

# Electric Resource Plan Annual Progress Report

for

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

**Submitted to:**

**Colorado Public Utilities Commission**

**May 31, 2017**

## Background

In accordance with the stipulated resource planning process approved by Commission Decision No. C10-0101, in Docket No. 09I-04IE 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 2017 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, capital expenditures, financing 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. To the extent issues addressed in the ERP have not materially changed, they are not addressed in this APR. Significant modeling decisions made in the 2015 ERP process are continued in this APR. Tri-State continues to make incremental improvements to its modeling and has incorporated changes to modeling input data.

Tri-State has made several changes to its resource portfolio since the 2015 ERP. Since the ERP filing, Tri-State has 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 1 will cease operations by 12/31/2025. Tri-State ownership share is 104 MW (24%) of this unit which has a total nameplate capacity of 428 MW.

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

Additionally, Tri-State has 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.

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. 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

Effective June 30, 2016, Tri-State’s membership decreased from 44 to 43 members. The exit of one of Tri-State’s members in New Mexico resulted in a corresponding decrease to Tri-State’s supply obligation by approximately 300 GWH of annual energy and 40 MWs of summer peak demand.

Tri-State’s demand and energy forecasts for this APR are based on analysis performed in 2016. The 2016 load forecast is lower than the prior version in the near term and slightly higher in the long term. The near term reduction reflects lower growth in the gas and oil production loads offset by continued load growth in residential and small commercial loads in several regions of the service area. Large commercial loads, including gas and oil production, are expected to trend higher as gas and oil prices slowly recover.

