
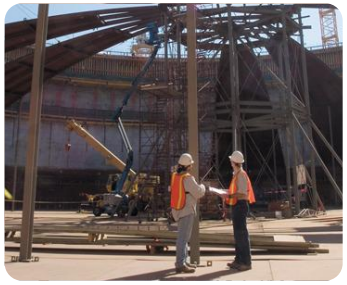


# The Economics of Natural Gas-fired Generation from a Wyoming Perspective

*Presentation to the*

**Wyoming Infrastructure Authority**

**November 9, 2010**

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*Slide from January 25, 2010 Presentation at Teton Mountain Lodge*
*Based on B&V Market Analysis of WECC…2010-2035*

# Gas Fired Generation Needs in the Future in WECC

- Significant new generation will be needed in WECC in the next 25 years
- Much of that new generation will likely be gas fired
- Quick start gas units will be needed to integrate wind and solar
- Pros and Cons for locating gas fired generation in the Rockies
  - Pros…lower cost gas, gas near production, may be easier to permit
  - Cons…Higher elevation causing lower heat rate and output, transmission losses to load.

# New Gas Fired Generation in Wyoming…
# From a Resource Planning standpoint

# Wyoming is Already a Power Exporting State

- Coal generation located in Wyoming exceeds the load in Wyoming
