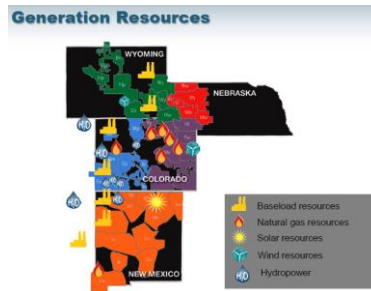


# *Tri-State Generation and Transmission:*



## **Time for A New Equation For Affordability**



**Oct 2014**

**By the Coop Members Alliance**

With Support from  
**Colorado Renewable Energy Society**  
**Clean Energy Action**  
**Western Clean Energy Campaign**



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## ACRONYMS

BTU	British Thermal Units
CREA	Colorado Rural Electric Association
CSP	Concentrating Solar Power
DMEA	Delta Montrose Electric Association
DG	Distributed Generation
EPA	Environmental Protection Agency
KWh	Kilowatt hours (Thousand watt hours)
LPEA	La Plata Electric Association
MMBTU	Million British Thermal Units
MWh	Megawatt hours (Million watt hours)
PPA	Power Purchase Agreement
PV	Photovoltaic
PVREA	Poudre Valley Rural Electric Association
TSGT	Tri-State Generation and Transmission

## PREFACE

This report is written with the goal of helping Tri-State Generation and Transmission (“TSGT”) take better advantage of the remarkable renewable energy resources in TSGT territory and to create a 21<sup>st</sup> century rural electric coop generation and transmission organization.

It is the authors’ belief that there are many fine staff members at TSGT who are coming to understand the benefits—and the imperative—of moving to a more renewable energy dependent system. This report is intended to generate discussion and policy changes at TSGT and within its member coops.

The vision of this report is of a vibrant 21<sup>st</sup> century TSGT organization that has learned to integrate high levels of renewable energy and has reduced reliance on non-renewable fuels such as coal, oil and natural gas. In doing so, member coops have been empowered to adopt strong energy efficiency programs and to use the abundant renewable energy resources in their territories. In addition, the member coops have learned from other coops how to develop and operate the efficiency programs and renewable systems that will help to manage and meet their members’ electrical needs in the post-fossil fuel era.

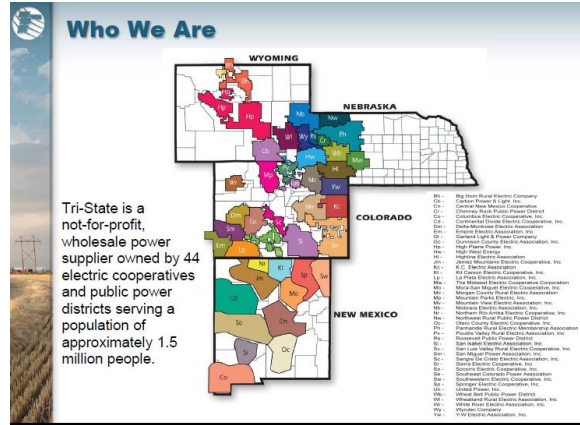
**We believe that TSGT and its member coops can—  
and will—become very important clean energy  
success stories in the 21<sup>st</sup> century.**

This report couldn’t have been written without the help of many groups and individuals. Our goal is to provide the most accurate information possible. Please send corrections or additions to [coopmembersalliance@gmail.com](mailto:coopmembersalliance@gmail.com).

# EXECUTIVE SUMMARY

## BACKGROUND

Tri-State Generation and Transmission serves 44 rural coops in Colorado, Wyoming, New Mexico and Nebraska. Tri-State's headquarters are in Westminster, Colorado in the Denver metro area.



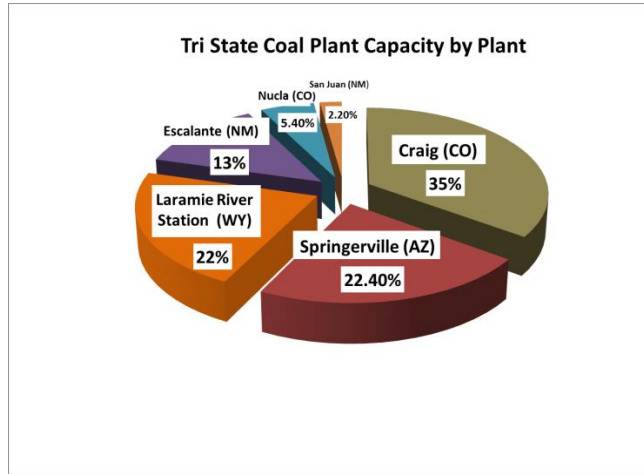
## THE GOOD NEWS

The good news is that Tri-State has already begun to take advantage of the abundant wind and solar resources that exist in its territory, that member coops are already beginning to experiment with increased reliance on local generation, that the price of free-fuel renewable energies is falling rapidly and that there are an increasing number of Tri-State staff members who understand the need for a new equation for affordability in the 21<sup>st</sup> century.

## COAL IS NO LONGER THE BEST CHOICE FOR AFFORDABLE ELECTRICITY

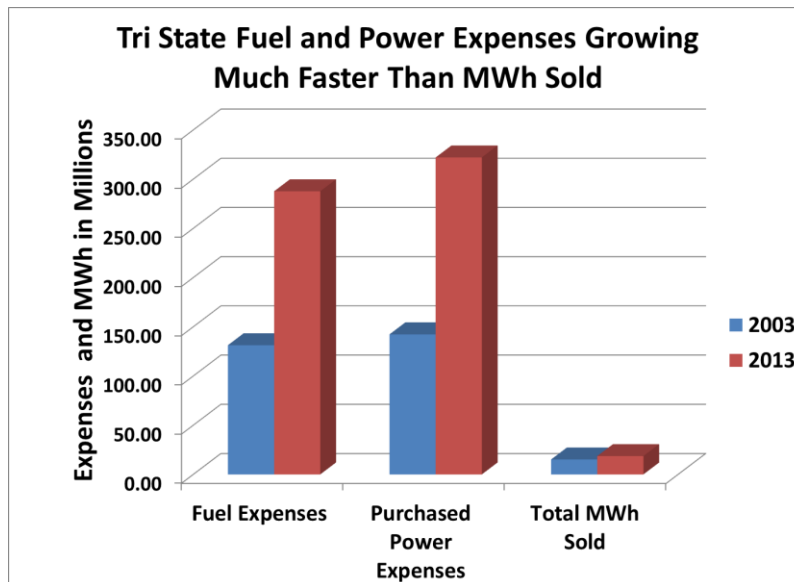
Currently, Tri-State is very coal dependent with typically over 70% of its electricity being provided by a fleet of aging coal plants.

## Tri-State Coal Capacity by Plant and State



Tri-State is experiencing fuel and power expenses that are rising much faster than its sales—a fact that is very likely driven in significant part by Tri-State’s heavy reliance on coal—a non-renewable fuel that is rising in price.

## Tri-State Fuel and Power Expenses Compared to MWh Sales 2003 v 2013





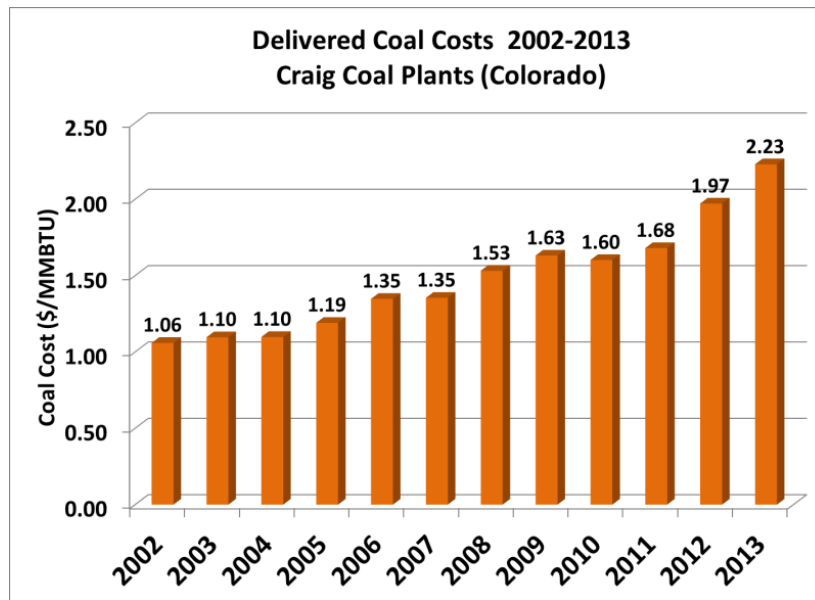
A review of Tri-State’s coal costs shows they are rising much more quickly than inflation with coal costs for the Craig coal plant more than doubling in the last decade. In addition, as discussed in the full report, Tri-State is relying on coal mines that are playing out and there are serious questions about the long term supply of coal for Tri-State’s coal plants.

### Delivered Coal Costs at TSGT Coal Plants<sup>1</sup>

TSGT Coal Plant	2003 Delivered Coal Cost	2013 Delivered Coal Cost	% Increase Per Year 2003-2013
Craig (CO)	\$1.10/MMBTU	\$2.23/MMBTU	7.3% per year
Springerville (AZ)	\$1.33/MMBTU	\$2.01/MMBTU	4.2% per year
Laramie River Station (WY)	\$0.55/MMBTU	\$1.14/MMBTU	7.5% per year
Escalante (NM)	\$1.27/MMBTU	\$2.34/MMBTU	5.5% per year
Nucla (CO)	\$1.23/MMBTU	\$1.87/MMBTU	4.3% per year
San Juan (NM)	\$1.77/MMBTU	\$2.81/MMBTU	4.7% per year

### Coal Cost at Craig Coal Plants Rising Quickly

Average Coal Costs Derived from EIA 923 Data<sup>2</sup>



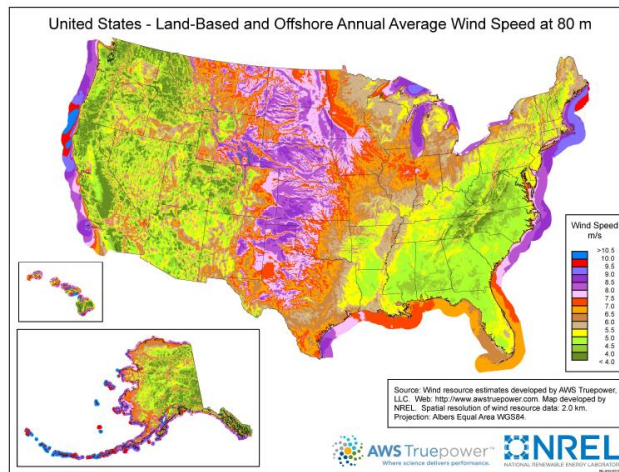
<sup>1</sup> Data from EIA 923 database. There are some differences depending on the version of 923 data used, but the differences are not large. <http://www.eia.gov/electricity/data/eia923/>

<sup>2</sup> Average delivered coal costs derived from EIA 923 data available from <http://www.eia.gov/electricity/data/eia923/>

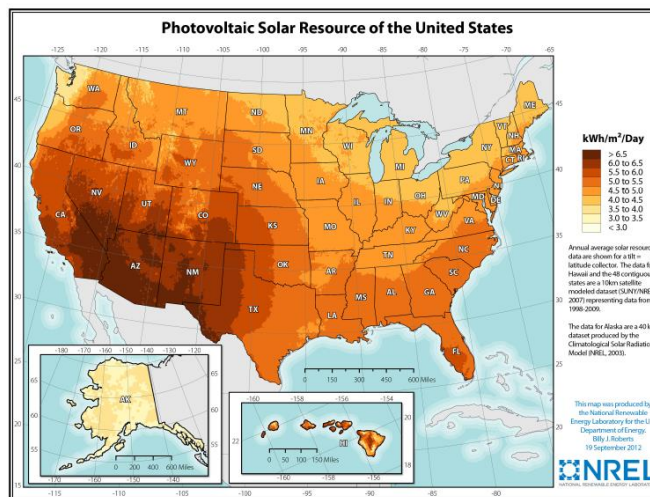
## TIME FOR A NEW EQUATION FOR AFFORDABILITY

Given the rising costs of coal and concerns about long term coal supply, it is time for Tri-State to consider a new equation for affordability. Tri-State has abundant wind, solar, geothermal and small hydro resources in its territory and as discussed in the full report, the price of these technologies has been plummeting.

