



# Generator Interconnection Planning

- Indiana Wind Working Group  
September 17, 2007

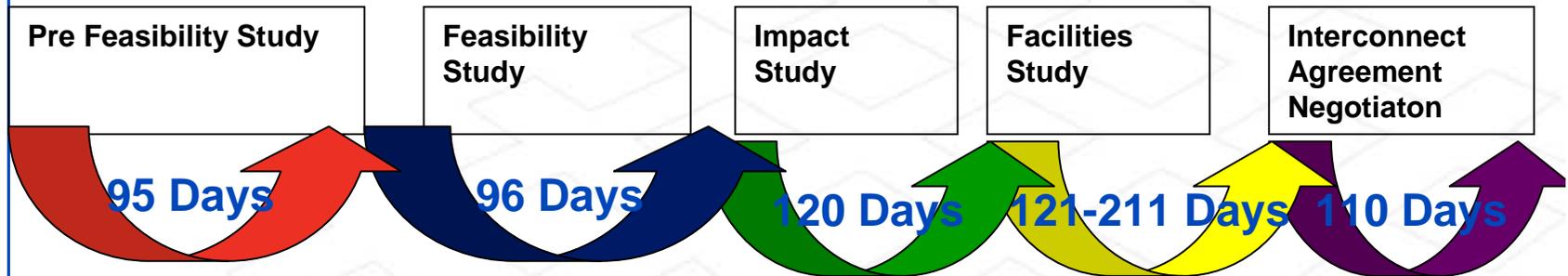
## ○ Outline

- Salient points
- Tariff - Attachments X and R overview
- Study Process
- Midwest ISO GI Queue statistics
- Ongoing and Upcoming Initiatives

# Generator Interconnection Process – Salient points

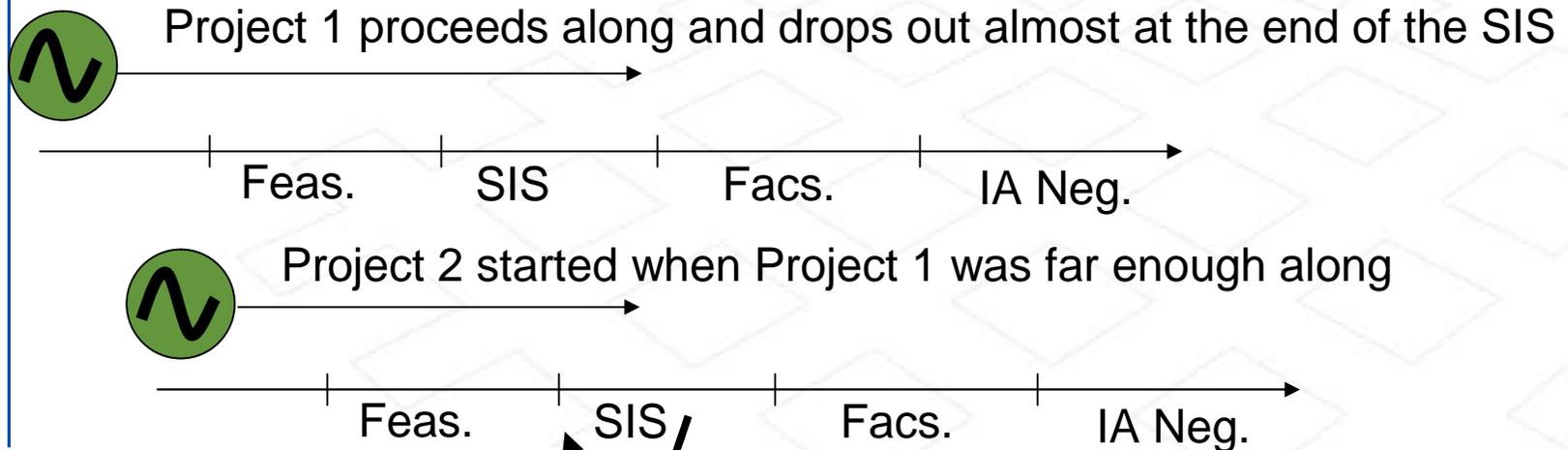
- Tariff driven process – Attachments X and R
- FERC Order 661 – requirements for Wind generators
- Products offered:
  - Energy Resource Interconnection Service (ERIS)
  - Network Resource Interconnection Service (NRIS)
- Requires formal application to the Midwest ISO to request interconnection – the Queue
- Associated Costs – study related and others
- Study process sequential in nature – first come, first served
- Tariff provision for performing Group Studies
- Successful interconnection results in an Interconnection Agreement with the Midwest ISO

