

# FEEDER PROJECT 2016



## **GROUP 5** **“STATE OF COLORADO”**

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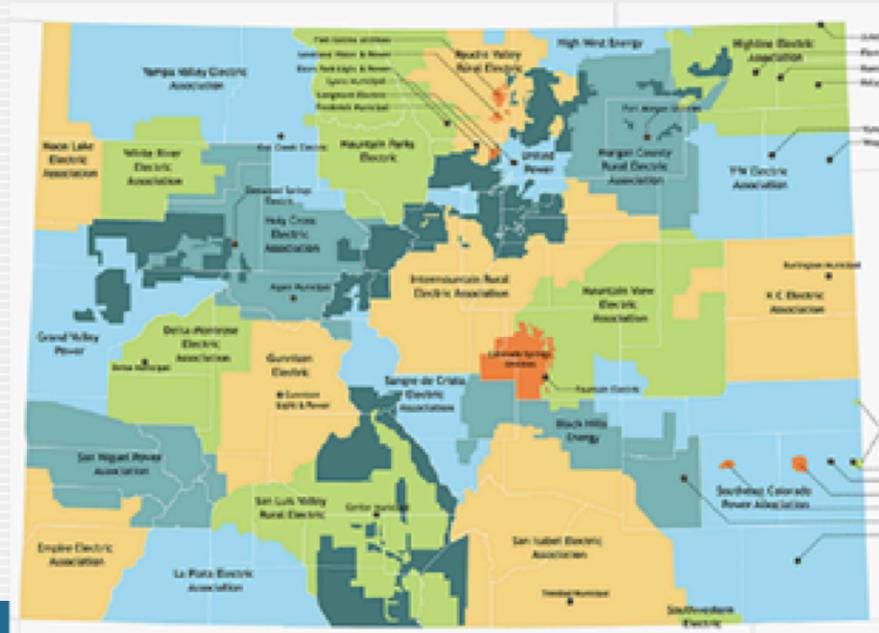
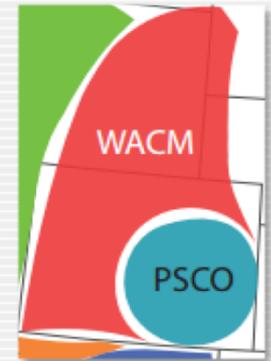
# Presentation Outline



- Current state of utilities, markets, and regulations in Colorado
- Evaluate Renewables, Conventional Generation, Demand Response and DER Opportunities
- Challenges to meeting energy targets
- Potential Solutions based on course info
- Broader energy impacts of land use
- Aging infrastructure, cost of generation, CO<sub>2</sub> regulation

# State of Utilities, Markets, and Regulations

- Regulated by CO Public Utilities Commission and NERC->WECC->RMPA
- Wholesale Power Producers
- Investor Owned Utilities – Xcel, Black Hills
  - Regulated Return on Investment and Rates
- Municipals – 29
- Co-Ops – 22