### US Wind Resources at 80 Meter Height On and Off Shore

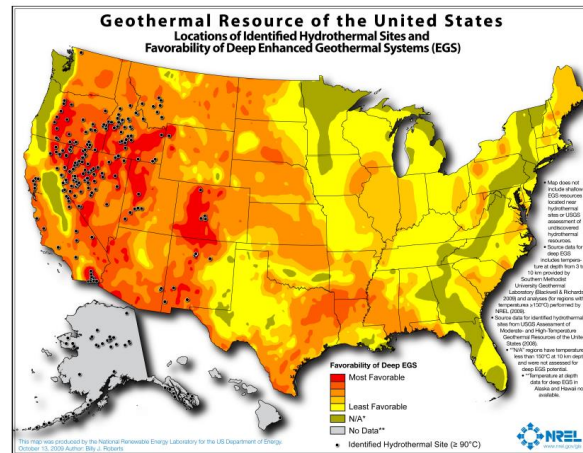


### Photovoltaic Solar US Resource Potential<sup>3</sup>



<sup>3</sup> US photovoltaic resource map from [http://www.nrel.gov/gis/images/eere\\_pv/national\\_photovoltaic\\_2012-01.jpg](http://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg)

## Geothermal Resources of the United States<sup>4</sup>



## RECOMMENDATIONS

As Tri-State searches for a new equation for affordable electricity, the following recommendations should be considered:

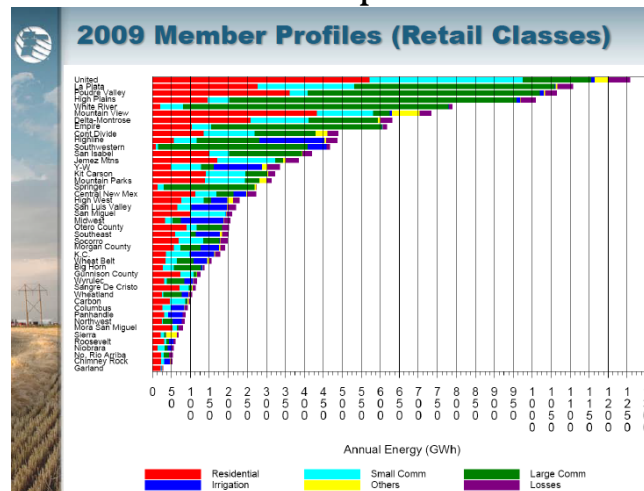
- Take a fresh and critical look at which generation resources will truly ensure the long-term affordability and accessibility of electricity in Tri-State’s territory
- Provide more detailed accounting of fuel and power expenses in annual and quarterly reports provided to coop members
- Provide accurate information to coop members regarding trends in coal prices and the impacts of these prices on Tri-State rates.
- Provide accurate information to coop members about the life span of coal mines that support Tri-State’s coal plants
- Provide accurate information to coop members about the costs of pollution controls for coal plants and the alternatives
- Recognize that power systems in the 21<sup>st</sup> century will likely become lower carbon, more distributed and designed around flexible generation that can accommodate increasing reliance on renewable energy resources.
- Help coop members recognize that in the 21<sup>st</sup> century, inflexible “base load” resources can interfere with adding cost-effective levels of free-

<sup>4</sup> Map of US geothermal resources from [http://www.nrel.gov/gis/images/geothermal\\_resource2009-final.jpg](http://www.nrel.gov/gis/images/geothermal_resource2009-final.jpg)

fuel renewable energy that are the key to affordable electricity moving forward

- Continue to gain more experience with adding renewable energy resources to Tri State’s system and provide accurate information to coop members about the long term cost savings potential of these technologies
- Begin to experiment with adding more storage capacity to Tri-State’s system to allow increasing reliance on renewable technologies
- Continue to encourage more energy efficiency and renewable energy programs by Tri-State member coops
- Implement policies to allow member coops to move above the 5% limit on self-generation in a step wise fashion.
- Revise Policies 115, 117 and 118 and adopt a pricing mechanism that encourages development of renewable energy technologies
- Develop a culture that encourages innovative thinking by Tri-State Board members and work to develop more diversity on the TSGT Board
- Consider a system that provides TSGT Board representation based on the size of the member coop so that the number of Board representatives from member coops is proportional to sales rather than having equal representation for all member coops.

### Tri-State Member Coop Size Distribution<sup>5</sup>



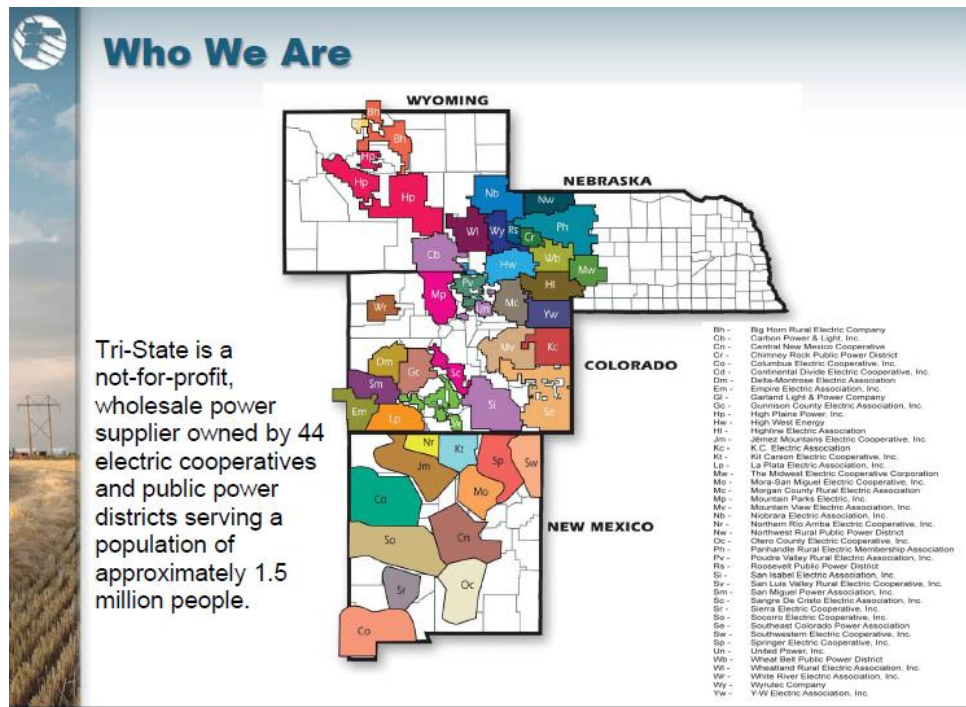
<sup>5</sup> For Tri-State member coop sizes, see Slide 41 in April 16, 2010 Powerpoint presentation available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm> This was the most recent publicly-available data on the size of member coops that could be found.

## PART I—TSGT: BACKGROUND

Tri-State Generation and Transmission is a non-profit wholesale power and transmission provider founded in 1952. It supplies power to 44 member electric coops and public power districts primarily in the rural areas of four states—Colorado, New Mexico, Wyoming and Nebraska. Tri-State serves approximately 1.5 million customers and has its headquarters in Westminster, Colorado in the Denver metro area of Colorado. <sup>6</sup>

A map of Tri-State member coops is shown in Figure 1.<sup>7</sup>

**Figure 1**  
**Tri-State Member Coops<sup>8</sup>**



<sup>6</sup> The description of Tri-State can be found at <http://www.tristategt.org/AboutUs/overview.cfm>

<sup>7</sup> For contact information for TSGT member coops, see <http://www.tristategt.org/OurMembers/members-directory.cfm> For links to the member coops webpages click on the TSGT map found at <http://www.tristategt.org/OurMembers/system-map.cfm>

<sup>8</sup> Slide 16, TSGT PPT April 16, 2010 available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

## PART II—TSGT: THE GOOD NEWS

In recent years, Tri-State and its member coops have begun to gain experience with the benefits of energy efficiency and non-hydro renewable energy. In addition, there are many TSGT staff who recognize the benefits of clean energy resources and are working hard to integrate them into the operational and policy structures of Tri-State.

### A. TSGT is Gaining Increased Experience with Non-Hydro Renewable Energy Resources

Tri-State began in the mid-1950s to administer contracts held by member coops for electricity produced at federally operated hydroelectric plants.<sup>9</sup><sup>10</sup> However, through decisions made in the last half of the 20<sup>th</sup> century, Tri-State became very heavily coal-dependent as discussed in Part III below.

The good news is that in the last several years, Tri-State has begun to gain experience with a variety of renewable energy sources that are connected to the Tri-State system and which are used to serve all member coops. Examples of renewable energy projects that serve all Tri-State members include:

- **Kit Carson Wind**—a 51 MW wind farm northwest of Burlington, Colorado, completed in November 2010 in partnership with a subsidiary of Duke Energy Corporation.<sup>11</sup>
- **Colorado Highlands Wind**—a 91 MW wind farm in northeastern Colorado that began operation in December 2012 and was expanded in October 2013. The 56 wind turbines in the project are equipped with carbon fiber constructed "smart" turbine blades that feature built-in wind velocity sensors that trigger blade pitch

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<sup>9</sup> For the formation of Tri-State to administer federal hydro power contracts, see <http://www.tristategt.org/greenpower/index.cfm>

<sup>10</sup> For a description of the federal hydro power contracts see <http://www.tristategt.org/greenpower/federal-hydro.cfm>

<sup>11</sup> For a description of the Kit Carson wind farm see <http://www.tristategt.org/greenpower/kitCarson.cfm>



adjustments for maximum efficiency during both high and low wind conditions.<sup>12</sup>

- **Cimarron Solar**—a 30 MW solar farm in northeastern New Mexico near the town of Cimarron in the territory of Springer Electric Cooperative. This is a thin film solar project developed by First Solar. It uses almost no water in its operation and at the time of installation was the largest solar facility developed by an electric coop.<sup>13</sup>

**Figure 2**  
**TSGT Cimarron Solar Project**

[Watch a video of the project](#)



- **Carousel Wind Farm**—A 150 MW wind farm under development in eastern Colorado in the service territory of K.C. Electric Association based in Hugo, Colorado. A 25 year Power Purchase Agreement (“PPA”) agreement was entered into in February 2014, with a subsidiary of Next Era Energy Resources. Development of this, the largest wind PPA by Tri-State to date will be made possible by transmission upgrades that have been in the planning stage since 2010 and are expected to be completed by late 2016.

