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Managing CO2 in rural America

Barbara Walz
Tri-State Generation and Transmission Association, bwalz@tristategt.org

TRI-STATE G&T

A Touchstone Energy® Cooperative

Managing CO_2 in Rural America

Barbara Walz

Senior Vice President, Policy & Compliance

Chief Compliance Officer

Outline

- The cooperative difference
- The CO_2 challenge
- Minimizing the emissions from our current fleet
- Growing our renewables portfolio
- Filling the gap with R&D

The Cooperative Difference

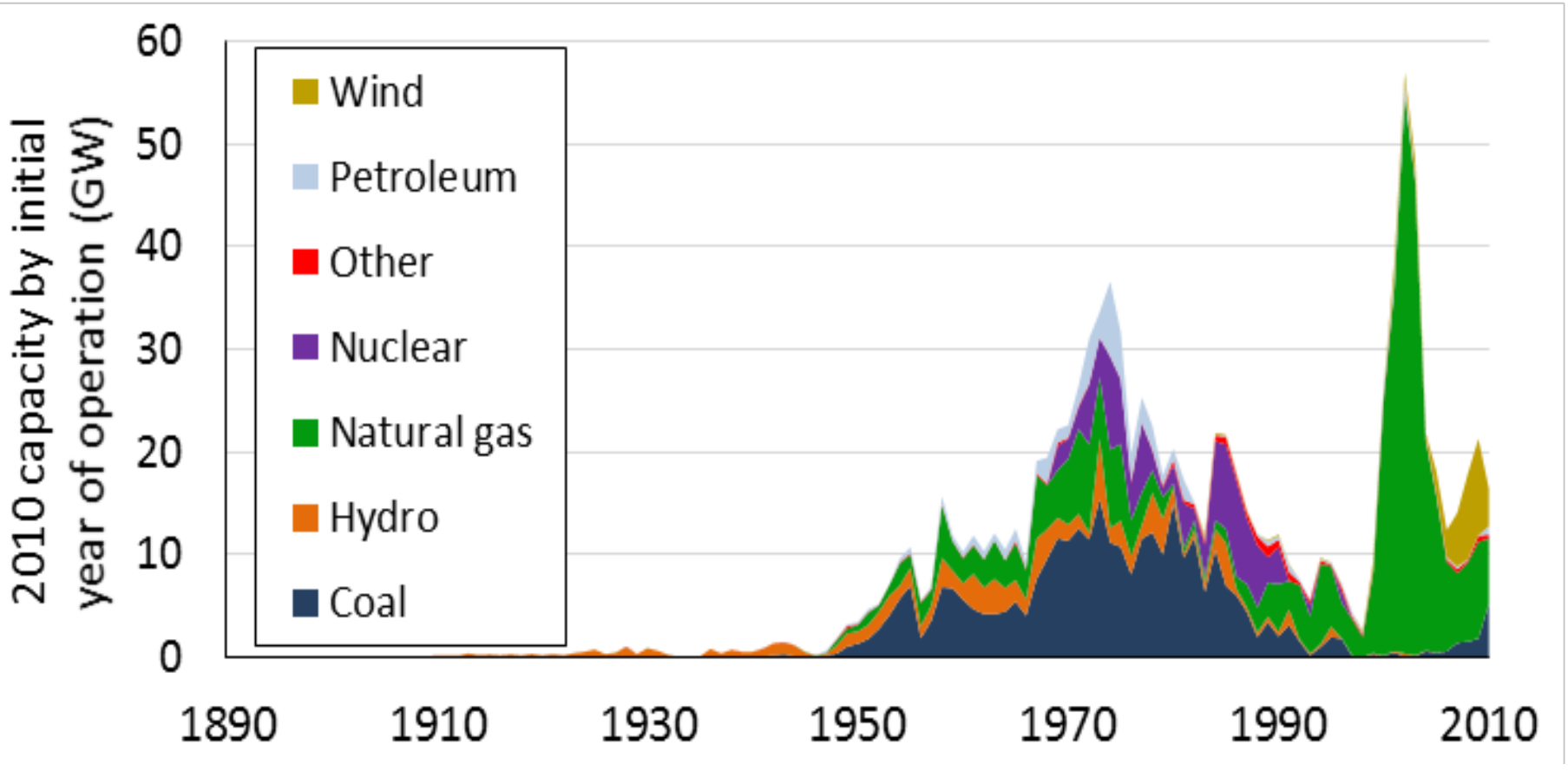
The Cooperative Difference

	Investor-Owned Utility	Cooperative
How are rates set?	By regulators	By member-owners
Structure	For-profit	Not-for-profit

The Cooperative Difference

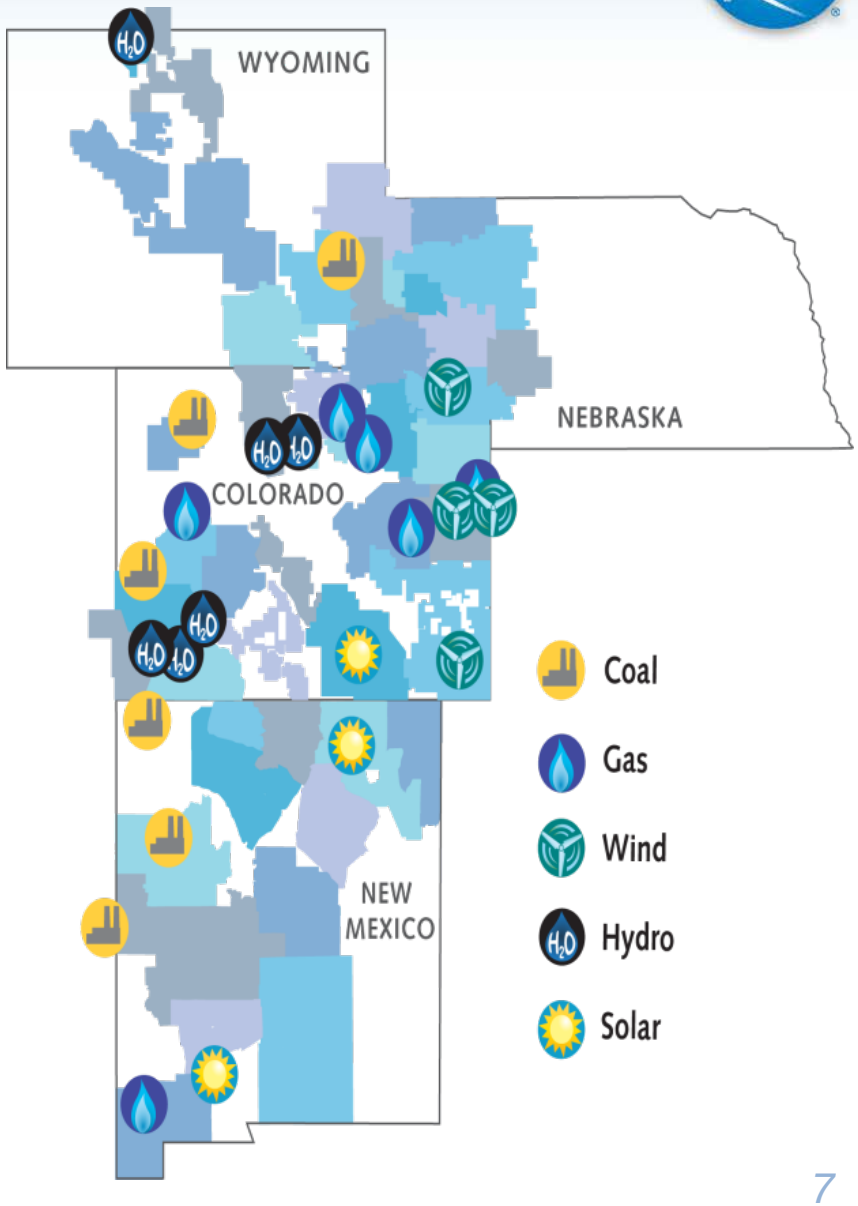
- Deliver 11% of US power
- Employ about 70,000 people
- Less affluent customer base
- Part of the communities we serve
- Not-for-profit

