Rogers in fiscal year 17/18.

- **Citi Base Contract**

  This contract is for 15 MW of 7x24 firm capacity and associated energy subject to *force majeure* conditions that is delivered to Western's Mead 230 kV substation. This contract provides 15 MW every month of the year. The contract began delivering power as of October 1, 2018 and is set to expire at the end of March 2020. This is Mesa's largest contractual resource which provided 38% of the energy at Rogers in fiscal year 17/18 (during which time this contract was provided by Constellation).

- **Constellation July August Peak Contract**

  This contract is for 10 MW of 7x16 firm capacity, associated energy subject to *force majeure* conditions that is delivered to Western's Pinnacle Peak 230 kV substation. This contract provides 10 MW in July and August. The contract began delivering power as of July 1, 2016 and is set to expire at the end of August 2020. Energy from the Constellation July August Peak contract provided ~3% of the energy at Rogers in fiscal year 17/18.

- **Constellation Dispatchable Contract**

  This contract was for 10 MW of 7x16 firm capacity, associated energy subject to *force majeure* conditions that was delivered to Western's Pinnacle Peak 230 kV substation. This contract provided 10 MW June through October that could be dispatched (or not) if Western determined that Mesa (or the RMS group) needed the additional resources and market conditions dictated that it was economical to dispatch it. The contract began delivering power as of June 1, 2014 and expired at the end of October 2018. Energy from the Constellation Dispatchable contract provided ~7% of the energy at Rogers in fiscal year 17/18.

- **Shell Energy North America Sculpted Base Contract**

  The capacity/energy of this contract varied by month from 0 to 11 MW as shown in Table 3 and provided 7x24 firm capacity and associated energy subject to *force majeure* conditions that was delivered to Western's West Wing 500 kV substation. The capacity of this contract was "sculpted" to better represent the energy needs of Mesa's customers in each month. This contract replaced a contract with SENA that expired in May of 2013 known as the SENA "1A" contract. The SENA 1A contract delivered 10 MW year-round on, also on a 7x24 schedule. The SENA 1A contract was first designed to meet Mesa's energy requirements dating back to 2004 – 2008 when Mesa's electric utility utilized significantly more energy per customer. By the time it was due for replacement (in 2013), electric loads had dropped significantly, and so Mesa found that 10 MW were not necessary in the shoulder and off-peak months. The resource was then sculpted to better match Mesa's customers' energy needs.

This contract expired in December of 2018. Energy from the SENA Sculpted Base contract provided 16% of the energy at Rogers in fiscal year 17/18.

Table 3) SENA Sculpted Base Contract Capacity and Energy

Month	***7x24 Capacity***	***MWh***
January	11 MW	8,184
February	6 MW	4,032/4,176
March	1 MW	744
April	4 MW	2,880
May	0 MW	0
June	10 MW	7,200
July	10 MW	7,440
August	10 MW	7,440
September	10 MW	7,200
October	7 MW	5,208
November	4 MW	2,880
December	7 MW	5,208

- **Shell Energy North America Summer Peak Contract**

  This contract is for 15 MW of 7x16 firm capacity, associated energy subject to *force majeure* conditions that is delivered to Western's West Wing 500 kV substation. This contract provides 15 MW from May through September. The contract began delivering power as of May 1, 2016 and is set to expire at the end of September 2020. Energy from the SENA Summer Peak contract provided ~10% of the energy at Rogers in fiscal year 17/18.

- **Resource Management Services**

  The resource scheduling and utilization of Mesa's resources is managed through the Mesa's participation in the Resources Management Services program (RMS) administered by Western. The RMS group consists of the City of Mesa, Electrical District Number Two (ED-2),

Town of Fredonia, Aha Macav Power Service, and Cortaro-Marana Irrigation and Drainage District. As part of the RMS group, these entities pool loads and resources to achieve the benefits of diversity and greater economies of scale when performing purchased power transactions. Western has been contracted to provide the necessary scheduling, dispatching and accounting functions to support the group plus purchase supplemental power as needed on a monthly, daily and real-time basis. On a net basis (after taking into account hourly purchases *and* sales), RMS provided 5% of the resources at Rogers in fiscal year 17/18.

- **Mesa Customer-Owned Photovoltaic Program**

  In 2012 Mesa began its incentivized solar net metering program as a result of its 2012 IRP. Since then, energy from customer-owned solar photovoltaics has grown rapidly, but this still only comprises a small portion of Mesa's overall power supply. As of April 2019, the photovoltaic program consists of 50 customers (residential and commercial customers) with a total of 808.5 kW of equivalent DC capacity. In fiscal year 17/18 the Customer-Owned Photovoltaic Program provided less than 1% of the resources (that would have been required otherwise) at Rogers.

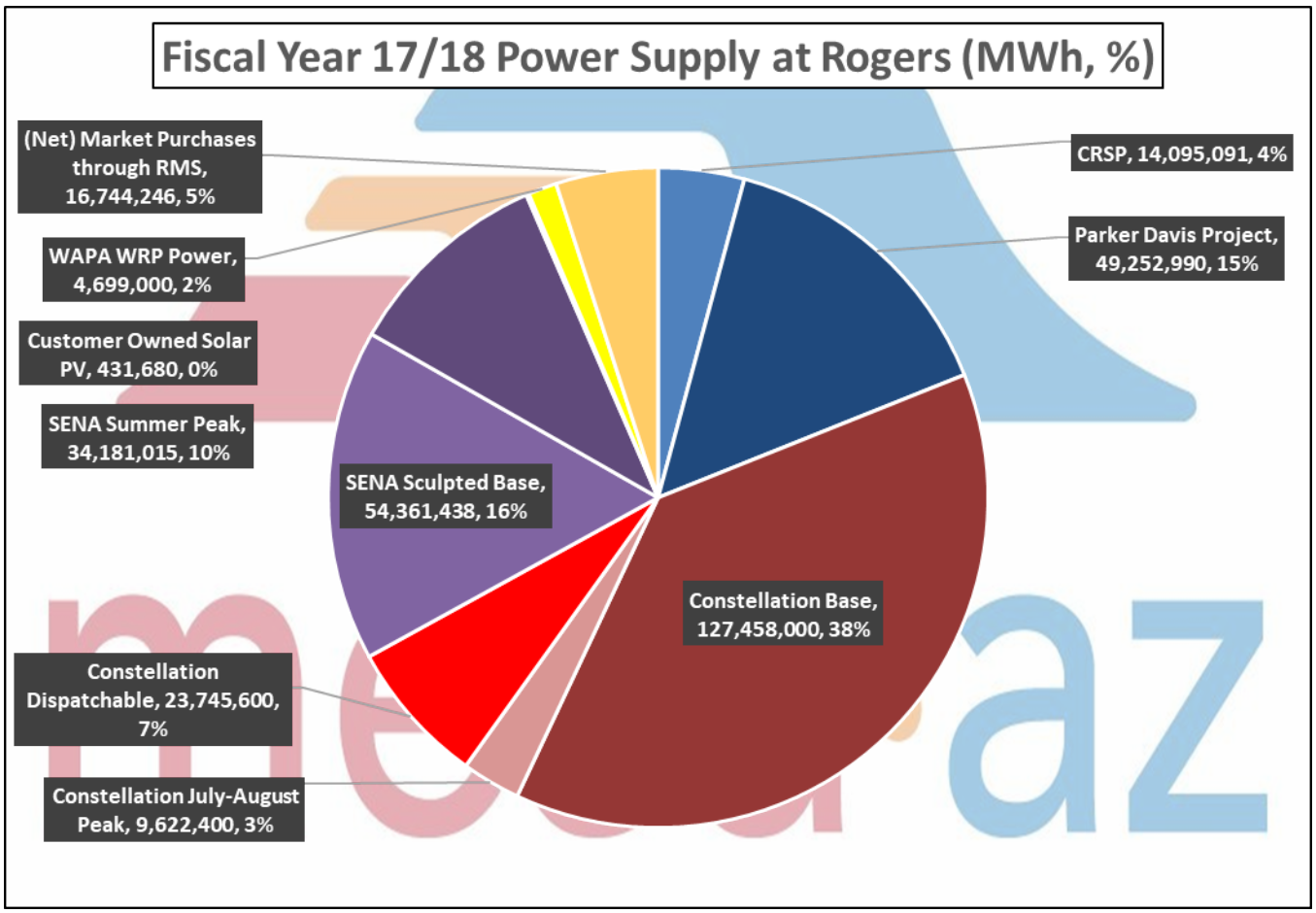


Figure 3) Fiscal Year 17/18 Power Supply at Rogers by resource with kWh provided and % of total.

Section 5.0 Customer Requirements and Resource Needs Forecast

5.1 Overall System Load Forecast

Mesa's 2019-2028 peak demand and energy load forecast was developed based on recent historical load patterns on a total load demand basis as registered at Mesa's Rogers Substation point of delivery for its power resources, time series trend analyses of weather normalized customer sales as billed and by class, and the identification of discrete commercial developments and their projected electrical requirements within the ESA.

The following graph illustrates the historical demand and energy loads and growth trends in peak demand since 2003 and the projected demand and energy loads based on forecasted peak demand growth for 2019-2028.

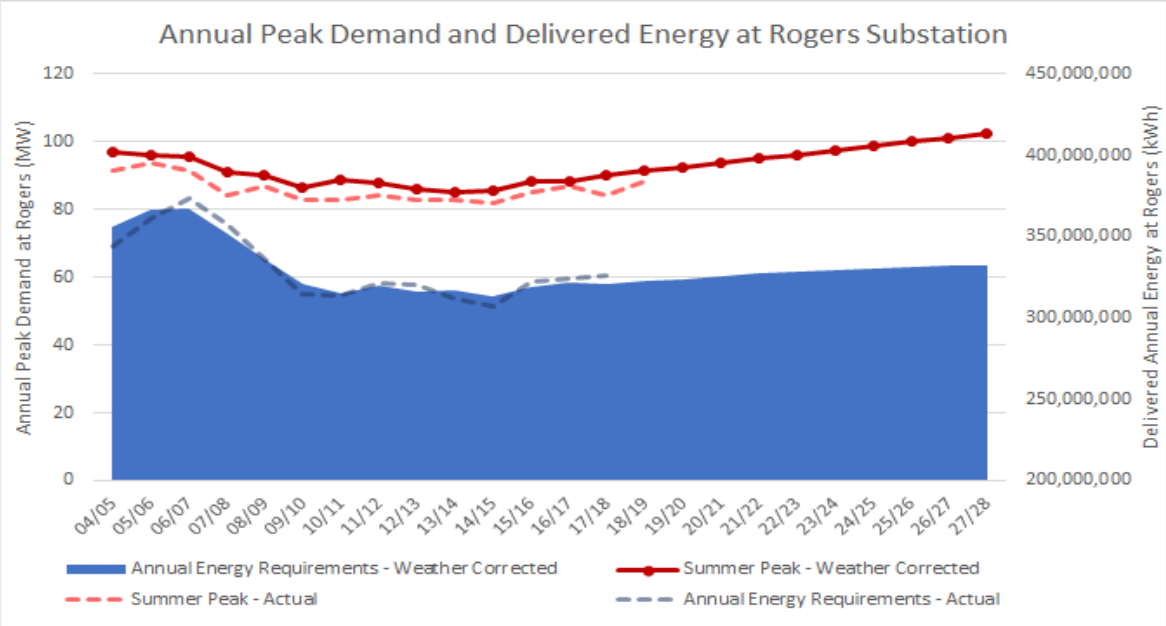
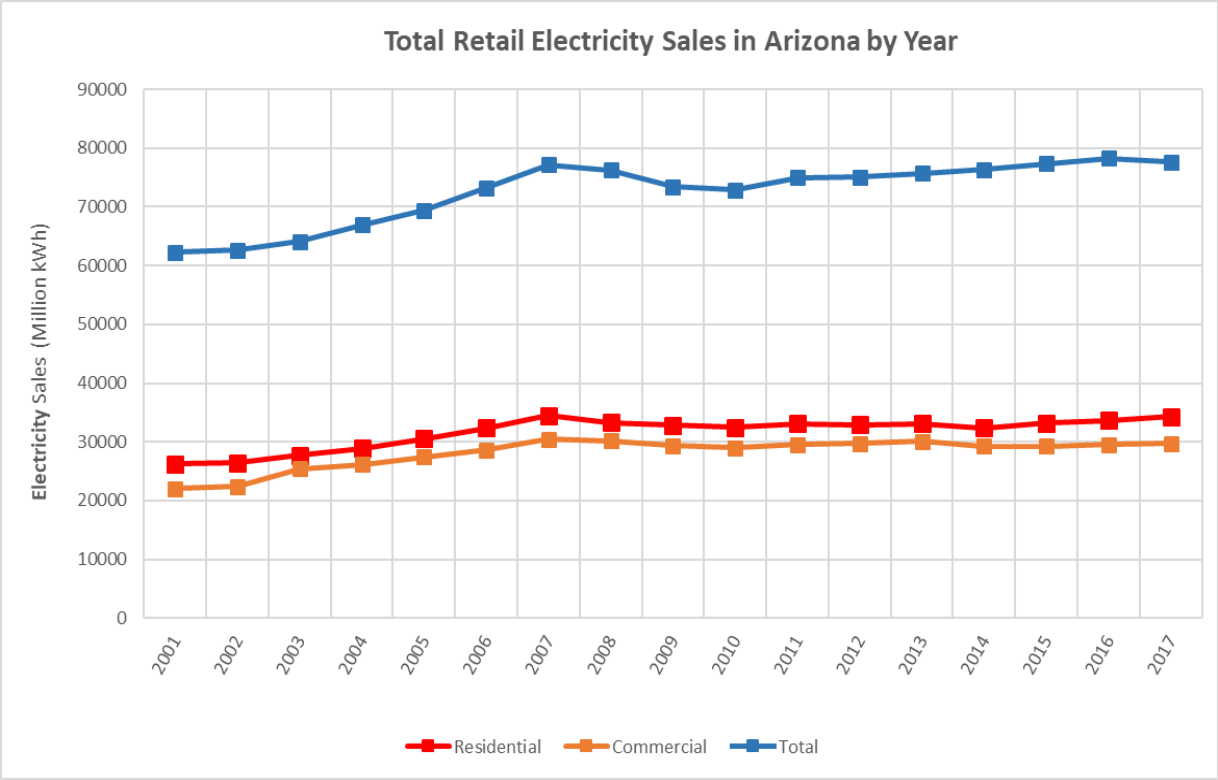


Figure 4) Annual Peak Demand at Rogers (MW) and Delivered Energy (MWh) at Rogers. All numbers for 18/19 and later are projections.

5.2 Customer Profile

Mesa's ESA is unique when in comparison to SRP's or APS's in that Mesa's ESA is landlocked with no room for outward expansion. As such, any growth in Mesa's ESA must come from infill of vacant parcels (e.g. re-development or re-use) or expansion of existing facilities. The ESA is experiencing a steady flow of infill growth in the downtown area, so growth is forecasted within the ESA as long as the overall economic climate of the area remains positive. Mesa's downtown is also experiencing development of taller vertical spaces as well.

As a whole, Arizona experienced a high level of growth in electricity sales during the period of overall economic prosperity in the early 2000's, however, from 2007 to 2008, this trend began to reverse and sales dropped through 2010. Since 2010, overall sales have shown very slow growth and much of this has been due to industrial growth (which Mesa has none in its ESA).


Total Retail Electricity Sales in Arizona by Year
Electricity Sales (Million kWh)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Residential
Commercial
Total

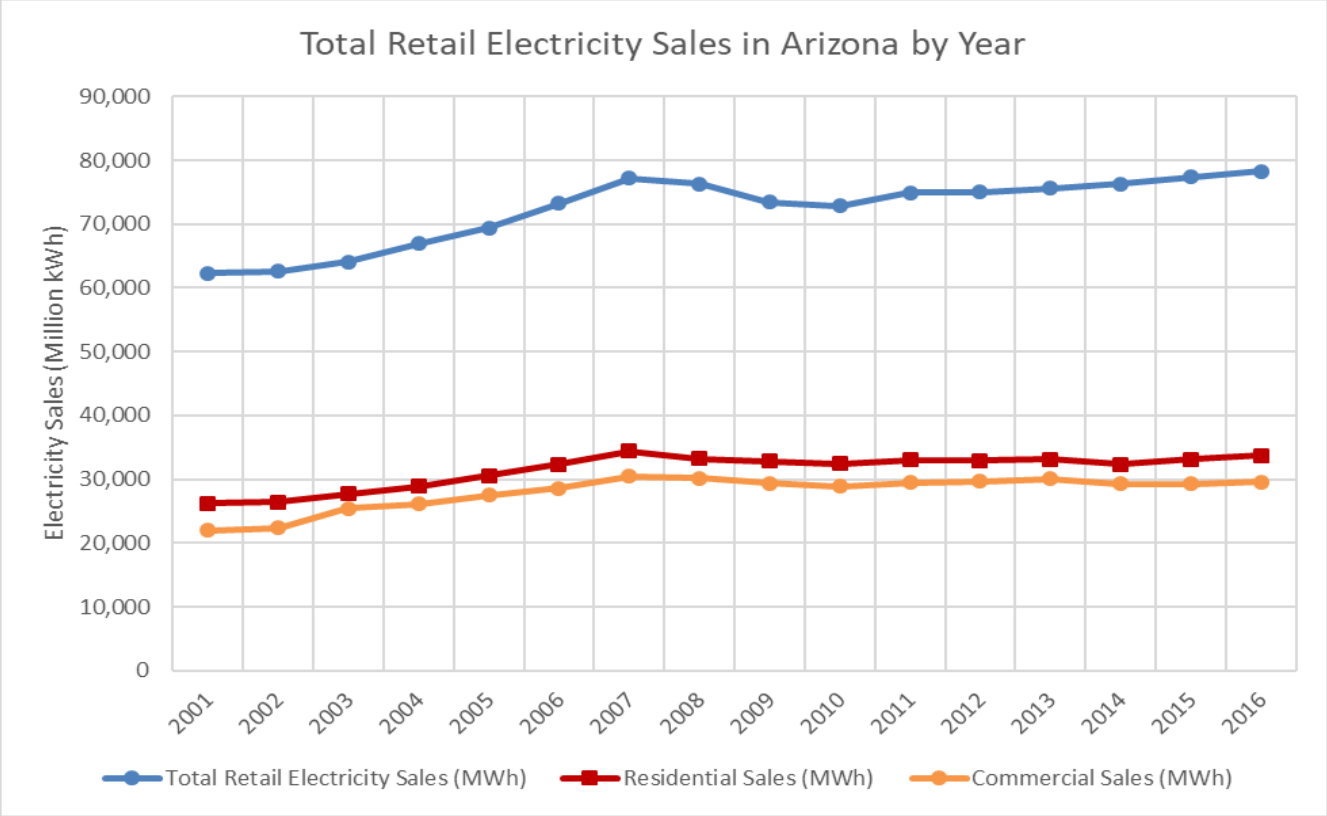

Total Retail Electricity Sales in Arizona by Year
Electricity Sales (Million kWh)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Total Retail Electricity Sales (MWh)
Residential Sales (MWh)
Commercial Sales (MWh)

Figure 5) Total Electricity Sales in Arizona (MWh) by Year. Residential Sales and Commercial Sales are also displayed [Energy Information Administration]

In addition, energy efficiency has been a steady force in continuing to reduce energy use per capita. The "Energy Independence and Security Act of 2007"[2] required many new energy efficiency improvements including:

- The progressive implementation of increasing energy standards on all new light bulbs (effectively phasing out the use of incandescent light bulbs in certain wattage ranges).
- Efficiency in residential boilers
- Water efficiency standards for dishwashers and clothes washers
- Efficiency in dehumidifiers
- Efficiency in electric motors
- Efficiency in walk-in coolers and freezers
- Efficiency in external power supplies
- Restrictions in the manufacturing of T12 fixtures for commercial lighting

The lighting standards from EISA 2007 were phased in from 2012 to 2014 and so the effects of this increase in efficiency are still reducing consumption for consumers.

