

Electric Resource Plan  
**Annual Progress Report**

**for**

**Tri-State Generation and Transmission  
Association, Inc.**

**Submitted to:  
Colorado Public Utilities Commission**

**October 31, 2018**

## Background

In accordance with the stipulated resource planning process approved by Commission Decision No. C10-0101, in Docket No. 09I-041E and Rule 3618 (a) of the Colorado Public Utilities Commission's Rules Regulating Electric Utilities, Tri-State Generation and Transmission Association, Inc. (Tri-State) submits the following Annual Progress Report (APR) to the Public Utilities Commission of Colorado (Commission). The APR includes the required information listed in Section 3, Subsection 4 of the stipulated resource planning process. Tri-State filed its latest Electric Resource Plan (ERP) in October 2015.

This 2018 APR to the 2015 ERP contains the following sections:

- A. An updated annual electric demand and energy forecast;
- B. An updated evaluation of existing resources;
- C. An updated evaluation of planning reserve margins and contingency plans;
- D. An updated assessment of need for additional resources;
- E. An updated report of the utility's action plan;
- F. An updated report on resource scenario modeling;
- G. An updated report on the utility's efforts to give the fullest possible consideration to the cost-effective implementation of new clean energy and energy-efficient technologies (as defined in Section 1, Subsection 8) in its consideration of generation acquisitions; and
- H. Any material changes to its resource plan or action plan.

## **Forward-Looking Statement**

Forward-looking statements include statements concerning our plans, objectives, goals, strategies, future events, future revenue or performance, forecasts, including load, energy and commodities, capital expenditures, capacity needs, plans or intentions relating to acquisitions, business trends and other information that is not historical information. When used in this APR, the words "estimates," "expects," "anticipates," "projects," "plans," "intends," "believes" and "forecasts" or future or conditional verbs, such as "will," "should," "could" or "may," and variations of such words or similar expressions, are intended to identify forward-looking statements. These forward-looking statements are subject to a number of risks, uncertainties and assumptions, including those described from time to time in our filings with the Securities and Exchange Commission. All forward-looking statements, including, without limitation, management's examination of historical operating trends and data, are based upon our current expectations and various assumptions. Our expectations and beliefs are expressed in good faith and we believe there is a reasonable basis for them. However, we cannot assure you that management's expectations and beliefs will be achieved. There are a number of risks, uncertainties and other important factors that could cause our actual results to differ materially from the forward-looking statements contained in this APR.

## Summary

The intent of the APR is to discuss material changes in assumptions, fleet characteristics, load forecasts and other factors that have occurred since the previous ERP and any subsequent APRs. To the extent issues addressed in the ERP have not materially changed, they are not addressed in this APR. Significant modeling assumptions made in the 2015 ERP and subsequent 2017 APR process are continued in this APR.

As stated in the 2017 APR, Tri-State has made several changes to its resource portfolio since the 2015 ERP. In late 2016, Tri-State announced the planned retirement of two coal-fired facilities. The Nucla Generating Station will cease operations by 12/31/2022. Tri-State owns 100% of this 100 MW facility. Craig Unit I will cease operations by 12/31/2025. Tri-State's ownership share is 102 MW (24%) of this unit which has a total nameplate capacity of 427 MW.

Also since filing the 2015 ERP, three new renewable projects for which Tri-State agreed to purchase the output for 25 years, achieved commercial operation. The 30 MW San Isabel Solar facility located near Trinidad, Colorado was completed in December 2016, the 25 MW Alta Luna Solar facility located near Deming, New Mexico was completed in January 2017 and the 75 MW Twin Buttes II Wind facility located near Lamar, Colorado was completed in December 2017.

Tri-State extended, for another 10 years, its purchase of the output of the 3.5 MW Williams Fork Hydro facility near Parshall, Colorado effective January 1, 2017 and extended, for another 10 years, its purchase of the output of the 5 MW Boulder Canyon Hydro facility near Boulder, Colorado effective June 1, 2018 and included several additional small hydro facilities with an additional total capacity slightly exceeding 1 MW, as a part of this contract extension.

For this APR, Tri-State has updated forecasts of electric demand, energy and fuel prices, and has modified the production cost model inputs to reflect the changes to the Tri-State portfolio as described above. These updates and related analysis were based on finalized available data as of August 31, 2018. The results of the updated modeling are discussed below.

Tri-State's approach to resource planning remains to evaluate various resource options to not only construct a reliable and economic supply portfolio, but also to achieve a balanced set of resources based on forecasted demand, forecasted commodity prices, environmental compliance, risk, and other input assumptions.

Those components of the ERP that entailed evaluation of existing resources, reserve margins, and contingency plans, as well as assessment of additional resources and the Action Plan, remain largely unchanged and are discussed further below.

## A. Updated Annual Electric Demand and Energy Forecast

Tri-State’s demand and energy forecasts for this APR are based on analysis performed in 2018. The 2018 load forecast is in line with the 2017 load forecast.