- There is little (flexible) gas generation
- Transmission Lines have been built to export coal generation, *including lines to Colorado and transmission west from Jim Bridger*
- If Hydro, Wind and Coal are all running at capacity on the Peak Load hour, export lines can still handle the desired amount of exports in the year 2011.
- B&V hourly dispatch analysis of all hours of the year indicates that there is not expected to be material congestion moving power out of Wyoming in the year 2011 although spot electricity prices in Wyoming are expected to be depressed compared to other areas of WECC

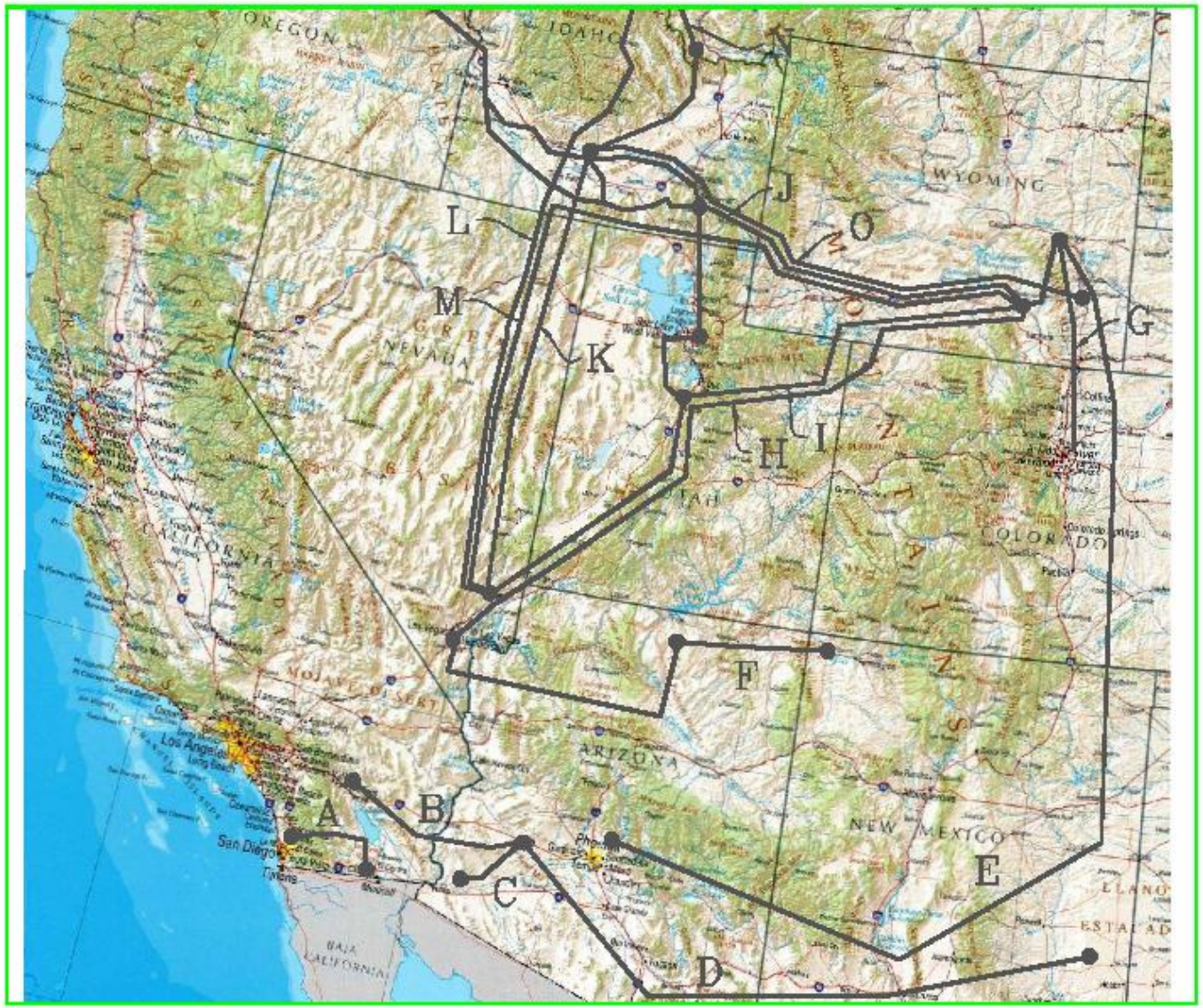
| | 2011<br>MW |
|---|---|
| Peak Load | **3,669** |
| Export Capability | 4,960 |
| **PkLd + ExportCap** | **8,629** |
| | |
| Hydro | 702 |
| Wind (nameplate) | 1,400 |
| Coal | 5,200 |
| Gas/Oil | 266 |
| **Total Nameplate** | **7,568** |