Beginning January 2006[3], Department of Energy's amended minimum efficiency standards require that all residential air conditioners sold in the United States have a Seasonal Energy Efficiency Ratio (SEER) of 13 or greater. Similarly, as of October of 2008, new packaged commercial air conditioners are also required to have higher Energy Efficiency Ratios (EER), dependent on the units rated size. This was followed in January 1, 2015 with an increase in the minimum requirement of all split system and packaged system central air conditioners to meet SEER 14 and 12.2 EER specifications in Arizona. Mesa's peak system demand, occurring in the hot summer months, is mostly driven by residential air conditioning load, so increases in required efficiency will continue to play a significant role in the reduction of Mesa's peak demand as legacy models are replaced with the new, higher efficiency models.

[2] http://www.gpo.gov/fdsys/pkg/PLAW-110publ140/pdf/PLAW-110publ140.pdf

[3] http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/ac_factsheet.pdf

The "American Recovery and Reinvestment Act of 2009"[4] provided additional tax incentives to homeowners of up to 30% of the cost of various home energy efficiency upgrades up to a maximum of $1,500 if the project was completed in 2009 or 2010.

Arizona HB-2332 of 2009[5] enacted minimum energy efficiency standards and additional public building requirements including:

- Guidelines for Energy Performance Contracting for existing schools
- Property tax exemptions for PV systems, Combined Heat and Power Systems, Energy Efficient Building Components, and Renewable Energy Equipment
- Minimum energy efficiency standards for portable electric spas, residential pool pumps and residential pool pump motors

These legislative changes are still affecting consumers while these appliances with new technologies and higher efficiency standards replace older technologies as those older technologies wear out and need replacement.

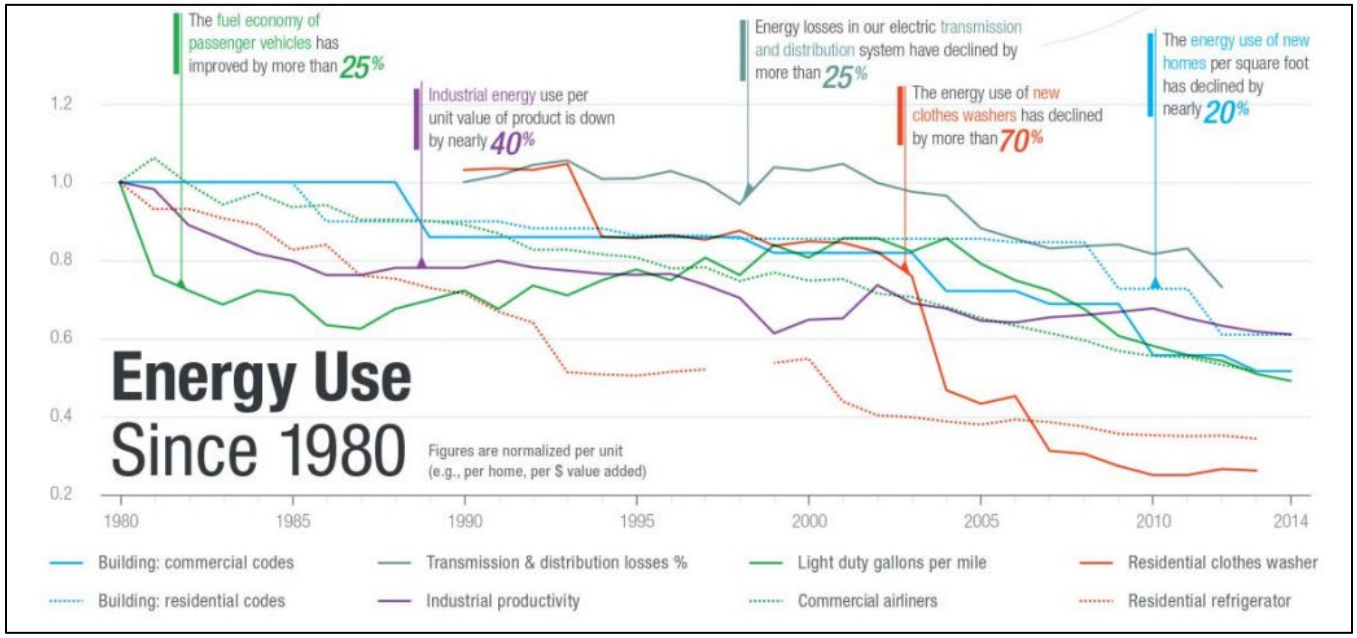


Figure 6) Energy Use Since 1980. American Council for an Energy-Efficient Economy, 2015.[6]

[4] http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf
[5] http://www.azleg.gov/legtext/49leg/1r/bills/hb2332s.pdf

[6] http://www.ourenergypolicy.org/wp-content/uploads/2015/07/e1502.pdf

The trend of a reduction in energy use per capita can be seen in the trends in Mesa's two largest customer classes. Residential customers (44% of Mesa's FY17/18 sales, in Figure 7) and General Service customers (also known as "Commercial Customers", as classified by the E3.1 rate, 36% of Mesa's FY17/18 sales, in Figure 8) annual consumption per customer followed a trend of increasing through fiscal year 2006 and 2007, respectively, but began to decrease afterwards. More recently, there has been a slight growth in both Residential consumption per customer (in 17/18) and Commercial consumption per customer (starting in 16/17), however, the general downward trend demonstrates that customers are already able to and willing to reduce their energy use patterns without any incentive-based programs.

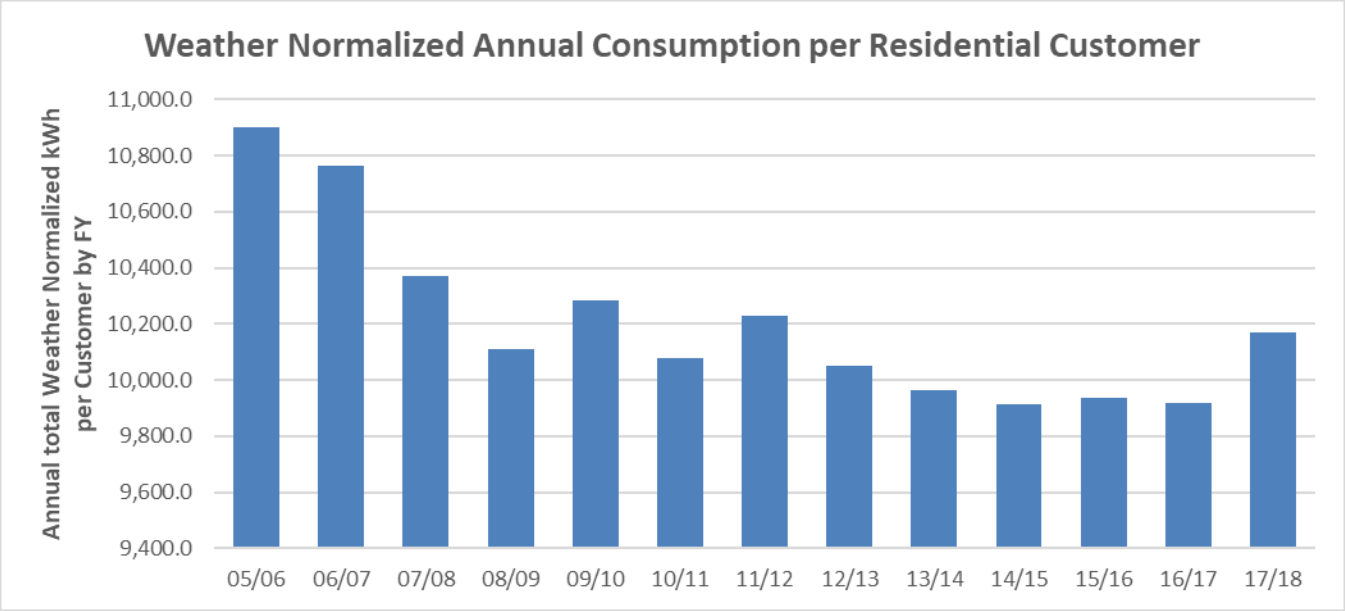


Figure 7) Annual kWh use/residential customer by fiscal year for residential electric customers in Mesa's ESA, weather normalized.

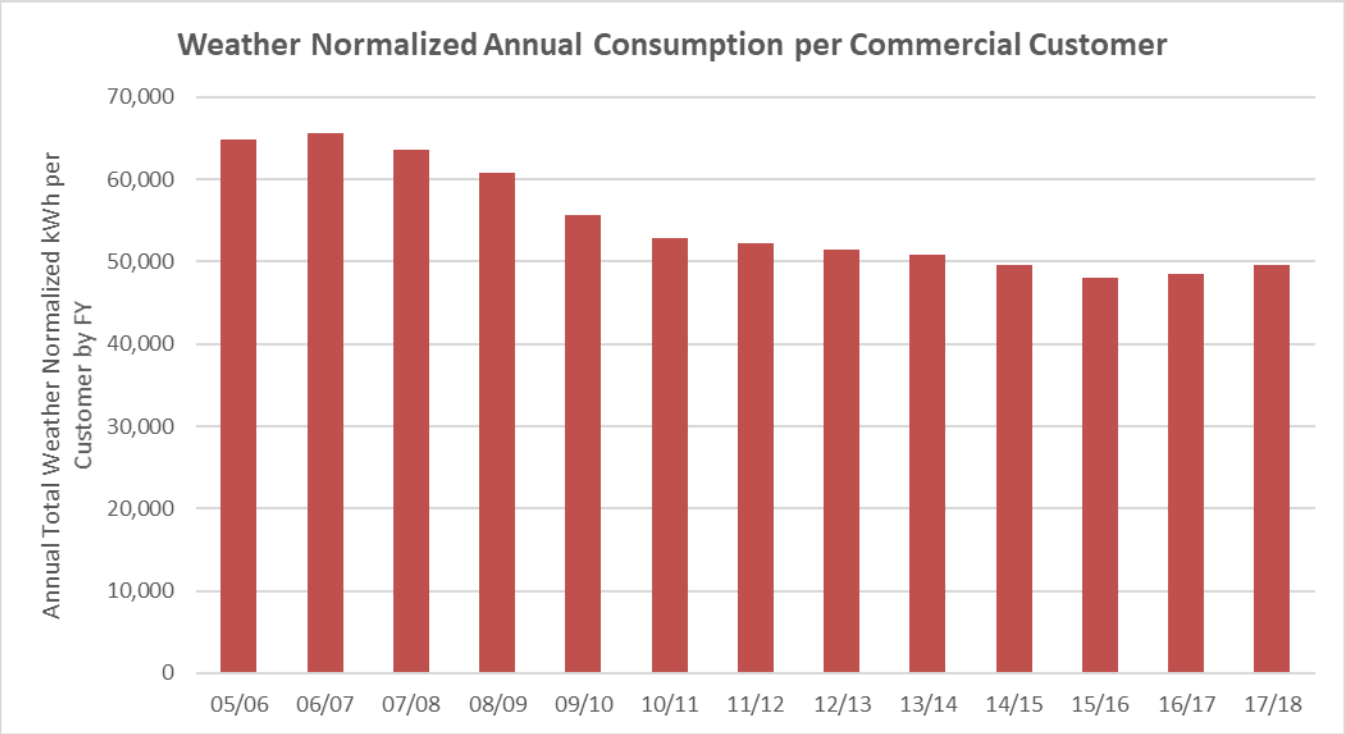


Figure 8) Annual kWh use per commercial customer by fiscal year for commercial customers in Mesa's ESA, weather normalized.

5.3 Forecasted Resource Needs

Mesa experiences its peak demand during the summer months (historically in June, July or August). In July of 2006, Mesa experienced a total system peak demand of 93.8 MW at Rogers Substation (unadjusted for weather). Most recently, Mesa experienced a total system peak demand of 88.3 MW at Rogers Substation (unadjusted for weather) in July, 2018. This reduction in peak demand has meant that Mesa's mix of contractual supplies has remained adequate for supporting the system's demand and energy requirements with only some modifications to the resources to decrease, rather than increase, their capacities. To determine the 2019-2028 forecasted resource needs, a comparison was made of existing and available resources with the forecast of customer requirements for the same period. Table 4 summarizes Mesa's net resource needs at time of forecasted system peak demand.

Table 4) Load & Resource Table for the Ten Year Outlook

2019-2028 FORECASTED RESOURCE NEEDS @ ROGERS										
YEAR	Citi	SENA	Constellation	Parker-Davis	CRSP	RMS Market Purchases	Customer-Owned Solar	**TOTAL SUPPLY (MW)**	**LOAD (MW)**	**(NEED) (MW)**
2019	14.1	14.1	9.7	10.4	4.3	18.7	0.6	71.9	91.3	**19.4**
2020	0	14.1	9.7	10.4	4.3	20.0	0.7	59.2	92.6	**33.4**
2021	0	0	0	10.4	4.3	21.2	0.9	36.8	93.8	**57.0**
2022	0	0	0	10.4	4.3	22.5	1.0	38.2	95.1	**56.9**
2023	0	0	0	10.4	4.3	23.7	1.2	39.6	96.3	**56.7**
2024	0	0	0	10.4	4.3	25.0	1.4	41.0	97.6	**56.6**
2025	0	0	0	10.4	4.3	26.2	1.5	42.4	98.8	**56.4**
2026	0	0	0	10.4	4.3	27.5	1.7	43.8	100.1	**56.3**
2027	0	0	0	10.4	4.3	28.7	1.8	45.2	101.3	**56.1**
2028	0	0	0	10.4	4.3	30.0	2.0	46.7	102.6	**55.9**

To meet the forecasted deficiencies, Mesa has undertaken a substantive review and analysis of those resource options available to safely, economically and reliably meet its projected resource needs over the planning period. This is more fully discussed in Section 6.0 Resource Options.

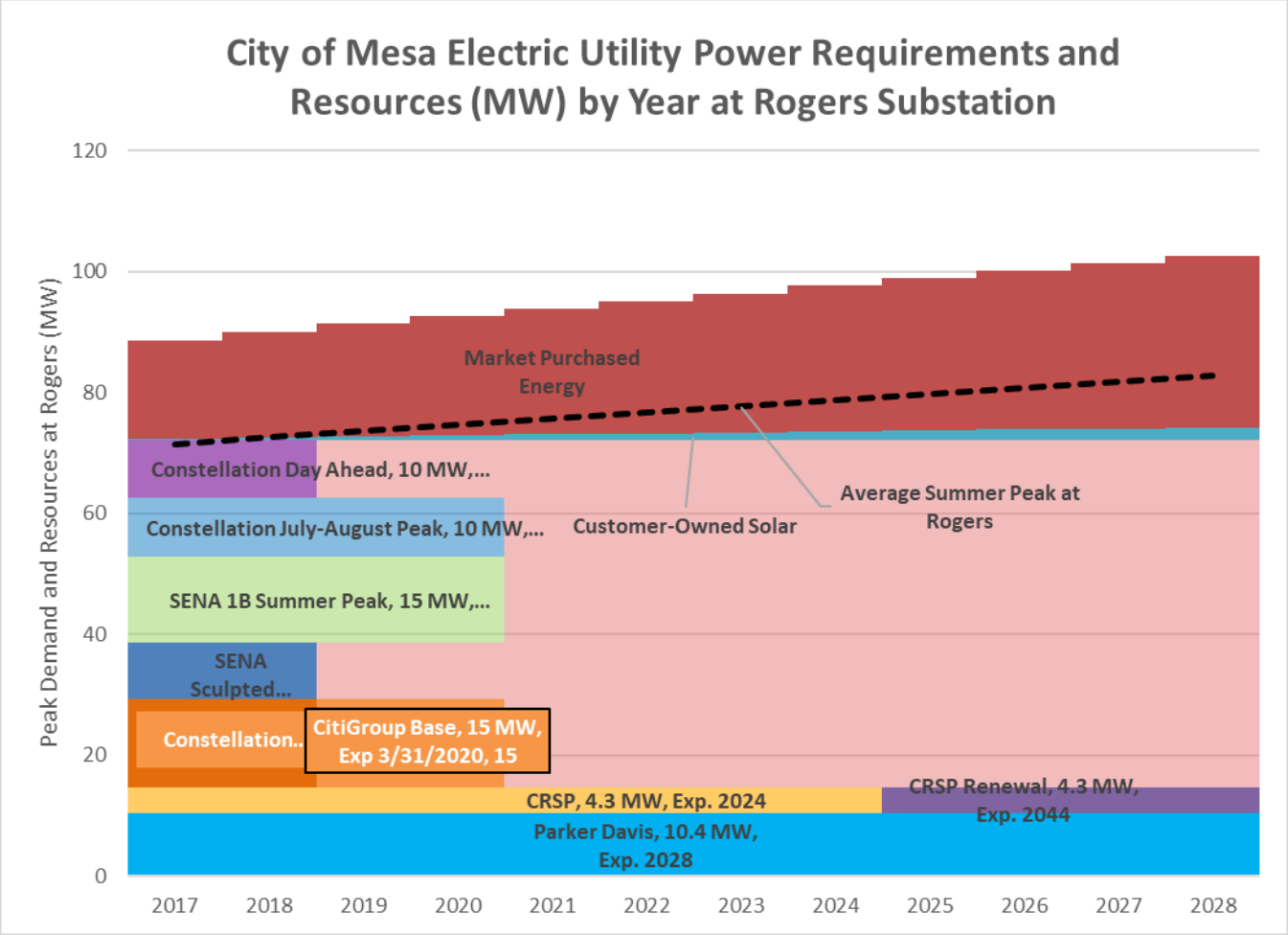


Figure 9) Peak system demand by year, and the associated supplies at peak

5.4 Mesa's Marginal Capacity Needs

During its 2012 IRP, Mesa was facing the situation where its system demand had declined substantially from its prior maximum peak and Mesa's peak demand continued falling until 2015. Beginning in 2016, it increased for the first time in nearly a decade and has increased since then (as seen in Figure 4). With continuing, steady customer growth due to redevelopment in downtown Mesa and the slow return of commercial customers with the completion of the light rail project in fall 2015, this growth in peak demand is predicted to continue even though use-per-customer continues on a downward or flat trend. With this growth, Mesa will encounter capacity constraints that will require operational or capital investment to intervene and secure rights to adequate upstream generation and transmission capacity. For example, Mesa currently is the owner of 100 MVA of transformer capacity in both transformers at

Rogers substation. As Mesa's peak demand approaches this 100 MVA (projected to happen in 2026), Mesa will need to decide how to serve this additional load. Similarly, a growing system peak load increases the impetus for Mesa to seek a second, redundant interconnection point with the bulk electric system. This 100 MVA limitation puts increasing emphasis on the need for Mesa to consider demand side resources as well as supply side resources.