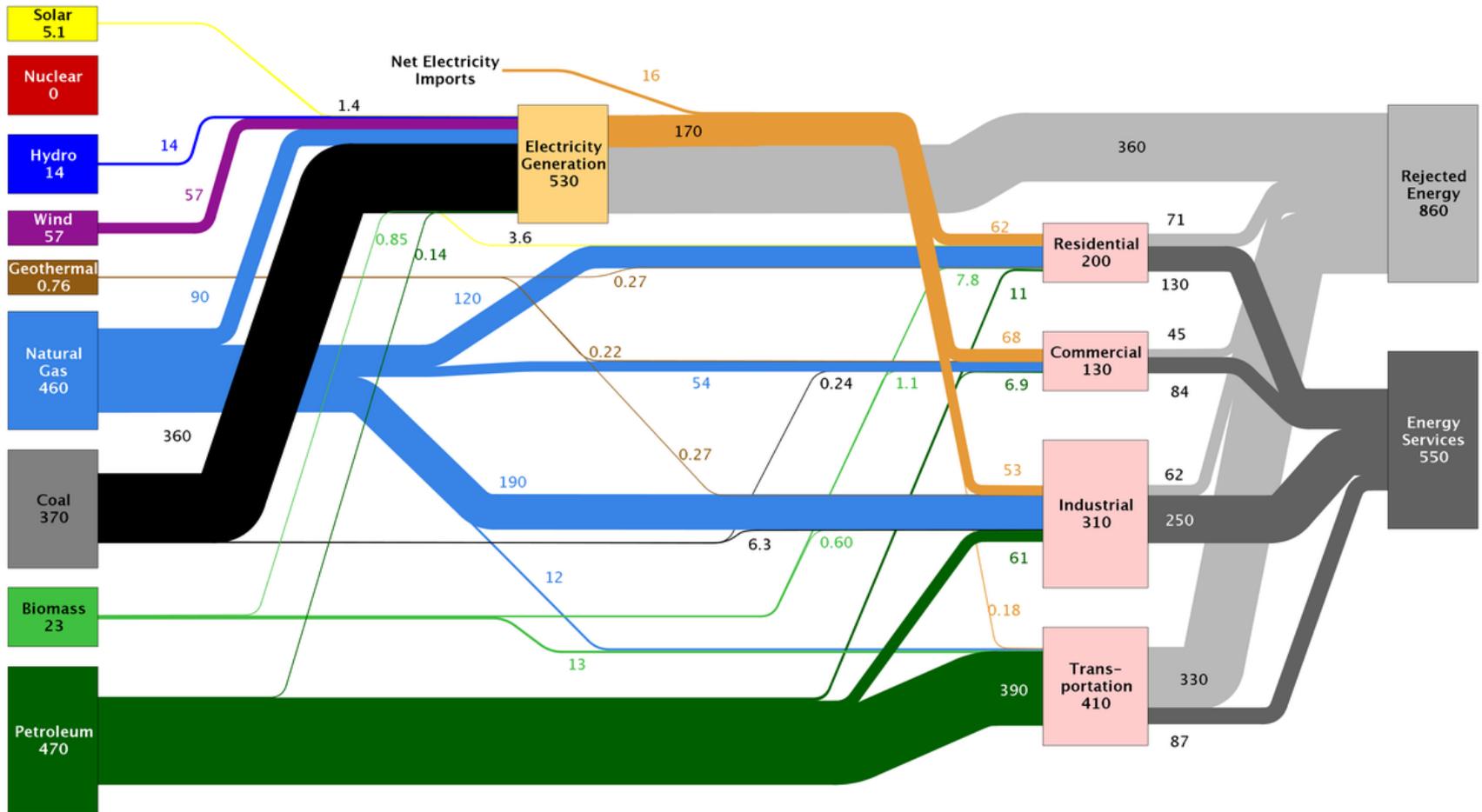


# Renewable Energy Regulations and Efforts



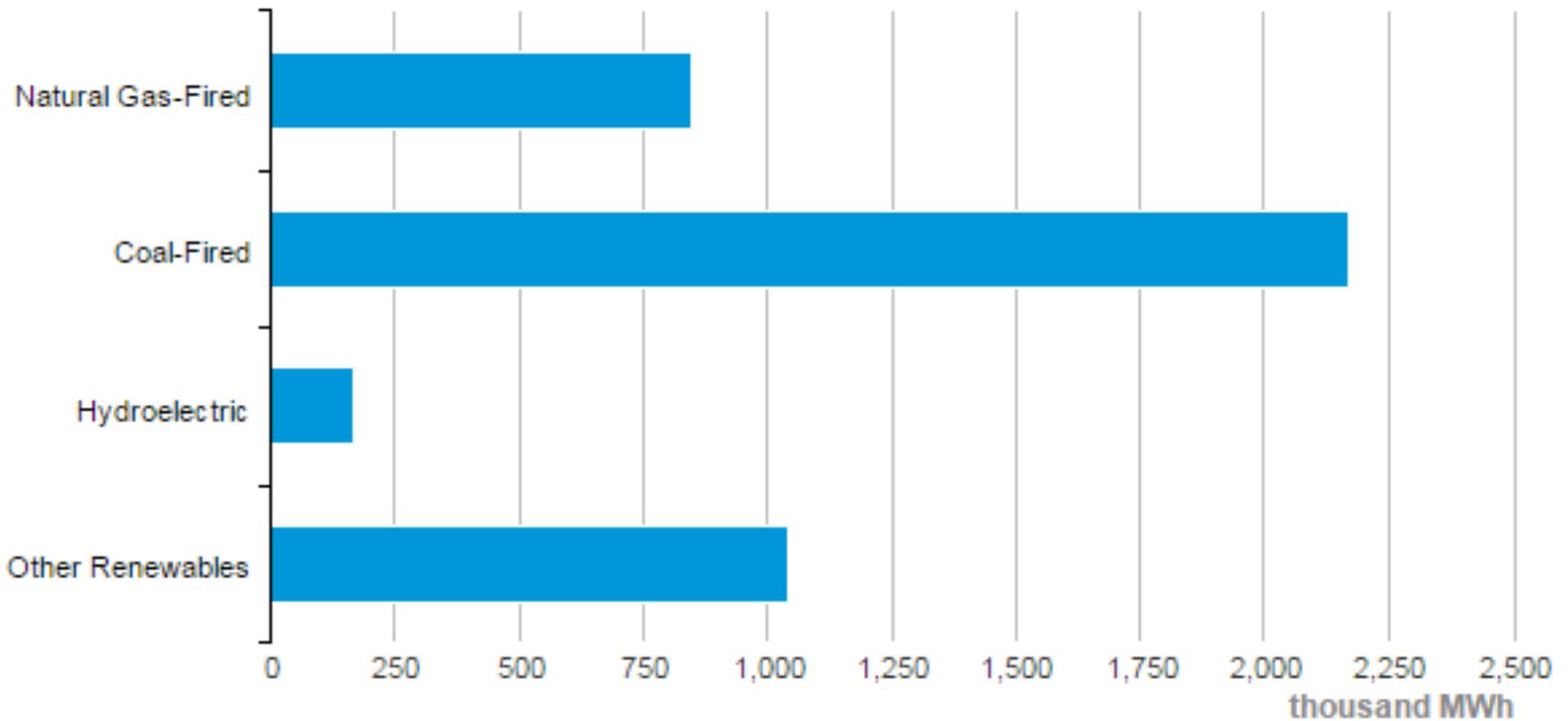
- First state to implement a renewable portfolio (2004)
  - IOUs must sell 30% renewable energy by 2020
    - 3% must come from DG, 50% of that from on-site DG
  - MUs/Co-Ops must sell 20% for >100k, 10% for <100k
    - Co-Ops must have 1% for >10k, .75% for <10k
  - Net Metering
    - Up to 120% of IOU customer's average annual consumption
    - MUs/Co-Op customer can do 10kW residential, 25kW non-residential
  - Financing of Renewable Energy Bill