The Cooperative Fleet



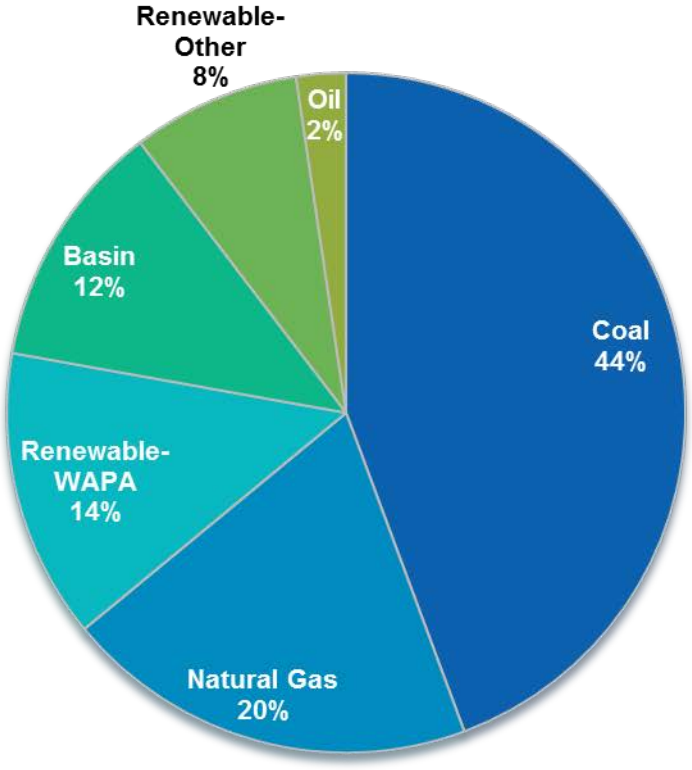
Tri-State G&T

- 1,875 MW baseload coal
- 867 MW intermediate and peaking natural gas
- 100 MW peaking oil-fired
- Renewables
  - ~580 MW federal hydro (2014)
  - Wind PPAs totaling 368 MW of capacity
  - Solar PPAs for 85 MW capacity
  - PPAs for 25 MW of capacity from small hydroelectric facilities
  - Tri-State supports, through incentives, a total of 79 MW from member renewable projects
- Member of Basin Electric for a total of 561 MW (2014)