Section 6.0 Resource Options

In developing a course of action to meet Mesa's forecasted resource needs the available options were broken down into six distinct categories:

1. Market-based Contractual Conventional Resources
2. Market-based Renewable Resources
3. Local/Distributed, Utility-Owned Conventional Resources
4. Local/Distributed, Utility-Owned Renewable Resources
5. Customer-Owned Renewable Resources
6. Demand Side Management

6.1 Market-based Contractual Conventional Resources

These resources are typically three to five-year long contracts between Mesa and energy suppliers (such as Shell Energy North America, Constellation Energy, Citigroup Energy Inc, Public Service Company of New Mexico, and American Electric Power company) for "WSPP Schedule C" firm energy products that are delivered to hubs on the Western Area Power Administration's transmission system where Mesa has transmission rights. Prior to 2012, (aside from its two hydroelectric power contracts) Mesa provided all the energy for its electric utility using market-based contractual conventional resources from one sole provider. Since 2012, Mesa has worked diligently to seek additional qualified counterparties to purchase energy from and is now "enabled" with five major suppliers which has helped to substantially reduce cost for Mesa's electric utility customers.

These market-based contractual conventional resources are not source specific in that neither Mesa nor the supplier requires the energy to come from a specific power plant. The resources are simply an

aggregation of energy that the supplier sources from various power plants and delivers to Mesa with the guarantee of the price and firmness of the energy, meaning that if the supplier cannot deliver, it is responsible for paying Mesa damages.

In Mesa's 2019 IRP, it will be assumed that Mesa will still be able to purchase market-based contractual conventional resources indefinitely without any limits on capacity availability. Pricing for (three year) market-based contractual conventional resources was determined through a request for indicative offers to energy suppliers.

Table 5) Pricing Assumptions for Market-Based Contractual Conventional Resources

Product	*Capacity*	*Schedule*	*Months*	*Term*	*Pricing ($/MWh)*
Base	15 MW	7x24	Jan. – Dec.	4/1/2020 – 3/31/2022	$35.85
				4/1/2022 – 3/31/2025	$38.56
				4/1/2025 – 3/31/2028	$42.50
July-August Peak	10 MW	7x16	July & August	7/1/2021 – 8/31/2023	$78.00
				7/1/2024 – 8/31/2026	$80.00
				7/1/2027 – 8/31/2029	$81.15
Summer Peak	15 MW	7x16	May – Sept.	5/1/2021 – 9/30/2023	$54.85
				5/1/2024 – 9/30/2026	$58.65
				5/1/2027 – 9/30/2029	$61.75

6.2 Market-based Renewable Resources

City Management, ERD Customers and the Mesa City Council have expressed a desire to incorporate more renewable resources into Mesa's electric supply portfolio. As a result, Energy Resources staff undertook a study of the renewable resources available to Mesa and studied the impact of procuring varying levels of renewable resources. From that study, the following conclusions were made:

- Renewable resources have dropped in price substantially to where they are competitive with conventional resources, however, due to the variability of the resources and lack of dispatchability, renewable resources still pose significant integration challenges without storage.
- Mesa's ability to procure renewable resources at a low cost is limited because low priced renewable resource typically require a minimum of 100 MW of installed capacity and Mesa cannot commit to anywhere near that level of a purchase. As such, Mesa must be flexible and ready to embrace opportunities where it can be a secondary player in a larger project to capitalize on economies of scale and not overcommit to a level of resources that are beyond the electric utility's ability to absorb.
- As technology evolves and costs continue to decline, Mesa would be saddling its customers with undue costs by committing to a large portion of renewable resources too quickly. Mesa should gradually and incrementally acquire renewable resources to minimize the cost and operational impacts to its customers.
- Any renewable energy project that Mesa wishes to participate in must be located in close proximity to Mesa's existing transmission rights. If not, additional transmission costs can make an otherwise economical project fall out of favor very quickly. Starting in October 2018, Mesa switched to Network Transmission Service with Western; greatly increasing Mesa's reach in terms of where it can procure power and so this will assist in overcoming this challenge.
- Any renewable energy project that Mesa wishes to participate in must be scheduled to come online at a time that coincides with another one of Mesa's energy supplies expiring. Over the past 5 years Mesa has staggered its energy supplies so it is in a good position to overcome this challenge.

Through the study, Mesa examined the following resources:

6.2.1 Market Purchased Solar Energy:

Mesa, with access to multiple transmission systems, is well situated to procure solar energy from across the desert southwest, and so Market Purchased Solar Energy remains one of Mesa's best options for procuring renewable energy. Additionally, these solar generators are often installed as single axis

tracking technology which significantly increases their capacity factor to better fit Mesa's load shape. Benefits of Market Purchased Solar Energy include:

- Often the least expensive solar power option
- Output of single axis tracking systems better matches Mesa's summer load profile
- A third-party vendor is generally responsible for the maintenance and operation of the system and is responsible to ensure that the system is outputting an optimal amount of energy
- No land is required to be given up in Mesa's Electric Service Area
- The current system of tax incentives makes this a more cost-effective option for procuring solar energy than ownership but the federal investment tax credit (ITC) will decrease from 30% of installed system cost to 26% of installed system cost on January 1, 2020. This credit decreases to 22% in 2021 and then from 2022 onwards decreases to only 10% of installed system cost. As a result, the economics of ownership vs using market purchased solar energy may shift as these tax incentives decrease.

Drawbacks of Market Purchased Solar Power include:

- These projects are often constructed far away from Mesa, therefore they don't provide a visual, tangible indication of Mesa's efforts towards sustainability
- Losses and transmission costs can "pancake" (layering costs and losses on top of each other every time a new transmission system is used), reducing the cost benefit of the projects
- Complex transmission arrangements can be difficult to administer

6.2.2 Market Purchased Wind Energy:

Similar to Market Purchased Solar Energy, there may be opportunities for Mesa to procure Market Purchased Wind Energy. There are far fewer wind projects being installed in comparison to the number of solar power projects being installed in the southwest, however, wind projects generally tend to be much larger than solar power projects. As a result, it is difficult for Mesa to take part in wind power projects because Mesa's small demand for wind power takes a backseat to the larger participants in the wind project who will dictate whether or not the project ultimately gets developed and the timeline of when this occurs. Manufacturers are continually increasing the size of the latest wind turbines (Siemens

recently installed an 8 MW turbine in Denmark and 10 – 20 MW turbines are being discussed in the wind industry) and so this makes trying to source 10 MW of wind power very difficult. Wind power developers are typically looking for utilities who want 100 MW or more as their anchor capacity off-take from these projects.

Two large electric transmission lines are planned to deliver power from eastern New Mexico to Arizona and California: the SunZia Project and the Southline Project. These two new transmission lines will enable Arizona utilities to access low price wind power similar to the wind boom which is taking place in Texas and the midwestern United States.

The SunZia Southwest Transmission Project is expected to begin delivering energy from eastern New Mexico (near Corona) to its customers in 2021. The actual generation project will be 1,500 MW of wind power which will be put in service by Pattern Development.

The Southline Project is similarly delivering wind power from Afton, New Mexico to Arizona and then California. It will provide ~1,000 MW of capacity, connect to 14 existing substations and can potentially provide both solar and wind energy.

Although wind energy hasn't seen the consistent decline in prices that solar has seen, some wind power PPA's are extremely competitive with conventional energy. The closest wind resources that Mesa has access to would be generated in either northern Arizona, or in New Mexico. New Mexico generally has higher capacity factors than northern Arizona, so the biggest challenge for Mesa is finding a project to which it can secure transmission access. Once the resources from Southline and SunZia are contracted for, Mesa will not have any opportunities to purchase wind power resources until more electrical transmission development takes place.

Benefits of wind energy include:

- Historically the least expensive option to procure renewable energy until recently
- Projects in New Mexico have very high capacity factors in comparison to solar power
- No land is required to be given up in Mesa's Electric Service Area
- Certain wind profiles compliment Mesa's load shape very well (Eastern New Mexico)

Drawbacks of wind energy include:

- The load shape of certain wind power projects can be the opposite of Mesa's load shape (wind peaks generally at night and during the winter)
- Wind energy projects are located very far away from Mesa, therefore, Mesa runs the risk of having to purchase transmission across multiple transmission providers, significantly increasing transmission costs and losses

6.2.2 Other Market Purchased Renewable Resources:

Through Mesa's RFP's, other renewable technologies have also been submitted. Geothermal energy, while not readily available in Arizona for power generation, is abundant in the Salton Sea area of California and in some areas of Utah as well. SRP is purchasing renewable energy from the 25 MW from the Cove Fort Geothermal Project in central Utah and both APS and SRP are purchasing power from geothermal generators in the Salton Sea area.

Biomass power, where wood or wood byproducts are burned to generate power, have a small presence in Arizona, but Mesa has not received any offers for Biomass power in any RFP's.

Through competitive solicitation, Mesa can check the market for these and all other renewable energy resources and so if they are available, they can be evaluated alongside other resources appropriately.

6.3 Local/Distributed, Utility-Owned Conventional Resources

Mesa has been active in analyzing opportunities to install generation within its ESA to serve a few purposes:

1. As Mesa's customers' peak electric demand approaches 100 MW, Mesa will have to decide how to avoid exceeding 100 MW of demand at Rogers; internal generation is one way to reduce the load seen at Rogers.
2. Increasing emphasis is being put on disaster readiness. Having internal generation capacity would allow the City to power critical infrastructure in the event of a utility outage.
3. Favorable natural gas prices and more competition in the market for small-scale generators has made natural gas-powered megawatt-scale generation more competitive with large scale generation (although small-scale generation is still more expensive than large scale generation)

4. These generators (depending on the technology) can be ramped up very quickly to respond to shortfalls in renewable resource generation and therefore help avoid penalties associated with renewable resources failing to deliver

Technologies that are considered include:

Technology	*Size per Unit*	*Typical Manufacturers*	*Time: Startup to Full Load*	*Heat Rate (HHV)*
Internal Combustion Engines	800 kW – 12 MW	Caterpillar, Wartsila, Kohler	5 minutes	8,000 Btu/kWh – 11,000 Btu/kWh
Combustion Turbines	6 MW - 35 MW	Solar Turbines, GE	25 minutes	11,000 Btu/kWh

6.4 Local/Distributed, Utility-Owned Renewable Resources

In mid-2015 Mesa solicited offers via a Request for Qualifications for solar vendors to design and construct solar PV structures at six sites in the City's electric service territory. The total requested capacity for these sites totaled over 4 MW. Through the RFQ process, Mesa qualified four vendors who were then given a progressively narrower scope of work as Mesa refined the sites that were to be used. This process has been ongoing; however, it has shown that while there is plenty of potential in Mesa's electric service territory, sites must have a number of converging factors to ensure that the project can be done in a cost-effective manner. Quoted pricing ranged from $65/MWh to well over $100/MWh, again, very dependent on the scope of the project.

Utility owned distributed solar energy has many benefits including:

- No revenue reduction or cross subsidization among customer classes
- A third-party vendor is generally responsible for the maintenance and operation of the system and is responsible to ensure that the system is outputting an optimal amount of energy
- Sites are generally more optimal for generation than customer-owned PV sites and therefore can see higher capacity factors

- Minimizes losses by siting generation close to load
- Projects at prominent City facilities serve as a visual example of Mesa's efforts towards sustainability
- Projects can serve multiple purposes including:
  - The creation of event spaces underneath solar canopies
  - Creating covered parking at facilities where the public and city employees park
  - Providing energy for a community solar program
- Mitigates Urban Heat Island effect by (typically) covering dark asphalt surfaces
- Can be sited (along with storage) to help support voltage or frequency in problem areas within the distribution utility

Drawbacks to utility owned distributed solar energy include:

- Generally, a higher cost than a utility scale, market-based renewable energy purchase
- Can occupy space that may be required later for other City projects or may occupy space that the City may wish to sell at a later date

The ancillary benefits of installing utility-owned, distributed solar generation help to make this a more attractive option for procuring renewable energy, however, the extra cost premium of this option when compared to larger utility scale projects must be justified through those ancillary benefits.

6.5 Customer-Owned Renewable Resources

Mesa has extensive experience with small scale solar installations throughout its various utilities and implemented its Solar PV Pilot Program in July of 2012. Since then, over 800 kW of customer-owned solar systems have been installed (approximately 120 kW per year). Data from the program has shown that fixed axis solar PV in Mesa generates approximately 1,680 kWh per kW-DC, for a capacity factor of 19.2%. Customer-owned solar PV has many benefits to Mesa such as:

- Mesa does not have to provide a site for the solar panels
- Mesa does not have to operate or maintain the solar panels
- The solar panels are sited at the point of electric consumption, minimizing losses

Despite these benefits, Mesa's experience with customer-owned solar has revealed drawbacks such as:

- Reduction in revenue from reduced electricity sales

- Customers are at risk of complex contractual provisions that often cannot be negotiated with solar installers
- Cross subsidization from non-solar PV customers to solar PV customers (for paying incentives and net metering checks)
- Customers are responsible for maintaining trees on site to ensure that the systems generate energy; many of the customers have trees which interfere with their solar generation
- One customer has altered its solar installation after Mesa paid the customer its incentive, causing Mesa to have to attempt to recover a portion of that incentive payment
- In total, customer-owned solar has been more expensive, per kWh, than quotes for other renewable resources
- Mesa devotes significant Energy Resources staff time to the installation and reading of the additional solar meters because the current customer service billing system cannot integrate net metering.
- Mesa also dedicates significant Energy Resources staff time to calculating the billing for these net metering customers and issuing checks to them. This is because Mesa's current customer service billing system cannot handle net metering as it's typically done at other utilities.

On average, payments for net metered energy cost Mesa $87.30 per MWh. When the incentive for that solar is taken into account and amortized across the 20-year life of the system, that cost increases to $96.10/MWh and so that cost will be used in the analysis going forward. Other utilities' IRP's forecast a consistent growth in customer-owned solar resources and so Mesa envisions that it will also see a consistent growth of ~12.5% per year of the customer-owned solar program.

6.6 Demand Side Management Resource Options

In 2007 Mesa hired a consultant to conduct a DSM potentials study of its residential and commercial class ESA customers. The results of this study indicated potential to reduce summer peak demand by implementing certain DSM programs. Mesa has furthered this analysis for 2012 and 2018 and concluded that opportunities exist to help both residential and commercial customers save energy during times of peak demand. The following technologies were evaluated due to 1) their use in other Arizona utilities'

DSM programs and 2) their potential to reduce demand during peak consumption hours (certain DSM measures wouldn't affect peak hour demand and, as such, were discarded from further analysis):

Residential Demand Side Technologies Considered

Room Heating/Cooling

- Duct Testing and Repair
- High Efficiency AC Upgrade
- Smart thermostats

Thermal Envelope

- Shade Screens

Rates

- Time of use rates
- Pay as you go rates

Customer Sourced Energy

- Customer-owned storage
- Customer-owned solar with storage
- Customer-owned solar

Other

- Shade Trees
- Pool Pump Upgrade
- Energy audits

Commercial Demand Side Technologies Considered

- Commercial "Standard" Demand Side Management
- Commercial Custom Energy Solutions
- Commercial Energy Audits
- Commercial solar

Other Demand Side Management Technologies Considered

- Municipal Energy Efficiency Upgrades
- Electric Vehicle Incentives
- Electric Vehicle Charging Rates
- Multifamily Efficiency Program
- Cogeneration
- Energy Storage

While Demand Side Management measures can reduce peak system demand, it should be noted that DSM measures can also reduce the total sales of energy, reducing the revenue contribution of each customer who has the means to implement such DSM measures. When measuring and evaluating the impact of DSM measures and their suitability for implementation, the balance of the benefits and costs associated with each measure are calculated using the Total Resource Cost Benefit Ratio (TRCBR). If the TRCBR is greater than 1.0 then the DSM measure can be considered to have more benefits than costs and would therefore be worth consideration of implementing.

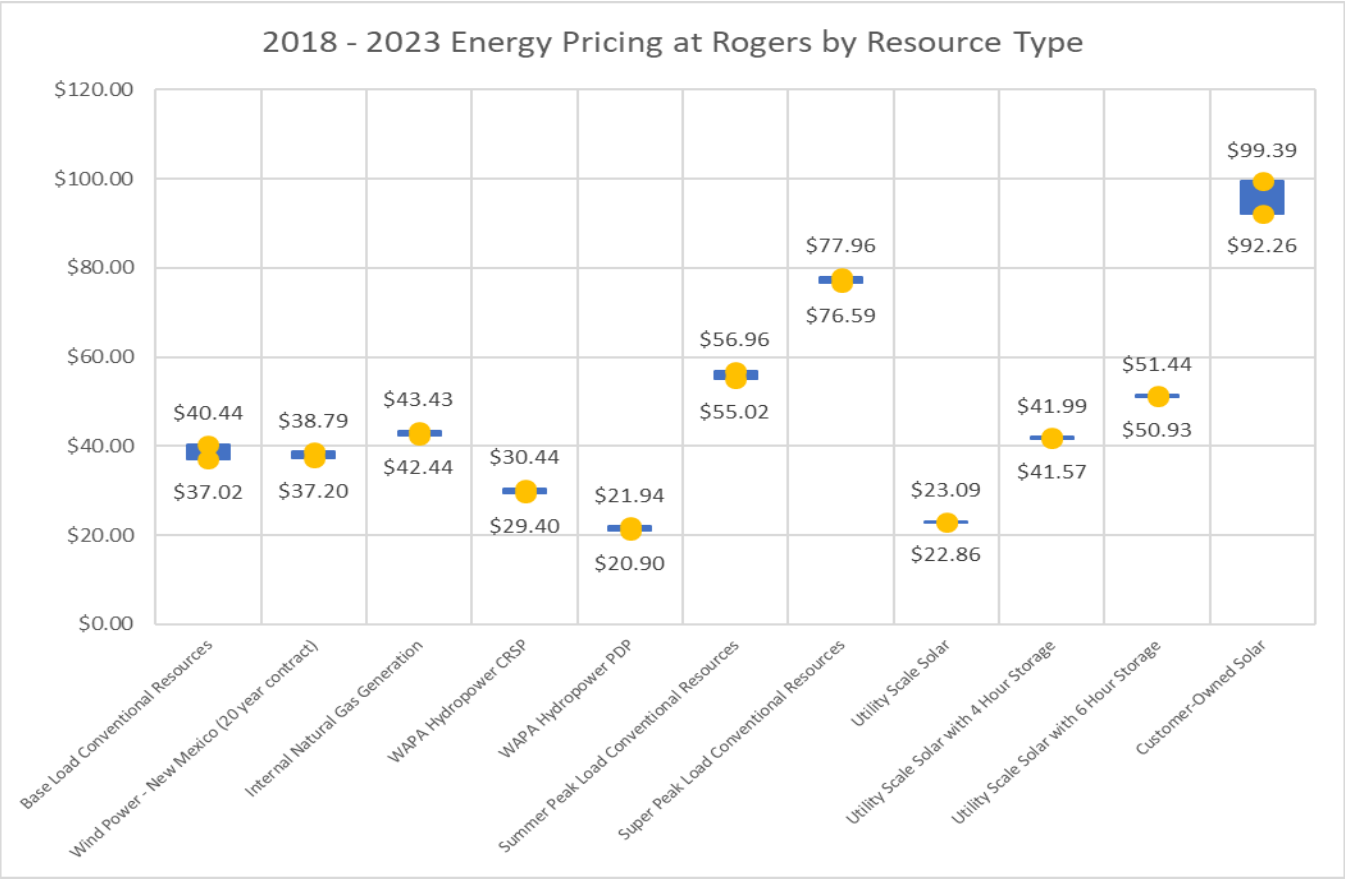


Figure 10) Range of Pricing used by resource type for the 2018 - 2023 timeframe at Rogers

Section 7.0 Public Input

To better gauge Mesa's customers' perception of renewable energy, Mesa created an online survey that was sent out to customers in its service territory. At the end of that survey, in September 2018, the survey has received 59 responses from Mesa customers that provide insight into customers' willingness to pay for renewable resources:

Providing you with more renewable energy involves using more costly resources (compared to the current energy that COM provides you). Which of the following choices below characterizes your support of the use of renewable power:

I am not willing to pay an increase in my utility energy bill0 for renewable resources	**53.45%**	31
I am willing to pay a 1-2% increase in my utility energy bill if some of it could come from renewable resources	**12.07%**	7
I am willing to pay a 2-5% increase in my utility energy bill if some of it could come from renewable resources	**13.79%**	8
I am willing to pay a 5-10% increase in my utility energy bill if some of it could come from renewable resources	**10.34%**	6
I am willing to pay a 10-20% increase in my utility energy bill if some of it could come from renewable resources	**0.00%**	0
I am willing to pay a 20-40% increase in my utility energy bill if some of it could come from renewable resources	**0.00%**	0
I am willing to pay whatever bill increase that it takes to maximize the renewable resources that provide my energy	**10.34%**	6
Total		**58**

From this first question, it is clear that a large portion of respondents (53%) do not want to pay more for their energy in order to receive renewable resources, however, 47% of respondents were willing to pay more for their energy at varying levels.