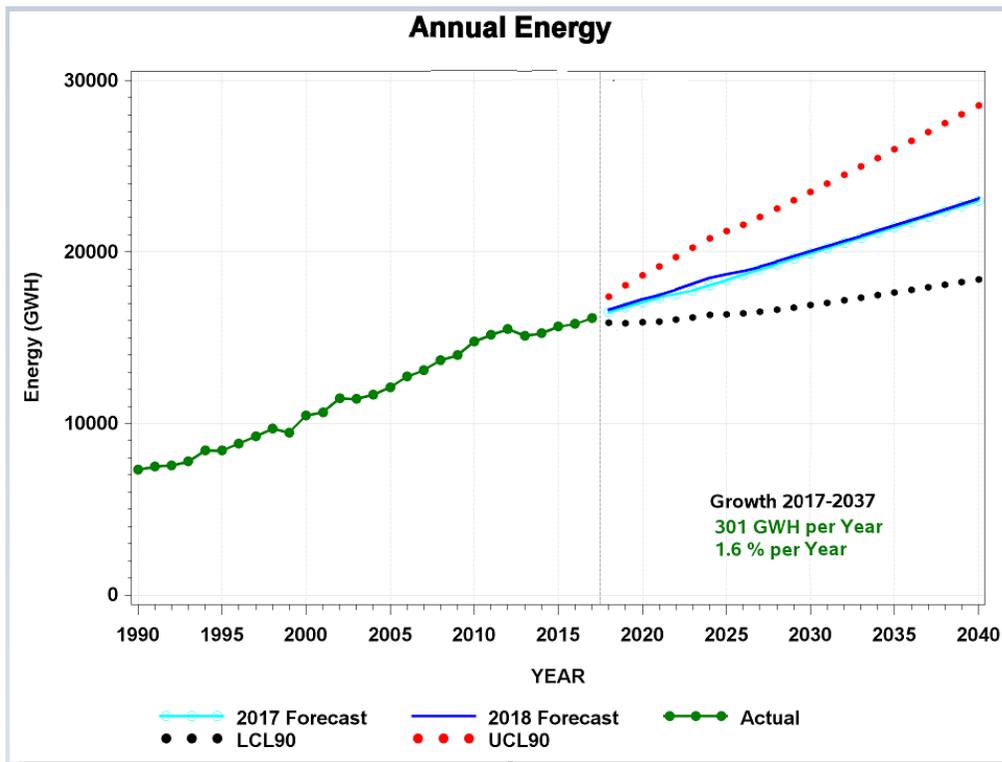
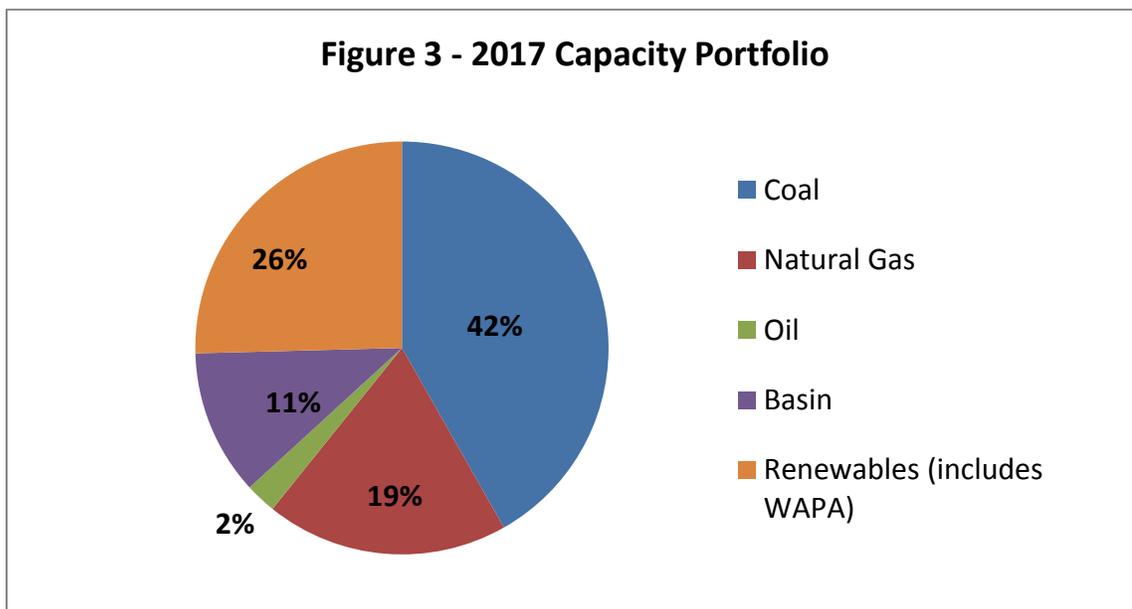
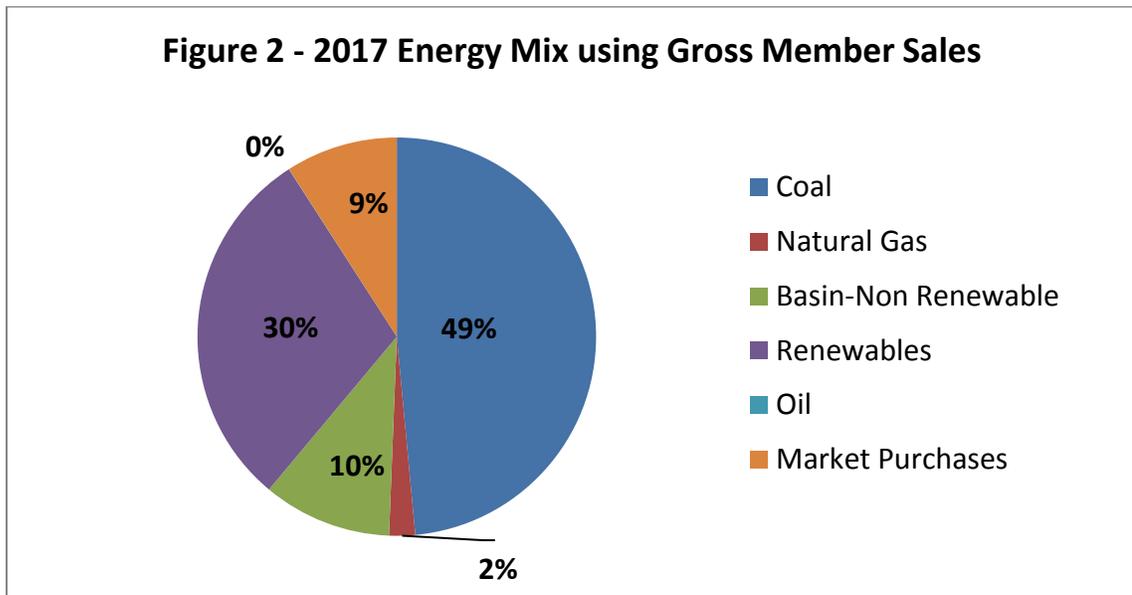