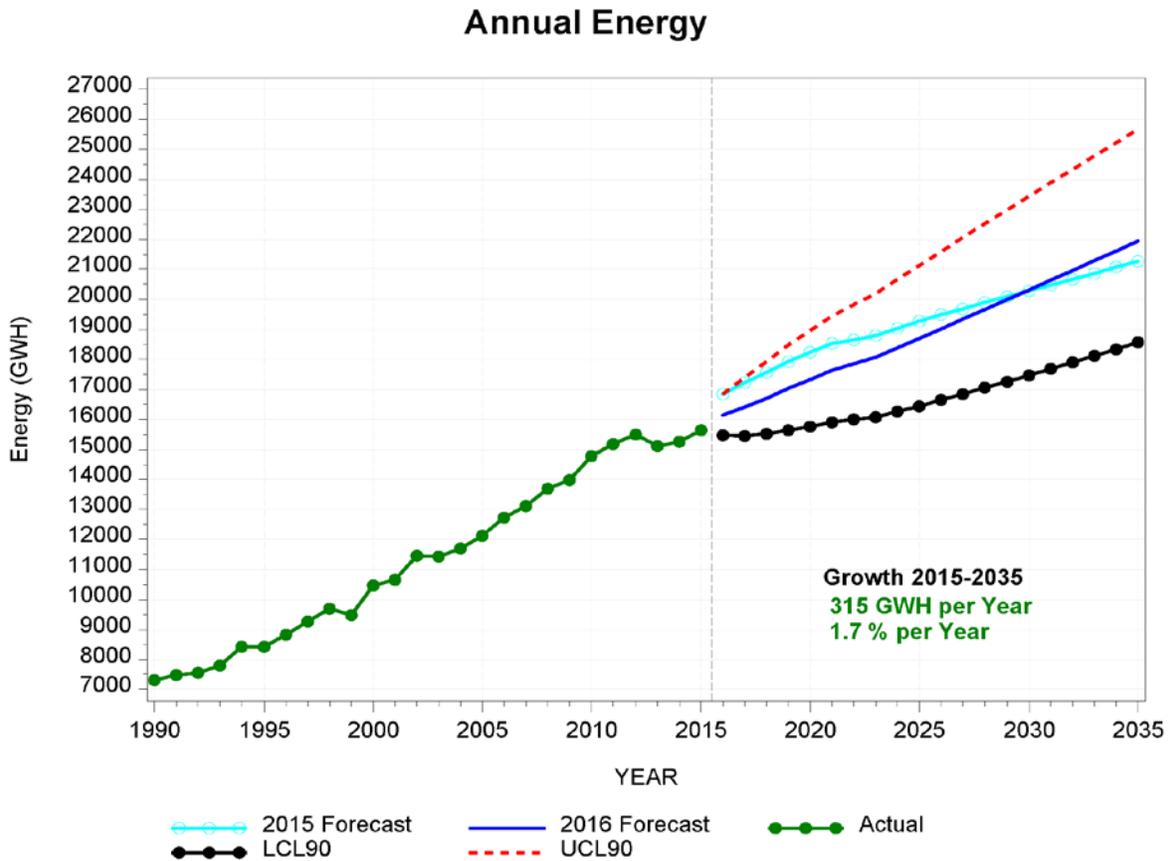
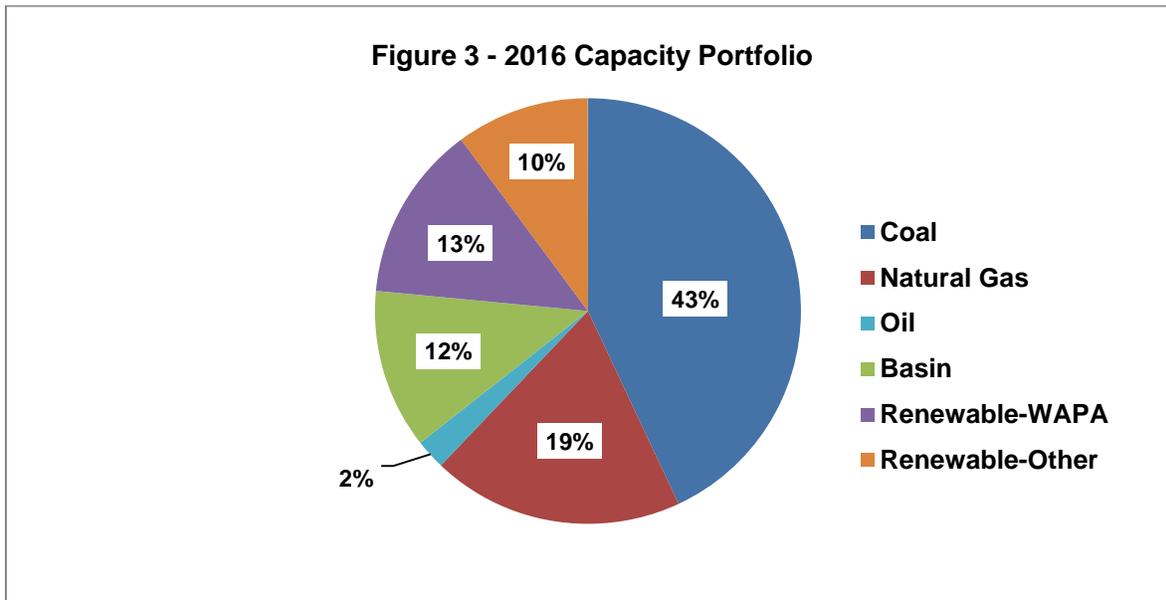
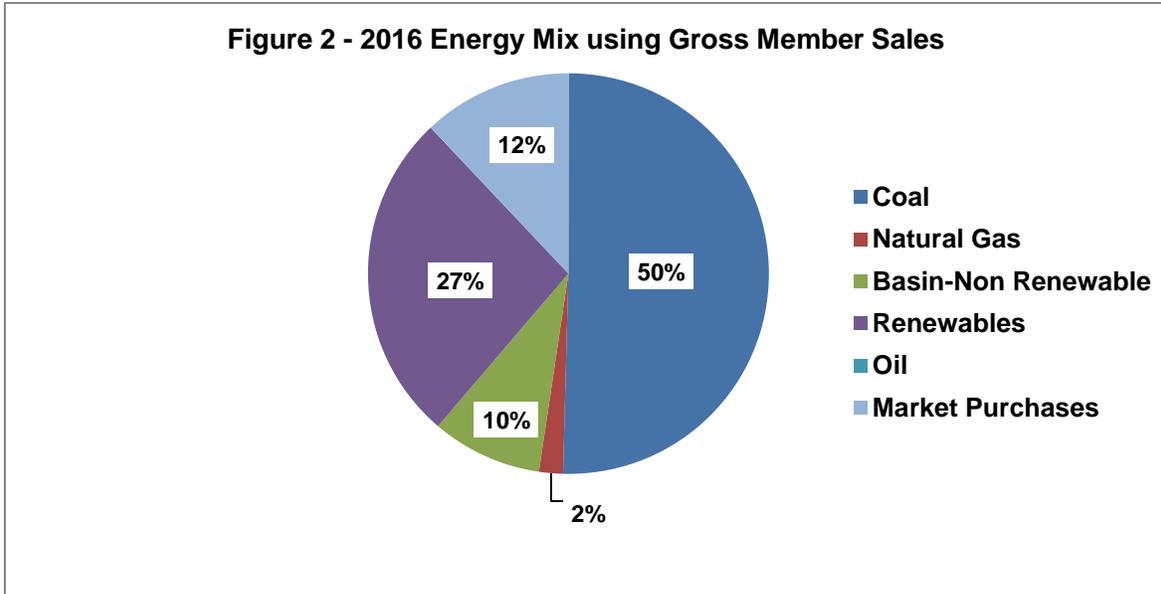