If, for instance, the City of Mesa wasn't able to purchase large amounts of renewable energy for all of the utility customers, there may be opportunities for those customers who are interested in covering their OWN energy use with renewable energy. Do you agree with this statement: "I am interested in participating in a program where, for some additional cost on my energy bill, Mesa will purchase renewable energy on my behalf to cover my OWN energy use."

I highly disagree	I disagree	I'm indifferent/neither agree nor disagree	I agree	I highly agree	Total
25.86%	13.79%	18.97%	25.86%	15.52%	100%
15	8	11	15	9	58

This question provides an option for the customer to purchase their *own* energy from renewable resources. This is similar to the community solar programs offered by SRP and APS. It appears that there would be interest in a program like this.

Do you agree with this statement? "I am interested in participating in a program where I can purchase environmental credits (sometimes called "Carbon offsets") for some additional cost to offset the emissions of my energy use."

I highly disagree	I disagree	I'm indifferent/neither agree nor disagree	I agree	I highly agree	Total
28.07%	15.79%	29.82%	12.28%	14.04%	100%
16	9	17	7	8	57

Response to this question was not as strong as the response to the prior question, however, it does appear that there is some interest in a program where customers could purchase Carbon Credits to offset the carbon from their energy use. The remainder of the survey results can be found in Appendix B.

In addition to surveying its customers, Mesa held a public meeting August 2018 and another public meeting in September 2018 to discuss the IRP with its customers. Customers in attendance provided the following feedback.

- Customers expressed interest in DSM programs such as:
    - Shade tree program partnership with SRP
    - Duct repair programs
    - Programmable thermostats
    - $99 energy audits
- Customers were frustrated by high summer bills

- Note: upon following up with the customers, both customers were not aware that their water, sewer, solid waste, and electric bills were combined into one and so the increase in bills was likely due to other utility rates. Their electric bills were in line with customers with similarly sized homes.

- Customers were curious about pre-warning systems for increased consumption. For example, if there were a water leak at their house, could Mesa let them know ahead of time?
- One customer expressed concern over smart meters and health concerns
- Customers suggested putting out case studies of other customers who had saved money on their own (without DSM incentives) to help the customers save energy on their own

Following the second customer meeting, Mesa released an updated online survey that has been shared through social media channels and will be continuing to gather more specific data related to the customers' preferences. That survey is ongoing and the results, to date, are as follows:

If Mesa provides you with more renewable energy, this will involve using more costly resources (compared to the current energy that COM provides you). Which of the following choices below characterizes your support of the use of renewable power:

I am not willing to pay an increase in my utility energy bill0 for renewable resources	**44.44%**	32
I am willing to pay a 1-5% increase in my utility energy bill if some of it could come from renewable resources	**29.17%**	21
I am willing to pay a 6-10% increase in my utility energy bill if some of it could come from renewable resources	**18.06%**	13
I am willing to pay a 11-20% increase in my utility energy bill if some of it could come from renewable resources	**1.39%**	1
I am willing to pay a 21-40% increase in my utility energy bill if some of it could come from renewable resources	**0.00%**	0
I am willing to pay whatever bill increase that it takes to maximize the renewable resources that provide my energy	**6.94%**	5
Total		**72**

The City of Mesa is considering offering a "Green Tariff" program. This is a program where you, as a customer, can elect to have either 25%, 50%, 75% or 100% of your annual energy come from a renewable resource (like solar or wind power) where each kWh of energy costs a little bit more. Would you be interested in participating in this program?

I would not participate in this program, but I would support the City of Mesa offering it if it doesn't impact my bills	**29.17%**	21

I would not participate in this program and don't want the City of Mesa to offer it	**4.17%**	3
I would participate in this program	**16.67%**	12
I would need more information to decide either way	**50.00%**	36
Total		**72**

What energy efficiency programs would you use if the City of Mesa Electric Utility implemented them? (check all that apply)

Incentive to upgrade air conditioner to a high efficiency model	28.36%	19
Low cost energy audits	32.84%	22
Low cost duct testing	34.33%	23
Shade tree program (to reduce direct sunlight on the building)	56.72%	38
Incentive for high efficiency pool pumps	7.46%	5
Incentive for a smart thermostat	53.73%	36
Incentive for high efficiency appliance upgrades (i.e. high efficiency refrigerator or washer/dryer)	40.30%	27
Incentive for battery storage	16.42%	11
Incentive for solar PV system	35.82%	24
Low cost window shade screens	58.21%	39
Incentive for solar water heating	37.31%	25
Other (please specify)	10.45%	7
Total		67

Section 8.0 – Other Considerations in Selecting a Resource Portfolio

8.1 Evaluation Criteria

8.1.1 Economic Impact

The criteria most important to Mesa's customers has historically been the economic impact to the customers' bills. Mesa has worked diligently to seek additional qualified counterparties to purchase energy from which has helped to substantially reduce cost for Mesa's electric utility customers. This

has resulted in a decline in the power supply cost for Mesa's customers beginning with the recession which is projected to continue through fiscal year 2019-2020.

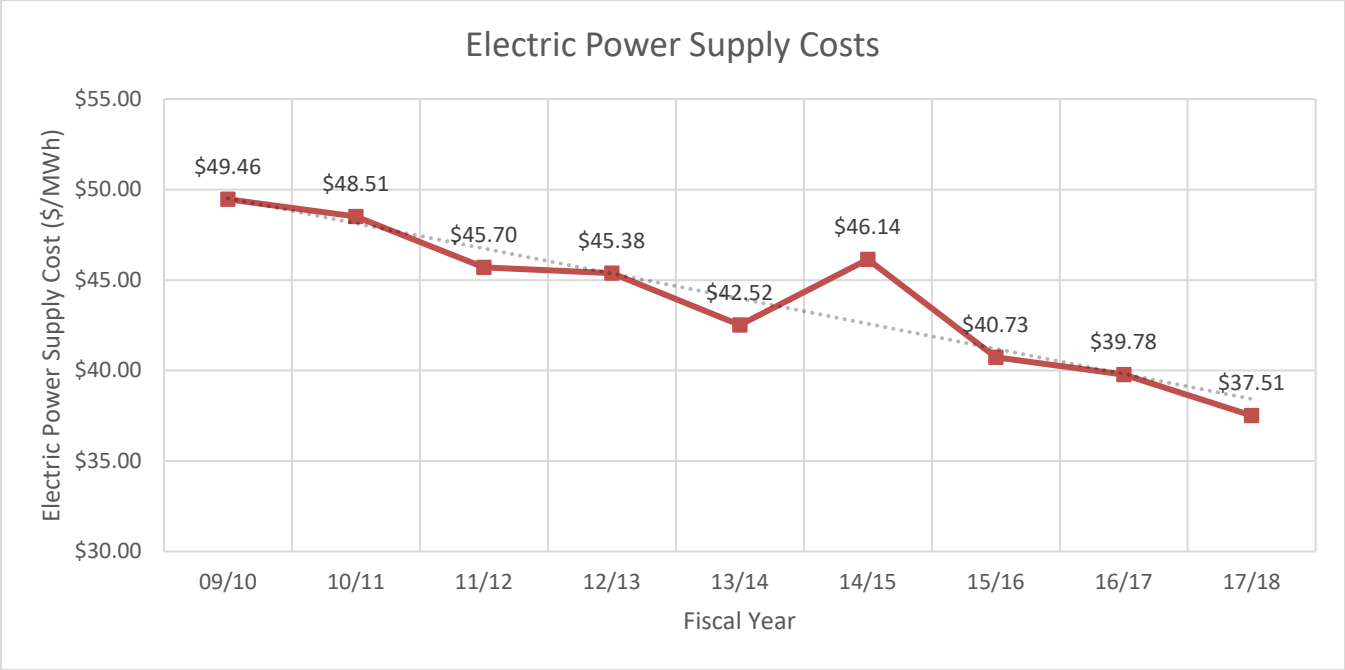


Figure 11) Overall electric power supply cost per MWh for Mesa's electric utility customers. The large spike in FY14/15 is due to the shifting of Mesa's capacity cost from a "pay after" contract to a "pay before" contract, effectively doubling up capacity costs on that particular contract in that fiscal year. If those costs were shifted to a more accrual-based look, the cost in FY14/15 would be substantially reduced and the cost in FY15/16 would increase.

When evaluating the scenarios going forward, any supply portfolios that put undue upward pressure on projected supply costs will not be viewed favorably.

8.1.3 Alignment with City Management, Council and Public Goals

Mesa's electric utility, which is not under the jurisdiction of the Arizona Corporation Commission (ACC), is not subject to the ACC's Renewable Energy Standard and Tariff (REST) which requires that Arizona utilities meet 15% of their annual energy requirements with renewable resources by 2025. In the Mesa City Council's strategic planning session on March 5th, 2018, Mesa's City Council discussed Mesa's 2018-2019 Strategic Plan. Two of the goals within that plan relate to this IRP:

- Support the development and sustainability of a strong Creative Economy
- Strengthen the sustainability of Mesa's arts and culture community

The action plans from this IRP must be evaluated with how strongly they fit within these Council goals, as well as how they tie in with the goals of City Management and the requests from Mesa's customers.

Additionally, the IRP was discussed at the City's Sustainability and Transportation committee meeting on September 23rd, 2019 where it was recommended to go to the full City Council on November 4th, 2019. The IRP was passed by Mesa City Council under a unanimous vote on November 4th, 2019.

8.1.3 Carbon Output and Water Use

As a whole, the electric industry has been reducing Carbon Dioxide intensity (measured in CO2 output per unit of energy generated) as the industry shifts from high carbon intensity coal generation to lower carbon intensity natural gas generation. Because Mesa's contractual resources are not source specific, the carbon intensity of its resources can be approximated by the carbon intensity in Arizona as a whole. This assumption does not take into account all of the nuances of where the energy could likely be coming from given Mesa's location and limited access to only so many transmission locations, but it serves as a proxy for the emissions of Mesa's electric utility. When taking into account Mesa's hydroelectric resources and solar resources, Mesa has seen a decreasing carbon intensity as seen in Figure 12.

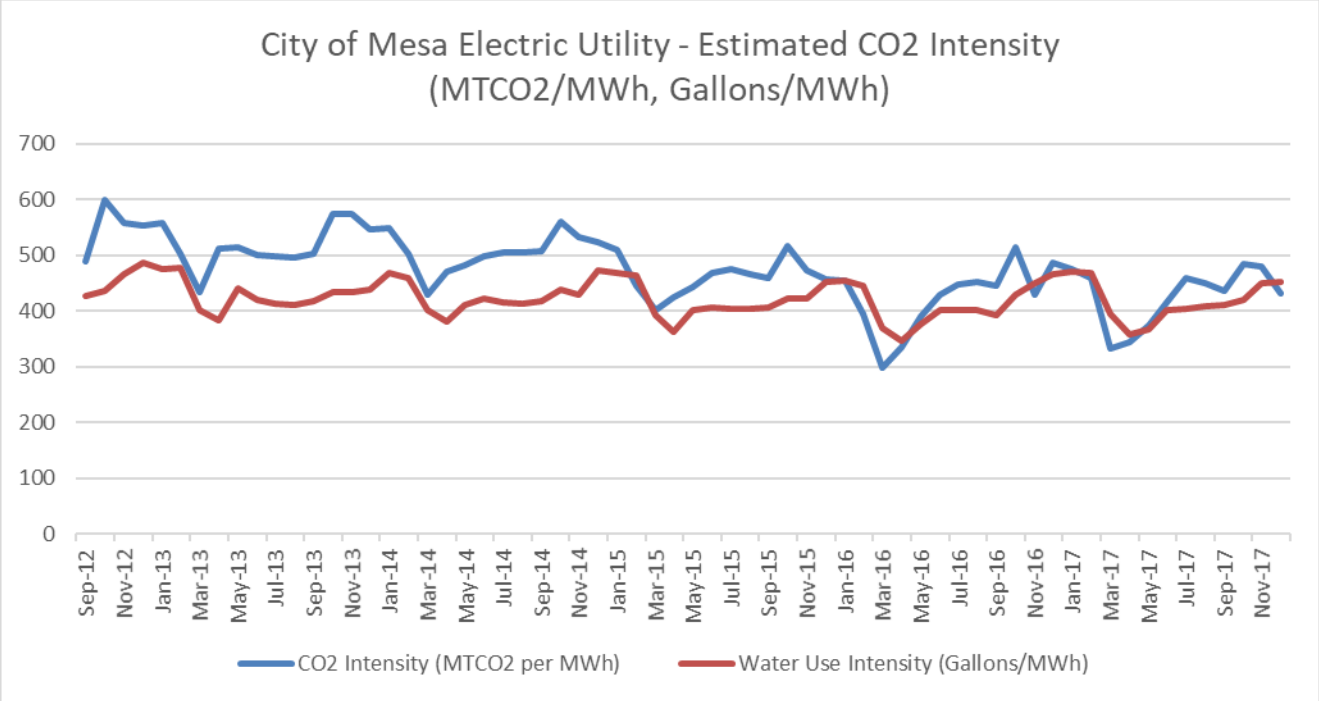


Figure 12) Carbon Intensity of Mesa's Electric Utility Supply by Month

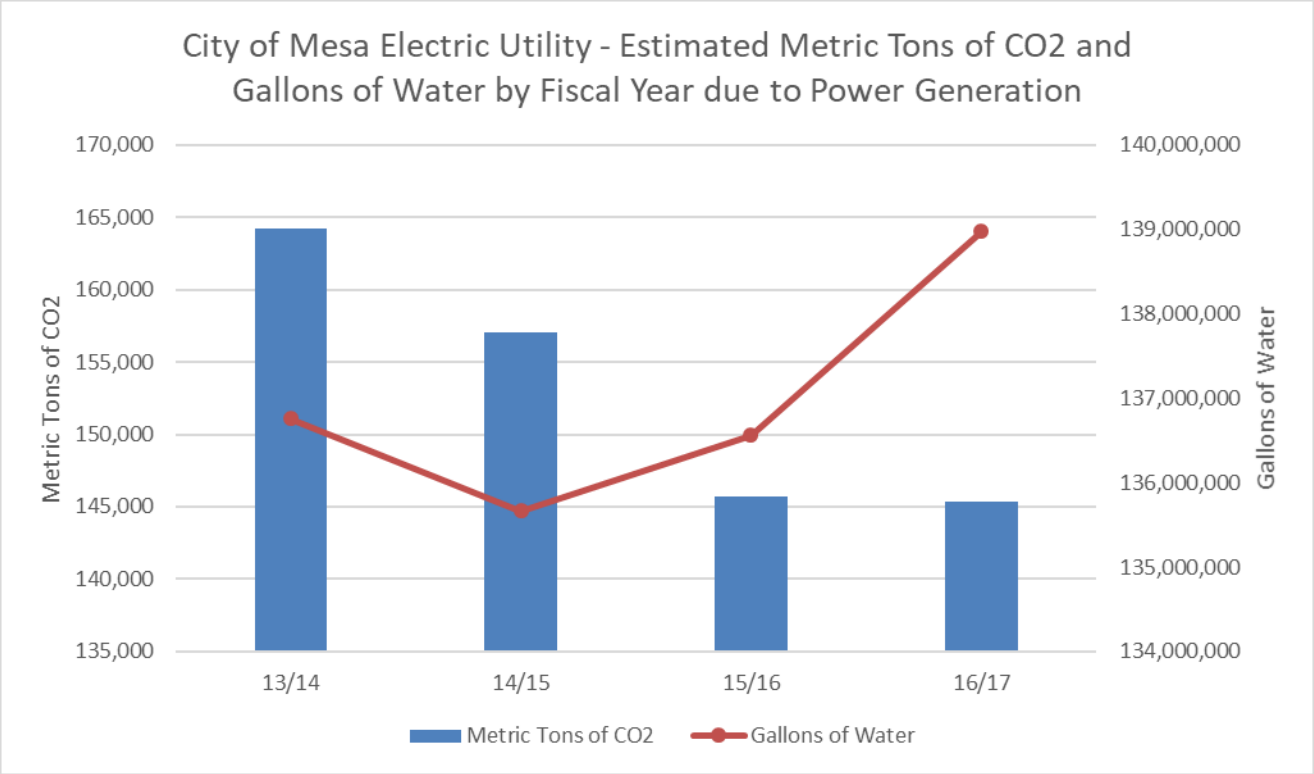


Figure 13) Estimated Total Carbon Emissions and Water Use for Power Generation by Fiscal Year

Carbon emissions can be offset through the generation of renewable energy credits ("RECs") and RECs can be purchased in Arizona at a very low cost currently. Mesa hasn't received any direct feedback that carbon emissions should be reduced, however, it has received feedback that the customers would prefer more renewable energy where possible, thereby implying the desire to lower carbon intensity.

Power generation uses substantial amounts of water for cooling the power generation cycles. Each power generation technology uses a distinctly different amount of water throughout their lifetime.