# Wyoming Has a Great Wind Resource…..There are Plans to Add More Wind in Wyoming [Source: Energy Velocity]

- In addition to the 1,400 MW of existing wind, on the date of this presentation developers are pursuing another 10,000 + MW of wind in Wyoming
- This is less then one-half of the 25,000 MW of wind that the Western Renewable Energy Zone (WREZ) study has indicated might be economically built in Wyoming
- The pursuit of this additional wind raises a few questions:
  - Will Wyoming loads grow to absorb a measurable amount of this additional wind?
  - Should/Will transmission be built to move this wind out of state?
  - Should the additional wind be used (at least in part) to back down coal in Wyoming? [Tradable Renewable Energy Credit world]
  - How will the variability of the additional Wyoming wind be dealt with?

| Wind: | MW |
|---|---|
| Existing | 1,400 |
| App Pending | 1,640 |
| Permitted | 112 |
| Proposed | 7,860 |
| Postponed | 500 |
| **Total** | **11,512** |

# There are plans to increase the Export Capability



# Transmission Projects from Wyoming..

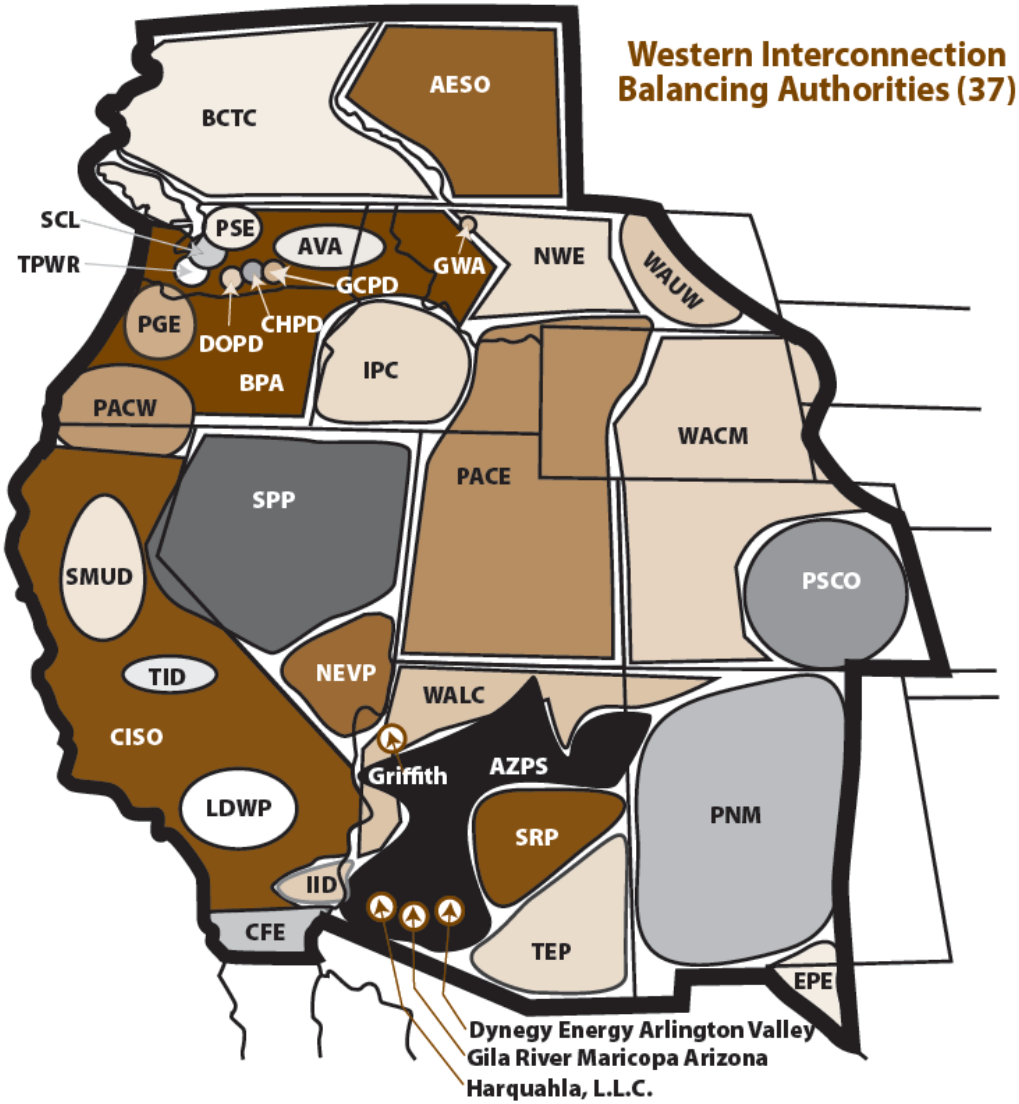
- As a result of an expectation that great renewable resources in Wyoming will be built to meet RPS goals in other states, developers are proposing projects to allow the renewables to be delivered elsewhere
- The future of these projects is critically tied to the amount of renewables that will be contracted to be delivered out of state

| Label | Line Out of Wyoming | Indicated MW | COD Indicated Yr |
|---|---|---|---|
| E | High Plains Express | 3,500 | 2017 |
| G | WY-CO Intertie | 850 | 2015 |
| H | TransWest Express | 3,000 | 2015 |
| I | Gateway South (PacifiCorp) | 3,000 | 2014-2017 |
| J | Gateway West (PacifiCorp) | 3,000 | 2014-2016 |
| M | Zephyr (TransCanada) | 3,000 | 2014 |
| O | Overland (LSPower) | 2000-3000 | 2016 |
| | Approximate Total | 18,000 | |

*PAC projects are being designed as 3,000 MW but will be built as 1,500 MW lines*