Figure 1 – Updated Load Forecast

## B. Updated Evaluation of Existing Resources

Figure 2 below depicts the sources of generation for Tri-State's 2016 energy sales to its members. Figure 3 below depicts Tri-State's 2016 capacity by generation source. Neither chart represents a material change from 2015, however Tri-State's energy supply to its members showed an increase in renewable energy, reduced supply from coal and an increase in market purchases due to favorable wholesale market pricing.



## **C. 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 mid 2020s unless there is a significant increase in load or existing resources were to become unavailable. The updated load forecast in this 2017 APR does not change this assessment.

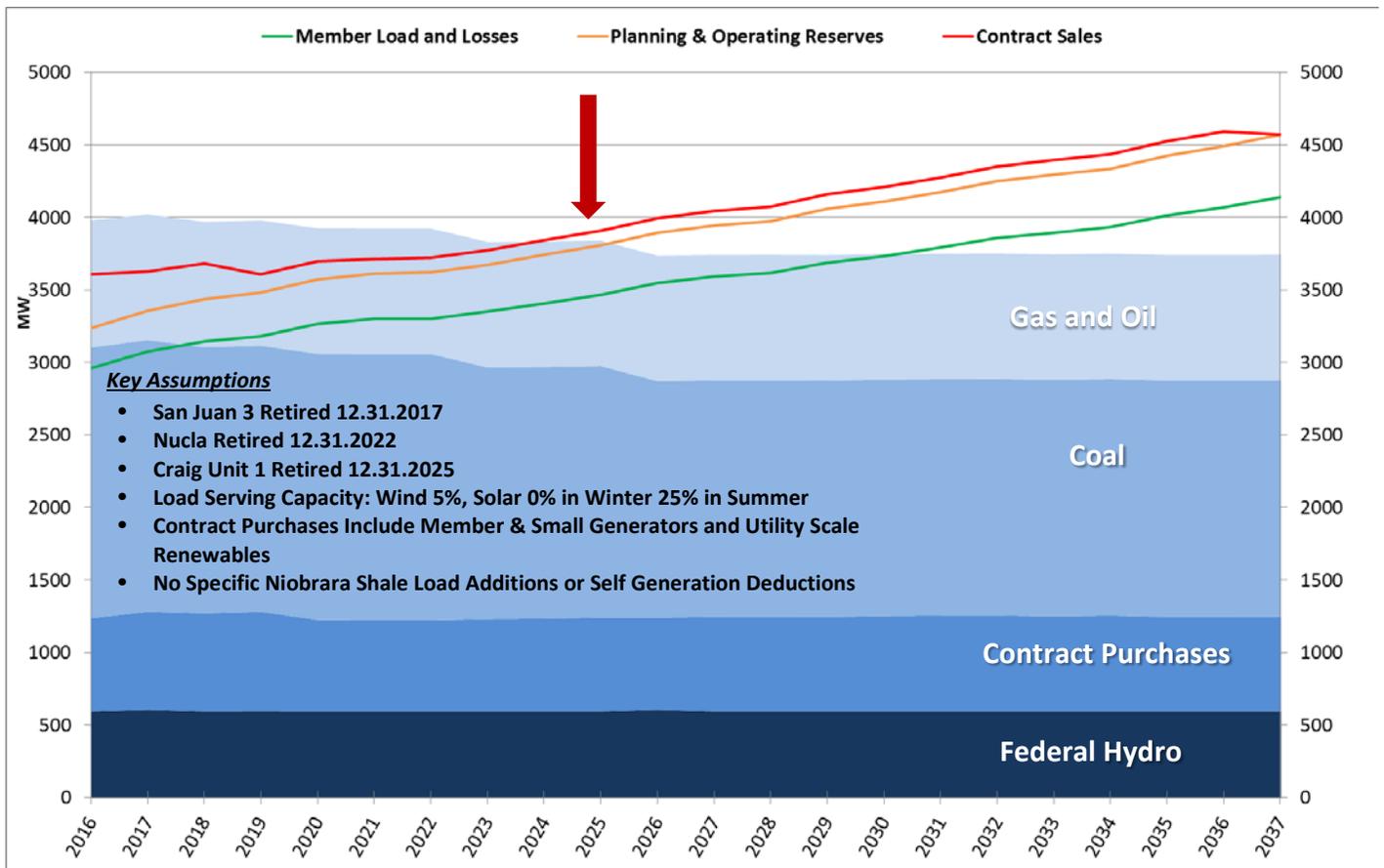
## **D. Updated Assessment of Need for Additional Resources**