Figure 1 – Updated Load Forecast

## B. Updated Evaluation of Existing Resources

Figure 2 below depicts the sources of generation for Tri-State's 2017 energy sales to its members. Figure 3 below depicts Tri-State's 2017 capacity by generation source. Neither chart represents a material change from 2016, however Tri-State's energy supply to its members showed an increase in renewable energy and reduced supply from coal.



## **C. Updated Evaluation of Planning Reserve Margins and Contingency Plans**

Tri-State continues to develop resource plans based on a 15 percent planning reserve margin. Tri-State's participation in the Rocky Mountain Reserve Group, Southwest Reserve Sharing Group, and several bilateral hazard sharing arrangements provide additional support for reliable operations.

Tri-State stated in the 2015 ERP that it does not expect a capacity shortfall until the early to the mid-2020s unless there is a significant increase in load or existing resources were to become unavailable. The impact of the updated load forecast in this APR is shown in Section D Figure 4.

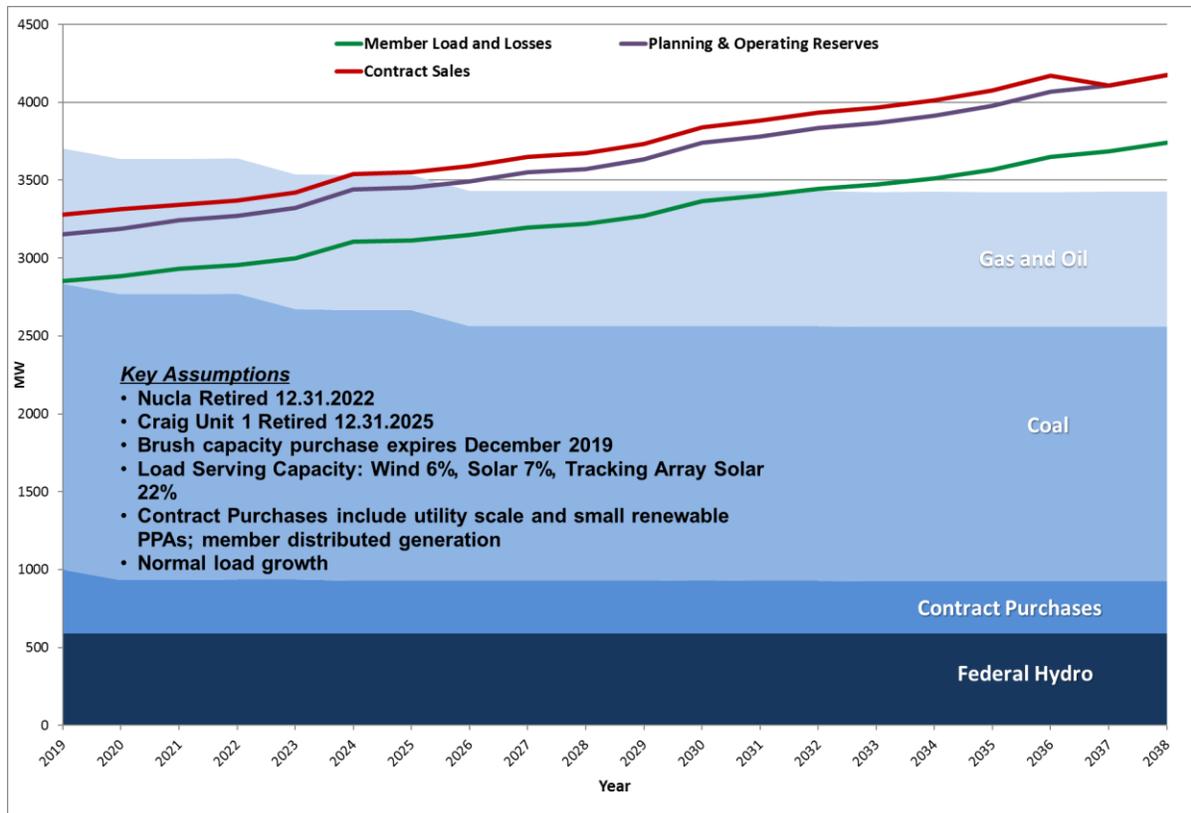
## **D. Updated Assessment of Need for Additional Resources**

Tri-State's need for additional resources was presented in Section I of the 2015 ERP. Figure 4 below provides an update based on the 2018 load forecast, new resources and demand side management effects.

The assumptions used in developing the load/resource chart below are unchanged from the 2015 ERP and are as follows:

- total obligations are defined as firm load, firm contract sales, operating reserves obligations, and planning reserves;
- all existing purchase and sales contracts are assumed to expire on their terms
- no planned capacity changes for existing plants except coal retirements as previously noted;
- no spot purchases or sales are included;
- capacity associated with renewable generation projects are listed in the assumptions on the chart.

The current load/resource balance forecast is shown in Figure 4, and indicates that under the median growth scenario, Tri-State anticipates the need for additional capacity to meet its supply obligations and planning reserve requirements in approximately 2026.



**Figure 4 - Updated Load/Resource Position**

Scenario modeling has been developed to project the timing and nature of resources that could be selected to satisfy this forecasted capacity shortfall. Resource options include demand side alternatives, natural gas generation including gas turbines and reciprocating engines, and renewable generation including solar and wind generation. No decisions have been made at this time regarding the timing, technology, size or location of new generation projects.