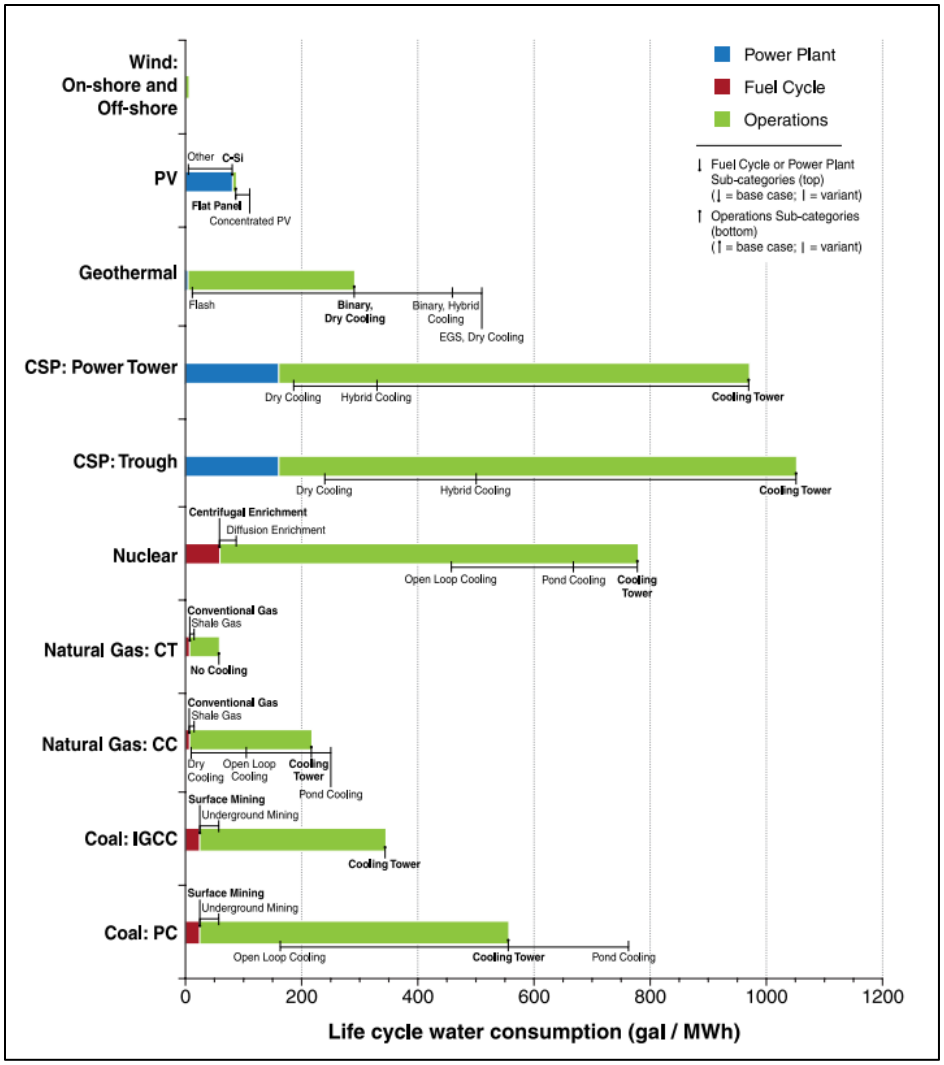


Figure 14) Median life cycle water consumption estimates in gal/MWh for different generation technologies.[7]

Similar to the estimates for CO2 output, because Mesa's power supplies are not plant-specific or resource-specific, Mesa must estimate the water consumption rate of its power supply based on averages for the Arizona power supply.

[7] http://iopscience.iop.org/article/10.1088/1748-9326/8/1/015031/pdf

Section 9.0 – Evaluation of IRP Scenarios

Three portfolio scenarios were proposed and evaluated for discussion. The scenarios represent three feasible paths forward for Mesa that would create different outcomes in terms of the resources chosen, however, all the scenarios share commonalities in that they all:

- Seek to create adaptability to react to changing market conditions
- Continue to use an approach that doesn't oversubscribe Mesa to any individual resource
- Focus on providing stable pricing for Mesa's customers
- Focus on providing a reliable supply of electricity to Mesa's customers
- Retain a focus on "least cost" competitive procurement for their individual constraints.

All scenarios take the same approach to Customer-Owned Solar generation, Mesa's hydroelectric allocations and the City's policy for installing renewable energy generation at City buildings but then all differ slightly for the other aspects of Mesa's electric supply portfolio. The scenarios are summarized here:

Table 6) IRP Scenarios considered for evaluation. This table is replicated in the executive summary.

Portfolio Metric	Preferred Scenario: Least Cost Mix of Conventional & Renewables Portfolio	Alternative Scenario 1: Conventional Resources Porfolio	Alternative Scenario 2: Solar/Renewable Focused Portfolio
Contract Replacement Strategy	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with a mixture of similar, conventional resource-based term contracts or renewable resource contracts based on economics as measured by the present worth of costs and applicability. Renewable resource acquisitions would be timed to maximize the benefits of tax advantages and drops in market pricing.	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with similar contracts using the competitive procurement processes (RFPs) that have used historically. The distribution of the RFPs will be extended to potential developers and marketers of both distributed and utility scale renewable resources. The acquisition of distributed and utility scale renewable resources would be restricted to those resources whose terms and conditions (including pricing) will be at or below the costs of conventional resources on a current cost basis	Mesa would focus on replacing its expiring conventional, wholesale-market-based term contracts with competitively sourced, renewable energy resource contracts. The amount of renewable resources to be acquired would be a function of i) the resources' "fit" into the utility's supply portfolio, ii) their costs (and, to the extent the costs of renewable energy resource contracts are more than conventional resource options) and iii) their impact on the electric utility's total costs of service. The renewable energy resource goal would be to acquire renewable resources over time up to an amount that increases costs to a level that causes ERD's customers' rates/bills to be in parity with SRP's equivalent rates.

Energy Efficiency	Demand side management programs would be developed based on industry standard benefit-cost tests including consideration of resources needed to effectively and efficiently implement the programs	Energy efficiency programs would be limited to pricing/rate-oriented initiatives such as time of use rates that become feasible with Mesa's conversion to AMI	Demand side management programs, including AMI enabled rate structures, that reduce peak demand and whose benefits reliably exceed costs, on a present value basis using industry standard benefit-cost tests would be developed and implemented.
Internal, Utility-Owned Generation	Internal generation (natural gas, renewable, storage based or some combination of those) would be added to help provide additional reliability for critical infrastructure, hedge against market fluctuations and support renewable resources.	Internal natural gas generation may be installed if justified by significant, currently unforeseeable, market conditions change	To help provide additional reliability, hedge against market resources and support renewable resources, Mesa will pursue options such as thermal and battery energy storage, internal combustion generation using renewable natural gas and other non-carbon technologies.
Requirement for Substation	Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.	Mesa would begin moving towards installing a new substation and second transmission feed in order to meet forecasted customer demands more than 100 MW	Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.
Customer owned solar	The customer-owned solar program (including net metering and dollar-per-watt incentives and caps on size and total new participants) will be reviewed annually and adjusted if appropriate. With the implementation of AMI, additional rate structures would help retain the value of those resources for all customers		
Hydro	Mesa's hydroelectric allocations will be retained for flexibility and economics		
Renewable Generation at City Buildings	Renewable generation at City Buildings would be implemented as deemed economical to provide other benefits that market based resources do not provide (e.g. shade and community development) alongside the benefit of local power generation.		

9.1 Preferred Scenario: Least Cost Mix of Conventional & Renewables Portfolio

In the preferred scenario, Mesa would seek the least cost mix of conventional and renewable resources based on the present worth analysis at the time of expiration of Mesa's current resources. Demand side management programs would be developed based on industry standard benefit-cost tests including consideration of resources needed to effectively and efficiently implement the programs (specifically related to staffing requirements to administer these programs). Internal generation (natural gas, renewable, storage based or some combination of those) would be added to help provide additional reliability for critical infrastructure, hedge against market fluctuations and support renewable resources. Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.

Mesa's resource supply portfolio would consist of the following resources under the Preferred Scenario:

YEAR		2019	2020	2021	2022	2023
LOAD (MW)		**91.3**	**92.6**	**93.8**	**95.1**	**96.3**
Demand Side and Distributed Resources	Energy Efficiency	0.1	0.1	0.5	0.9	1.3
	Dist. Utility Solar	0.0	0.3	0.5	0.8	1.1
	Customer-Owned Solar	0.5	0.6	0.6	0.7	0.8
	Thermal Storage	0.0	0.7	0.7	0.7	0.7
Net Demand at Rogers		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
Supply Side Resources	SENA	14.1	14.1	0	0	0
	Citi	14.1	0	0	0	0
	Constellation	9.7	9.7	0	0	0
	Utility Scale Solar	0.0	0.0	0.0	0.0	0.0
	Utility Scale Solar with Storage	0.0	0.0	9.7	19.4	19.4
	Parker- Davis	10.4	10.4	10.4	10.4	10.4
	CRSP	4.3	4.3	4.3	4.3	4.3
	New Competitively Sourced Market Purchases	19.6	33.7	47.8	38.1	38.1
	RMS Market Purch.	18.5	18.8	19.2	19.8	20.3
TOTAL SUPPLY (MW)		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
(NEED) (MW)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

The Preferred Scenario falls somewhere in between Alternative Scenarios 1 & 2 in terms of renewable penetration. The Preferred Scenario does not foresee Mesa accepting offers for wind power and reduces the amount of solar to 20 MW (with 4 hours of storage) by 2023. In total, 34.9% of Mesa's electric supply portfolio would come from renewable resources in this portfolio. Additional DSM and thermal storage compared to Alternative Scenario 1 slow down the growth in the system's demand towards 100 MW.

9.2 Alternative Scenario 1: Conventional Resources Portfolio

In the first Alternative Scenario, Mesa would proceed, largely, in the same manner that it has historically; utilizing competitive requests for proposal to source standard market-based, conventional resource contracts. This method of operation has saved Mesa's customers significant amounts of cost through Mesa continually seeking additional competitive counterparties to maximize competition for Mesa's business. Resource acquisitions would be evaluated based on current cost rather than a present value basis, so renewable resources could potentially beat out conventional resources in certain instances, however, they must do so from the beginning of their acquisition. Energy efficiency programs would be

limited to rate-based programs (such as voluntary time-of-use rate pricing). Mesa would not actively seek to add internal generation (natural gas or otherwise) unless market conditions changed significantly from expectations. Because of the continued addition of load and lack of internal generation, Mesa would move to add a second substation and transmission feed to support the system as it grows to over 100 MW.

Mesa's resource supply portfolio would consist of the following resources under Alternative Scenario 1:

YEAR		2019	2020	2021	2022	2023
LOAD (MW)		**91.3**	**92.6**	**93.8**	**95.1**	**96.3**
Demand Side and Distributed Resources	Energy Efficiency	0.0	0.0	0.3	0.6	0.9
	Distributed Utility-Owned/PPA Solar	0.0	0.3	0.5	0.8	1.1
	Customer-Owned Solar	0.5	0.6	0.6	0.7	0.8
	Thermal Storage	0.0	0.0	0.0	0.0	0.0
Net Demand at Rogers		**90.8**	**91.8**	**92.3**	**93.0**	**93.5**
Supply Side Resources	SENA	14.1	14.1	0	0	0
	Citi	14.1	0	0	0	0
	Constellation	9.7	9.7	0	0	0
	Utility Scale Solar	0.0	0.0	6.2	12.4	12.4
	Parker- Davis	10.4	10.4	10.4	10.4	10.4
	CRSP	4.3	4.3	4.3	4.3	4.3
	New Competitively Sourced Market Purchases	19.6	33.7	51.3	45.1	45.1
	RMS Market Purch.	18.6	19.6	20.1	20.8	21.3
TOTAL SUPPLY (MW)		**90.8**	**91.8**	**92.3**	**93.0**	**93.5**
(NEED) (MW)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

In this scenario, Mesa would procure approximately 20 MW of single axis tracking solar (with 10 MW being acquired in 2021 and 10 MW more acquired in 2022. In 2023, renewable resources would comprise of 33.6% of the power portfolio. The remaining resource expirations would be replaced with similar products that are competitively sourced from the wholesale market. This scenario's pricing is lower than the base case (business as usual) because the assumed price of utility scale solar beats out the energy that would be otherwise purchased as a term contract. The additional cost of storage for the solar would not be cost-justified on a present cost basis because the price of storage is not estimated to come down quickly enough within the timeframe.

9.3 Alternative Scenario 2: Solar/Renewable Focused Portfolio

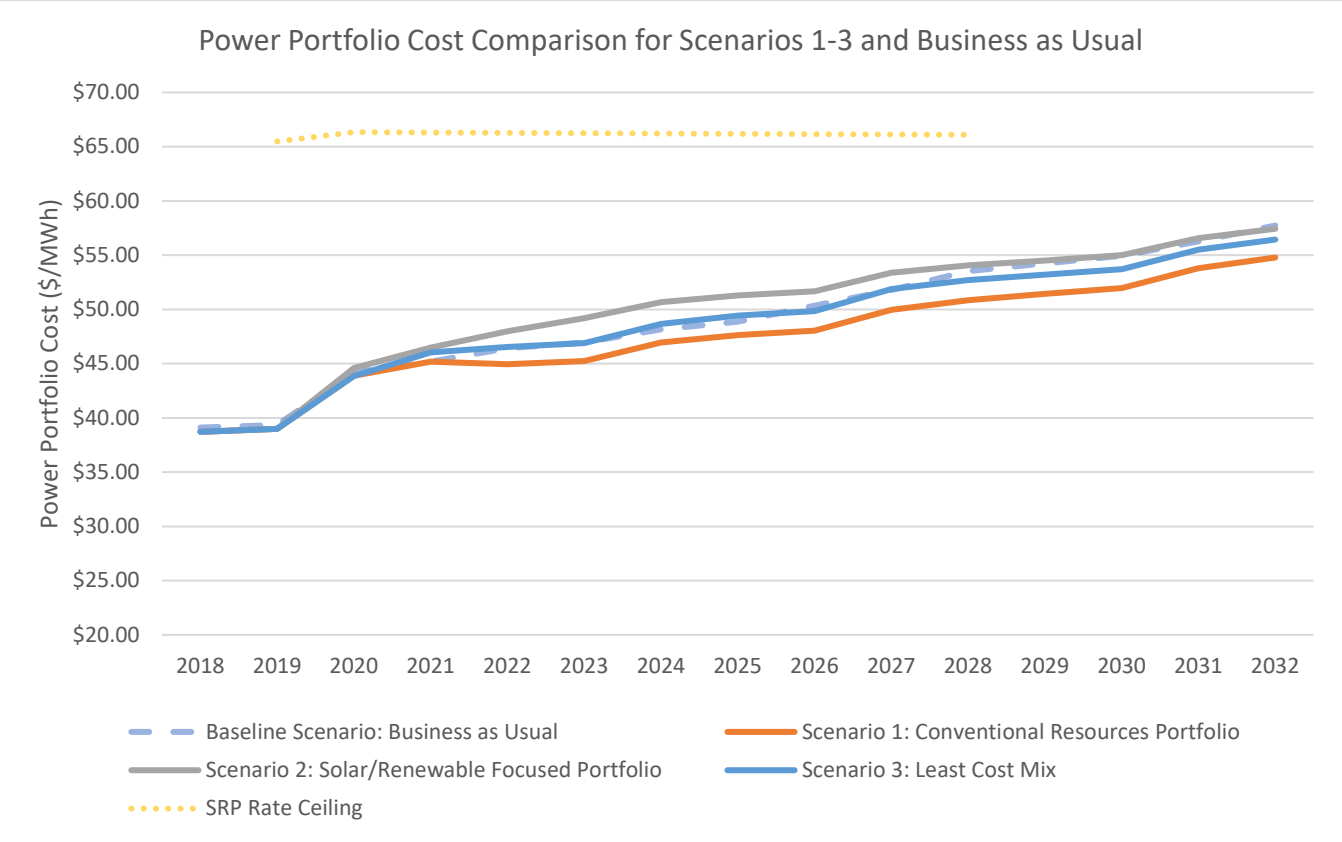
In the second Alternative Scenario, Mesa would proceed, in a similar manner to how it has historically; utilizing competitive requests for proposals, however, it would actively seek solar and renewable power products through those competitive requests. Because it is anticipated that this would place some upward pressure on overall portfolio costs, Mesa would acquire renewable resources over time only up to an amount that increases costs to a level that causes ERD's customers' rates/bills to be in parity with SRP's equivalent rates (in FY17/18 Mesa's utility rates were more than 10% below SRP's for an average residential customer). Demand side management programs, including AMI enabled rate structures, that reduce peak demand and whose benefits reliably exceed costs, on a present value basis using industry standard benefit-cost tests, would be developed and implemented. To help provide additional reliability, hedge against market resources and support renewable resources, Mesa will pursue options such as thermal and battery energy storage, internal combustion generation using renewable natural gas and other non-carbon technologies. Internal demand would grow slowly, but through the installation of internal/distributed generation and peak demand reductions, the requirement for investments in new transmission, substation and distribution infrastructure could be avoided or delayed for substantial amounts of time.

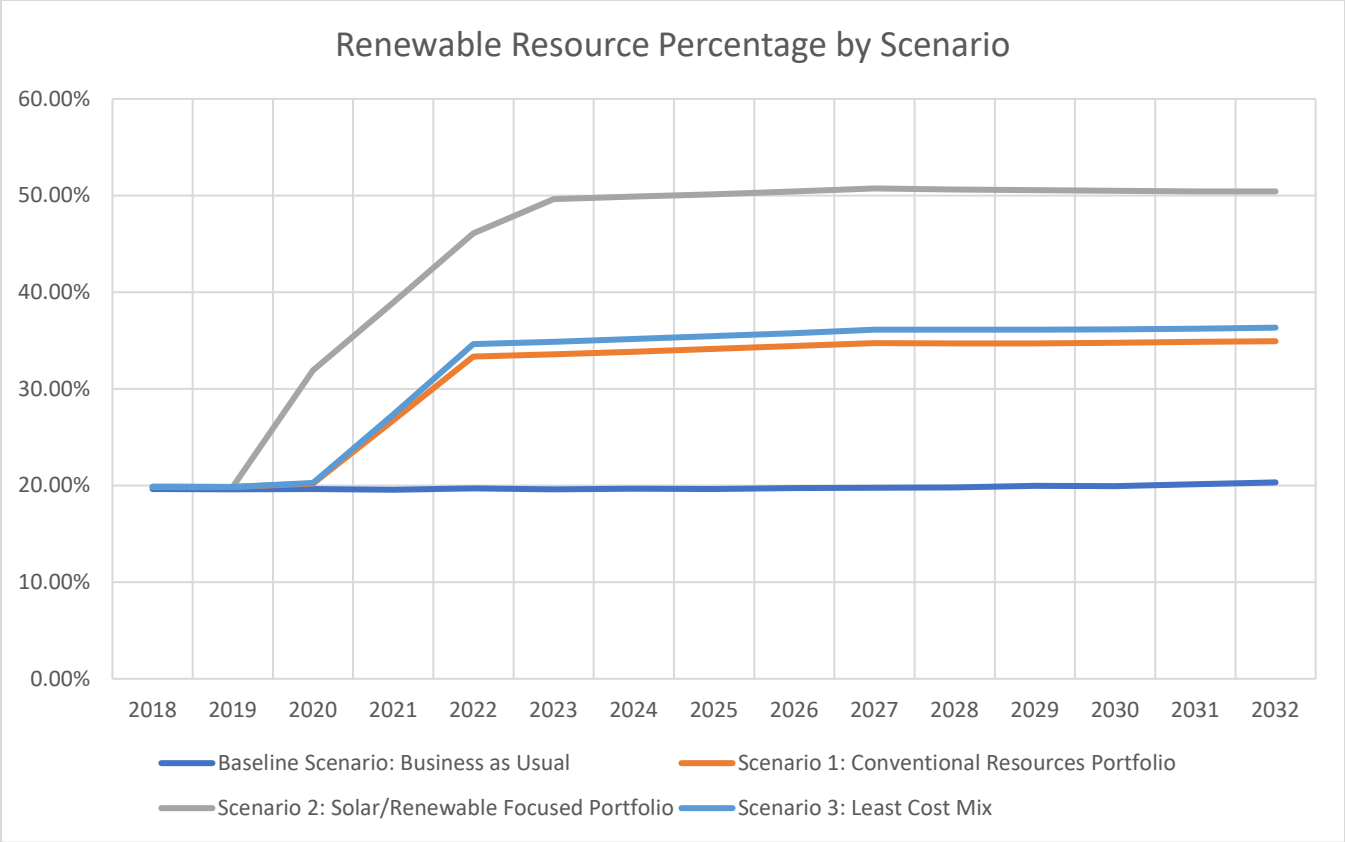
Mesa's resource supply portfolio would consist of the following resources under Alternative Scenario 2:

YEAR		2019	2020	2021	2022	2023
LOAD (MW)		**91.3**	**92.6**	**93.8**	**95.1**	**96.3**
Demand Side and Distributed Resources	Energy Efficiency	0.1	0.1	0.5	0.9	1.3
	Distributed Utility-Owned/PPA Solar	0.0	0.3	0.5	0.8	1.1
	Customer-Owned Solar	0.5	0.6	0.6	0.7	0.8
	Thermal Storage	0.0	0.7	0.7	0.7	0.7
Net Demand at Rogers		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
Supply Side Resources	SENA	14.1	14.1	0	0	0
	Citi	14.1	0	0	0	0
	Constellation	9.7	9.7	0	0	0
	Utility Scale Solar	0.0	0.0	0.0	0.0	0.0
	Utility Scale Solar with Storage	0.0	0.0	9.7	19.4	24.3
	Wind Power	0.0	3.2	3.2	3.2	3.2
	Parker- Davis	10.4	10.4	10.4	10.4	10.4

	CRSP	4.3	4.3	4.3	4.3	4.3
	New Competitively Sourced Market Purchases	19.6	30.5	44.6	34.9	30.0
	RMS Market Purch.	18.5	18.8	19.2	19.8	20.3
TOTAL SUPPLY (MW)		**90.7**	**91.0**	**91.4**	**92.0**	**92.5**
(NEED) (MW)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Alternative Scenario 2 differs from Alternative Scenario 1 in that much more renewable resources are integrated into the portfolio. This is because the wide gap between SRP rates and City of Mesa rates allows Mesa to integrate substantial amounts of renewable resources, up to the point where the addition of more renewable resources becomes logistically difficult with today's technology. Mesa would procure 10 MW of New Mexico wind (beginning deliveries in 2020). Mesa would also procure 10 MW of solar with 6 hours of storage in 2021 and 2022 and then an additional 5 MW of solar with 6 hours of storage in 2023. In total, 49.7% of Mesa's electric supply portfolio would come from renewable resources in this portfolio. Additional DSM and thermal storage compared to Alternative Scenario 1 slow down the growth in the system's demand towards 100 MW.