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 2016 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 (except for the Western Area Power Administration purchases which are assumed to extend through the planning horizon);
- 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 2025.



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

Scenario modeling has been developed to project the timing and nature of resources. Resource options may include demand side alternatives, natural gas generation including gas turbines and reciprocating engines, and renewable generation including solar and wind generation. No firm commitments have been made at this time as to the timing, technology, size or location of new conventional 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. The 2015 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, the implementation of the CPP in its current form has become more uncertain. As a result, Tri-State has moderated efforts to plan for CPP implementation.

## **Generation Planning and Development**

Except for the expected implementation of new member generation projects and new utility scale renewable projects, no material changes in Tri-State generation planning and development have occurred since the filing of the 2015 ERP.

## **Transmission Planning and Development**

Tri-State is one of the major participants in the analysis and development of transmission in Colorado and the other states in which it has retail load. Tri-State owns (wholly or jointly) more than 5,500 miles of transmission lines across Colorado, Nebraska, New Mexico and Wyoming. Tri-State will continue to support vital transmission studies that are directed at supporting the acquisition of traditional and renewable generation resources to meet the needs of both our members and of other regional utilities.

Tri-State is making significant 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 alleviate existing constraints in eastern Colorado and allow for the delivery of new renewable energy projects, including the 150 MW Carousel Wind Farm. Plans call for this project to be followed by the Lamar – Burlington 230kV project which is expected to further alleviate existing constraints and potentially support additional interconnections.