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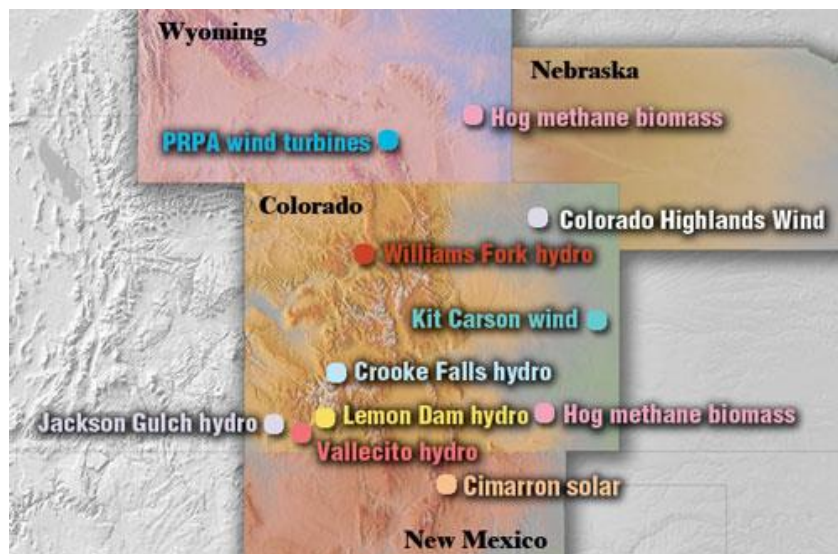
<sup>12</sup> For a description of the Colorado Highlands Wind project see <http://www.tristategt.org/greenpower/colorado-highlands-wind.cfm>

<sup>13</sup> For a description of the Cimarron Solar project see <http://www.tristategt.org/greenpower/cimarron.cfm>

The Carousel Wind Farm will be so named because of its relative proximity to the Kit Carson County Carousel, an antique amusement ride and national historic landmark located in nearby Burlington, Colo.<sup>14</sup>



**Figure 3**  
**Location of Some TSGT Renewable Resource Projects<sup>15</sup>**



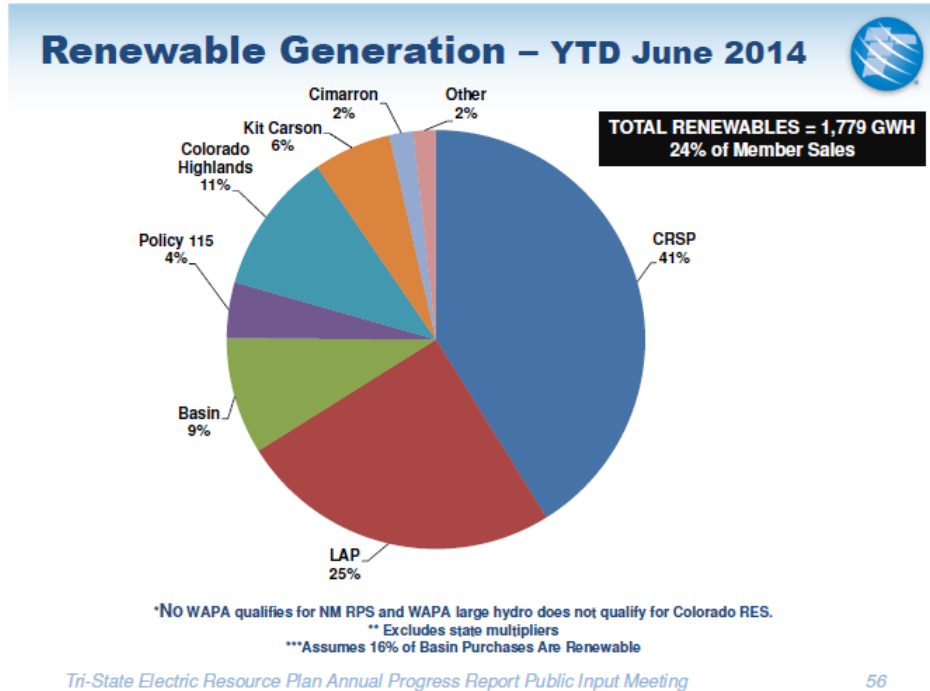
<sup>14</sup> For a description of the Carousel Wind Farm see <http://www.tristategt.org/greenpower/Carousel-Wind-Farm.cfm>

<sup>15</sup> Map of TSGT renewable resource locations from <http://www.tristategt.org/greenpower/renewable-locations.cfm>



**Figure 4**  
**Tri-State Generation from Renewable Resources**  
**Including Federal Hydro Contracts<sup>16</sup>**

[CRSP = Colorado River Storage Project hydro generation,<sup>17</sup>  
LAP = Loveland Area Projects from Western Power Administration,<sup>18</sup>  
Basin = Purchases from Basin Electric Coop<sup>19</sup>]



From Figure 4 it can be seen that while most of the renewable energy delivered by TSGT comes from large hydro projects, there is now a significant amount of renewable energy coming from wind (e.g. Colorado Highlands and Kit Carson) and solar (e.g. Cimarron) projects as well as from TSGT members self-generating up to 5% of their power needs (often with local renewable energy resources) in accordance with their contract with Tri-State and TSGT Board Policies 115, 117 and 118 as discussed further below and in Part III.

<sup>16</sup> See slide 56, TSGT August 8, 2014 Annual Resource Update available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

<sup>17</sup> For information on the Colorado River Storage Project see <http://www.usbr.gov/uc/rm/crsp/history.html>

<sup>18</sup> For information on the Loveland Area Projects of the Western Power Administration see <https://ww2.wapa.gov/sites/western/about/power/pages/default.aspx>


<sup>19</sup> For information on the Basin Electric Coop see [http://www.basinelectric.com/About\\_Us/Corporate/At\\_a\\_Glance/](http://www.basinelectric.com/About_Us/Corporate/At_a_Glance/)

## B. TSGT Member Coops are Gaining Experience With Renewable Energy Projects

In recent years, several TSGT member coops have been gaining experience with distributed renewable energy development in their own territories. These projects are undertaken in accordance with the ability of coops to generate up to 5% of their need under their contract with TSGT and in accordance with TSGT Board Policies 115, 117 and 118 discussed in more detail in Part III.

According to Tri-State there are now 38 distributed generation projects undertaken by Tri-State members total approximately 51 MW of generation.<sup>20</sup> Examples of Distributed Generation (“DG”) projects by Tri-State member coops are shown in Figure 5 below.

**Figure 5**  
**Examples of TSGT Member Coop**  
**Distributed Generation Projects<sup>21</sup>**

**Member Distributed Generation** 

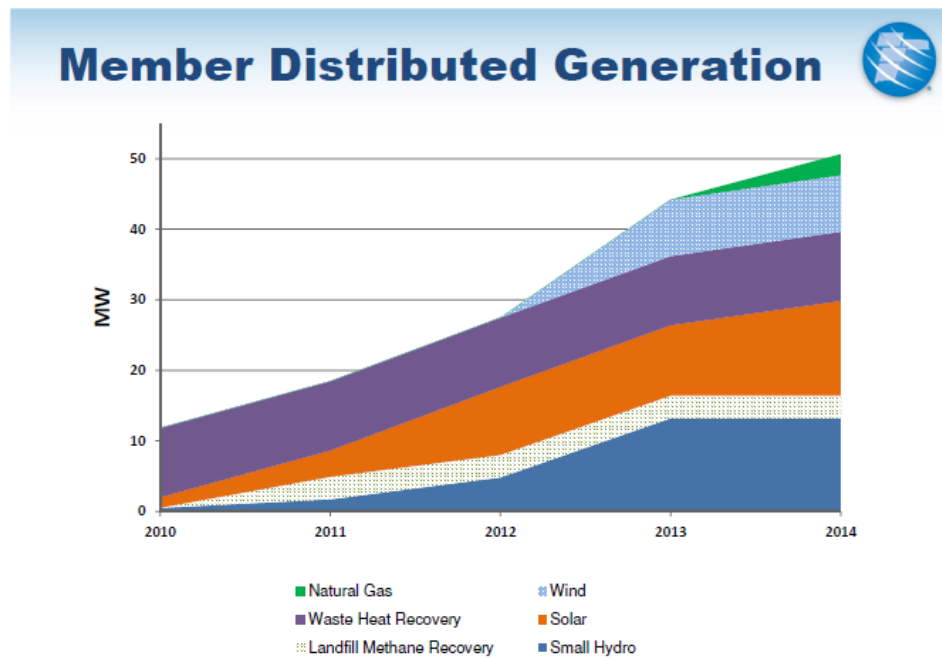
- Recent Projects;
  - Taos Charter School Solar 50 kW
  - PVREA Community Solar Farm II 500kW
  - Springer 1 Community Solar 1 MW
  - Pandora Hydro 320 kW
  - Storrie Lake Solar 1.5 MW
  - Granby Hydro 1.2 MW
  - Alamogordo Solar Garden 76 kW
  - Gunnison County Community Solar 5 kW

<sup>20</sup> See slide 53 in August 8, 2014 Annual Resource Update Presentation, found at <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

<sup>21</sup> See slide 54 in August 8, 2014 Annual Resource Update Presentation, found at <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

As shown in Figure 6 below, distributed generation developed by TSGT coop members includes generation from (in approximate order of size) small hydro, solar, wind, waste heat, landfill methane and a small amount of natural gas—totaling over 50 MW of member coop distributed generation projects in 2013.

**Figure 6**  
**TSGT Member Distributed Generation by Resource Type<sup>22</sup>**



*Tri-State Electric Resource Plan Annual Progress Report Public Input Meeting*

55

### **C. Some Tri-State Member Coops Are Leading the Way in Developing Efficiency and Renewable Energy Programs**

A growing number of Tri-State member coops are gaining experience offering a wide array of efficiency and renewable energy programs that customers can choose to participate in. The Colorado Rural Electric

<sup>22</sup> See slide 55 in August 8, 2014 Annual Resource Update Presentation, found at <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

Association webpage provides information on a number of these projects<sup>23</sup> including:

- **Geothermal Heat Pump Installations with Delta Montrose Electric Association:** Delta Montrose Electric Association (“DMEA”) in western Colorado offers a special geothermal “tariff” that allows customers to benefit from a geothermal system for heating and cooling and pay for it through a monthly fee on their DMEA bills.<sup>24</sup>
- **Solar Financing by Grand Valley Power:** Under this program, Grand Valley Power customers in western Colorado can pay \$15/month for five years and receive bill credits for solar production from Grand Valley’s solar installation for a total of 23 years. The bill credits start at about \$4/month and will very likely increase as power costs increase, while the \$15/month charge is fixed and ends after five years.<sup>25</sup>
- **Community Solar:** A number of rural electric coops are offering solar gardens programs including Kit Carson Coop in New Mexico),<sup>26</sup> Poudre Valley Rural Electric Association (PVREA),<sup>27</sup> United Power,<sup>28</sup> and La Plata Electric Association (LPEA),<sup>29</sup> in Colorado and several others.

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<sup>23</sup> For descriptions of rural coop efficiency and renewable energy programs, see <http://www.crea.coop/RenewableEfficiency/RenewableEnergy.aspx> (It appears that CREA membership may be needed to see archived stories.)

<sup>24</sup> For a description of the Delta Montrose Electric Association geothermal heat pump tariff see [http://www.dmea.com/index.php?option=com\\_content&view=article&id=60&Itemid=64](http://www.dmea.com/index.php?option=com_content&view=article&id=60&Itemid=64)

<sup>25</sup> For a description of the Grand Valley Rural Coop Solar Financing Program see <http://crea.coop/RenewableEfficiency/RenewableEnergy/ElectricCo-opOffersHotSolarDeal.aspx>

<sup>26</sup> For the Kit Carson Electric community solar program, see <http://www.kcecsolar.com/>

<sup>27</sup> For the Poudre Valley Rural Electric Association community solar program, see <http://www.pvrea.com/solar/>

<sup>28</sup> For a description of the United Power community solar garden program see <http://unitedpower.com/mainNav/greenPower/solPartners.aspx>

<sup>29</sup> For a description of the La Plata Electric Association community solar program, see [http://www.lpea.com/renewables/solar\\_garden.html](http://www.lpea.com/renewables/solar_garden.html)

- **Agriculture Efficiency Programs:** Several rural coops joined with TSGT and the Colorado Rural Electric Association to capture grant funding to support electric, heating and lighting efficiency measures at farms, saving participants money while reducing pollution and greenhouse gas emissions.

#### **D. Tri-State has Not Built a New Coal Plant in This Century**

Tri-State has talked about building a new coal plant in Holcomb, Kansas in coordination with Sunflower Electric Power for much of the last decade and has spent at least \$77 million in support of this effort.<sup>30</sup> Yet, due to extensive efforts by grass roots groups in Kansas and Colorado and legal work challenging the permits for the plant,<sup>31</sup> the Kansas Holcomb/Sunflower coal plant does not appear likely to be built.

While Tri-State seems determined to continue pursuing the development of the Holcomb coal plant, it will face significant legal, financial and public opposition hurdles if it attempts to move forward. Given the rising costs of coal, likely future coal supply constraints and the legal and financial issues accompanying carbon emissions controls for coal plants, the fact that the Holcomb coal plant is not likely to move forward is good news with respect to the effort to keep electricity for Tri-State members affordable.

Moreover, as shown in Figure 8 below, it does not appear that Tri-State will need additional capacity until the 2020s or beyond and by that time it should be clear that to keep electricity affordable, the correct choices will very likely be those that use the abundant wind, solar, hydro, geothermal, efficiency and other clean resources available in Tri-State territory.