## **E. Updated Report of the Utility's Action Plan**

Tri-State's Action Plan was provided in Section V of the 2015 ERP and was updated in the 2017 APR. The 2017 Action Plan included the following elements which are discussed below:

- Clean Power Plan and State Plan Review and Evaluation

- Generation Planning and Development
- Transmission Planning and Development
- Possible Expansion of Renewable Energy Portfolio
- Refinement and Development of Energy Efficiency Products (EEP) & Services
- R&D Programs and Projects via EPRI & CRN

## **Clean Power Plan**

Since the 2015 ERP filing, the implementation of the Clean Power Plan (CPP) was effectively halted by a stay of the United States Supreme Court. Given that stay and the current administration's priorities, Tri-State has moderated efforts to plan for CPP implementation. Since the filing of our 2017 APR, additional activity around this item has occurred. In October 2017 the United States Environmental Protection Agency (EPA) issued a Notice of Proposed Rulemaking to repeal the CPP and provided Advanced Notice of a Proposed Rulemaking in December 2017 to begin work on a replacement rule. On August 31, 2018 the EPA published the proposed Affordable Clean Energy (ACE) rule which is intended to replace the CPP. Finalization of the ACE rule and repeal of the CPP are expected to be completed during 2019. Tri-State is currently reviewing the proposed rule and investigating its impact to our future resource plans.

## **Generation Planning and Development**

Since the filing of the 2015 ERP and subsequent 2017 APR, expected implementation of new member generation projects and new utility scale renewable projects has occurred, efforts to join the Southwest Power Pool as part of the Mountain West Transmission Group have been frustrated. Tri-State has increased its ownership share in the Missouri Basin Power Project by 3% which includes an increased share in Laramie River station and related transmission rights. This transaction was finalized in September 2018 and is not included in the expansion plan analysis for this update.

## **Transmission Planning and Development**

Tri-State owns (wholly or jointly) more than 5,500 miles of transmission lines in Colorado, Nebraska, New Mexico and Wyoming. Tri-State continues to support regional transmission study efforts.