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**

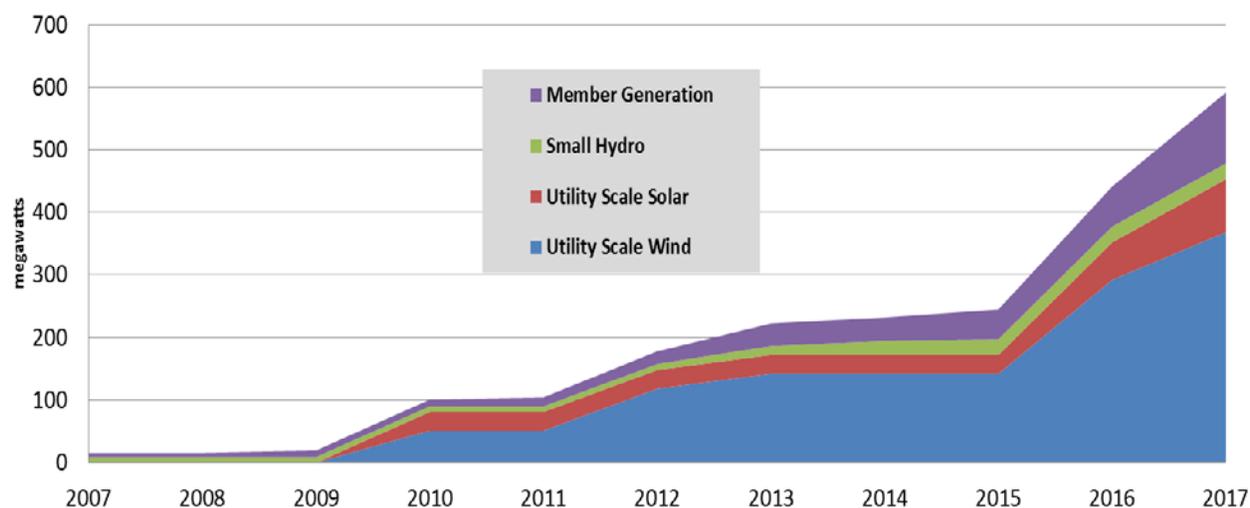
Since the filing of the 2015 ERP, two new solar projects, totaling 55 MWs, achieved commercial operation and the 75 MW Twin Buttes II Wind Project has commenced construction and is expected to be completed in late 2017. All three renewable projects were a result of a solicitation for new resources issued in late 2014.

In evaluating future renewable portfolio additions, Tri-State will continue to monitor market conditions, tax credit expiration schedules for both the production tax credit (PTC) and investment tax credit (ITC), impacts of current renewable resources on reliable system operations and the operation of existing generating assets, transmission system capacity, Tri-State's likely participation in an organized market, and the regulatory requirements for meeting state renewable portfolio or energy standards. Tri-State currently has 367 MWs of utility scale wind projects under contract and 85 MWs of utility scale solar projects under contract. In addition, Tri-State purchases the output from approximately 25 MWs of small hydroelectric projects located throughout its members' service territories.

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

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 MWs of federal hydropower brings Tri-State's renewable resource portfolio to over 1,000 MWs.

**Figure 5 - Tri-State Renewable Generation Capacity by Category**  
2007-2017



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

An ongoing part of Tri-State's Action Plan is the implementation of Demand Side Management (DSM) and Energy Efficiency (EE) programs. Options that have been evaluated include those related to residential/small commercial load control, irrigation load control, large commercial and industrial programs, and distribution system programs (including harvesting distributed generation). These offerings are continually refined based on effectiveness and member feedback. The impact of these programs (including actual and estimated use by our members) has been updated and is reflected in Figure 4 of this APR.

### **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), 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. CO2 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 CO2 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 2017 APR updates the base load forecast scenario with the following changes:

- Updated 2016 long-term load forecast
- Updated electricity market, natural gas, and coal price forecasts
- Nucla and Craig Unit 1 retirements in 12/31/2022 and 12/31/2025, respectively
- Updated Tri-State small renewable projects and member renewable and distributed generation projects