## Estimated Colorado Energy Use In 2012 ~1400 Trillion BTU



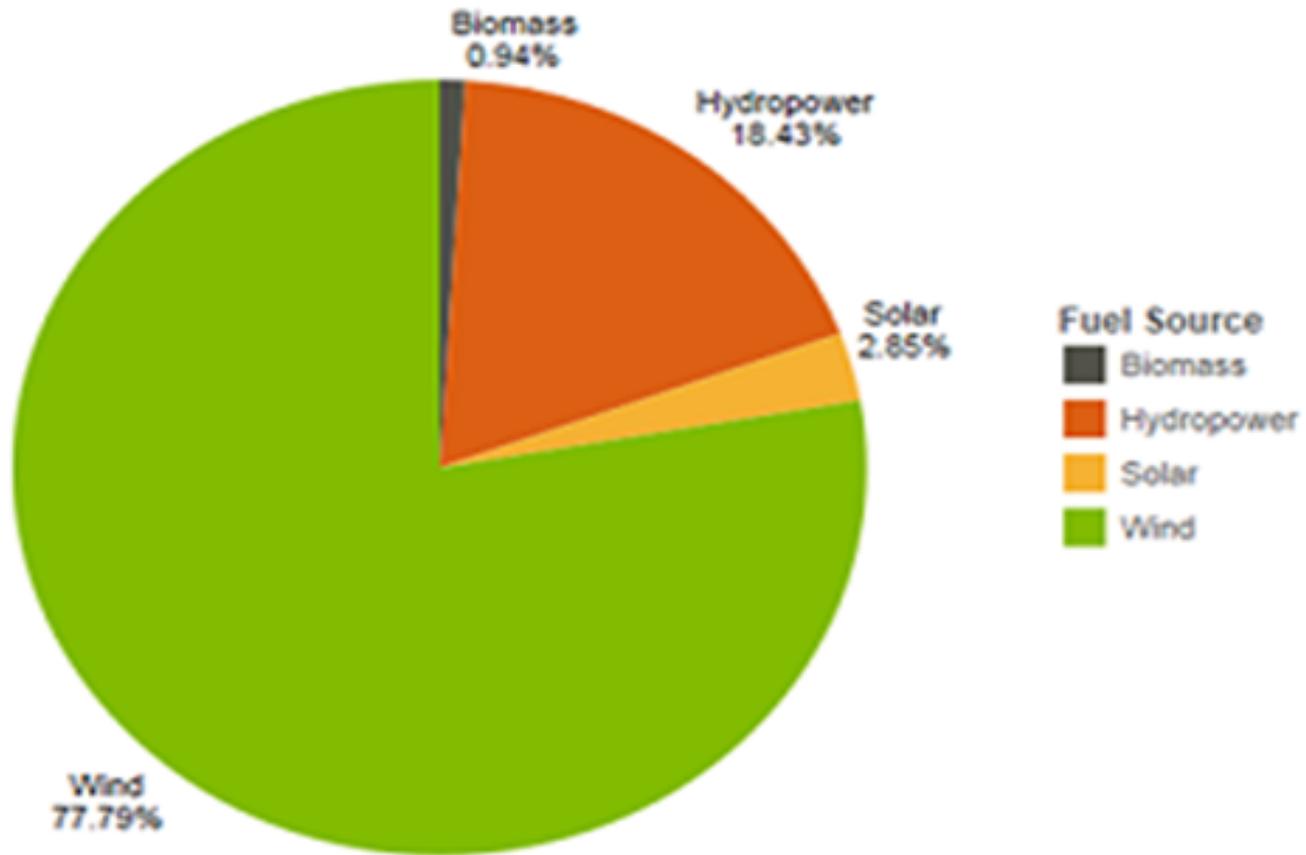
Source: LLNL 2013. Data is based on DOE/EIA-0214(2011), June 2013. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated for each sector as 65% residential, 65% commercial, 80% industrial and 21% transportation. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