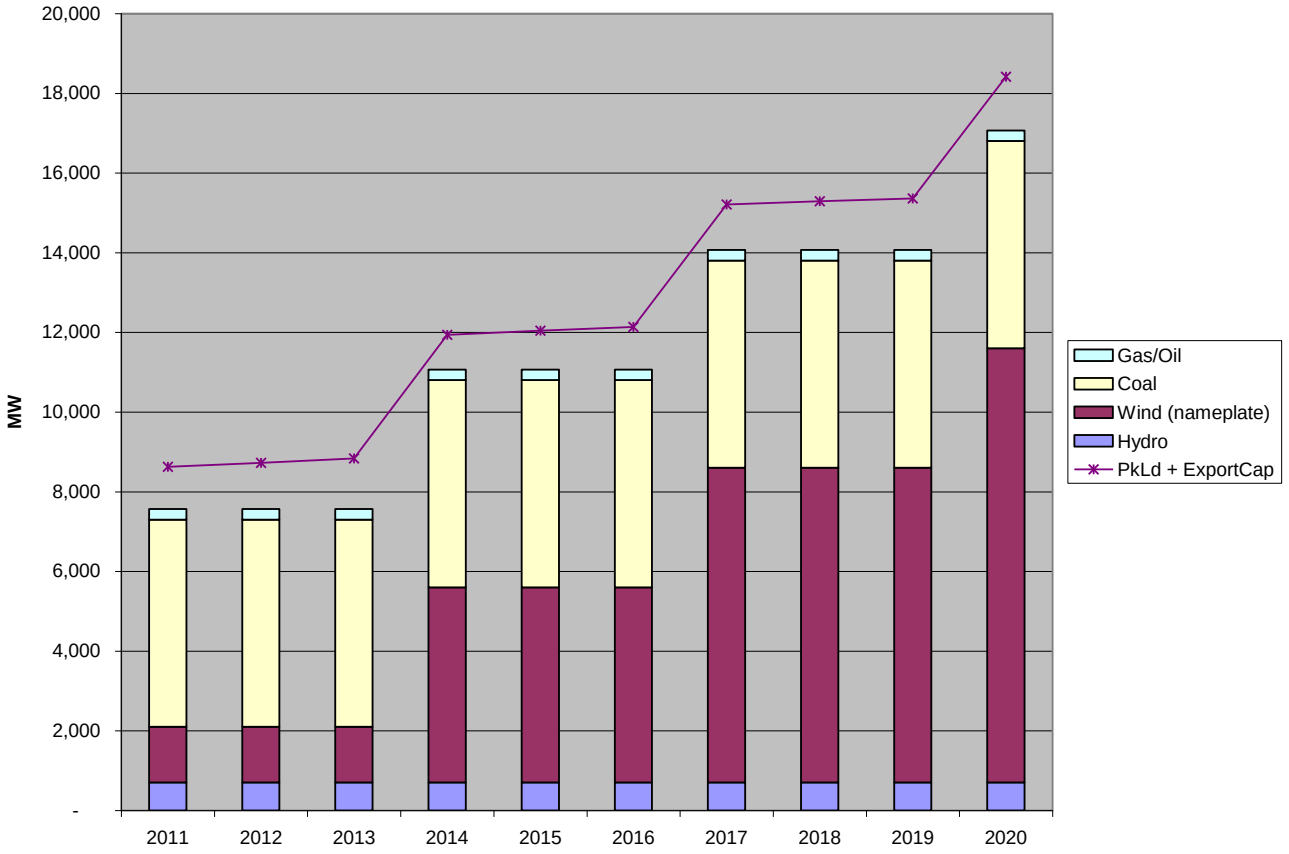
# Dealing with Wind Volatility…Balancing Authorities in WECC

- There are currently two Balancing Authorities covering Wyoming
- There are currently four “generation only” Balancing Authorities in WECC (i.e. Balancing Authorities that don’t have any load)
- One of these “generation only” Balancing Authorities is the GWA BA in Montana (aka the BA formed by NaturEner to integrate its wind farm in Montana)



# The Planned Future….

- Ideally Transmission construction would be timed to match wind construction
- If the wind comes in ahead of the transmission there may be a need to back down coal and, there may be a need to "feather out" the wind on some hours
- Coal is not well designed to accommodate the wind volatility
- Without new gas, Balancing Authorities in Wyoming will face considerable problems in dealing with wind volatility.