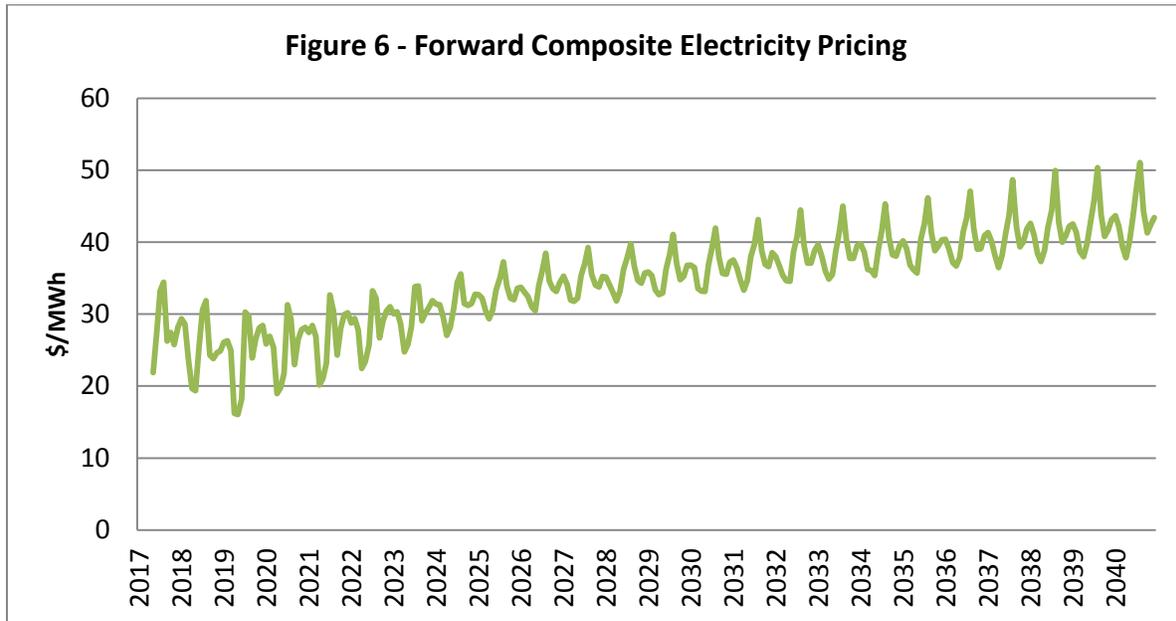
In the updated BAU scenario, 911 MWs of new thermal additions and 200 MWs of renewable generation over the 20-year planning horizon are planned. The updated thermal and wind additions are as follows:

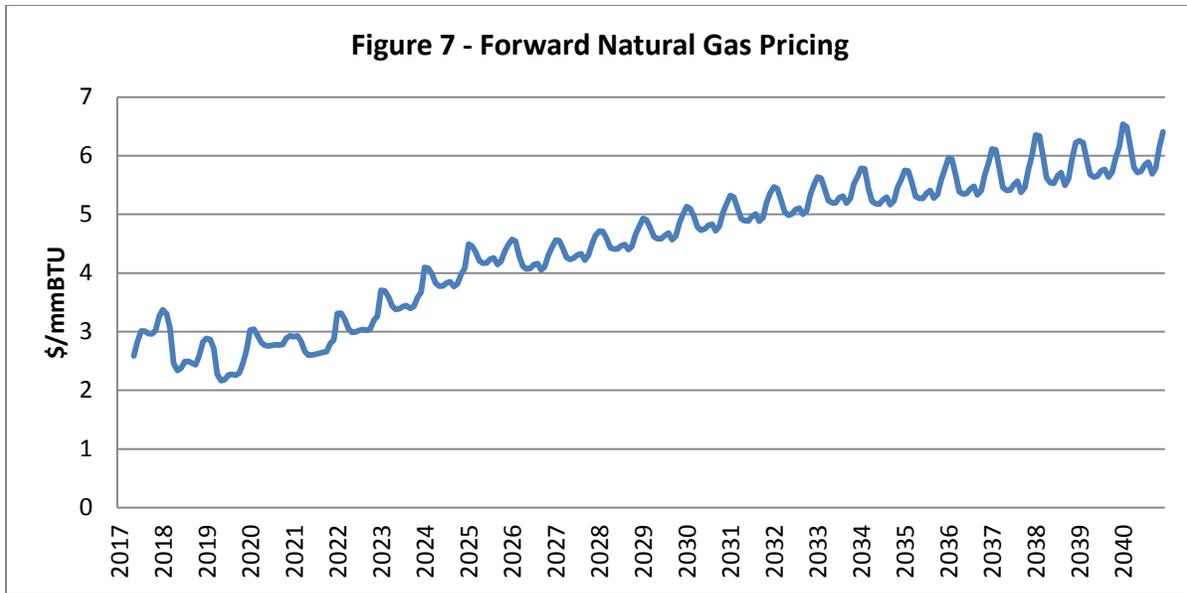
- 165 MW natural gas simple cycle in 2026
- 93 MW natural gas reciprocating engines in 2027
- 165 MW natural gas simple cycle in 2029
- 488 MW natural gas combined cycle in 2032
- 200 MW wind in 2036