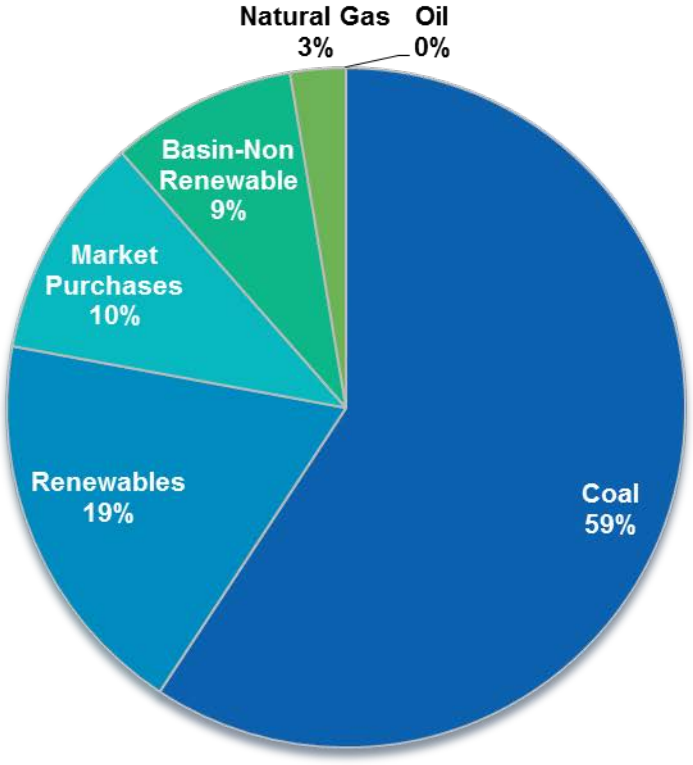
Tri-State's Generation Fleet

2015 Capacity



Total GWh: 4,229

2015 Energy Supply



Total GWh: 19,413

The CO_2 Challenge

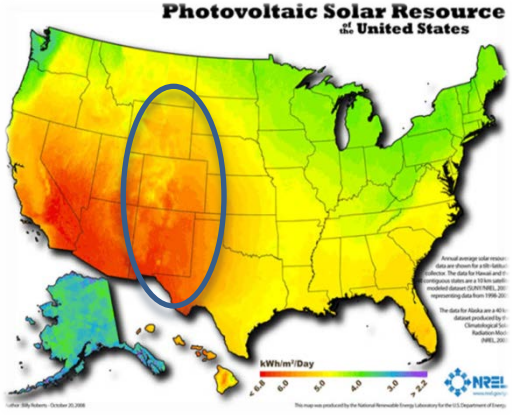
The CO_2 Challenge

- Criteria emissions from coal-fired power plants in the US have dropped 90% per kWh while capacity increased over 180%
- It is difficult to replicate this success for CO_2 because of the difference in scale
- Tri-State is advancing collaborative R&D
- More cost-effective solutions are needed to meet pending and future regulations

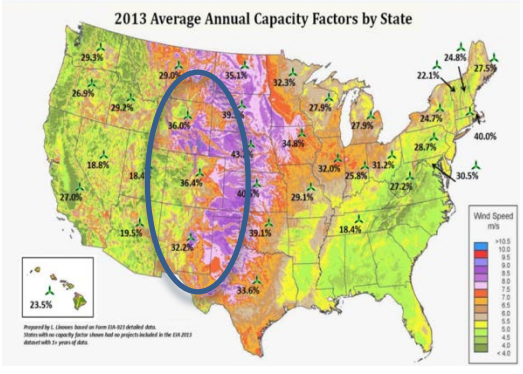
Low Cost Renewable Potential

- Significant wind and solar resources in Tri-State region
- Solar and wind can be complimentary
- Higher capacity factors lead to lower electric production cost and less intermittency
- Our wind and solar capacity factors are above national averages, and our average PPA prices are at or below national averages

Average Solar Resource Data



Average Annual Capacity Factors for Wind (2013)



Source: http://instituteforenergyresearch.org/wp-content/uploads/2015/09/avg-annual-capacity-wind-action.png