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<sup>30</sup> Tri-State acknowledges spending over \$77 million on the possible development of the Holcomb coal plant on page 35 of the 2013 Tri-State Annual Report available from <http://www.tristategt.org/Financials/annual-report.cfm>

<sup>31</sup> The most recent air permit was issued in May 2014 by the Kansas Department of Health and the Environment (KDHE) (see <http://www.kansas.com/news/article1144680.html> ) and this permit was once again challenged in court (see <http://content.sierraclub.org/press-releases/2014/06/sierra-club-takes-legal-action-after-proposed-holcomb-coal-plant-fails-meet> )

## **E. Tri-State Has Many New Staff Who Are Interested in Moving Tri-State into the 21<sup>st</sup> Century**

While thinking at Tri-State has generally been slow to change, observers note that there are an increasing number of new employees who understand the benefits and imperatives of moving Tri-State into the 21<sup>st</sup> century. As these employees gain in seniority and aging staff members retire, it should be easier for Tri-State to take advantage of its monumental efficiency and renewable opportunities, as outlined in Part IV below.

## **F. There is Abundant Evidence that Renewable Energy and Energy Efficiency are Cost Effective**

The very good news for TSGT coop members is that the time has finally begun to arrive when renewable energy is not only cleaner and more resilient—it is also more cost effective under many reasonable sets of assumptions.

While details on Tri-States’ analyses of renewable energy are not generally made public, Tri-State insiders confirm that the prices of new wind projects are “very competitive,” which is code for being equal to or better than the costs associated with fossil fuel plants.

In addition, news reports indicate that solar can be obtained at very desirable prices, particularly in New Mexico which has favorable tax credit arrangements.<sup>32</sup>

Also, in Colorado, both analyses by Xcel as well as by the City of Boulder (as part of its municipalization process)<sup>33</sup> have confirmed what many have long felt—investing in renewable energy now will save customers money over the long run.

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<sup>32</sup> For examples of low cost solar projects see <https://www.greentechmedia.com/articles/read/first-solar-macho-update> and <https://www.greentechmedia.com/articles/read/Cheapest-Solar-Ever-Austin-Energy-Buys-PV-From-SunEdison-at-5-Cents-Per-Ki> For additional information on the falling costs of solar energy see <http://www.greentechmedia.com/articles/read/solar-pv-module-costs-to-fall-to-36-cents-per-watt> or <http://cleantechnica.com/2014/02/18/cost-of-solar-pv/>

<sup>33</sup> The City of Boulder’s modeling showing the cost savings from moving to a renewable energy dominated grid can be found in City of Boulder Council information packets for February 26, 2013 and July 23, 2013 available from <https://bouldercolorado.gov/tags/energycouncildocuments2013>

Below is a graph of what Xcel’s most recent analysis of wind and solar bids shows:<sup>34</sup>

**Figure 7**  
**Xcel Analysis of Cost Savings Over Time**  
**from Wind and Solar Projects in Colorado**

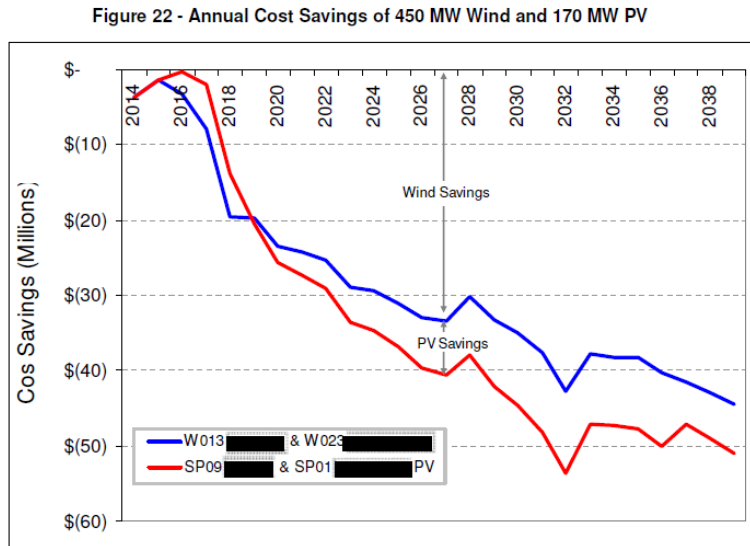


Figure 22 illustrates how adding the 450 MW of W013 and W023 to Portfolio 1 provides \$33 million of energy cost savings in 2027. Similarly, adding the 170 MW of SP09 and SP01 to the 450 MW of wind provides an additional \$7 million of savings bringing the total combined savings of 450 MW of wind and 170 MW of PV to \$40 million in 2027.

As shown in Figure 7 above, adding 450 MW of wind and 170 MW of solar to Xcel’s Colorado system is projected to save customers approximately \$40 million in 2027 with further annual savings in the 2030s—and likely beyond.

As the price of wind and solar installations continue to fall and fossil fuel costs continue to rise, TSGT coop members can look forward to a cleaner and more cost-effective future electric supply.

The evidence mounts by the month that we are entering the era when renewable electricity is not only cleaner, it will also lower energy costs. That is, renewable energy is now key to the equation for creating affordable energy in the 21<sup>st</sup> century.

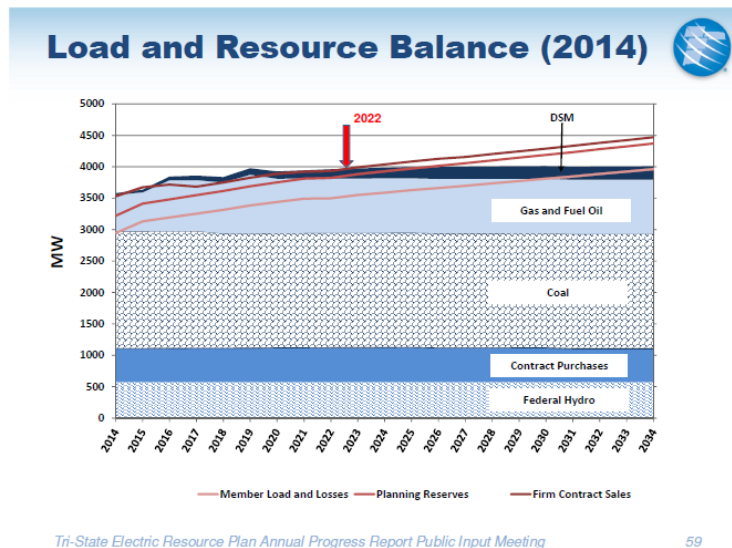
<sup>34</sup> Figure 22, Public Service Company of Colorado 2013 All Source Solicitation, 120 Day Report, 2011 Electric Resource Plan, Public Version, September 9, 2013 (Docket 11A-869E CO PUC), page 70.

## PART III—TSGT: COAL NO LONGER THE BEST OPTION FOR “AFFORDABILITY”

### A.TSGT is Very Coal Dependent

Coal provides over 60% of Tri-States Energy as shown in Figure 8 below in the slide from page 59 of the August 8, 2014 Tri-State Resource Plan Update. In addition to the stippled “coal” segment, the solid blue segment labeled “Contract Purchases” is energy supplied by Basin Electric which is very coal dependent with 2013 Basin Electric generation being about 77 percent coal.<sup>35</sup>

**Figure 8**  
**TSGT Generation Mix and Resource Balance (2014)**<sup>36</sup>



Below is a table showing the coal plants that contribute to Tri-State’s coal fleet, with the Craig coal plants in Colorado providing the largest share of coal capacity for TSGT.

<sup>35</sup> For 2013 Basin Electric generation percentage from coal see [http://www.basinelectric.com/About\\_Us/Corporate/At\\_a\\_Glance/](http://www.basinelectric.com/About_Us/Corporate/At_a_Glance/)

<sup>36</sup> Slide 59, TSGT 2014 Update, August 8, 2014, available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

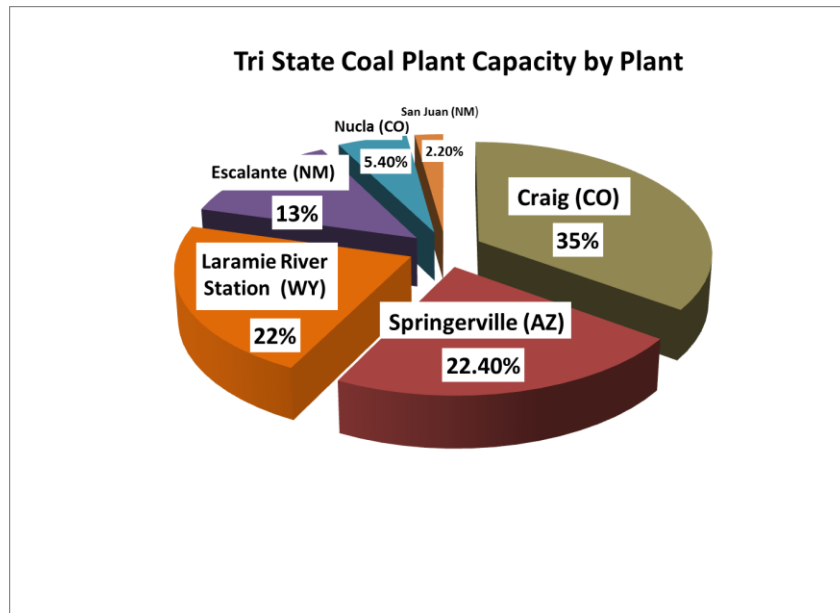


**Table 1**  
**Tri-State Coal Plants<sup>37</sup>**

<b>Coal Plant (State)</b>	<b>Total Size</b>	<b>TSGT Ownership</b>	<b>% of TSGT Coal Capacity</b>
Craig (CO)	1304 MW	653 MW	35%
Springerville (AZ)	1558 MW	418 MW	22.4%
Laramie River Station (WY)	1697 MW	410 MW	22%
Escalante (NM)	245 MW	245 MW	13%
Nucla (CO)	100 MW	100 MW	5.4%
San Juan (NM)	1800 MW	41 MW	2.2%
<b>TOTAL</b>	<b>N/A for TSGT</b>	<b>1867 MW</b>	<b>100%</b>

From the table above, it is clear that TSGT’s ownership of the Craig coal plant in Colorado is the largest component of Tri-State’s coal ownership—providing over one-third of Tri-State’s coal capacity, as shown in Figure 9 below.

**Figure 9**  
**Tri-State Coal Capacity by Plant and State**



<sup>37</sup> Information generally from Tri-State April 23, 2010 presentation available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

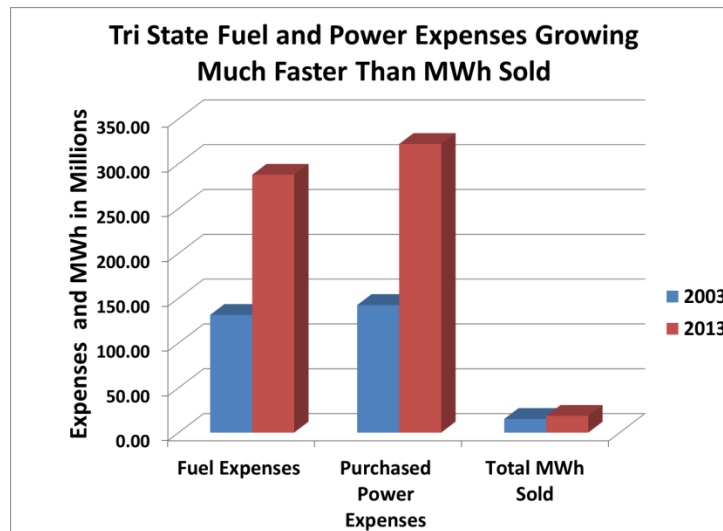
## B. TSGT's Fuel and Power Expenses Are Increasing Much Faster Than Sales

As shown in Table 2 and Figure 10 below, the cost of fuel and purchased power on the Tri-State system has grown much faster in the last decade than Tri-States MWh sales. The likely reasons are discussed below.