Tri-State is continuing to make transmission investments to serve growing loads, increase reliability, ensure system stability, and support additional generation development.

In 2016, Tri-State energized the 230kV Burlington-Wray transmission project which will help relieve constraints in eastern Colorado and allow for the delivery of new renewable energy projects, including the 150 MW Carousel Wind Farm. Plans for the Lamar – Burlington 230kV project are on track to be completed by 2023, which will further alleviate existing transmission constraints in eastern Colorado and potentially support additional generation.

The planned Wayne Child Phase II project is expected to increase north to south transfer capability between southeast Wyoming and northeast Colorado. Other active projects include the Montrose – Nucla – Cahone 230kV project which is currently under construction and the planned San Luis Valley – Poncha 230kV project.

### **Possible Expansion of Renewable Energy Portfolio**

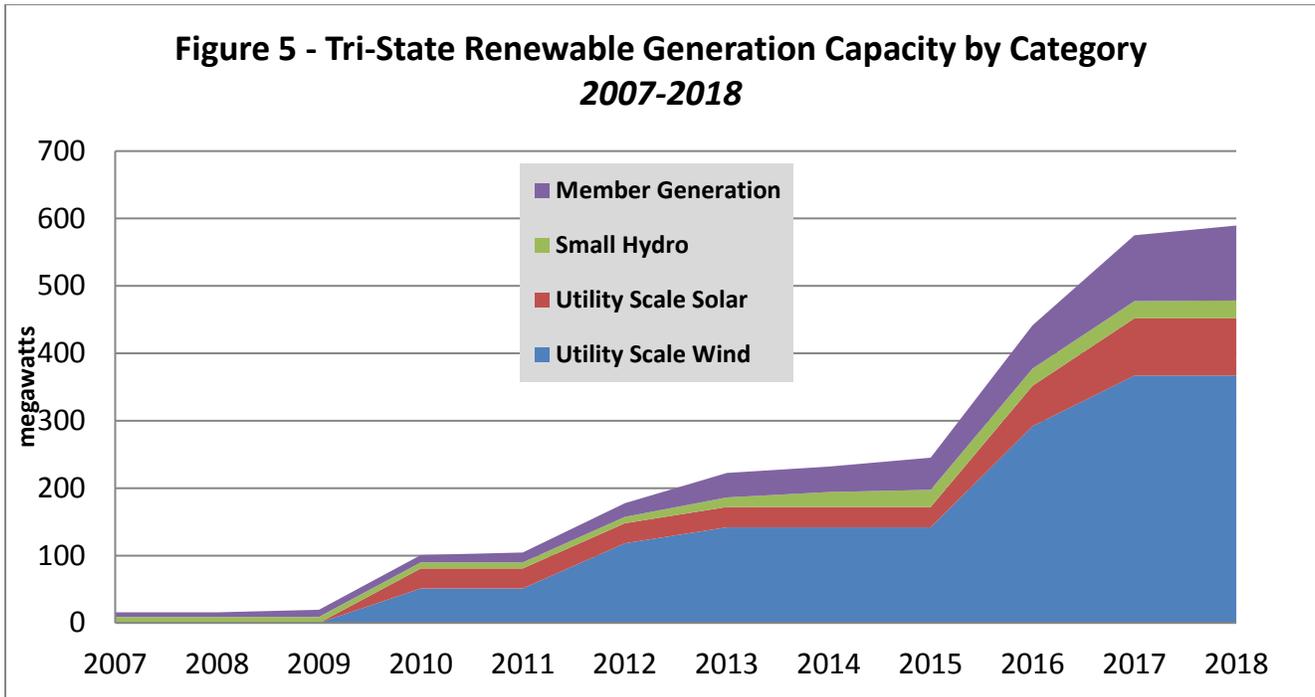
Tri-State currently has 367 MW of utility scale wind and 85 MW of utility scale solar under long term power purchase agreements. In addition, Tri-State purchases the output from approximately 27 MW of small hydroelectric projects located in Colorado and Wyoming.

In June 2018, Tri-State issued a Request for Proposals (RFP) for new renewable resources. Tri-State continues to advance through the evaluation and negotiation process and plans to announce the results of the RFP in early 2019. In evaluating future renewable portfolio additions beyond this most recent RFP, Tri-State will continue to monitor market conditions, tax credit expiration schedules, impacts of current renewable resources on reliable system operations and the operation of existing generating assets, transmission system capacity, Tri-State's participation in an organized market, and the regulatory requirements for meeting state renewable portfolio or energy standards.

In addition to the utility-scale renewable energy projects described above, Tri-State's members have developed over 100 MW of local renewable projects. The development of these projects has been facilitated by Tri-State for members wishing to serve a portion of their load requirements through projects they own or control through power purchase agreements. The number of these projects is expected to grow, with a total of over 140 MW expected to be online by early 2020.