Power Portfolio Cost Comparison for Scenarios 1-3 and Business as Usual
Power Portfolio Cost ($/MWh)
$70.00
$65.00
$60.00
$55.00
$50.00
$45.00
$40.00
$35.00
$30.00
$25.00
$20.00
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
Baseline Scenario: Business as Usual
Scenario 1: Conventional Resources Portfolio
Scenario 2: Solar/Renewable Focused Portfolio
Scenario 3: Least Cost Mix
SRP Rate Ceiling



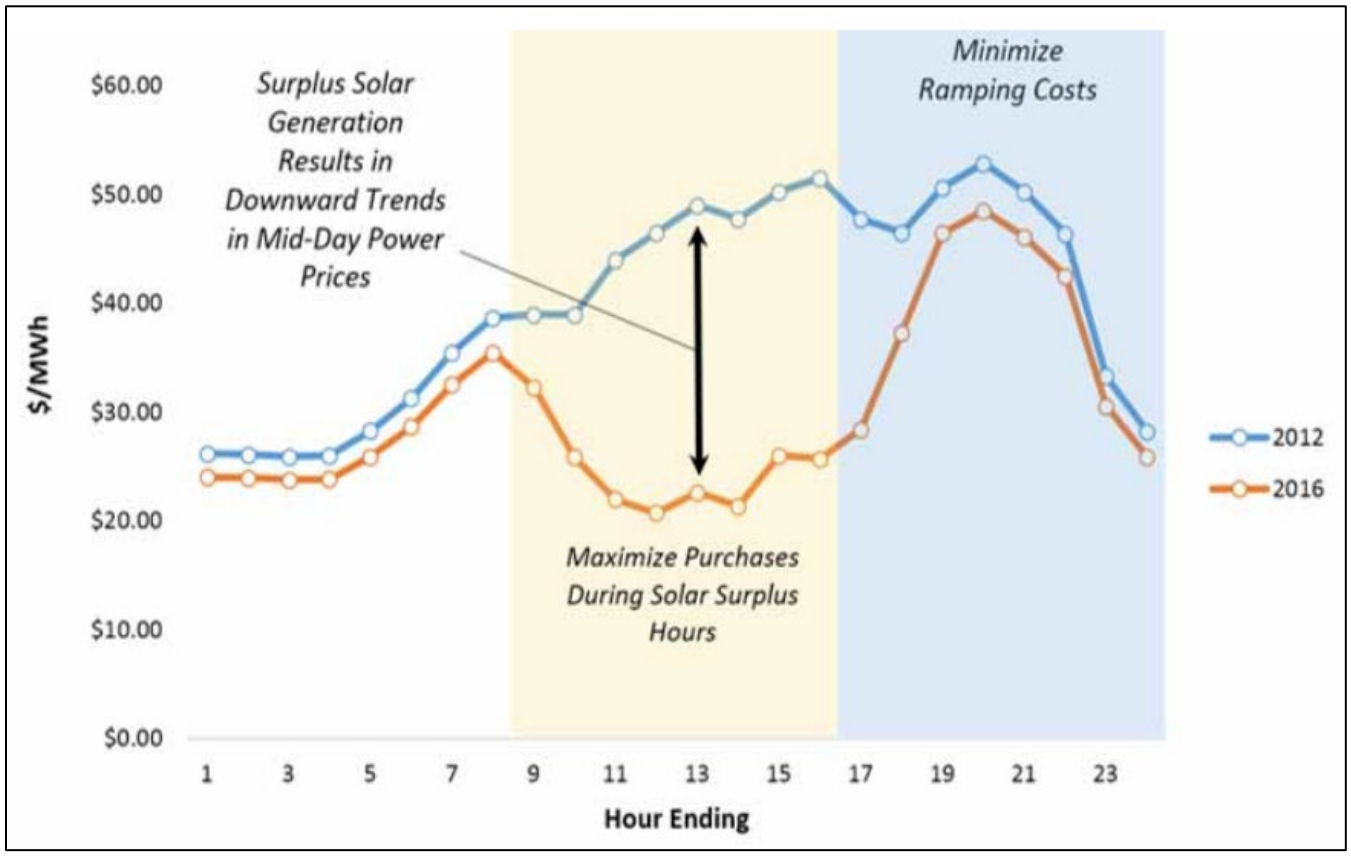
Section 10.0 – Recommended Action Plan

After discussion with City Management, council and customers, Mesa will be enacting the following Integrated Resource Plan consistent with the Preferred Scenario.

YEAR		2019	2020	2021	2022	2023 Capacity	2023 Energy
LOAD (MW)		**91.3**	**92.6**	**93.8**	**95.1**	**96.3**	**342,050**
Demand Side and Distributed Resources	Energy Efficiency	0.5	1.0	1.5	2.0	2.3	9,067
	Dist. Utility Solar	0.3	0.5	0.9	1.2	1.6	5,697
	Dist. Gas Generation	0.0	0.0	2.1	2.1	4.2	18,250
	Customer-Owned Solar	0.4	0.4	0.5	0.5	0.6	1,848
	Thermal Storage	0.0	0.0	0.0	0.6	0.6	0
	Battery Storage	0.0	0.5	1.0	1.0	1.0	0
Net Demand at Rogers		**90.2**	**90.1**	**87.8**	**87.6**	**86.0**	**307,189**
Supply Side Resources	SENA	14.1	14.1	0.0	0.0	0.0	0
	Constellation	9.7	9.7	0.0	0.0	0.0	0

	Utility Scale Solar	0.0	0.0	6.2	6.2	6.2	22,999
	Utility Scale Solar with Storage	0.0	0.0	0.0	0.0	9.7	22,999
	Parker- Davis	10.4	10.4	10.4	10.4	10.4	49,253
	CRSP	4.3	4.3	4.3	4.3	4.3	14,095
	New Competitively Sourced Market Purchases	29.1	29.1	48.5	48.5	38.8	179,412
	RMS Market Purch.	22.6	22.5	18.4	18.2	16.6	18,431
TOTAL SUPPLY (MW)		**90.2**	**90.1**	**87.8**	**87.6**	**86.0**	**307,189**
(NEED) (MW)		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**

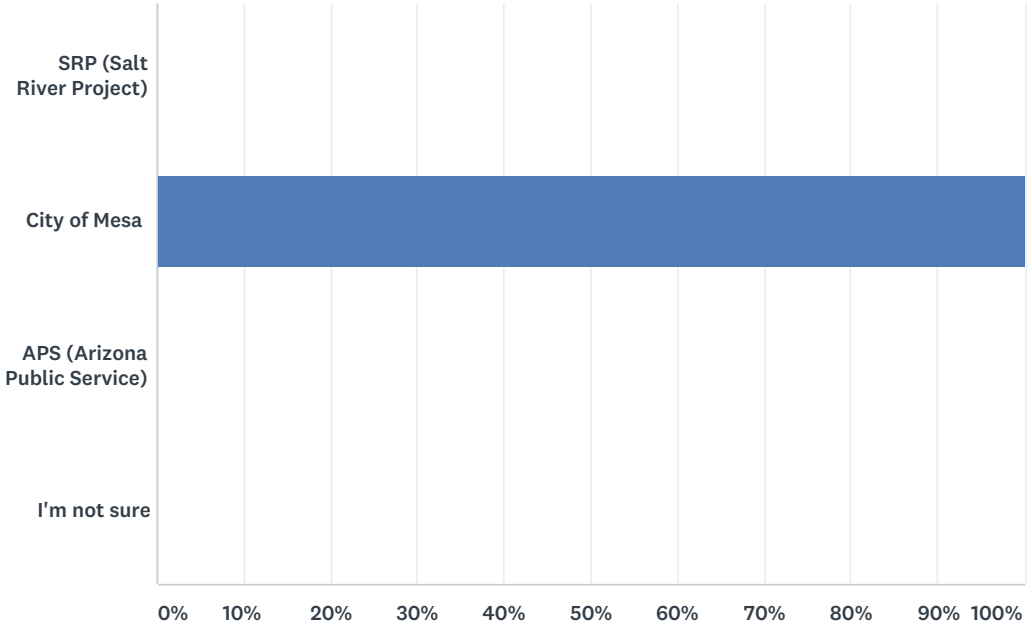
Appendix A: Solar Energy Effect "Duck Curve"



Appendix B: First Customer Survey Full Results

Q1 Who is your electricity provider?

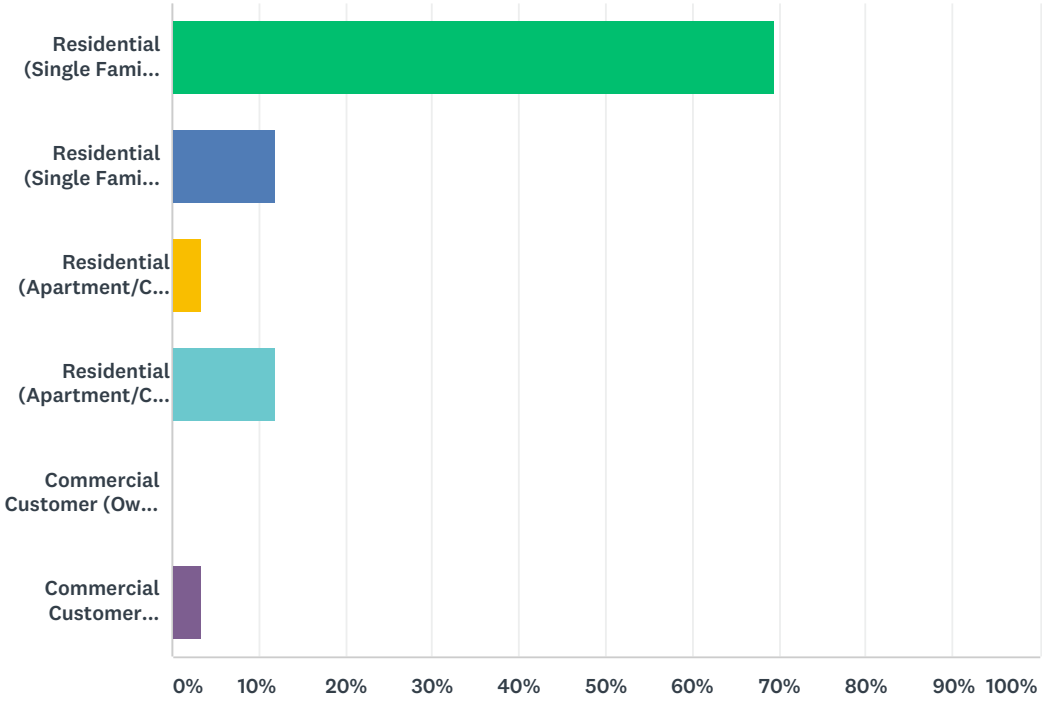
Answered: 59 Skipped: 0



ANSWER CHOICES	RESPONSES	
SRP (Salt River Project)	0.00%	0
City of Mesa	100.00%	59
APS (Arizona Public Service)	0.00%	0
I'm not sure	0.00%	0
TOTAL		59

Q2 What type of electric customer are you:

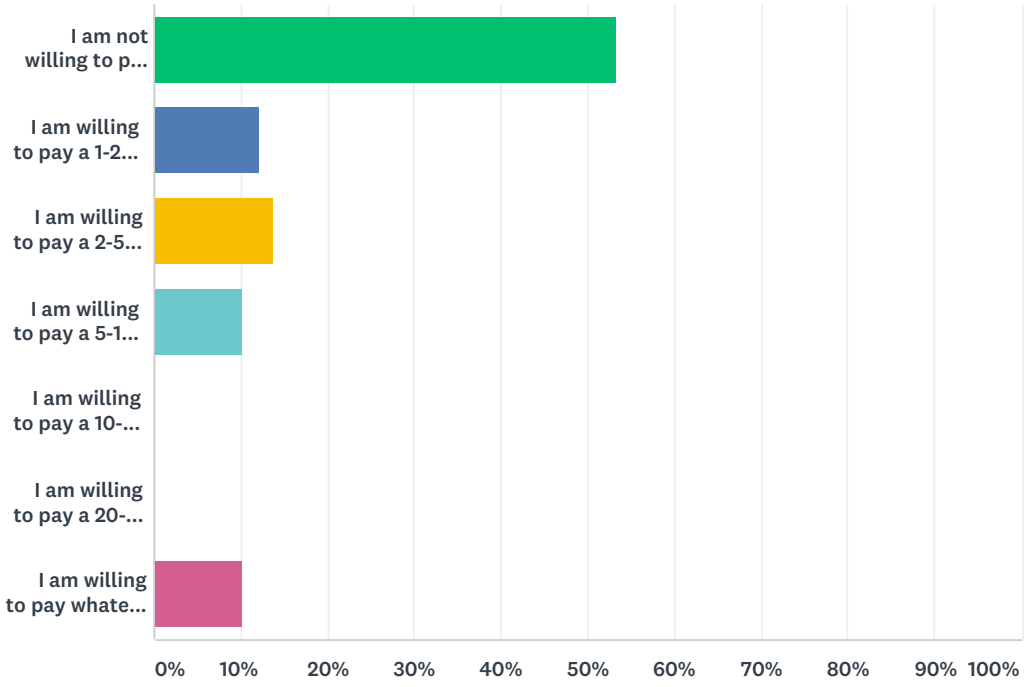
Answered: 59 Skipped: 0



ANSWER CHOICES	RESPONSES	
Residential (Single Family Home – Owner Occupied)	69.49%	41
Residential (Single Family Home – Renting)	11.86%	7
Residential (Apartment/Condominium – Owner Occupied)	3.39%	2
Residential (Apartment/Condominium – Renting)	11.86%	7
Commercial Customer (Owner Occupied)	0.00%	0
Commercial Customer (Rent/Lease space)	3.39%	2
TOTAL		59

Q3 Providing you with more renewable energy involves using more costly resources (compared to the current energy that COM provides you). Which of the following choices below characterizes your support of the use of renewable power:

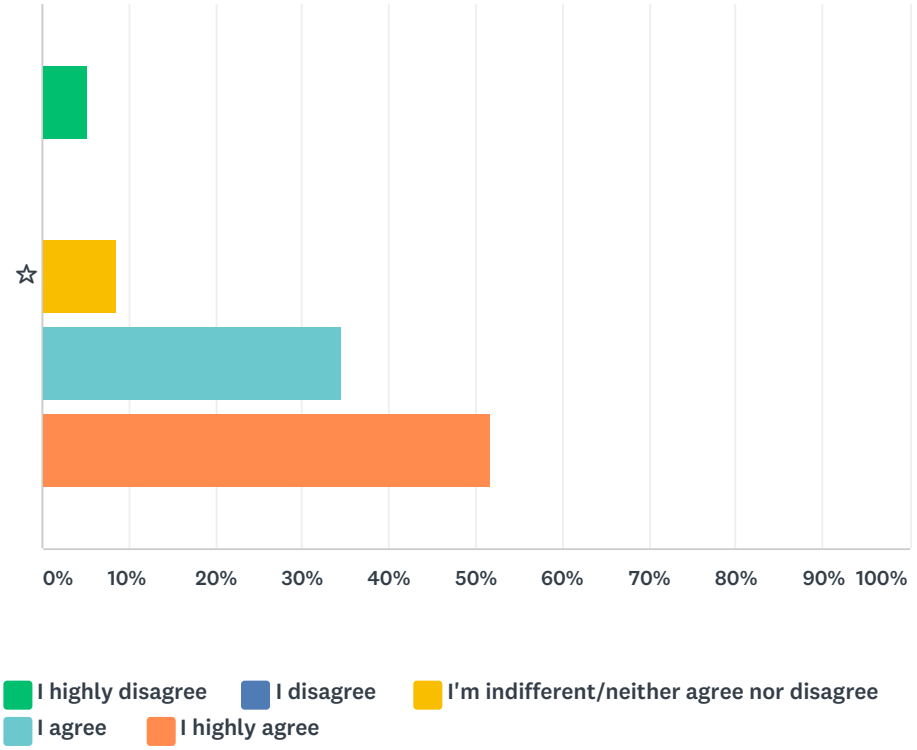
Answered: 58 Skipped: 1



ANSWER CHOICES	RESPONSES	
I am not willing to pay an increase in my utility energy bill for renewable resources	53.45%	31
I am willing to pay a 1-2% increase in my utility energy bill if some of it could come from renewable resources	12.07%	7
I am willing to pay a 2-5% increase in my utility energy bill if some of it could come from renewable resources	13.79%	8
I am willing to pay a 5-10% increase in my utility energy bill if some of it could come from renewable resources	10.34%	6
I am willing to pay a 10-20% increase in my utility energy bill if some of it could come from renewable resources	0.00%	0
I am willing to pay a 20-40% increase in my utility energy bill if some of it could come from renewable resources	0.00%	0
I am willing to pay whatever bill increase that it takes to maximize the renewable resources that provide my energy	10.34%	6
TOTAL		58

Q4 Do you agree with this statement?"I actively manage my energy use by trying to conserve energy."