**TABLE 2**  
**Tri-State Fuel, Purchased Power Expenses and MWh Sold**  
**2003 v 2013<sup>38</sup>**

	2003	2013	% Change 2003-2013
<b>Fuel Expenses</b>	\$131.28 Million	\$287.65 Million	+119%
<b>Purchased Power</b>	\$142.29 Million	\$322.06 Million	+126%
<b>MWh Sold to TSGT Members</b>	11.728 Million Mwh	15.313 Million MWh	+30.6%
<b>MWh Sold to Non-TSGT Members</b>	3.44 Million MWh	3.316 Million MWh	-3.6%
<b>Total MWh Sold</b>	15.168 Million MWh	18.629 Million MWh	+22.8%

**FIGURE 10**  
**Tri-State Fuel and Power Expenses Compared to MWh Sales**  
**2003 v 2013<sup>39</sup>**



<sup>38</sup> 2003 data from pages 18 and 21 of 2005 TSGT Annual Report. 2013 data from pages 17 and 20 of 2013 TSGT Annual Report. TSGT Annual Reports back to 2005 available from <http://www.tristategt.org/Financials/annual-report.cfm>

<sup>39</sup> Data from Table 2

### C. TSGT's Coal Costs Are Rising

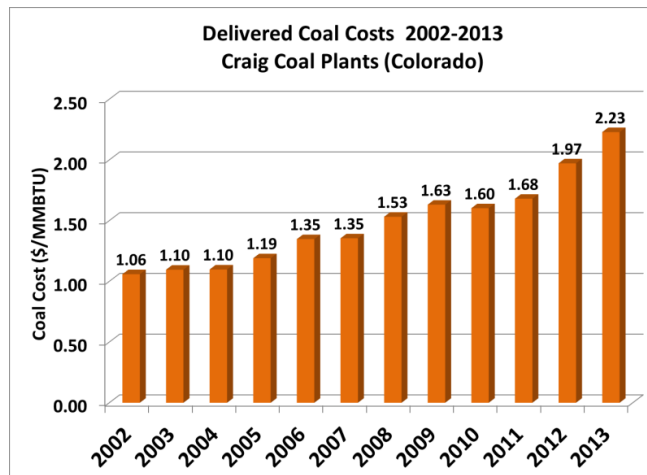
A very likely significant contributor to the increased fuel expenses experienced by TSGT over the last decade is the rising cost of coal needed to fuel TSGT's coal plants. Below are the average delivered coal costs and annual percentage increase for the coal plants in the TSGT system.

**TABLE 3**  
**Delivered Coal Costs at TSGT Coal Plants<sup>40</sup>**

TSGT Coal Plant	2003 Delivered Coal Cost	2013 Delivered Coal Cost	% Increase Per Year 2003-2013
Craig (CO)	\$1.10/MMBTU	\$2.23/MMBTU	7.3% per year
Springerville (AZ)	\$1.33/MMBTU	\$2.01/MMBTU	4.2% per year
Laramie River Station (WY)	\$0.55/MMBTU	\$1.14/MMBTU	7.5% per year
Escalante (NM)	\$1.27/MMBTU	\$2.34/MMBTU	5.5% per year
Nucla (CO)	\$1.23/MMBTU	\$1.87/MMBTU	4.3% per year
San Juan (NM)	\$1.77/MMBTU	\$2.81/MMBTU	4.7% per year

Craig is the largest coal plant in Tri-State's system and its coal costs more than doubled over the last decade as shown in Figure 11 below.

**FIGURE 11**  
**Coal Cost at Craig Coal Plants Rising Quickly**  
Average Coal Costs Derived from EIA 923 Data<sup>41</sup>



<sup>40</sup> Data from EIA 923 database. There are some differences depending on the version of 923 data used, but the differences are not large. <http://www.eia.gov/electricity/data/eia923/>

<sup>41</sup> Average delivered coal costs derived from EIA 923 data available from <http://www.eia.gov/electricity/data/eia923/>

As seen from Figure 11 above, from 2003-2013, delivered coal costs at Tri-State's Craig Coal Plant more than doubled from \$1.10/MMBTU<sup>42</sup> in 2003 to \$2.23 in 2013. This means coal costs at Craig, one of the most important Tri-State coal plants have been rising at a rate above 7%/year.<sup>43</sup>

Importantly, TSGT now assumes for planning purposes that coal costs will rise about 3% a year for the next 18 years,<sup>44</sup> while actual coal costs appear to be rising at a rate significantly greater than 3% per year, as shown in the Table 3 and Figure 11 above. Failure to properly forecast the price of the dominant fuel on Tri-State's system is not likely to lead to decisions that will provide the most affordable resource portfolios.

Delivered coal costs are rising significantly at Tri-State's coal plants. Tri-State members and others should be informed of these rising coal costs as a likely significant contributor to rising costs for TSGT. Coal is no longer the "cheap" and affordable option that TSGT members have often been told it is.

#### **D. TSGT is Relying on Coal Mines That Are Playing Out**

In addition to issues related to increasing coal costs, there are significant issues related to long term coal supply as mining coal is becoming increasingly less profitable and coal mines are playing out as they rapidly approach the end of economically recoverable coal.

For example, the Laramie River Station is dependent on the Black Thunder coal mine in Wyoming for a significant amount of its coal.<sup>45</sup> The Black Thunder used to be the largest US coal mine and is responsible for about 10% of the country's coal, yet its owner, Arch Coal has acknowledged that production at the Black Thunder could start declining significantly in

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<sup>42</sup> MMBTU is short for a "thousand-thousand" (i.e. "MM") or million British Thermal Units—a measure of heat content.

<sup>43</sup> Compound rates of increase can be calculated mathematically or on line at [http://www.moneychimp.com/calculator/compound\\_interest\\_calculator.htm](http://www.moneychimp.com/calculator/compound_interest_calculator.htm)

<sup>44</sup> For the 3% per year assumed increase in coal costs, see Slide 49, TSGT 2014 Annual Update, August 8, 2014 available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>. Until 2013, TSGT assumed that coal prices would magically stay flat for the next 20 years. See for example slide 175 in the April 23, 2010, slide 22 in the August 29, 2011 and slide 60 in the July 27, 2012 resource plan PPTs available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

<sup>45</sup> Coal mines supplying coal plants can be followed on the EIA 923 data base found at <http://www.eia.gov/electricity/data/eia923/>

2020.<sup>46</sup> Additional reserves available to the Black Thunder are on the west side of the Joint Line railroad serving the Powder River Basin and are buried significantly deeper than the coal being mined in the existing Black Thunder mine.<sup>47</sup>

**Figure 12**  
**The Black Thunder Coal Mine, Wyoming<sup>48</sup>**



Tri-State's largest coal plant, the Craig coal plant in Colorado largely relies on two Colorado coal mines, the Trapper and the ColoWyo mine.<sup>49</sup> It is clear that prices for coal for the Craig coal plant are rising (see Figure 11), an indication that these mines are facing increasing production costs. It is also not clear for how many more years these mines can continue to produce coal. Tri-State claims that the ColoWyo mine can fuel the Craig coal plant to

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<sup>46</sup> See page 15 in Arch Coal's 2013 10-K available from <http://investor.archcoal.com/phoenix.zhtml?c=107109&p=irol-irhome>

<sup>47</sup> See page 3-14 in the Wright Area Final EIS by the Bureau of Land Management, available from <http://www.blm.gov/wy/st/en/info/NEPA/documents/hpd/Wright-Coal.html> Compare overburden in the West Hilight area (west of the Joint Line Railroad) at 428 feet to overburden in the existing mine 282 feet. Many of the draglines in the Powder River Basin are designed to go down about 200 feet. Mining coal buried over 400 feet deep is likely to be very expensive and Arch is already reporting very large losses as can be seen in their quarterly and annual reports found at <http://investor.archcoal.com/phoenix.zhtml?c=107109&p=irol-irhome>

<sup>48</sup> Picture of the Black Thunder coal mine from Ecoflight <http://www.publicnewsservice.org/2012-12-03/energy-policy/tribe-members-to-weigh-in-at-wa-coal-plant-hearing/a29507-1>

<sup>49</sup> For a discussion of the acquisition of the ColoWyo mine by Tri-State's subsidiary, Western Fuels, see <http://www.poweringthewest.org/2011/12/01/western-fuels-colorado-closes-on-purchase-of-colowyo-mine/#more-1144>.

the end of its expected life<sup>50</sup> (currently expected to be 2041), but at least one web site indicates that the ColoWyo coal mines' expected life is only to 2017.<sup>51</sup>

In addition, the former owner of the mine, Rio Tinto, stated that it intended to close the mine in 2017,<sup>52</sup> and production had dropped from about 4.4 million tons in 2008 to 2.4 million tons in 2010 .<sup>53</sup> Also, Rio Tinto stated the “marketable reserves” at the Rio Tinto mine to be 15 million tons<sup>54</sup>—an amount that is likely to last less than a decade at 2 million tons per year production.

**Figure 13**  
**In 2011, Tri-State Purchased the ColoWyo Mine from Rio Tinto<sup>55</sup>**



<sup>50</sup> For Tri-State's claim that the ColoWyo coal mine can fuel the Craig coal plants for their expected life, see <http://www.poweringthewest.org/2011/12/01/western-fuels-colorado-closes-on-purchase-of-colowyo-mine/#more-1144>

<sup>51</sup> For the ColoWyo coal mine projected life to 2017, see <http://www.infomine.com/minesite/minesite.asp?site=colowyo> .

<sup>52</sup> The former owner of the ColoWyo coal mine, Rio Tinto had planned on closing the mine in 2017 (see page 57, 2010 Rio Tinto Annual 10-K available from [http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab\\_2010](http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab_2010)

<sup>53</sup> For the ColoWyo coal mine production falling from about 4.4 million tons in 2008 to 2.4 million tons in 2010, see page 81, 2010 Rio Tinto Annual 10-K available from [http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab\\_2010](http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab_2010)

<sup>54</sup> For marketable coal reserves of 15 million tons at the ColoWyo mine at the end of 2010 as stated by the former owner, Rio Tinto, see page 85, 2010 Rio Tinto Annual 10-K available from [http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab\\_2010](http://www.riotinto.com/investors/results-and-reports-2146.aspx#tab_2010)

<sup>55</sup> Picture from <http://www.poweringthewest.org/2011/12/01/western-fuels-colorado-closes-on-purchase-of-colowyo-mine/#more-1144>

While Rio Tinto’s 2010 Annual Report stated that the ColoWyo had 59 million tons of coal “resources,” it appears likely that mining these coal “resources” is likely to be expensive and the rural coops being served by Tri-State could easily see future rate increases driven by the rising cost of coal mined at ColoWyo to serve the Craig coal plants.<sup>56</sup>

The Craig coal plants are also served by the Trapper mine which is expected to operate until the 2020s, but it is not clear if it will be able to operate after that.<sup>57</sup>

Detailed and public analyses should be conducted for the mines serving all of Tri-State’s coal plants. Coal mines have largely become losing operations<sup>58</sup> and it isn’t clear who will be mining coal in the coming years and decades. The remaining coal in the US will be more difficult and expensive to mine and it is questionable whether a profit can be made mining coal in the coming years. If coal can’t be mined at a profit, it isn’t clear how much of it will be mined.

The mines supporting Tri-State’s key coal plants are likely to begin playing out in the next decade. Given the rising costs of mining coal, it isn’t clear that these or other US coal mines will be producing large quantities of coal in the 2020s and beyond.

### **E. TSGT Coal Plants are Likely to Need Expensive New Pollution Controls**

Coal plants produce large quantities of air pollutants, including particulates, sulfur dioxide, heavy metals like mercury and carbon dioxide.

As the 21st century unfolds, it is likely that Tri-State’s coal plants will

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<sup>56</sup> While it is possible that the Craig coal plants could attempt to source coal from Wyoming, this coal would be lower heat content subbituminous coal while the current Colorado coal being burned at Craig is a higher heat content bituminous coal. Some coal plants can be transitioned from burning bituminous coal to burning subbituminous, it is not known whether the Craig coal plants would function with subbituminous coal. In addition, as discussed in the text, the Wyoming mines such as the Black Thunder mine are also approaching the end of economically recoverable coal, so it is not clear that even if the Craig coal plants could switch to Wyoming coal that that would provide a long term source of coal.