Figure 5 provides a graphical representation of the growth in Tri-State's renewable resource portfolio over the last 10 years. Although not represented in this chart, another 600 MW of

federal hydropower brings Tri-State’s renewable resource portfolio to approximately 1,200 MW.



### **Refinement and Development of Energy Efficiency Products (EEP) & Services**

An ongoing part of Tri-State’s Action Plan is the implementation of Energy Efficiency (EE) programs. Options that have been evaluated include programs related to residential/small commercial, irrigation, large commercial and industrial programs. These offerings are continually refined based on effectiveness and member feedback.

### **R&D Programs and Projects via EPRI & CRN**

Tri-State supports research, development and advanced technology and has been a full-member of the Electric Power Research Institute (EPRI) and the National Rural Electric Cooperative Association (NRECA) research program since 1993. Tri-State is also a founding member of several other research groups. Tri-State is committed to continuing this support for vital R&D going forward.

An important part of our R&D efforts involves direct participation in research projects. This helps solve unique problems, brings us early information on advanced technology, facilitates the

commercialization of new products and provides information exchange with industry subject matter experts.

Some examples of Tri-State's ongoing involvement in R&D projects include:

1. CO<sub>2</sub> capture, utilization, and sequestration studies.
2. Development of more durable icephobic materials for transmission applications.
3. Development and demonstration for a live-line insulation test system.
4. Novel generation power cycles to increase fossil fleet efficiency and provide low cost options for CO<sub>2</sub> capture.
5. Use of unmanned aerial vehicles to improve transmission, distribution, and generation maintenance.
6. Electric water heaters for high-speed remote control demand response.
7. DOE / NRECA SUNDA project (solar utility network deployment acceleration).
8. Electrification studies to improve local air quality and increase energy efficiency.
9. Energy storage to enhance power system performance.

## **F. Updated Report on Resource Scenario Modeling**

Tri-State addressed scenario modeling in the 2015 ERP. This APR updates the base load forecast scenario with the following additional changes:

- Updated with retirement of Nucla at end of 2022 and Craig I at end of 2025 per 2017 APR
- Updated 2018 long-term load forecast
- Updated 2018 electricity market, natural gas, and coal price forecasts
- Updated Tri-State small renewable projects and member renewable and distributed generation projects

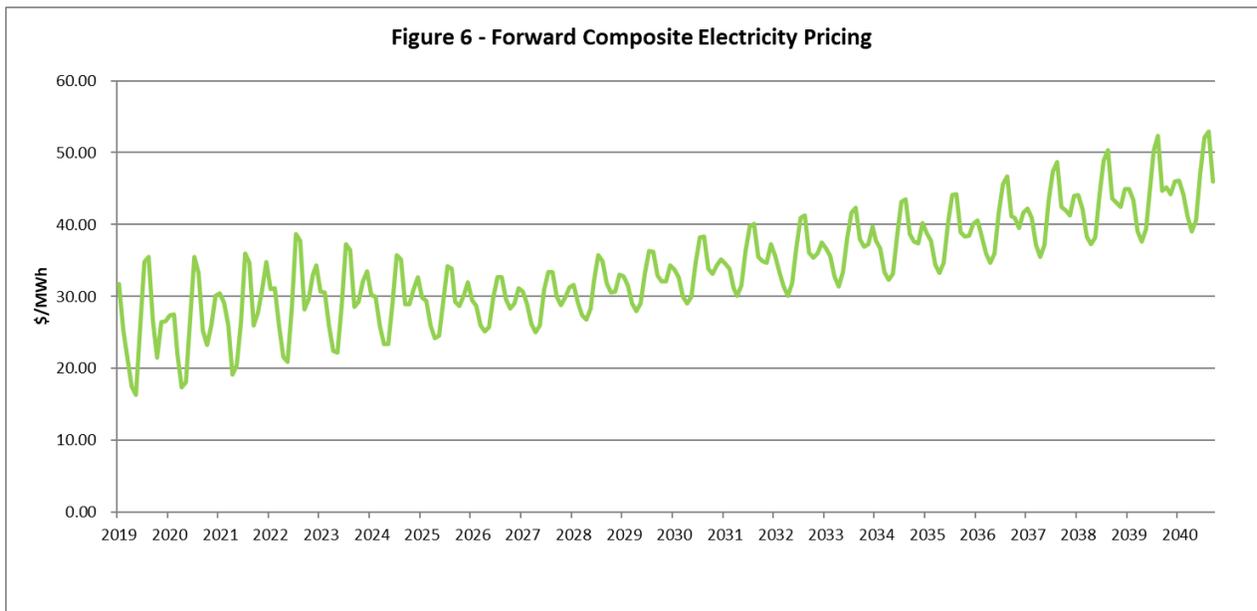
In the updated BAU scenario, 818 MW of new thermal additions and 260 MW of renewable generation over the 20-year planning horizon are planned. The updated thermal and wind additions are as follows:

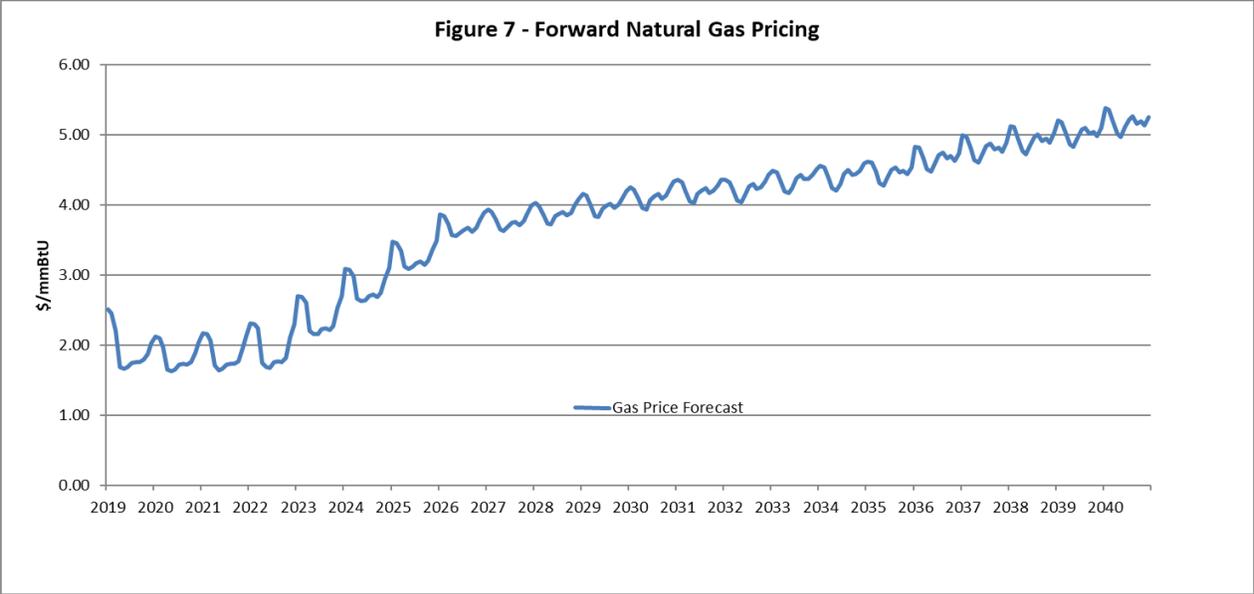
- 100 MW wind in 2022
- 30 MW solar in 2023
- 165 MW natural gas simple cycle in 2026
- 488 MW natural gas combined cycle in 2029
- 30 MW solar in 2038
- 100 MW wind in 2039
- 165 MW natural gas simple cycle in 2040

### ***Inputs and Variables used in the Scenario Modeling***

#### **Forward Price Curves**

For this APR, Tri-State used updated forward price curves for electricity and natural gas based on the near term market activity and independent long term price forecasts. The latest price forecasts for electricity and natural gas used by Tri-State are shown in Figures 6 and 7, respectively.





**Potential Generation Sources and Associated Costs**

The Electric Power Research Institute (EPRI) Technical Assessment Guide (TAG) provides cost and performance data for power plants of various technologies. The TAG has become an industry standard for power plant cost and performance information. As in previous filings, Tri-State used the TAG to estimate variable O&M costs, generation forced outage rates, and overnight capital costs. Use of the TAG data provides two major benefits in Tri-State’s resource planning process. First, the TAG provides consistent financial and economic assumptions between the various technologies eliminating any financial or economic bias between the technologies. Second, the annual TAG updates provide updated cost analysis that capture technology and market trends allowing Tri-State to have the latest technological information.