# Colorado Net Electricity Generation by Source Feb, 2016



Source: Energy Information Administration, Electric Power Monthly

# Evaluate Renewables



# Demand Response and DER Opportunities



There are three ways for responding to the demand

- Conservation Voltage reduction
- Turning on more gas turbine or using pump storage
- Using the batteries

# Challenges to meeting energy targets



The challenge to the renewable energy standard (RES) was based on four arguments with represented a group of renewable energy companies in the case:

- Issues facing the current energy delivery infrastructure, including transmission.
- Colorado does not control out of state companies for their method of generation.
- States close to Colorado don't have much demand
- Easy eastern interconnections have a different grid operation and lots of wind already

# Aging Infrastructure



## COLORADO INFRASTRUCTURE GRADES

2010 REPORT  
CARD GPA: **C+**

 AIR QUALITY	<b>B-</b>	 AVIATION	<b>B+</b>	 BRIDGES	<b>C-</b>
 DAMS	<b>C+</b>	 DRINKING WATER	<b>C-</b>	 EDUCATION	<b>D+</b>
 ENERGY	<b>D</b>	 ENVIRONMENTAL CLEANUP	<b>C+</b>	 ROADS	<b>D</b>

- Mostly focused on upgrading/retiring coal plants
  - Xcel retired 6 coal units and switched 2 to natural gas
- Aging transmission lines is also a big problem

# Greenhouse Gas Emissions



- **EPA Clean Power Plan (2015)**
  - Cut 32% of CO<sub>2</sub> Emissions by 2030
  - CO's goal is too reduce emission rate by 38% or mass of emissions by 31%
- **Colorado Climate Action Plan (2007)**
  - Reduce GHG emissions by 20% (compared to 2005) by 2020 and 80% by 2050
    - Investments in catalytic converters and retiring/upgrading older plants