<sup>57</sup> For a discussion of the 2006 land slide that buried much of the Trapper Mine’s remaining coal reserves and the steps that have been taken since then to access the coal and extend the life of the mine into the 2020s, see <http://www.poweringthewest.org/tag/trapper-mine/>

<sup>58</sup> Detailed reports on US coal costs and the coal industry available from <http://cleanenergyaction.org/research-reports/>



need to add additional pollution controls. For example, in the summer of 2014 Tri-State entered into an agreement that will lead to additional controls for oxides of nitrogen for the Craig coal plants.<sup>59</sup>

Before spending the money (likely to be well above \$100 million) to add expensive nitrogen oxide controls to the Craig power plant, Tri-State should undertake a thorough analysis of all alternatives, including increasing reliance on free-fuel renewable generation combined with natural gas and/or storage and include a realistic assessment of future coal cost and supply issues. Tri-State should not assume that coal costs will remain low and adequate coal supplies can be assumed for the future.<sup>60</sup>

As Tri-State faces the need to add expensive pollution control measures or other expenditures at its other aging coal plants, similar analyses should be done rather than assuming that coal remains the best choice for affordable electricity in the 21<sup>st</sup> century.

## **F. TSGT Has Wasted Tens of Millions of Dollars on Bad Bets on Coal in the 21<sup>st</sup> Century**

Unfortunately, Tri-State has spent tens of millions of its members' dollars on bad bets related to the mistaken assumption that heavy reliance on coal will be the most affordable option. These "bad bets" on coal include:

- **Holcomb Coal Plant Planning:** Tri-State has talked about building a new coal plant in Holcomb, Kansas in coordination with Sunflower Electric Power for much of the last decade and spent at least \$77 million in support of this effort.<sup>61</sup> Yet, due to extensive efforts by grass roots groups in Kansas and Colorado and legal work challenging the permits for the plant,<sup>62</sup> this

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<sup>59</sup> For the settlement that calls for additional controls for nitrogen oxides on the Craig coal plant, see [http://www.bizjournals.com/denver/blog/earth\\_to\\_power/2014/07/tri-state-reaches-settlement-with-enviros-on-craig.html?page=all](http://www.bizjournals.com/denver/blog/earth_to_power/2014/07/tri-state-reaches-settlement-with-enviros-on-craig.html?page=all)

<sup>60</sup> Lengthy reports on coal cost and supply issues and why assuming that coal supplies will remain adequate are available at <http://cleanenergyaction.org/research-reports/>

<sup>61</sup> Tri-State acknowledges spending over \$77 million on the possible development of the Holcomb coal plant on page 35 of the 2013 Tri-State Annual Report available from <http://www.tristategt.org/Financials/annual-report.cfm>

<sup>62</sup> The most recent air permit was issued in May 2014 by the Kansas Department of Health and the Environment (KDHE) (see <http://www.kansas.com/news/article1144680.html>) and this permit was once again challenged in court (see <http://content.sierraclub.org/press-releases/2014/06/sierra-club-takes-legal-action-after-proposed-holcomb-coal-plant-fails-meet>)



Kansas Holcomb/Sunflower coal plant does not appear likely to be built.

- **ColoWyo Mine Purchase:** In December 2011, Tri-State’s subsidiary, Western Fuels purchased the ColoWyo mine from Kennecott Colorado Coal Company and Rio Tinto White Horse Company for \$77 million in cash. The transaction also involved the transfer of coal supply contracts that were below market value (i.e. the coal was to be supplied at a price below what it would cost to produce the coal), leading to complex accounting transactions.<sup>63</sup>
- **Opposition to Carbon Regulations:** While the total amount spent by Tri-State opposing regulation of carbon emissions is not currently available, given the rising concern about the impacts of climate change and the falling cost of renewable energy and efficiency alternatives, it appears that TSGT member money would have been better spent investing in clean energy alternatives than in opposing regulation of carbon emissions.

### **G. TSGT Has Adopted Policies that are Counter Productive to Maintaining Adequate and Affordable Electric Power Available to Its Members**

Tri-State member coops have access to vast wind, solar, hydro, geothermal and other renewable resources, but they are often limited in their ability to develop these resources as a result of the “all requirements” contract that members have with Tri-State.

While public information is difficult to obtain on Tri-State contracts with its member and the TSGT Board policies that affect the further development of the renewable resources in member coop territory, it appears that the following is true:

- **Rural Coops Have a Long Term “All Requirements” Contract with Tri-State:** As can best be determined, the rural coop members of Tri-State have an “all requirements” contract with Tri-State that requires that the member coop buy all of its electricity from Tri-State.

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<sup>63</sup> For a description of the accounting transactions surrounding the purchase of the ColoWyo mine, see pages 32-33 in the Tri-State 2013 Annual Report available from <http://www.tristategt.org/Financials/annual-report.cfm>

The contracts allow for up to 5% “self-generation,” using local wind, solar, hydro, geothermal or other forms of locally-generated electricity that are owned or controlled by the rural coop.<sup>64</sup> Some rural coops are beginning to approach this 5% “self generation” limit. Also, as discussed below, the financial transactions for this self-generation are not favorable to the member coops. Member coop contracts with Tri-State are generally for 40 years and most are not up for renewal in the near future.

- **TSGT Policies 115 and 117 Establish Unfavorable Price Treatment for Local Generation Projects:** TSGT Policies 115 and 117 set the contract, financing and pricing policies that will govern the development of locally owned or controlled generation up to the 5% limit in the contract between the member coops and Tri-State. As currently implemented, Policies 115 and 117 are structured in such a way that the rural coop pays for all electricity consumed from Tri-State at Tri-State’s (now regularly escalating) rates and then receives a credit (typically for a much lower amount) for the amount of generation produced by the locally owned or controlled generation. As a result, many rural coop members see the pricing mechanism of Policies 115 and 117 as an effective “tax” on local production.

To ensure a long-term affordable, and increasingly clean, electricity supply to rural coop members, TSGT should establish a policy for step-wise escalation of the 5% self-generation limit in Tri-State contracts (e.g. 10% by 2020, 20% by 2025 etc.) In addition, TSGT policies 115 and 117 should be rewritten to encourage development of local generation that will provide cleaner, lower risk and very likely more affordable electricity for rural coop members.

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<sup>64</sup> The 5% limit on self generation has often been attributed to the requirements of the Rural Utility Service and loans they provided to build large centralized generation such as coal plants. In October 2014, Tri State announced that it was considering refinancing some of its debt in order to pay off the Rural Utility Service debts. See <http://www.prnewswire.com/news-releases/tri-state-generation-and-transmission-association-inc-considering-refinancing-of-certain-debt-279545242.html> It appears that paying off the RUS debts may make it possible for Tri State to reconsider the limit on 5% self generation by the member coops.

## H. TSGT Has Not Maintained an Open and Transparent Flow of Communication With Its Members

As discussed in detail in Part IV below, Tri-State claims to operate by seven principles of cooperatives, including democratic control by the membership, yet there is increasing concern among rural coop members that Tri-State is unwilling to provide full and open communication with its members. Examples of inadequate communication between Tri-State and its member coops and their members include:

- **Inadequate communication around decisions to increase rates:** When Tri-State decided to institute a major change in its rate structure, many member coops complained that they did not have adequate input. In New Mexico, this has led to several coops taking a rate complaint to the New Mexico Public Regulation Commission and entering into negotiations that allow more freedom for member coops to enter into supply discussions with other electrical providers.<sup>65</sup>
- **Inadequate information on large investment decisions:** While there is some information in Tri-State's Annual Reports on the expenditures on the proposed new Holcomb coal plant and the purchase of the ColoWyo coal mine, this information is buried in small font in the text of the Annual Reports. As a result, TSGT members have not had a clear picture of the tens of millions of dollars spent on investments that have not led to more affordable electricity.
- **Inadequate responses to questions from members on Tri-State finances and policies:** In recent years, an increasing number of members of rural coops served by Tri-State have attempted to obtain information on Tri-State policies and expenditures and have had a very difficult time getting that information. For example, TSGT Board Policies (including Policies 115 and 117 summarized above) do not appear to be posted on Tri-State's website in a publicly accessible fashion.

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<sup>65</sup> For a summary of the situation with the New Mexico cooperatives, see <http://kitcarson.coopwebbuilder2.com/sites/kitcarson/files/PDF/TRISTATE%20TALKING%20POINTS%20%20RATE%20IMPACT.pdf>

- **Inadequate information on coal cost and supply issues:** As discussed above, Tri-State is very coal dependent and yet they have failed to provide clear and accurate information to member coops and their members on the rising costs of coal and possible coal supply constraints in the coming decades. Fuel and power supply expenses have been rising much faster than Tri-State’s sales (See Figure 10), but TSGT members have received almost no information detailing this situation and its impact on Tri-State expenses and rates.

To ensure affordable electricity supplies in the future, Tri-State should begin a full and complete communication with members around rising fuel and power production costs, the full array of costs leading to rate increases and the possible savings and risk reduction benefits of increasing reliance on more distributed and renewable energy sources.

### **I. TSGT Has Not Encouraged Innovative Thinking On The TSGT Board**

Tri-State Board members are presented in Tri-State’s Annual Reports.<sup>66</sup> In general, Tri State Board members are not representative of the younger, more ethnically diverse, and gender balanced population they serve. In addition, it is not clear that Tri-State’s Board members are well versed in engineering, technology or financial issues. As a result, the Tri-State Board is generally not positioned with the critical thinking required to meet the challenges facing wholesale electricity providers in the 21<sup>st</sup> century. In addition, many Tri-State Board members have been holding their positions for many years. Without an input of fresh thinking, it will be harder for Tri-State to adapt to the new realities of the 21<sup>st</sup>

To ensure innovative thinking appropriate to the 21<sup>st</sup> century, Tri-State should develop policies that encourage more diversity on the Tri-State board—including more young people, women and people of color.

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<sup>66</sup> Tri-State’s Board Members are portrayed on pages 13-15 of Tri-State’s 2013 Annual Report available from <http://www.tristategt.org/Financials/annual-report.cfm>

## PART IV--TSGT: FINDING A NEW EQUATION FOR AFFORDABILITY

### A. Tri-State Professes a Dedication to Affordability and Cooperative Principles

Tri-State emphasizes its dedication to providing an affordable supply of electricity in accordance with cooperative principles. Tri-State’s mission is stated as follows:

**Tri-State's mission is to provide our member systems a reliable, cost-based supply of electricity while maintaining a sound financial position through effective utilization of human, capital and physical resources in accordance with cooperative principles.<sup>67</sup>**

In presentations, Tri-State often professes its dedication to “The Seven Cooperative Principles.” as shown in Figure 14.

**FIGURE 14**  
**Tri-State: Seven Cooperative Principles<sup>68</sup>**



<sup>67</sup> Tri-State’s Mission Statement can be found at <http://www.tristategt.org/AboutUs/overview.cfm>

<sup>68</sup> For the Seven Principles of Coops, see Slide20 in the April 16, 2010 Resource Planning PPT available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm>

As discussed in Section III above, Tri-State appears to be having a harder time living up to the Seven Cooperative Principles as the fundamentals of electric power change in the 21<sup>st</sup> century.

To ensure affordability and action in accordance with the Seven Cooperative Principles, Tri-State should begin open and honest communication with its members regarding the rising costs of coal and other fossil fuels and the declining cost and risk-avoidance benefits of renewable energy and energy efficient technologies.

### **B. Tri-State Needs a New Equation to Keep Electricity Affordable**

A careful review of Tri-State’s financial statements and its coal cost and supply situation will likely lead to the conclusion that Tri-State needs a new equation for affordability.

This equation will likely include increasing amounts of renewable energy. As detailed below, Tri-State territory includes an abundance of opportunities to develop cost-effective renewable energy technologies. Opening discussions with member coops about this new economic reality and the new equation for affordability can allow Tri-State to move into the 21<sup>st</sup> century and to behave in accordance with the Seven Principles of Cooperatives that it has professed to.