**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

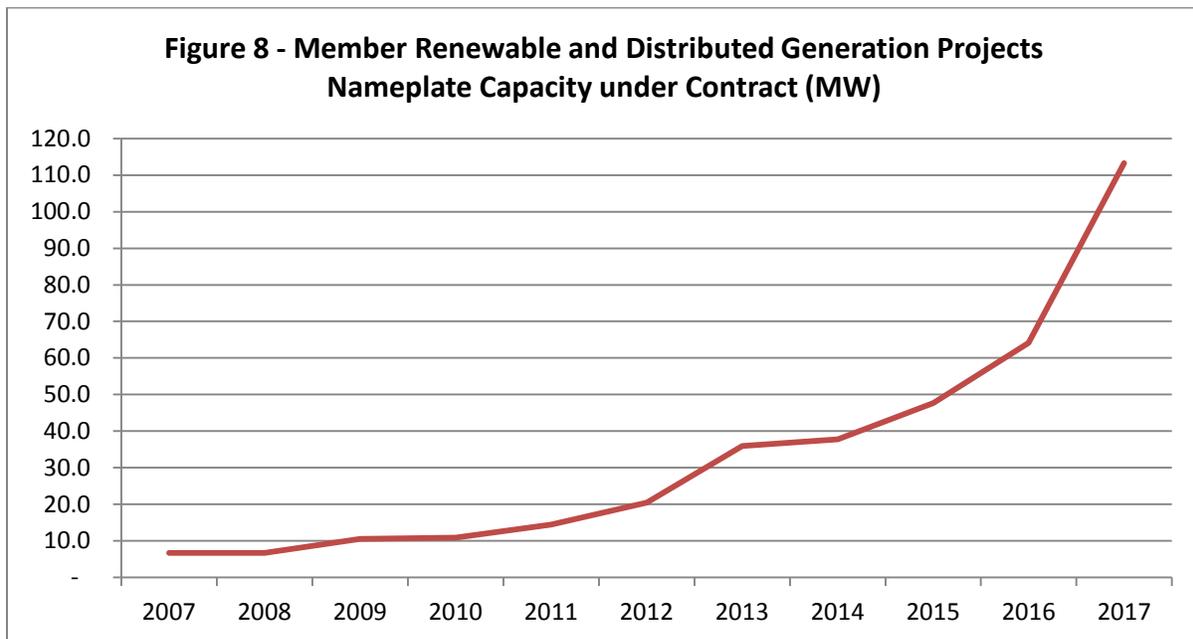
The "median" load forecast for Tri-State’s members is based on the best available data created in 2016 from the forecasts for each member. The "high" and "low" load forecasts (UCL and LCL) represent two standard deviations above and below the median load forecast, respectively.

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

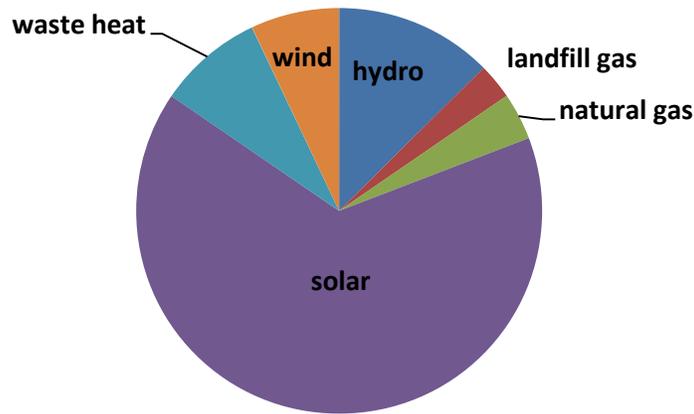
The growth in Tri-State's renewable resource portfolio, including utility scale projects and smaller generation projects, is graphically depicted in Figure 5.

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 facilitate 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 2016. Figure 9 shows the breakdown of these projects by technology category. As of the end of 2016, 61 renewable or distribution generation projects totaling 113 MWs 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, have 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. Approximately a quarter of Tri-State’s members participate in these programs.

### **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.

Changes have occurred to our generation portfolio – which include the announced retirements of the 100 MW Nucla Generating Station and the 428 MW (Tri-State share of 104 MW) Craig Unit I at the Craig Generating Station. After updating the Tri-State resource planning model inputs to prepare this APR, the need for new generating capacity has shifted from 2023 to 2025.