# Realistic View of the Interconnection Queue Process



- Up to 658 days are allowed for the tariff process, which requires decisions and actions by the Midwest ISO, The Developer, and the Transmission Owners
  - This timeline does not reflect an additional 36 - 72 months for state regulatory approval and construction
- Per the tariff, requests must be processed sequentially and the first requestor requiring the upgrade pays for it
- To provide improved customer service, Midwest ISO begins processing the next study in the queue in parallel, typically starting the next request evaluation once the prior request has finished the Feasibility Study Phase
  - When projects withdraw from the queue, the entire process (and the 658 day tariff timeline) may have to start again
  - Alternative to parallel processing is to wait 19-20 months before addressing the next item in the queue

## ○ Impact of Queue Churn



Project 2 must now be restudied!!!  
The clock gets reset, so MISO is adhering to the Tariff, but the customer is not well served

*You can repeat this phenomena with projects going into suspension, breaching an IA, etc.*

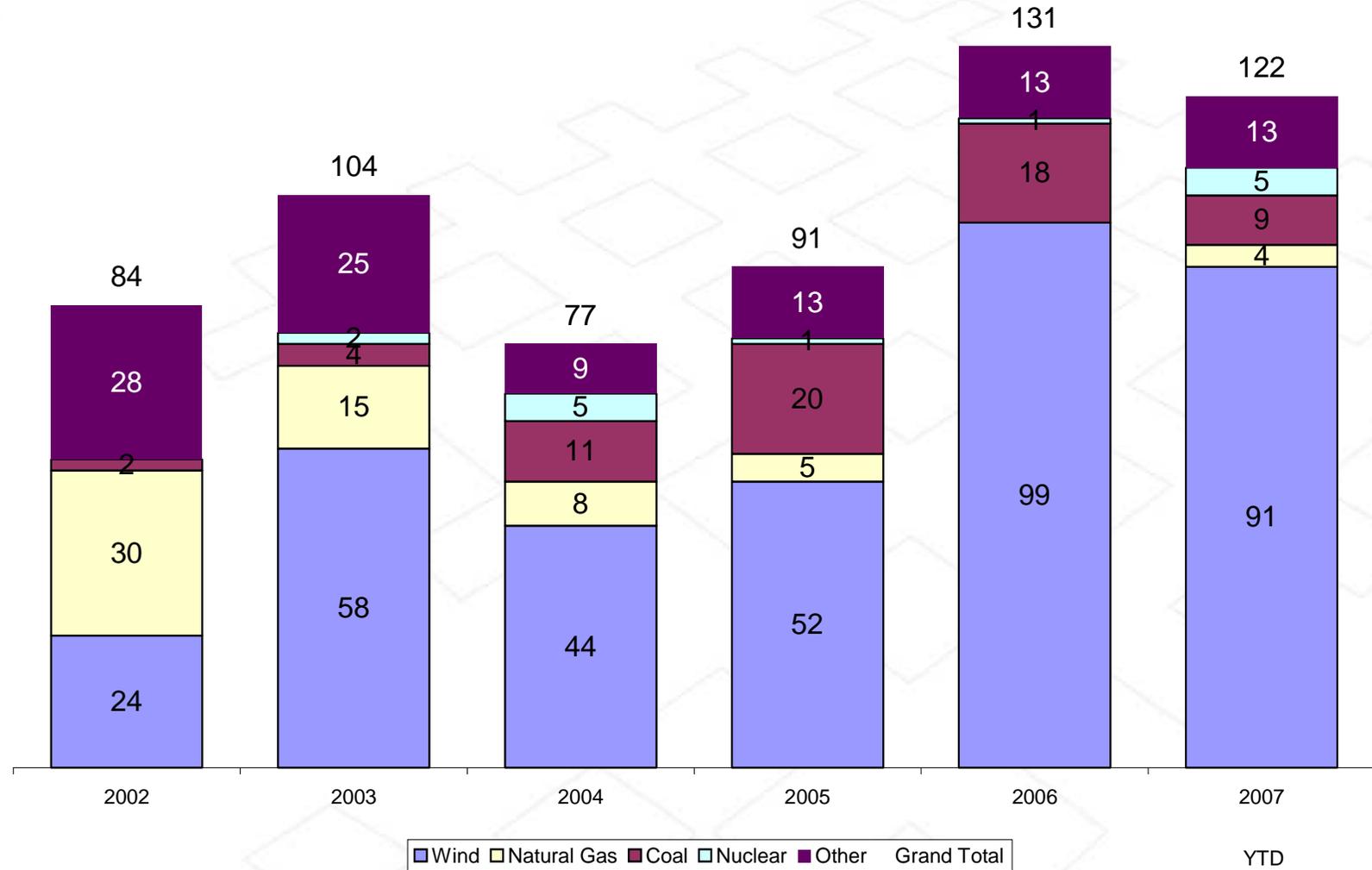
This dynamic, multiplied between 3 and 30 times, shows the effect of the churn on a group study. All the time in the looped part is essentially wasted. As 60% of projects drop out, this translates to a lot of FTE's reworking lots of projects.