### **C. Tri-State Territory Includes Excellent Wind Resources**

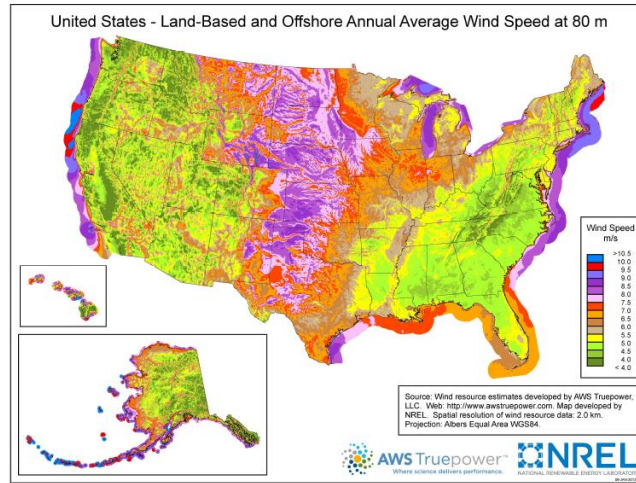
The four state territory covered by Tristate Generation and Transmission—Colorado, Wyoming, New Mexico and western Nebraska is home to excellent wind resources—indeed some of the very best in the United States. Figure 15 is a map of US wind resources at 80 meters above ground:<sup>69</sup>

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<sup>69</sup> For maps of US wind resources, refer to <http://www.nrel.gov/gis/wind.html> The 80 meter US wind resource map for on and off shore is at [http://www.nrel.gov/gis/images/80m\\_wind/awstwsdpd80onoffbigC3-3dpi600.jpg](http://www.nrel.gov/gis/images/80m_wind/awstwsdpd80onoffbigC3-3dpi600.jpg)



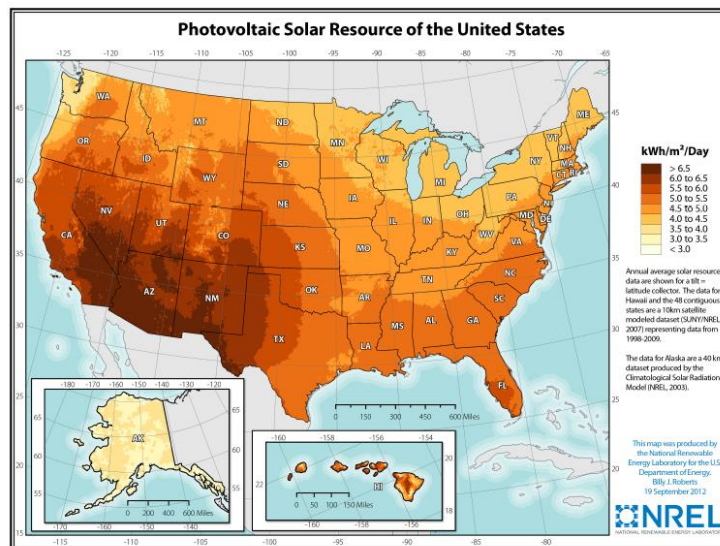
**Figure 15**  
**US Wind Resources at 80 Meter Height On and Off Shore**



**D. Tri-State Territory Includes Excellent Solar Resources**

Maps of the US solar resource are available from the National Renewable Energy Laboratory<sup>70</sup>

**Figure 16**  
**Photovoltaic Solar US Resource Potential<sup>71</sup>**



<sup>70</sup> For maps of the US solar resource go to <http://www.nrel.gov/gis/solar.html>

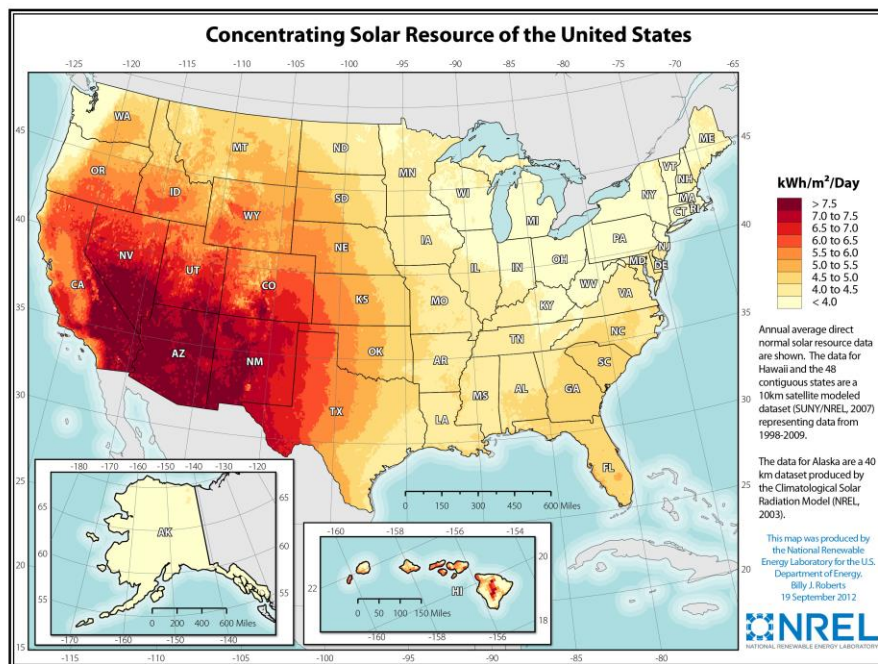
<sup>71</sup> US photovoltaic resource map from [http://www.nrel.gov/gis/images/eere\\_pv/national\\_photovoltaic\\_2012-01.jpg](http://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg)

The dark orange and reds in New Mexico, Colorado, Wyoming and western Nebraska in Figure 16 indicate that Tri-State member coop territories are blessed with abundant photovoltaic solar resources.

As a sign of affordability, a New Mexico utility, El Paso Electric bought photovoltaic electricity from New Mexico for less than 6 cents per kwh in 2013—significantly less than electricity from a new coal plant would likely cost.<sup>72</sup>

Photovoltaic (“PV”) solar converts sunlight directly to electricity using photovoltaic panels. Another form of solar energy, referred to as Concentrating Solar Power (“CSP”) uses the thermal energy of the sun to warm liquids and then uses that thermal energy to produce electricity.

**Figure 17**  
**Concentrating Solar Power US Resource Potential**



<sup>72</sup> For information on the El Paso Electric purchase of solar photovoltaic electricity for less than 6 cents per kwh, see <http://thinkprogress.org/climate/2013/02/03/1529651/new-mexico-utility-agrees-to-purchase-solar-power-at-a-lower-price-than-coal/> Also, in October 2014, Georgia utilities announced that they were signing contracts for 500 MW of distributed utility scale (e.g. 2-20 MW) solar projects for less than 6.5 cents/kwh. See <http://www.utilitydive.com/news/georgia-power-inks-solar-contracts-for-less-than-65-centskwh/321898/>

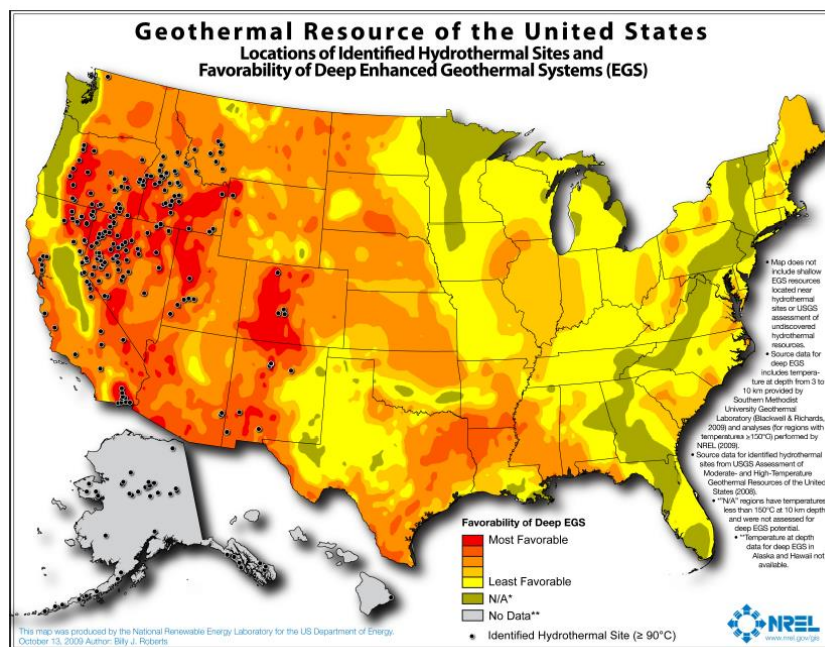


Once again, the dark reds and oranges in New Mexico, Colorado, Wyoming and western Nebraska in Figure 17 indicate that Tri-State member coop territories are blessed with abundant concentrating solar power resources

### E. Tri-State Territory Includes Excellent Geothermal Resources

Maps of geothermal resources are available from the National Renewable Energy Laboratory.<sup>73</sup>

**Figure 18**  
**Geothermal Resources of the United States<sup>74</sup>**



Once again, the large areas of reds and oranges in TSGT territory in Colorado, Wyoming, New Mexico and Nebraska indicate that the area served by Tri-State is rich in geothermal resources—resources which

<sup>73</sup> For geothermal resource assessments go to <http://www.nrel.gov/gis/geothermal.html>

<sup>74</sup> Map of US geothermal resources from [http://www.nrel.gov/gis/images/geothermal\\_resource2009-final.jpg](http://www.nrel.gov/gis/images/geothermal_resource2009-final.jpg)

can help complement the wind, solar and hydro resources that also exist in Tri-State territory.

A number of groups in Tri-State territory are advancing the development of geothermal resources. One example of such a group is Pagosa Verde, based in Pagosa Springs, Colorado.<sup>75</sup>

## **F. Tri-State Territory Includes Significant Small Hydro Resources**

The United States Department of Energy has surveyed many states for potential small hydro sites.<sup>76</sup> Assessments on a statewide basis show significant small hydro potential in Tri-State Territory, as shown in Figure 20<sup>77</sup> and Delta Montrose Electric Association (DMEA) brought two 3-4 MW “run of the river” turbines in the “South Canal” small hydro project on line in 2013 in conjunction with the Uncompahgre Valley Water Users Association.<sup>78</sup>

**Figure 19**  
**DMEA Engineer Jim Heneghan Explains the**  
**South Canal Small Hydro Project<sup>79</sup>**



<sup>75</sup> For information or to contact the geothermal experts at Pagosa Verde go to <http://pagosaverde.com/>

<sup>76</sup> For information on small hydro potential sites see <http://hydropower.inl.gov/resourceassessment/>

<sup>77</sup> For statewide assessments of small hydro potential, see <http://hydropower.inl.gov/resourceassessment/states.shtml>

<sup>78</sup> For a description of the DMEA South Canal small hydro project see <http://www.poweringthewest.org/2013/08/30/dmea-makes-good-on-100-year-old-hydro-plan/#more-2548>

<sup>79</sup> Picture of the South Canal small hydro project from <http://www.poweringthewest.org/2013/08/30/dmea-makes-good-on-100-year-old-hydro-plan/#more-2548>



Figure 21 reproduces Figure 1.3 from the 2010 TSGT System Wide Electric Energy Efficiency Potential Study.

**Figure 21**  
**TSGT Energy Efficiency Potential By Year<sup>84</sup>**

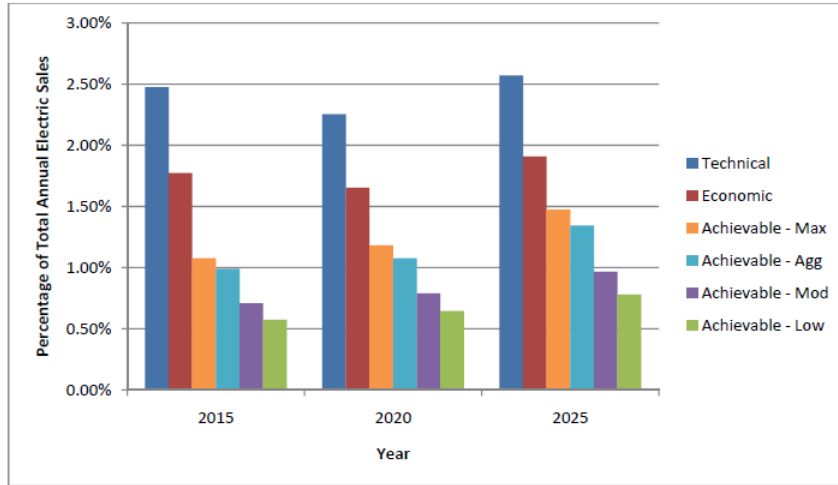


Figure 1.3 Potential Annual Energy Savings as a Percentage of Annual Sales

As shown in Figure 21 above, the achievable energy efficiency savings are in the range of 1-1.5% per year—showing potential for efficiency savings on par with many other utilities’ potential savings. The study identified many efficiency programs that are expected to have positive benefit to cost ratios, depending on which parts of the Tri-State system are being analyzed.