Access to Projected CO_2-EOR Pipelines

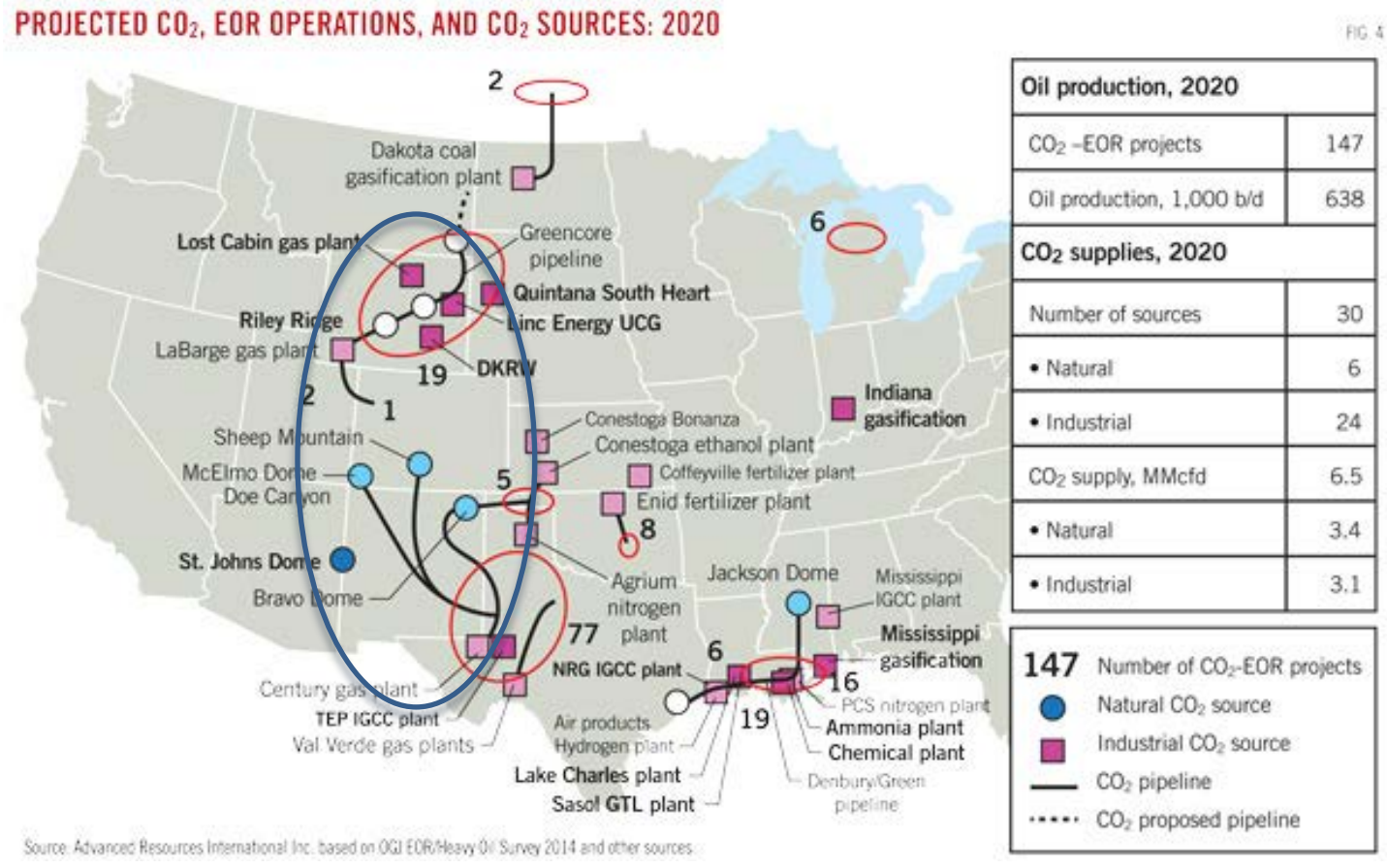


*Image courtesy of Advanced Resources International

Surrounded by Potential CO_2 Storage

*Image courtesy of DOE NETL

Minimizing Emissions From Our Current Fleet

Our Existing Fleet

- Existing baseload fleet has been retrofitted
- Maintained to ensure high-efficiency operation

Fleet Emission Reductions Since 2009

Plant and Select Project	Annual CO_2 Reduction (tons/yr)
Craig 1-2 Yampa Environmental Project	207,737
Craig 1 HP-IP turbine project	55,646
Escalante turbine heat project	68,459