## ○ Overview of Attachments X and R

- Attachment X (Large Generation Interconnection Procedure)
  - LGIP for generators larger than 20 MW
  - 650+ days process
  - Only way to acquire Network Resource (NR) Status
- Attachment R (Small Generation Interconnection Procedure)
  - SGIP for generators 20 MW or smaller
  - Shorter process if there's nothing ahead of it in queue
- LGIP and SGIP information posted on the Midwest ISO website

# Evolution of the Queue \*

Number of Requests



\*All requests received as of September 10, 2007

# Generator Interconnection - Studies Performed

- Feasibility Study
  - “Fatal flaw” analysis
- System Impact Study
  - Comprehensive study to determine transmission upgrades required for interconnection
- Facilities Study
  - Engineering study to determine cost and schedule for constructing transmission upgrades

## ○ Feasibility Study

- Somewhat optional study
- Provide the customer a list of potential thermal injection constraints
- Includes steady-state thermal analysis only
- Does not identify mitigation for constraints observed

## ○ System Impact Study

- Determines transmission improvements required for a project to reliably interconnect to the Midwest ISO transmission system
- Analyses performed:
  - Steady-state thermal and voltage
  - Transient stability and voltage
  - Short circuit
  - Deliverability (only if NRIS is requested)
    - Wind generators tested at 20% output
- Constraint mitigation

## ○ Wind study criteria - Order 661-A

- Low Voltage Ride Through Standard (LVRT)
  - Wind generators are required to remain in-service during 3-phase faults with normal clearing (~ 4-9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to prefault voltage unless clearing the fault effectively disconnects the generator from the system.
  - Wind generators shall remain interconnected during such faults for a voltage level as low as zero volts, as measured at the high voltage side of the wind GSU.
- Power Factor Design Criteria
  - Wind generators shall maintain a power-factor within the range of 0.95 leading to 0.95 lagging
  - Wind plants should be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system, if required.

## ○ Facilities Study

- Creates an engineering plan for the interconnection facilities and network upgrades
- Performed by the affected transmission owner(s)
- Provides all information necessary to build the project
  - Timelines
  - Cost estimates
  - Engineering diagrams

## ○ Interconnection Agreement

- Legal documentation necessary for the generator to connect to the system and operate
- Typically three-party agreement: Customer, TO and Midwest ISO.
- Filed at FERC if it deviates from the pro forma
- Mostly pro forma
  - Appendices are negotiated

## ○ Some recent initiatives

- Open season approach
  - Transmission leading generation
  - For more details, please see the July 31<sup>st</sup> Open Season Stakeholder Session notes
  - Will require a Tariff change
- GIQPWG (Generator Interconnection Queue Process Working Group)
  - Holistic review of the Tariff process
  - Kicking off 9/25 here in Carmel

## ○ What is Open Season?

- Given the difference between outlet capability and requested service, we had to try something new
- Idea of the Open Season is to get the transmission built to match expected demand with the queued supply
  - Preferably ahead of the interconnections
  - We're already starting out behind
- Further, idea is to eliminate the “free rider” situation we have now
  - You pay for an upgrade, later generator gets to connect using the lumpiness

## ○ Renewable Energy Mandates

- Various states have established requirements or goals to increase renewable energy use (REO, RES)
- Within the Midwest ISO footprint – MN, IA, WI and IL have renewable energy requirements
- Midwest ISO involved in the transmission study for the MN Renewable Energy Standard
  - Using the MISO queue to locate and size wind generation
  - Providing analysis and modeling support
- Transmission developments recommended by the study would be candidate Open Season projects

## ○ Relevant Links

- Midwest ISO Tariff

[http://www.midwestmarket.org/publish/Document/2b8a32\\_103ef711180\\_-75b10a48324a?](http://www.midwestmarket.org/publish/Document/2b8a32_103ef711180_-75b10a48324a?)

- Generator Interconnection page

<http://www.midwestmarket.org/page/Generator+Interconnection>

- Open Season Proposal

- Whitepaper located at [www.midwestmarket.org](http://www.midwestmarket.org)  
Documents > Planning Information > Open  
Season Whitepaper