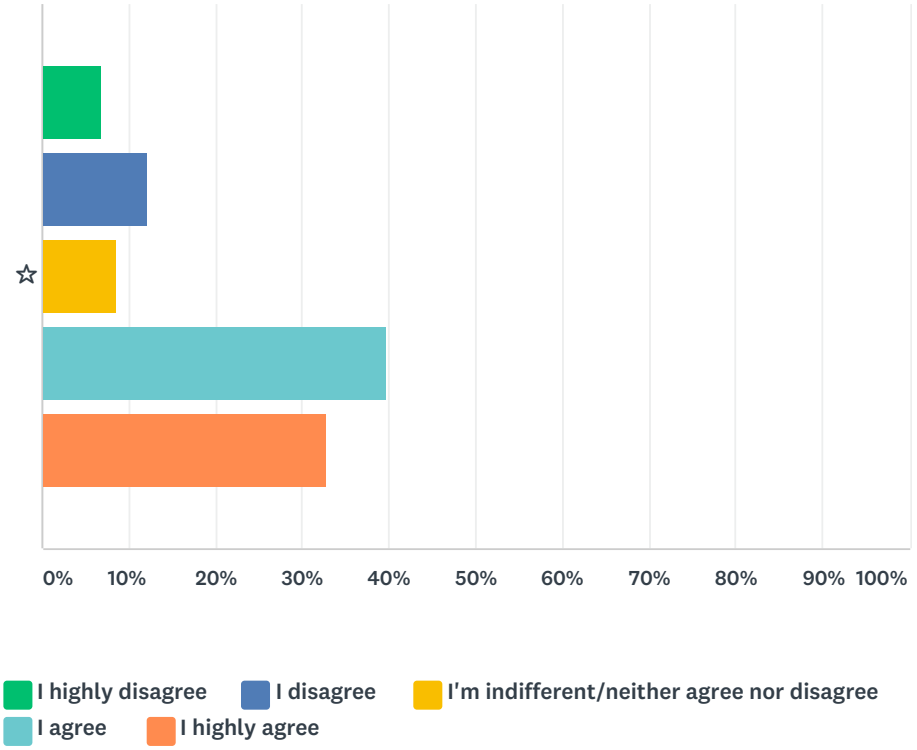
Answered: 58 Skipped: 1



	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	5.17% 3	0.00% 0	8.62% 5	34.48% 20	51.72% 30	58	4.28

Q5 Do you agree with this statement?"I feel that I have the information necessary to make decisions on how to best save energy."

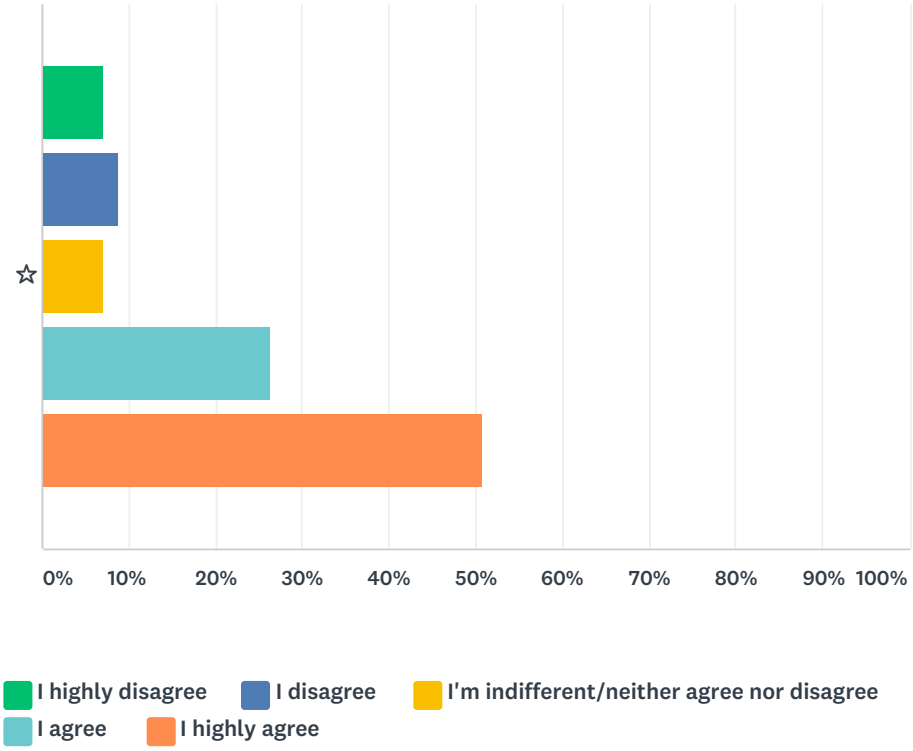
Answered: 58 Skipped: 1



	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	6.90% 4	12.07% 7	8.62% 5	39.66% 23	32.76% 19	58	3.79

Q6 Do you agree with this statement?"I have upgraded fixtures or appliances in my home/business that reduce my energy consumption (i.e. replaced air conditioner, replaced light bulbs with more efficient bulbs) over the past five years."

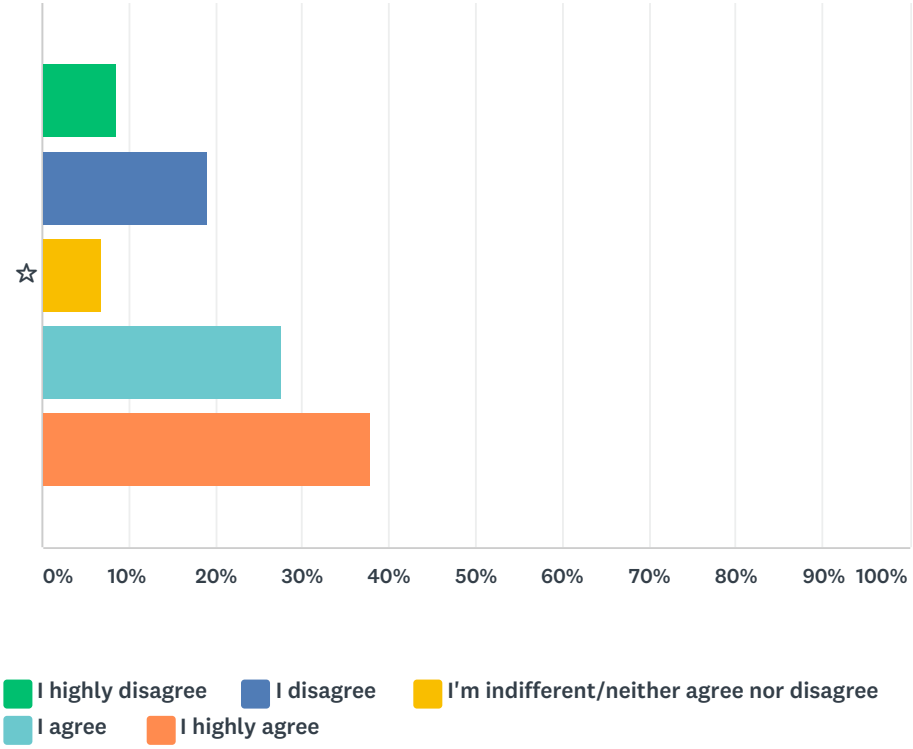
Answered: 57 Skipped: 2



	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	7.02% 4	8.77% 5	7.02% 4	26.32% 15	50.88% 29	57	4.05

Q7 Do you agree with this statement?"I have paid more money for high efficiency fixtures or appliances specifically to save more energy than the standard options (such as buying a higher efficiency air conditioner than the base model or purchasing ENERGY STAR labelled appliances and electronics)"

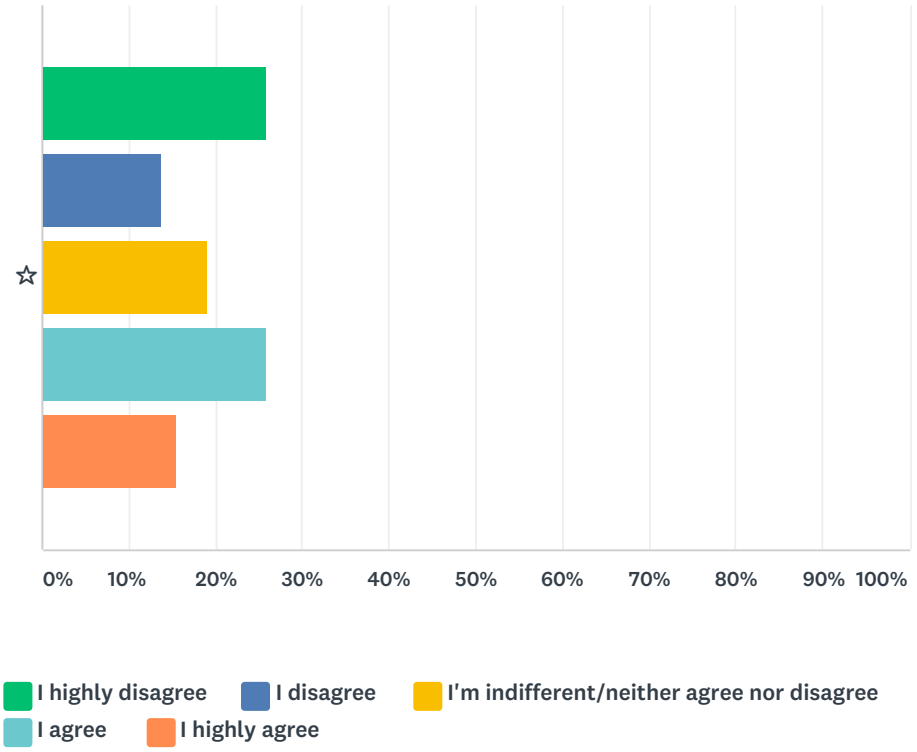
Answered: 58 Skipped: 1



	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	8.62% 5	18.97% 11	6.90% 4	27.59% 16	37.93% 22	58	3.67

Q8 If, for instance, the City of Mesa wasn't able to purchase large amounts of renewable energy for all of the utility customers, there may be opportunities for those customers who are interested in covering their OWN energy use with renewable energy. Do you agree with this statement:"I am interested in participating in a program where, for some additional cost on my energy bill, Mesa will purchase renewable energy on my behalf to cover my OWN energy use"

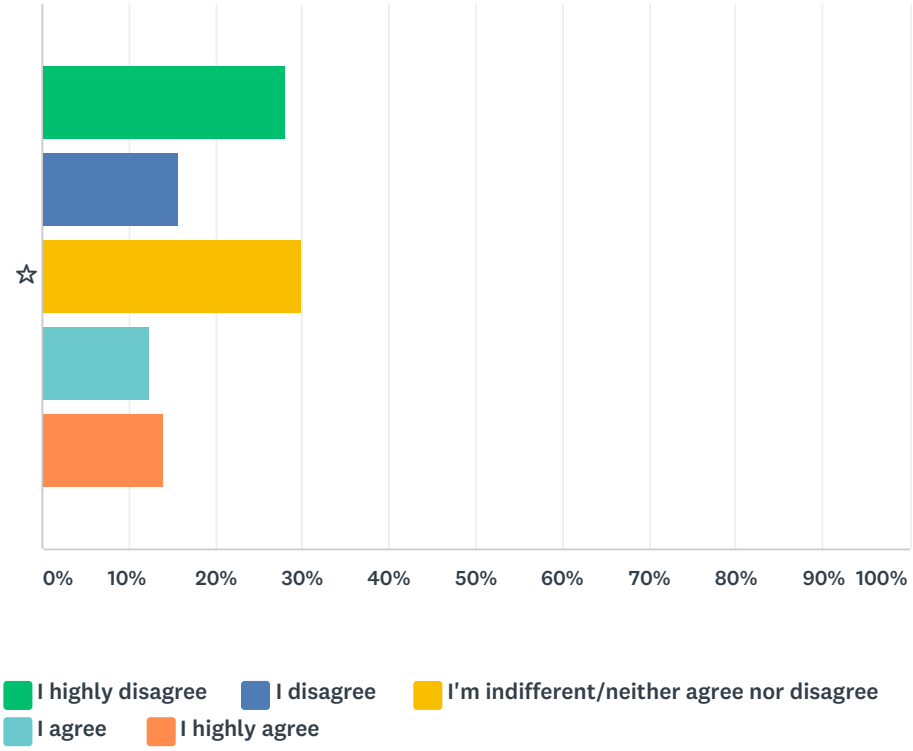
Answered: 58 Skipped: 1



	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	25.86% 15	13.79% 8	18.97% 11	25.86% 15	15.52% 9	58	2.91

Q9 Do you agree with this statement?"I am interested in participating in a program where I can purchase environmental credits (sometimes called “Carbon offsets”) for some additional cost to offset the emissions of my energy use"

Answered: 57 Skipped: 2

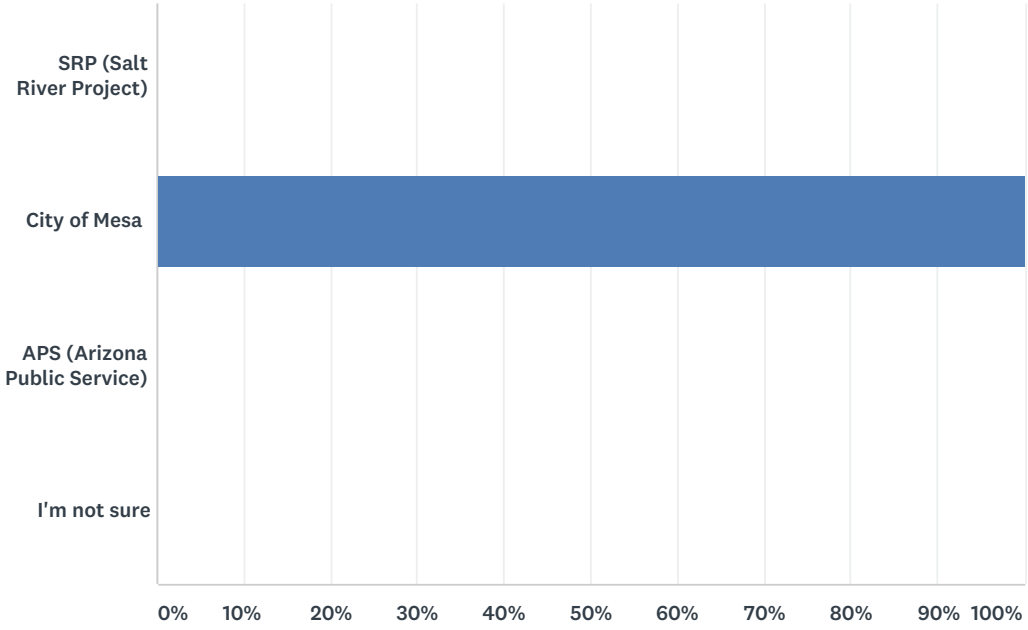


	I HIGHLY DISAGREE	I DISAGREE	I'M INDIFFERENT/NEITHER AGREE NOR DISAGREE	I AGREE	I HIGHLY AGREE	TOTAL	WEIGHTED AVERAGE
☆	28.07% 16	15.79% 9	29.82% 17	12.28% 7	14.04% 8	57	2.68

Appendix C: Second Customer Survey Full Results

Q1 Who is your electricity provider?

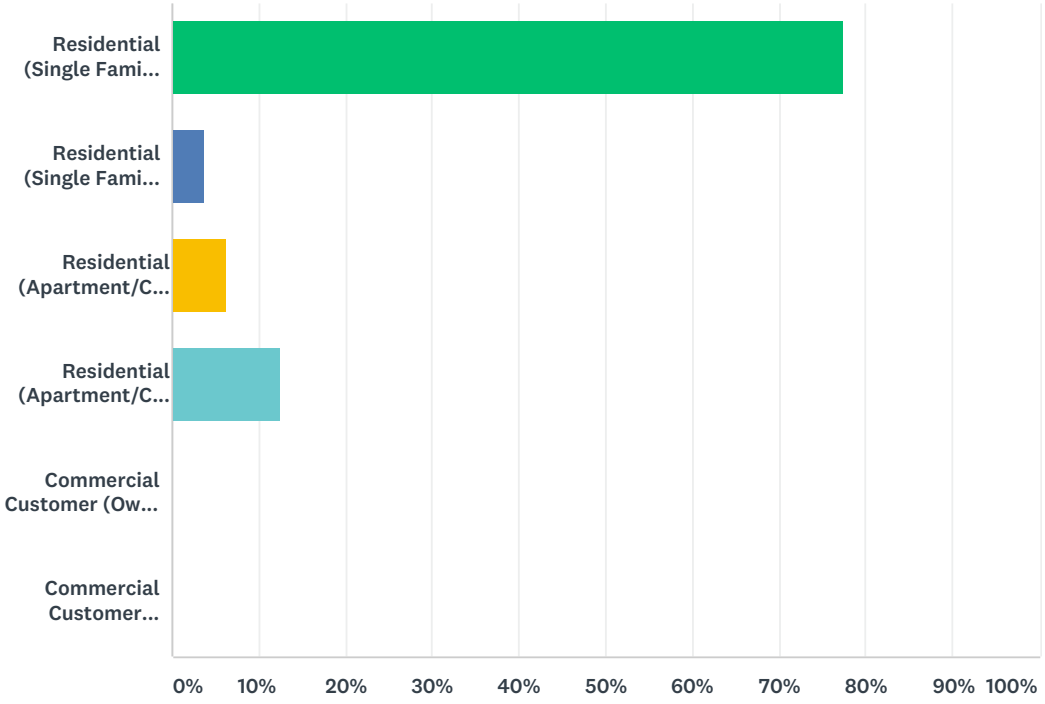
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
SRP (Salt River Project)	0.00%	0
City of Mesa	100.00%	80
APS (Arizona Public Service)	0.00%	0
I'm not sure	0.00%	0
TOTAL		80

Q2 What type of electric customer are you:

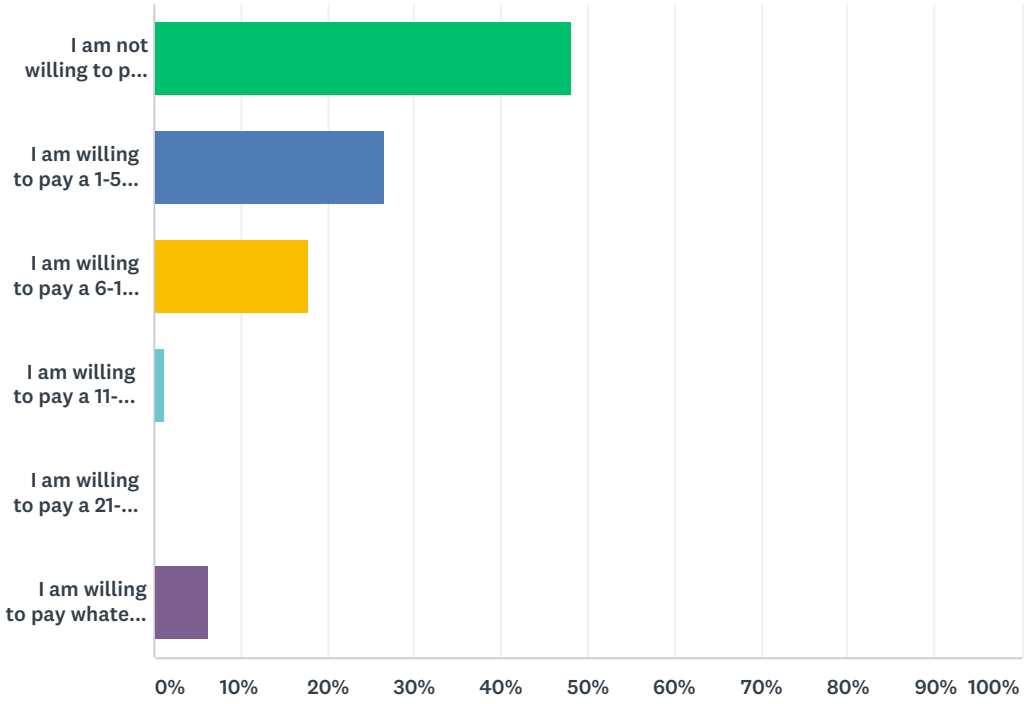
Answered: 80 Skipped: 0



ANSWER CHOICES	RESPONSES	
Residential (Single Family Home – Owner Occupied)	77.50%	62
Residential (Single Family Home – Renting)	3.75%	3
Residential (Apartment/Condominium – Owner Occupied)	6.25%	5
Residential (Apartment/Condominium – Renting)	12.50%	10
Commercial Customer (Owner Occupied)	0.00%	0
Commercial Customer (Rent/Lease space)	0.00%	0
TOTAL		80