Estimated a total of 3,380,836 tons CO_2 saved to date

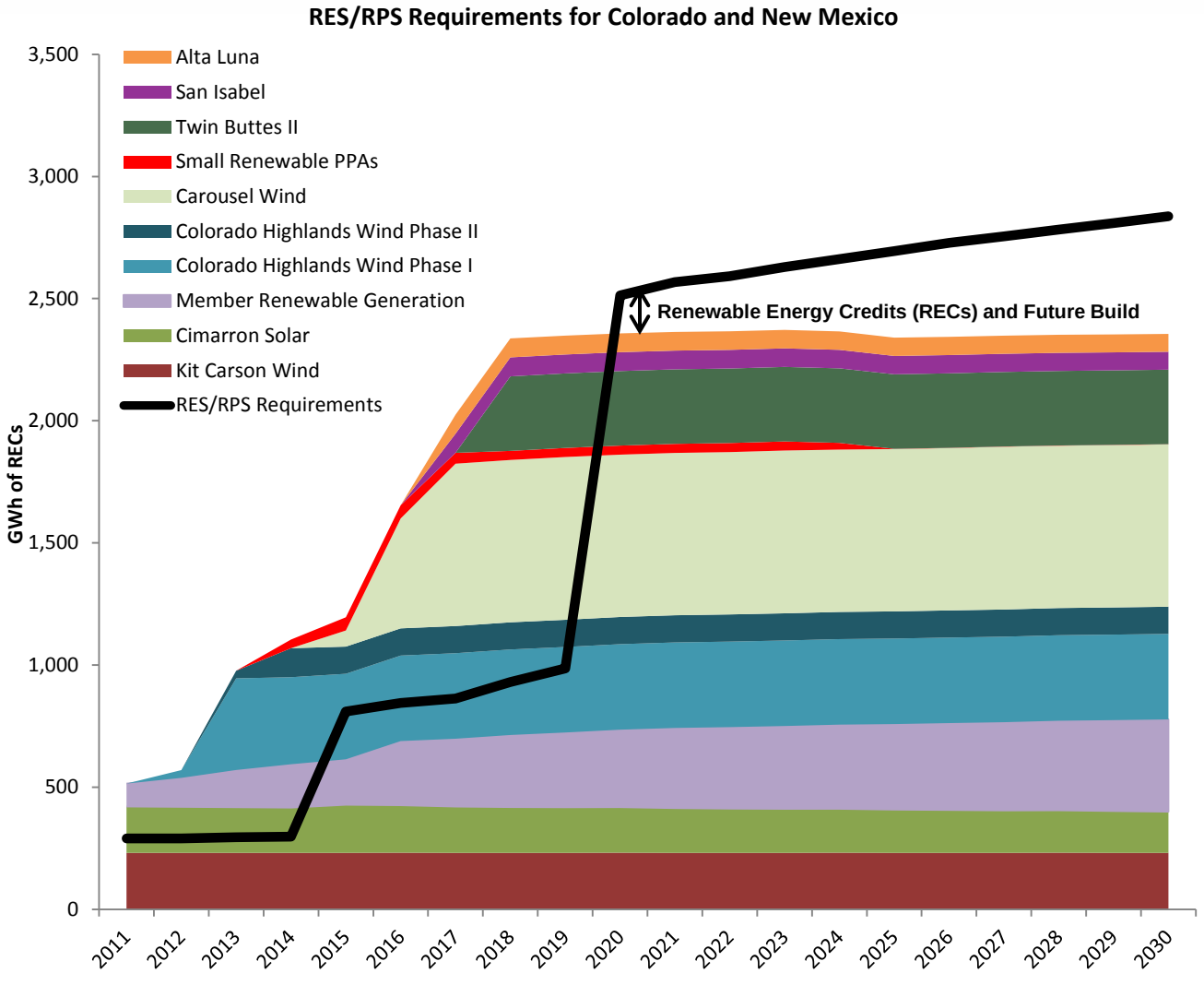
Another 224,036 tons CO_2/yr saving opportunities are planned

Additional 1,316,957 tons CO_2/yr opportunities identified

Our efficiency improvements have resulted in substantial emissions reductions.