While the TSGT System Wide Electric Energy Efficiency Potential Study is now a few years old, it still provides a wealth of important information on Tri-State loads and opportunities for cost-effective energy efficiency savings.

<sup>84</sup> Figure is from the TSGT Systemwide Energy Efficiency study found at <http://www.tristategt.org/EEPrograms/energy-efficiency-study.cfm>

## **H. Tri-State's Load is Well Matched to Emerging Storage Technologies**

In order to accommodate increasing levels of renewable energy, gaining experience with storage mechanisms is important. Electricity storage technologies are evolving rapidly, and Tri-State should keep a careful eye on these emerging technologies and look for opportunities to begin adding storage capacity to the Tri-State system.

For example, in September 2014, a 5 MW storage battery that can provide operating reserves equivalent to a 50 MW turbine went on line in Germany<sup>85</sup> and these technologies are likely to become available in the US before long. Most of Tri-State's load is distributed in rural areas (as opposed to serving large cities like Denver) where storage capacity in the 50 MW range should work well to support increasing levels of free-fuel renewable energy generation.

Another development in storage uses a cement-like medium as a new method to store the excess thermal energy from a Concentrating Solar Power plant, allowing the sun's heat to be used to produce electricity in a dispatchable, 24-hour fashion.<sup>86</sup>

## **I. Tri-State has Tremendous Potential to Demonstrate Renewable Potential for a Distributed Load**

The National Renewable Energy Lab has modeled a future with 80% renewable energy to meet national loads.<sup>87</sup> The conclusions of the study were as follows:

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<sup>85</sup> For a description of the German storage battery that can provide operating reserves equivalent to a 50 MW turbine going on line see <http://reneweconomy.com.au/2014/battery-storage-make-reserve-coal-plants-redundant-80130> and <http://www.renewablesinternational.net/wemag-and-yunicos-win-the-greentec-award/150/537/79046/>. For other examples of improvements in battery technology see <http://reneweconomy.com.au/2014/battery-storage-breakthrough-allows-recharge-in-just-2-mins-35258> and [http://www.pv-magazine.com/news/details/beitrag/byd-unveils-two-electric-buses-with-vast-battery-capacity\\_100016811/#axzz3GbYPc6Ng](http://www.pv-magazine.com/news/details/beitrag/byd-unveils-two-electric-buses-with-vast-battery-capacity_100016811/#axzz3GbYPc6Ng)

<sup>86</sup> For a description of the "cement-like" storage that is being developed for CSP plants, see <http://news.yahoo.com/israeli-firm-looks-keep-solar-power-generators-running-110846637--finance.html>

<sup>87</sup> For the National Renewable Energy Lab "Renewable Energy Futures" study see [http://www.nrel.gov/analysis/re\\_futures/](http://www.nrel.gov/analysis/re_futures/)

- Renewable electricity generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050 while meeting electricity demand on an hourly basis in every region of the country.
- Increased electric system flexibility, needed to enable electricity supply and demand balance with high levels of renewable generation, can come from a portfolio of supply- and demand-side options, including flexible conventional generation, grid storage, new transmission, more responsive loads, and changes in power system operations.
- The abundance and diversity of U.S. renewable energy resources can support multiple combinations of renewable technologies that result in deep reductions in electric sector greenhouse gas emissions and water use.
- The direct incremental cost associated with high renewable generation is comparable to published cost estimates of other clean energy scenarios. Improvement in the cost and performance of renewable technologies is the most impactful lever for reducing this incremental cost.

One result that comes from the NREL study, as well as other studies that have examined the move towards increasing reliance on renewable technologies, is that old ideas about the necessity of baseload are being replaced by an understanding that 21<sup>st</sup> century electric systems will need to be more flexible to accommodate the variable nature of renewable systems. Indeed high levels of inflexible baseload coal (and nuclear) plants can impede the ability to benefit from free-fuel resources like wind and solar.<sup>88</sup>

Tri-State territory includes abundant renewable energy resources and Tri-State can lead the way in developing a flexible, innovative 21<sup>st</sup> century, renewable-energy based electric system.

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<sup>88</sup> There are many on-line resources on the concept that “baseload” generation is becoming an obsolete concept. Here are a few:  
<http://mitei.mit.edu/system/files/intermittent-renewables-findings.pdf>  
<http://www.smartplanet.com/blog/the-energy-futurist/why-baseload-power-is-doomed/>  
<http://www.nytimes.com/gwire/2009/04/22/22greenwire-no-need-to-build-new-us-coal-or-nuclear-plants-10630.html>

There are three short videos on the concept of baseload becoming obsolete at [http://energyshouldbe.org/Delve\\_Deeper.html](http://energyshouldbe.org/Delve_Deeper.html)

## PART V—TSGT: RECOMMENDATIONS

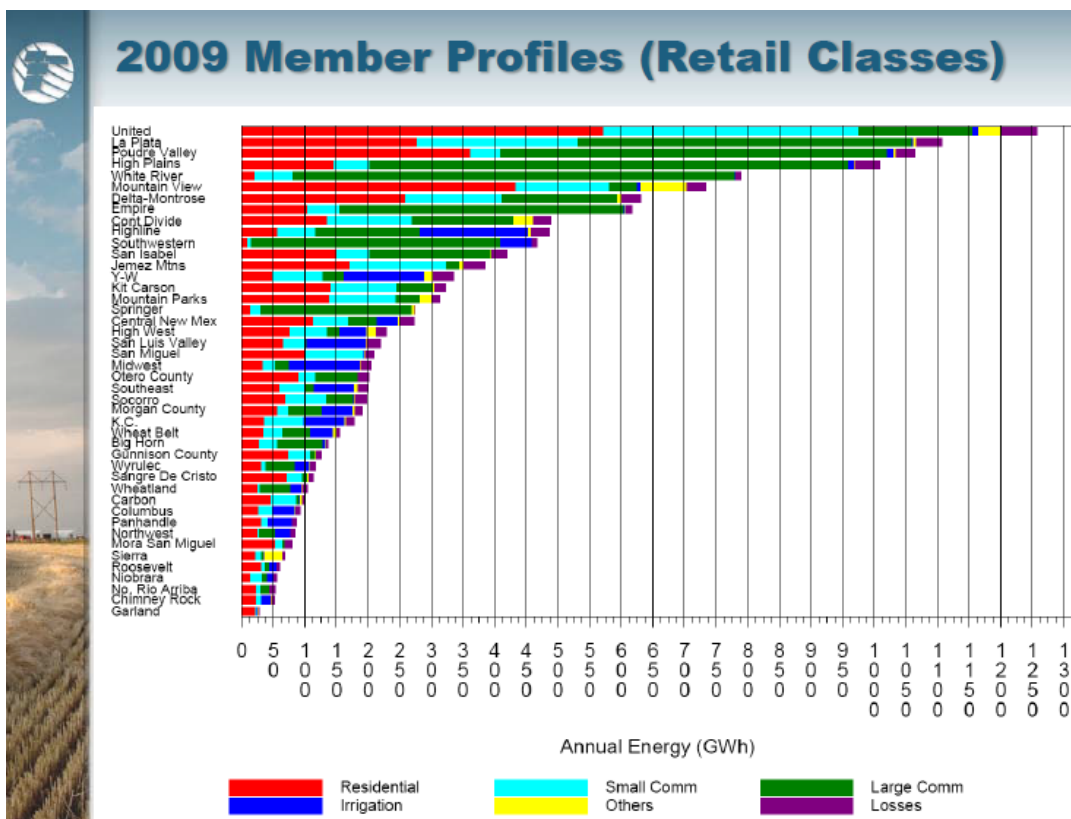
As Tri-State searches for a new equation for affordable electricity, the following recommendations should be considered:

- Take a fresh and critical look at which generation resources will truly ensure the long-term affordability and accessibility of electricity in Tri-State’s territory
- Provide more detailed accounting of fuel and power expenses in annual and quarterly reports provided to coop members
- Provide accurate information to coop members regarding trends in coal prices and the impacts of these prices on Tri-State rates.
- Provide accurate information to coop members about the life span of coal mines that support Tri-State’s coal plants
- Provide accurate information to coop members about the costs of pollution controls for coal plants and the alternatives
- Recognize that power systems in the 21<sup>st</sup> century will likely become lower carbon, more distributed and designed around flexible generation that can accommodate increasing reliance on renewable energy resources.
- Help coop members recognize that in the 21<sup>st</sup> century, inflexible “base load” resources can interfere with adding cost-effective levels of free fuel renewable energy that are the key to affordable electricity moving forward.
- Continue to gain more experience with adding renewable energy generation resources to Tri State’s system and provide accurate information to coop members about the long term cost savings potential of these technologies
- Begin to experiment with adding more storage capacity to Tri-State’s system to allow increasing reliance on renewable technologies
- Continue to encourage more energy efficiency and renewable energy programs by Tri-State member coops.
- Adopt policies to allow member coops to move above the 5% limit on self-generation in a step wise fashion.
- Revise Policies 115 and 117 and adopt a pricing mechanism that encourages development of renewable energy technologies



- Develop programs and policies that encourage innovative thinking by Tri-State Board members in order to best adapt to the new realities of the 21<sup>st</sup> century.
- Consider a system that provides TSGT Board representation based on the size of the member coop so that the number of Board representatives from member coops is proportional to sales rather than having equal representation for all member coops. (See Figure 22.)

**Figure 22**  
**Tri-State Member Coop Size Distribution<sup>89</sup>**



<sup>89</sup> For Tri-State member coop sizes, see Slide 41 in April 16, 2010 Powerpoint presentation available from <http://www.tristategt.org/ResourcePlanning/ResourcePlanDoc.cfm> This was the most recent publicly-available data on the size of member coops that could be found.



## PART VI—TSGT: WHAT COOP MEMBERS CAN DO

Helping Tri-State achieve the vision of a model 21<sup>st</sup> century utility depends on the involvement of people of all ages and from all walks of life. Here are a few things that anyone can do to help move TSGT forward.

- Attend local Coop Board meetings and make presentations that help inform local coop members about the new equation for affordability.
- Arrange to have personal meetings with local coop Board members.
- Talk to your elected officials at all levels, including your coop board members about the rising costs of fossil fuels and the declining costs and other benefits of clean energy.
- Join or form a local clean energy group.
- Hold regular talks in your community regarding the new equation for affordability and accessibility of electricity in the 21<sup>st</sup> century.
- Talk to others in your community—write letters to local newspapers and elected officials about the new equation for affordability.
- Elect new rural coop board members who understand that a new equation for affordability and accessibility is needed in the 21<sup>st</sup> century

The Coop Members Alliance, CRES, CEA, WCEC  
and others stand ready to help at each step.

Just ask for help by writing

[CoopMembersAlliance@gmail.com](mailto:CoopMembersAlliance@gmail.com)

## **PART VII—TSGT: CONCLUSION**

Through the 20<sup>th</sup> century, Tri-State functioned on a belief that burning coal was the key to affordable energy. As the cost of coal increases (independent of the environmental and social costs of coal), it is time for a new equation of affordability for the 21<sup>st</sup> century.

Tri-State territory includes excellent efficiency and fuel-free renewable energy opportunities including wind, solar, geothermal and hydro resources that can be used to create a new equation for affordability in the 21<sup>st</sup> century. To advance this new equation, Tri-State members need to receive accurate information about rising fuel costs and the declining costs of renewable energy, and Tri-State policies need to evolve to support a cleaner, more distributed and affordable system of electricity generation.