**Load Forecast**

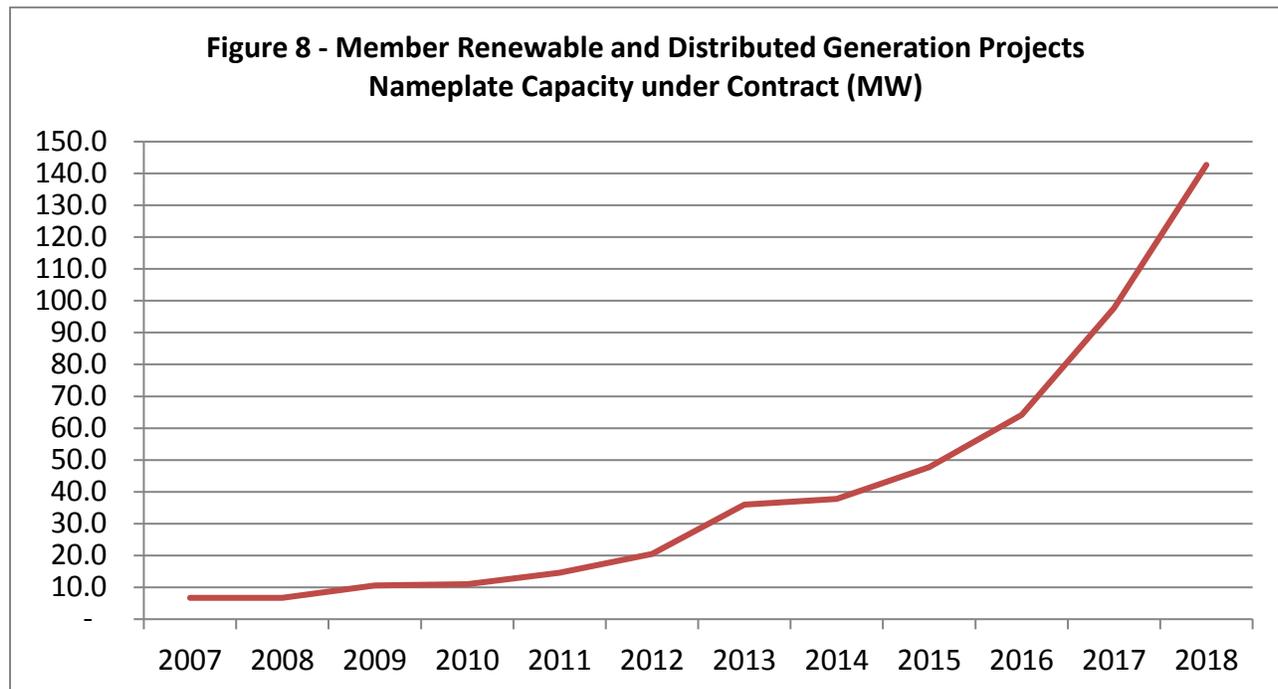
The median (or base) load forecast for Tri-State’s members is based on the best available data created in 2018 from the forecasts for each member.

## G. Update on Implementation of Cost-effective New Clean Energy and Energy-efficient Technologies.

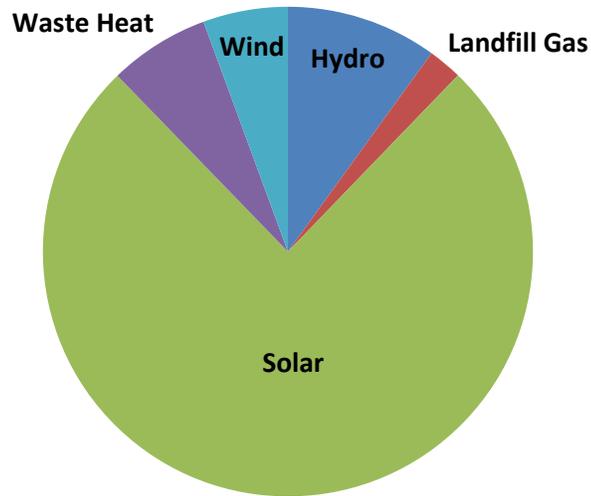
The growth in Tri-State's renewable resource portfolio, including utility scale projects and smaller generation projects, is graphically depicted in Figure 5.

As noted previously in this report and other filings, Tri-State's wholesale power contract with each of its members and board policies allow for and facilitates the development of local distributed generation projects in its members' service territories. These renewable and distributed projects are helping to fulfill both Colorado and New Mexico RES/RPS requirements, as well as satisfy members'/consumers' interest in purchasing renewable power.

Figure 8 below shows the growth in capacity of these distributed projects through the end of 2017. Figure 9 shows the breakdown of these projects by technology category. As of December 2017, 60 renewable or distribution generation projects totaling 143 MW were operating or under development. It is expected that the number of these projects will continue to grow as pricing for solar and wind resources continue to be attractive and more members are showing interest in supporting local renewable projects.



**Figure 9 - Member Renewable and Distributed Generation Projects by Technology (nameplate capacity)**



### **Demand Response and Energy Shaping**

Tri-State, in association with its members, developed a portfolio of demand response and energy shaping offerings for all customer segments from residential and small commercial to irrigation to large commercial and industrial to system enhancements. In the past approximately a quarter of Tri-State’s members participated in these programs. However, changing market conditions, updates to Tri-State’s rate structure, and changing member priorities have resulted in a phase out of these offerings.

### **H. Material Changes to its Resource Plan or Action Plan**

There are no material changes to report regarding the action plan contained in the 2015 ERP, and Tri-State remains confident in its ability to achieve the elements of this action plan.

No material changes to Tri-State's generation portfolio have occurred since the 2017 APR update. After updating the Tri-State resource planning model inputs to prepare this APR, the need for new generating capacity has shifted from 2025 per the 2017 APR to 2026.