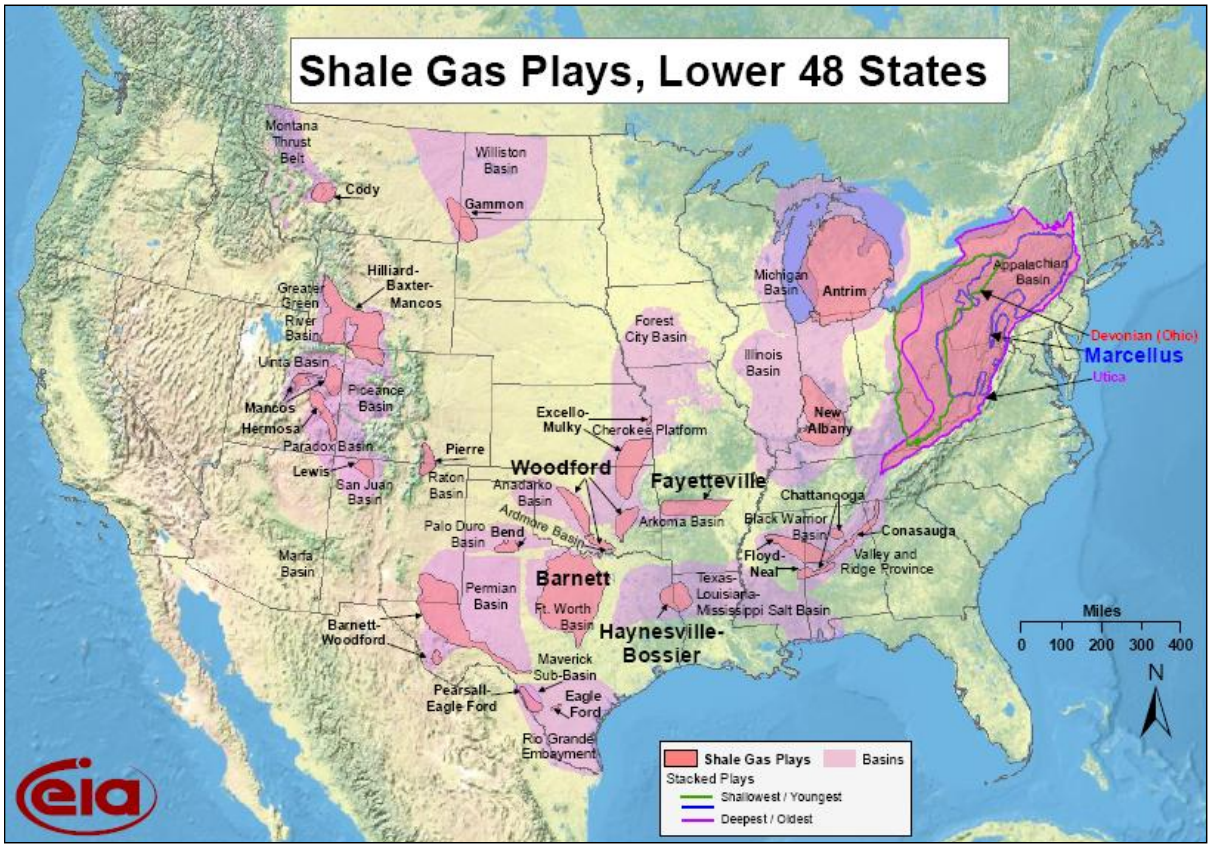


# New Gas in Wyoming…

- A workable future will necessarily need new transmission lines and will need a "plan" to deal with the wind volatility
  - If there are 10,000 MW of new transmission lines built to match the new wind, then the "plan" to deal with wind volatility could consist of new flexible gas fired units **located at either end** of the new lines
- A workable future would **not necessarily** need 10,000 MW of new transmission lines. Some of the wind could meet California RPS needs by selling TRECs (i.e. the power itself is actually not delivered to California)
  - In this case, Wyoming would need new flexible gas fired generation in amount at least sufficient to accommodate the variability of the wind that remains in Wyoming and is not delivered to California.
- Any new flexible gas fired generation that might be built in Wyoming to accommodate the wind volatility could be associated with an existing Balancing Authority or could be associated with a new "generation only" Balancing Authority

# Locating the new gas units in Wyoming…

- Locating new gas units in Wyoming rather than California benefits from the fact that gas reserves are located there
- A disadvantage of locating the gas units in Wyoming and delivering the power to California is the losses that occur on the transmission lines.
- Building transmission lines with lower losses is helpful.



# Conclusion..

- Given the great wind resource located in Wyoming, it makes sense to use this resource to help other states (e.g. California) meet their Renewable Portfolio Standards at a competitive price [albeit, California is not a sure market]
- If only 10,000 MW (less than half of the WREZ identified Wyoming economic wind) is developed (i.e. that wind currently being pursued in Wyoming), new transmission lines will be necessary.  Even under a TREC world.
- The addition of variable energy wind resource will very likely require additional new flexible gas fired generation to accommodate the variability
- In any realistic scenario where Wyoming wind helps California meet its RPS, at least some of the added new flexible gas fired generation would need to be built in Wyoming.
- The lower the losses on the transmission lines that will be built, the more of the new flexible gas fired generation would economically be located in Wyoming because of the Shale Gas reserves that are located there.