2012
National Electric Transmission Congestion Study

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There are two kinds of congestion

- Type 1: Competitive access to least-cost energy, many sellers vying to serve lucrative markets.
- Type 2: "Real" physical congestion – characterized by the inability to transmit all available generation.
- (Type 2a: We can expect the cumulative effect of new EPA rules to make a significant difference on where and how much* congestion we will see.
  - * probably more of each

Wyoming is an energy and electron exporting state

- We are concerned with Type II congestion.
- We are energy rich, with high quality wind, natural gas and low sulfur coal resources, but . .
- Bridger West (Path 19) is ranked as the most heavily loaded and most congested path in the Western Interconnection.
  - 2009 DOE Study, p. 70, Table 5-1 TEPPC Historical Analysis Work Group (2009). *2008 Annual Report of the Western Electricity Coordinating Council's Transmission Expansion Planning Policy Committee, Part 3 – Western Interconnection Transmission Path Utilization Study*
- TOT 4A remains an intrastate congestion problem until the Gateway project fixes it.

When you suffer from Type II Congestion . . .

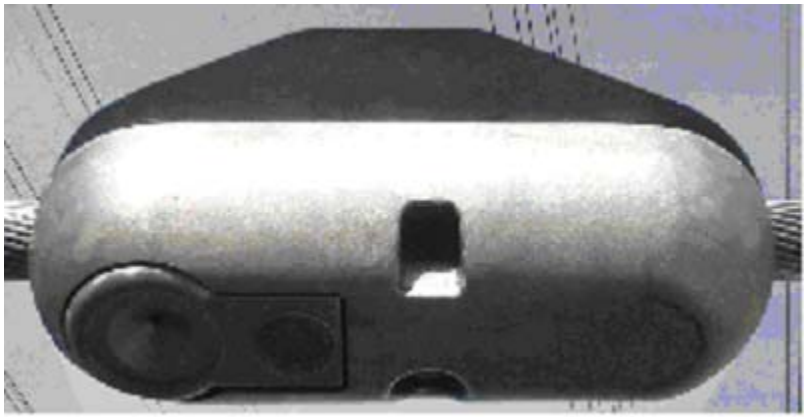
- Low-cost thermal generation assets must sometimes be displaced to allow more costly must-run wind generation to flow west out of Wyoming.
- There isn't room for all of the electrons at once, so
  - This congestion increases wear and tear on thermal plants
  - Increases the overall cost of generation and transmission to generators and ratepayers.
  - Curtails off-system sales by limiting transmission
- The irony:
  - It also limits the development of high quality Wyoming wind resources.

There are solutions.

- Upgrading existing transmission assets will help (but only lessens the problem and can be expensive).
- Building new transmission may alleviate the problem (but it is slow and expensive).
- Make better use of what we have.
  - new technology
  - new operational approaches
- Innovation can be relatively cheap and quick

Technology: Fight congestion with information.

The wave of the future may be small and lumpy . . .



Not very glamorous, but . . .

- It is INL's Transmission Line Security monitor
- Sensors produce lots of transmission line data
  - e.g., line temperature, vibration, sag
  - Real-time data for transmission operators.
- Use radio frequency transceivers, and function together as a network (specific monitors can be interrogated in real time).
- Self-contained, powered by the magnetic field surrounding high-voltage lines.
- Can be installed on hot lines by a single technician*
- Cheap [relatively speaking] at $350 to $400 per unit.

* (like a bun around a hot dog).

How cheap is cheap?

- Pretty cheap considering . . .
- Unnoticed line sag triggered the 2003 Ohio blackout that spread to states in the Midwest, East Coast, and central Canada, affected 50 million people; cost billions of dollars in economic damage.
- It could have been averted if the problem were quickly detected and isolated.
- **You could buy at least 2.5 million little sensors with the money you saved by not having this one blackout.**

Will it work?

- It seems to work
- Successfully Tested by INL and BPA
- California field trials.
- Going commercial: California-based Lindsey Manufacturing Co. has licensed the technology.
- Expect some deployment on power lines this summer.

What will they cost?

- According to INL, there are about 158,000 miles of lines, supported by nearly 800,000 towers in the United States.
- Many lines, like those in Wyoming, run through isolated areas as they deliver electricity from sources to sinks – meaning they are hard to keep tabs on regularly.
- So, if you bought a little smart TLS for each segment at $400, it would cost about $320,000,000 for the whole country.
- Our economy could get more than three times its money back if we avoided only a single $1 billion blackout.

Congestion relief through information

- Increase capacity with real time data on wind cooling of transmission lines
- According to INL, an increase in wind speed of 5 mph can cool the line enough to increase the current it can safely carry between 30% and 50%
- Real time data can make this an operational reality
- No guesswork staring at nomograms or tables of historical wind data
- Long-term records of dynamic line rating data could help utilities identify bottleneck line segments

But wait, there's more . . .

- Operationally, an Energy Imbalance Market in the West makes a great deal of sense.
- If it can be set up and run relatively cheaply
- If enough transmission operators will participate.
- An EIM thrives on real time information
- The little footballs can help.

The biggest operational improvement

- WECC has studied the costs and benefits of an EIM
- Western Commissioners, with the assistance of LBNL, are pursuing an even more granular cost/benefit study
- Helps utility decision makers
- I support an EIM if there is money to be saved for the ratepayers

Fighting with information on all fronts

- For the skittish:
  - An EIM is not an RTO
  - Participation should be voluntary

- For the rest of us:
  - Savings appear to outweigh costs*
  - Produces real time information on operational dynamics and market clearing prices – optimizes grid performance
  - Can be monitored to alleviate gaming and help new participants
  - Integrates renewables at reduced cost
  - We have a model of an EIM developed outside of the RTO context**

    - * to be proven
    - ** SPP

Techniques and technological innovations

- Black & Veatch has finished a draft **report:** *Transmission Technologies – Technical Assessment & Application Guide*
- Comprehensive report on technology and operational changes that can enhance performance of the existing grid.
- Under NREL review and final report expected by the end of 2011.
- The report discusses and assesses techniques and technologies that could increase transmission capacity faster than new transmission construction and sometimes without new rights-of-way.
- A guidebook for regulators and transmission owners.

What to do today? Be very pragmatic.

- Remember we are all here *only* because the people deserve reliable low-cost power.
- Make use of subregional and regional planning group efforts.
  - They are close to the problems and the solution.
- Get into the habit of working together
  - Little fiefdoms are easily compromised
- Take advantage of every available tool
- Don't look at congestion – look at solutions
  - Observe the "mountain and sea" spirit.

The “mountain-sea” spirit

.The "mountain-sea" spirit means that it is bad to repeat the same thing several times when fighting the enemy. There may be no help but to do something twice, but do not try it a third time. If you once make an attack and fail, there is little chance of success if you use the same approach again.

Miyamoto Musashi

In the second year of Shoho, the fifth month, the 12th day. (1645)