# Broader energy impacts of land use



- Renewable energy may require significant land area

Land Requirements to make electricity for 1,000 households/yr



# Broader energy impacts of land use



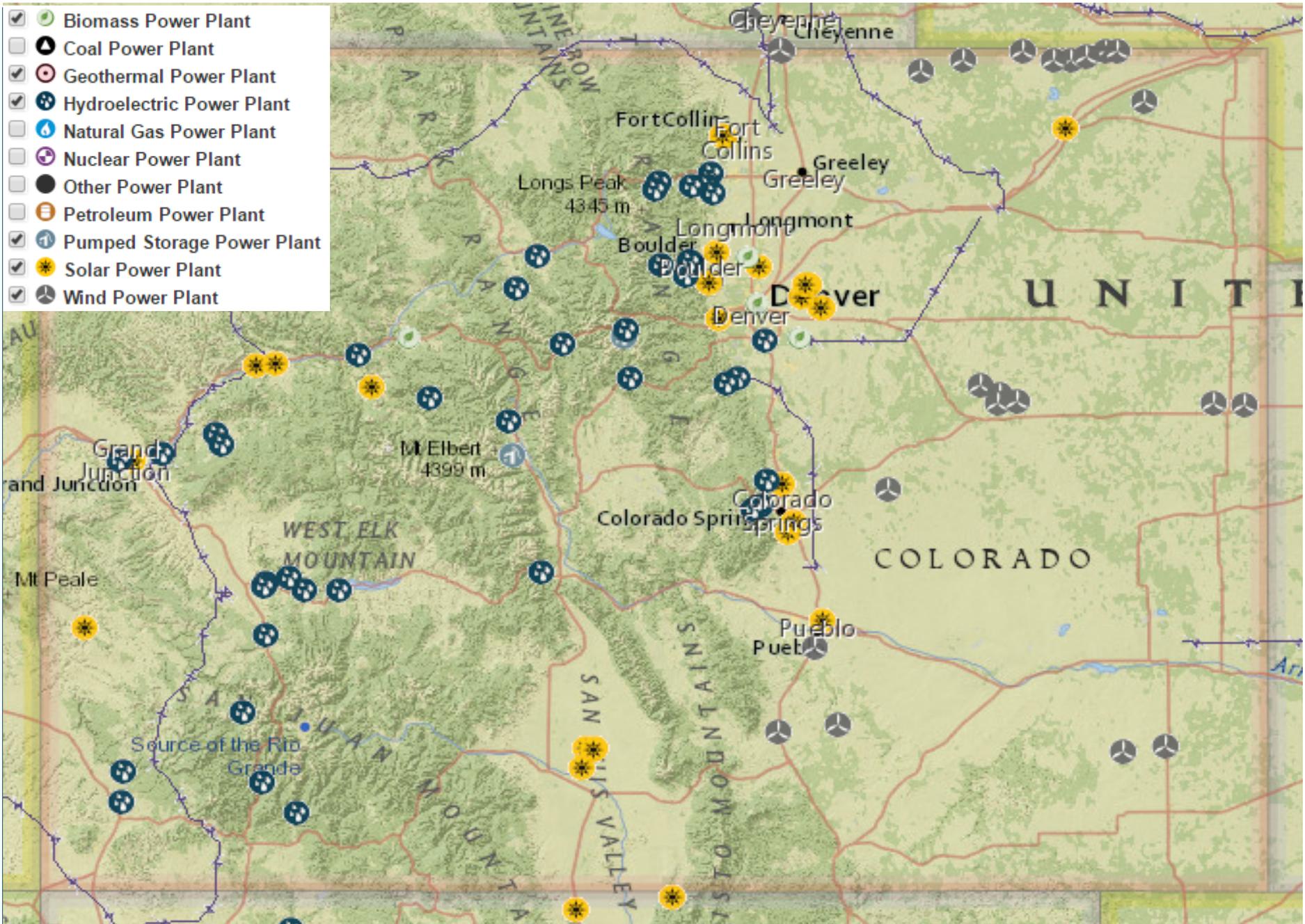
- Installing renewable energy sources can disturb the natural environment, so wildlife studies required to be conducted before projects proceed.
- Hydro power plant and wind turbine generate more than 95 % of the total renewable energy generation in CO.
  - noise produced by the rotor blades, visual impacts, and deaths of birds and bats that fly into the rotors.
  - hydropower facilities can have large environmental impacts by changing the environment and affecting land use, homes, and natural habitats in the dam area

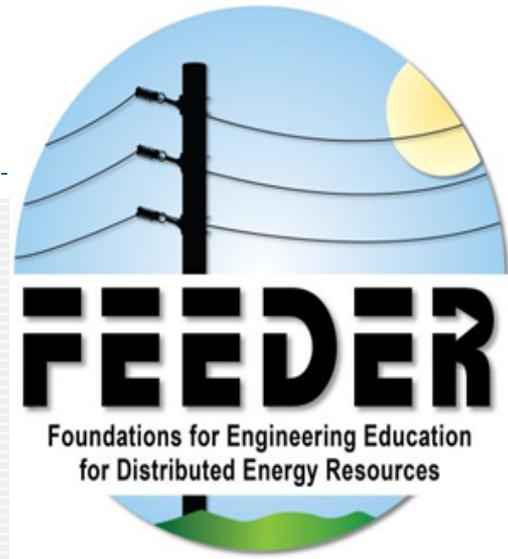
# Potential Solutions



- Not enough transmission to deliver the wind power from eastern side to western interconnect.
  - Transmission lines need to be replaced/built to handle increasing wind capacity.
- Impaired Lands
  - The lands that have previously have been used for other human purposes including old industrial sites, former military bases, abandoned mines, and marginal agricultural land. Example: Fort Carson Landfill Solar Development. 2MW PV array on 12 acres of a former landfill
- High penetration of renewable energy sources
  - Adopting smart/micro inverters to improve the reliability and cope with the fluctuation comes from the intermittency of the renewable energy sources♪

-  Biomass Power Plant
-  Coal Power Plant
-  Geothermal Power Plant
-  Hydroelectric Power Plant
-  Natural Gas Power Plant
-  Nuclear Power Plant
-  Other Power Plant
-  Petroleum Power Plant
-  Pumped Storage Power Plant
-  Solar Power Plant
-  Wind Power Plant





Thank you