Growing Our Renewables Portfolio

Investing in Renewables



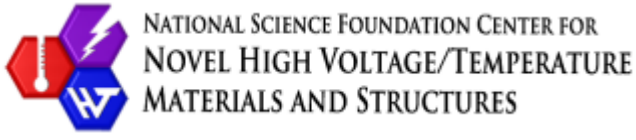
TRI-STATE WAS NAMED 2014 WIND COOPERATIVE OF THE YEAR IN THE GENERATION AND TRANSMISSION COOPERATIVE CATEGORY.
U.S. Department of Energy

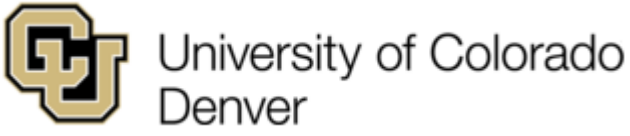
79 MW
MEMBER RENEWABLE AND DISTRIBUTED GENERATION

1,140 MW
OF TOTAL RENEWABLE RESOURCES

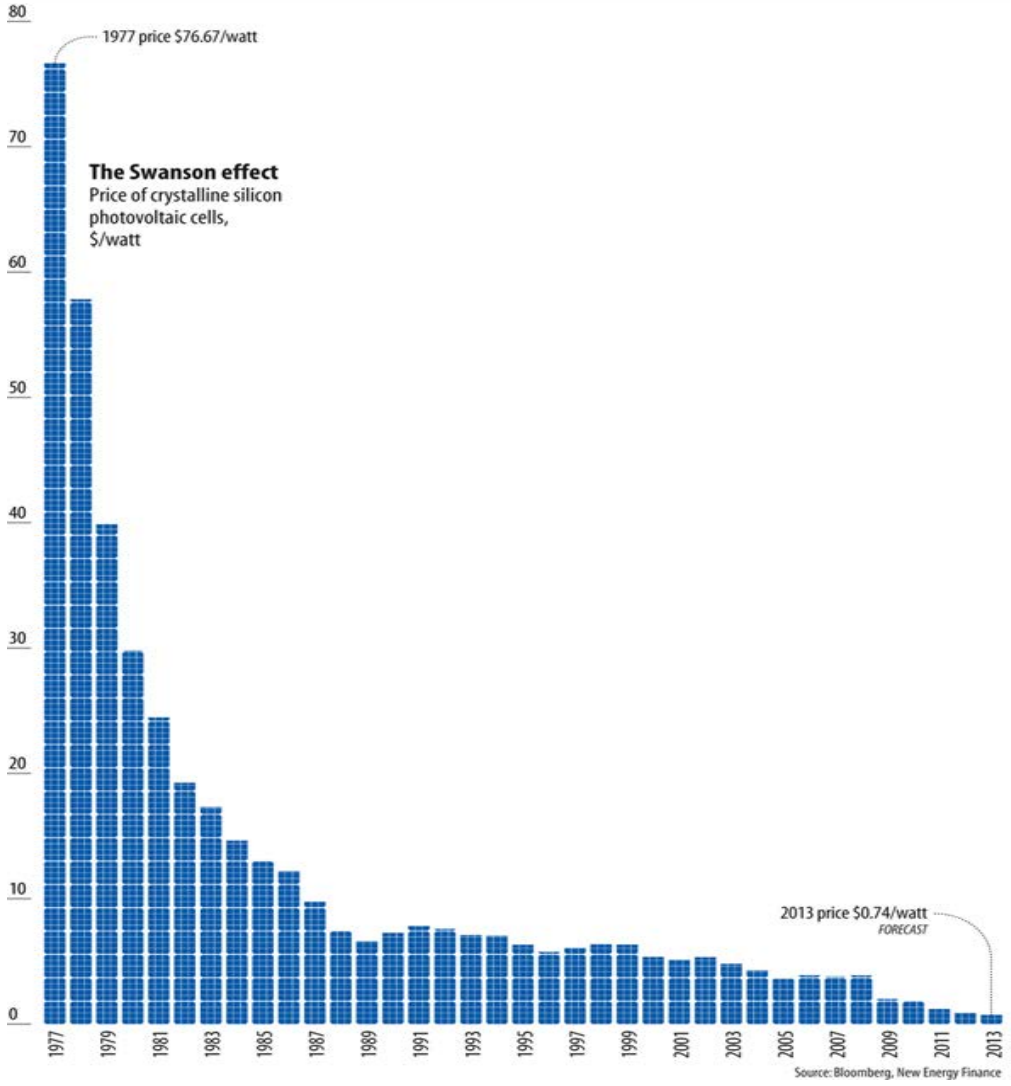
Filling the Gap

R&D Through Collaboration





Solar


1977 price $76.67/watt
The Swanson effect
Price of crystalline silicon photovoltaic cells, $/watt
2013 price $0.74/watt
FORECAST
80
70
60
50
40
30
20
10
0
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
Source: Bloomberg, New Energy Finance