Q3 If Mesa provides you with more renewable energy, this will involve using more costly resources (compared to the current energy that COM provides you). Which of the following choices below characterizes your support of the use of renewable power:

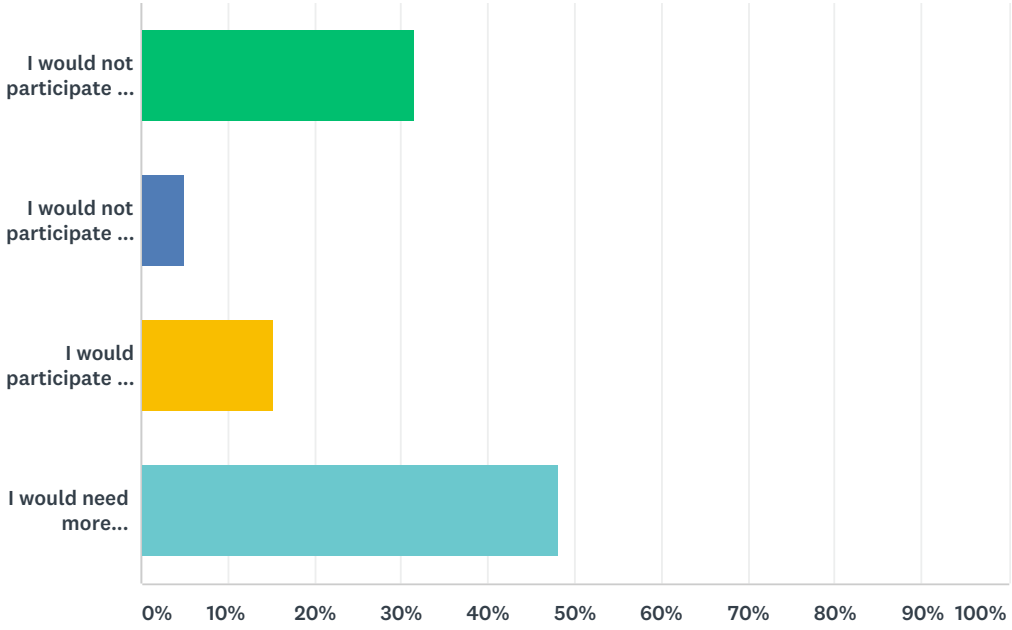
Answered: 79 Skipped: 1



ANSWER CHOICES	RESPONSES	
I am not willing to pay an increase in my utility energy bill for renewable resources	48.10%	38
I am willing to pay a 1-5% increase in my utility energy bill if some of it could come from renewable resources	26.58%	21
I am willing to pay a 6-10% increase in my utility energy bill if some of it could come from renewable resources	17.72%	14
I am willing to pay a 11-20% increase in my utility energy bill if some of it could come from renewable resources	1.27%	1
I am willing to pay a 21-40% increase in my utility energy bill if some of it could come from renewable resources	0.00%	0
I am willing to pay whatever bill increase that it takes to maximize the renewable resources that provide my energy	6.33%	5
TOTAL		79

Q4 The City of Mesa is considering offering a "Green Tariff" program. This is a program where you, as a customer, can elect to have either 25%, 50%, 75% or 100% of your annual energy come from a renewable resource (like solar or wind power) where each kWh of energy costs a little bit more. Would you be interested in participating in this program?

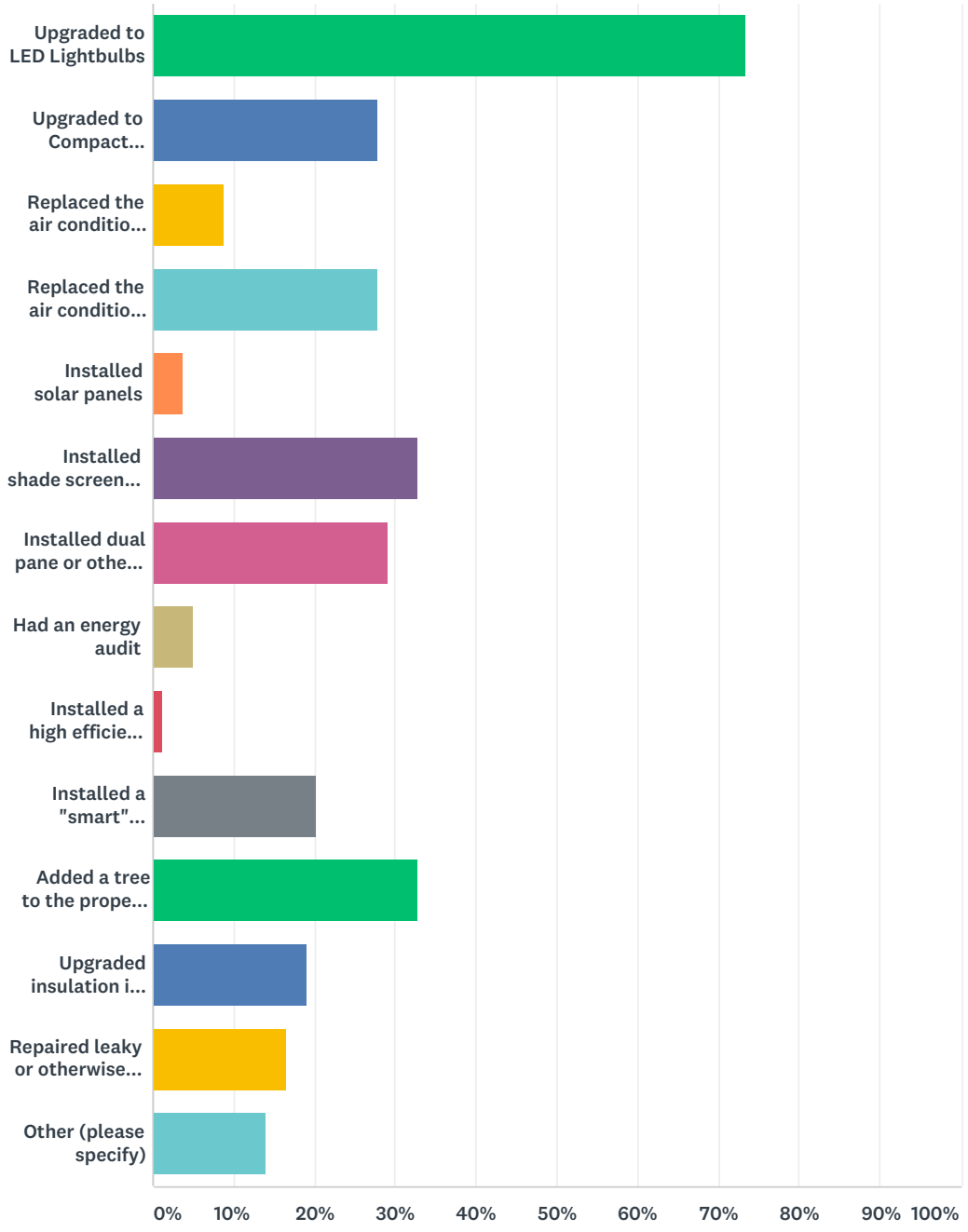
Answered: 79 Skipped: 1



ANSWER CHOICES	RESPONSES	
I would not participate in this program, but I would support the City of Mesa offering it if it doesn't impact my bills	31.65%	25
I would not participate in this program and don't want the City of Mesa to offer it	5.06%	4
I would participate in this program	15.19%	12
I would need more information to decide either way	48.10%	38
TOTAL		79

Q5 What energy efficiency upgrades have you made to your home or business? (check all that apply)

Answered: 79 Skipped: 1

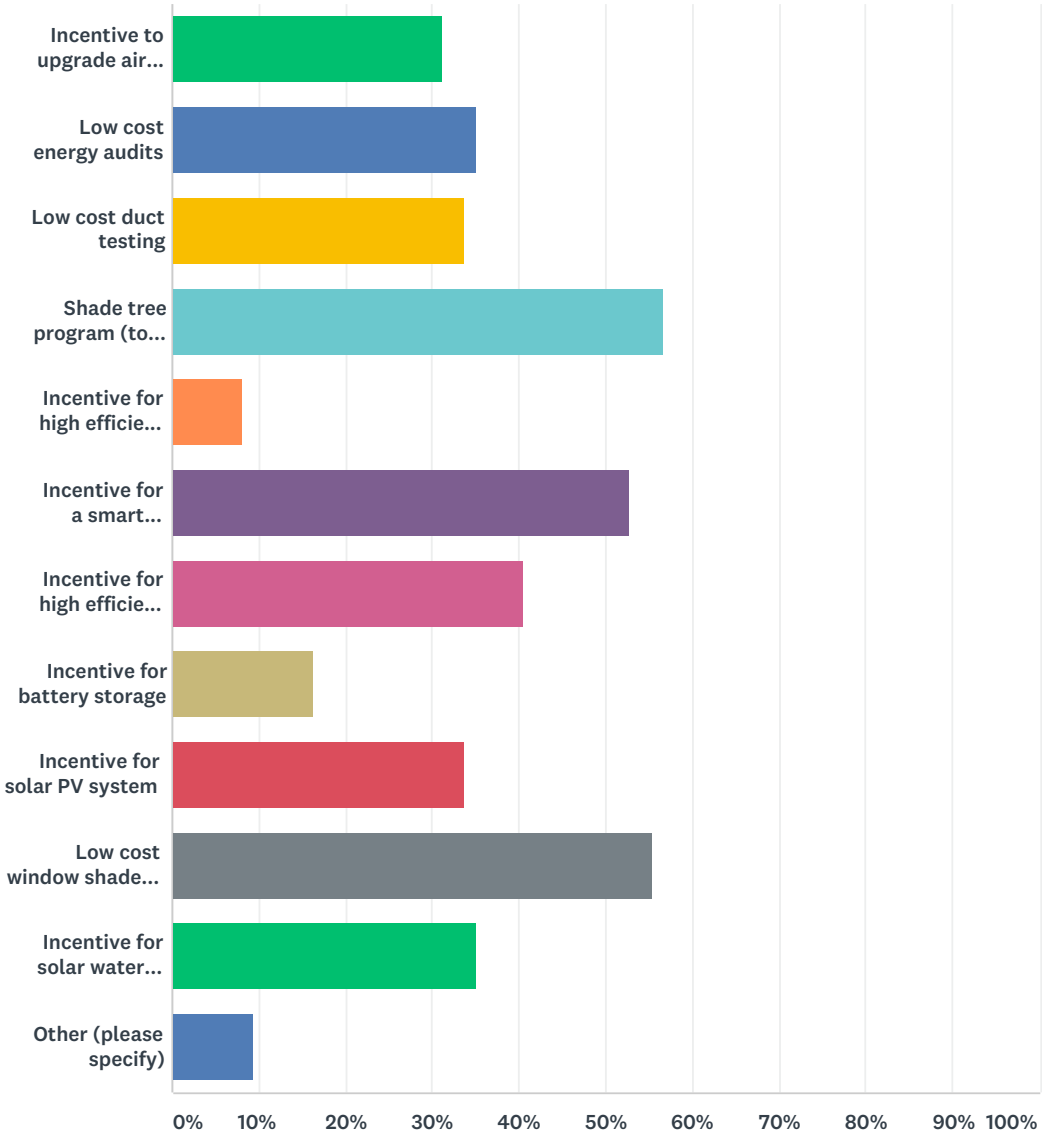


ANSWER CHOICES	RESPONSES	
Upgraded to LED Lightbulbs	73.42%	58
Upgraded to Compact Flourescent (CFL) Lightbulbs	27.85%	22
Replaced the air conditioner in the last 5 years with a standard model	8.86%	7
Replaced the air conditioner in the last 5 years with a high efficiency model	27.85%	22

Installed solar panels	3.80%	3
Installed shade screens over the windows	32.91%	26
Installed dual pane or other high efficiency windows	29.11%	23
Had an energy audit	5.06%	4
Installed a high efficiency pool pump	1.27%	1
Installed a "smart" thermostat	20.25%	16
Added a tree to the property to shade the building	32.91%	26
Upgraded insulation in the attic or walls	18.99%	15
Repaired leaky or otherwise broken air conditioning ducts	16.46%	13
Other (please specify)	13.92%	11
Total Respondents: 79		

Q6 What energy efficiency programs would you use if the City of Mesa Electric Utility implemented them? (check all that apply)

Answered: 74 Skipped: 6



ANSWER CHOICES	RESPONSES	
Incentive to upgrade air conditioner to a high efficiency model	31.08%	23
Low cost energy audits	35.14%	26
Low cost duct testing	33.78%	25
Shade tree program (to reduce direct sunlight on the building)	56.76%	42
Incentive for high efficiency pool pumps	8.11%	6
Incentive for a smart thermostat	52.70%	39
Incentive for high efficiency appliance upgrades (i.e. high efficiency refrigerator or washer/dryer)	40.54%	30

Incentive for battery storage	16.22%	12
Incentive for solar PV system	33.78%	25
Low cost window shade screens	55.41%	41
Incentive for solar water heating	35.14%	26
Other (please specify)	9.46%	7
Total Respondents: 74		

Appendix D: Western Area Power Administration IRP Requirements

1. Does the IRP evaluate the full range of alternatives for new energy resources (905.11(a))?
    - New generating capacity?
    - Power purchases?
    - Energy conservation and efficiency?
    - Cogeneration and district heating/cooling applications?
    - Renewable energy resources?
2. Does the IRP provide adequate and reliable service to the customer's electric consumers (905.11(a))?
3. Does the IRP take into account the necessary features for system operation (905.11(a))?
    - Diversity?
    - Reliability?
    - Dispatchability?
    - Other risk factors?
4. Does the IRP take into account the ability to verify energy savings achieved through energy efficiency (905.11(a))?
5. Does the IRP take into account the projected durability of such savings measured over time (905.11(a))?
6. Does the IRP treat demand and supply resources on a consistent and integrated basis (905.11(a))?
7. Does the IRP consider electrical energy resource needs? The IRP may, at the customer's option, consider water, natural gas, and other energy resource options (905.11(b)).
8. Does the IRP identify and compare resource options? The customer must conduct an assessment and comparison of available existing and future supply and demand-side resource options based on its size, type, resource needs, geographic location and competitive situation. The options should relate to the customer's unique resource situation as determined by profile data (service area, geographical characteristics, customer mix, historical loads, projected growth, existing system data, rates and financial information) (905.11(b)(1)).
    - Supply-side options include, but are not limited to, purchased power contracts, and conventional and renewable generation options (905.11(b)(1)(i)).

- Demand-side options alter the customer's use pattern to provide for an improved combination of energy services to the customer and ultimate consumer (905.11(b)(1)(ii)).
- Considerations that may be used to develop potential options include cost, market potential, consumer preferences, environmental impacts, demand or energy impacts, implementation issues, revenue impacts, and commercial availability (905.11(b)(1)(iii)).

9. Does the IRP clearly demonstrate that decisions were based on a reasonable analysis of the options (905.11(b)(1)(iv))?

10. Does the IRP include an action plan describing specific actions the customer will take to implement the IRP (905.11(b)(2))?

11. Does the IRP list the time period that the action plan covers (905.11(b)(2)(i))?

12. Does the IRP include an action plan summary consisting of (905.11(b)(2)(ii)(a-c):

- Actions the customer expects to take in accomplishing the goals identified in the IRP?
- Milestones to evaluate accomplishment of those actions during implementation?
- Estimated energy and capacity benefits for each action planned?

13. Does the IRP, to the extent practicable, minimize adverse environmental effects of new resource acquisitions and document these efforts (905.11(b)(3))?

14. Does the IRP include a qualitative analysis of environmental effects in a summary format (905.11(b)(3))?

15. Does the IRP provide ample opportunity for full public participation in preparing and developing the IRP (905.11(b)(4))?

16. Does the IRP include a brief description of public involvement activities (905.11(b)(4))?

- How the customer gathered information from the public?
- How public concerns were identified?
- How information was shared with the public?
- How public comments were responded to?

17. Does the IRP document that each MBA member approved the IRP, confirming that all requirements have been met (905.11(b)(4)(i))?

18. Does the IRP contain the signature of each MBA member's responsible official, or document passage of an approval resolution by the appropriate governing body (905.11(b)(4)(i))?

19. Does the IRP contain a statement that the customer conducted load forecasting, including specific data (905.11(b)(5))?

20. Does the IRP contain a brief description of measurement strategies for identified options to determine whether the IRP's objectives are being met (905.11(b)(6))?

21. Does the IRP identify a baseline from which the customer will measure the benefits of IRP implementation (905.11(b)(6))?

22. Does the IRP specify the responsibilities and participation levels of individual members of the MBA and the MBA (905.12(b)(2))?

Appendix E: Large Customer (Data Center) Addition

Mesa has been active in pursuing small to medium data center customers as new customer additions within the ESA. These data center customers are large electrical loads (Mesa's target data center is approximately 5 – 20 MW of load) which have very high load factors. This addition would very quickly increase the potential peak load at Rogers to over 100 MW; above Mesa's current capacity. Mesa has studied various alternatives to provide for more capacity including:

1. **Install a second substation with WAPA and corresponding transmission extension.** This option would involve a large capital investment and would likely require a long lead time to secure funding, put in place all necessary easements and other land acquisitions and design and seek approval for the project.
2. **Request Additional Capacity at Rogers from SRP.** Rogers substation was built with a total redundant capacity of 280 MW, of which Mesa owns 100 MW. Mesa could approach SRP to purchase additional short-term or long-term capacity rights at the substation.
3. **Construct Additional Capacity at Rogers.** Rogers substation has available space for another transformer of similar size to the transformers that are installed. Installing a third transformer would provide for a total of 200 MW of N+1 capacity at the station.
4. **Construct Mesa's District Energy Center.** The addition of a customer of this size could provide a revenue justification for installing a "District Energy Center" or "DEC". The DEC would be a highly efficient, economic generation station that would integrate Mesa's electric utility to Mesa's district cooling utility through trigeneration and energy storage. The DEC would consist of 10-20 MW of natural gas powered reciprocating or turbine engines. The engines would be setup so that the waste heat from the exhaust and/or cooling systems would be extracted and run through absorption chillers which would provide cooling services for the district cooling system and/or the data center customer itself. The natural gas for the center would be sourced directly from Mesa's own natural gas utility; ensuring stable and economic pricing. Additionally, thermal and possibly battery storage could be installed on site to help shift demand away from peak times. Solar photovoltaics could be installed on the roof of the DEC, however, this would only contribute a minimal amount of energy to the DEC because of the small footprint required.

5. **Implement Energy Efficiency and Other Demand Side Measures to Offset the Additional Demand.**

If a large data center is proposed within Mesa's system, Mesa will first approach SRP to request additional capacity at Rogers. Following that, Mesa will coordinate with City Management, Council, Customers and the data center customer to determine the most optimal plan of action.