Investing in CCUS

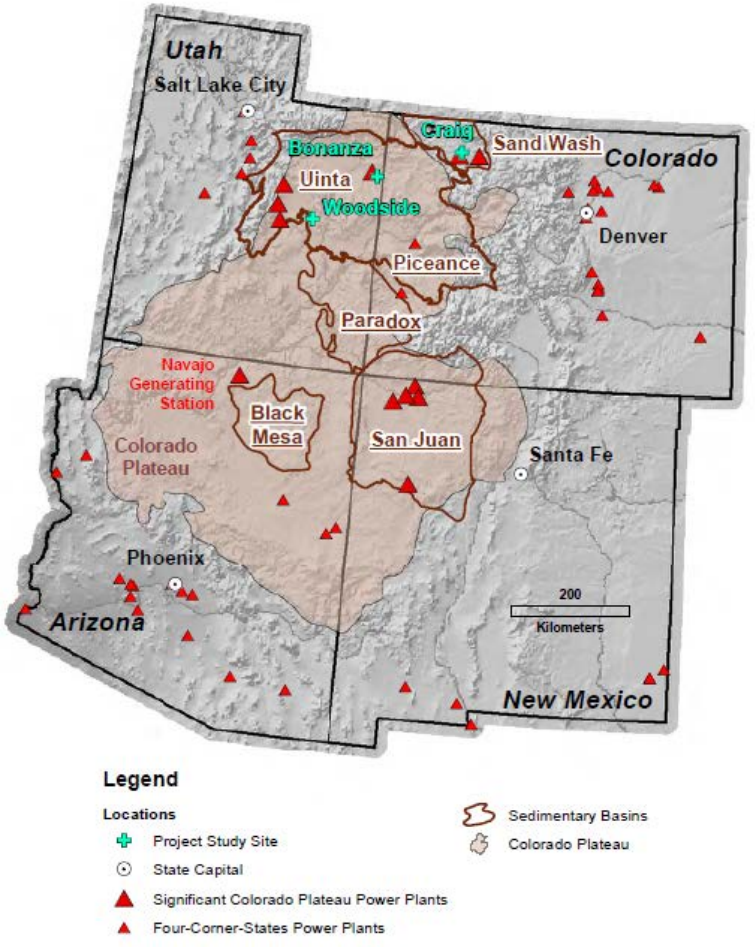
- Tri-State is contributing $5M in the Wyoming Integrated Test Center (ITC)
- The ITC will provide actual coal-fired flue gas to CCUS technology developers
- XPRIZE will be the first tenant of the ITC

Dakota Gasification Plant

- Captures between 2.5 and 3 million tons CO_2 per year
- As of the start of 2011, the project had captured more than 20 million tons of CO_2

Rocky Mountain Carbon Capture and Sequestration Participant

- Study from 2009–2013
- Team also included
  - Schlumberger
  - University of Utah
  - Colorado Geological Survey
- Focused on Colorado Plateau
- Mid-case estimated 150 years storage at current emission rates



No-Regret Solutions

- Investing in user-side energy efficiency for decades
- R&D efforts on demand-side management and energy storage

ETS room

ETS house

ETS industrial

Filling the Gap

- Additional R&D is necessary to develop technologies that can meet stricter emissions limits, provide reliable power, and keep electricity affordable
- Tri-State and other cooperatives are potential end users and R&D partners
- Ability to be an all-of-the-above technology deployer for cost-effective technologies

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