Is the Interconnection Process Broken?

How can we fix it?

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March 23, 2022

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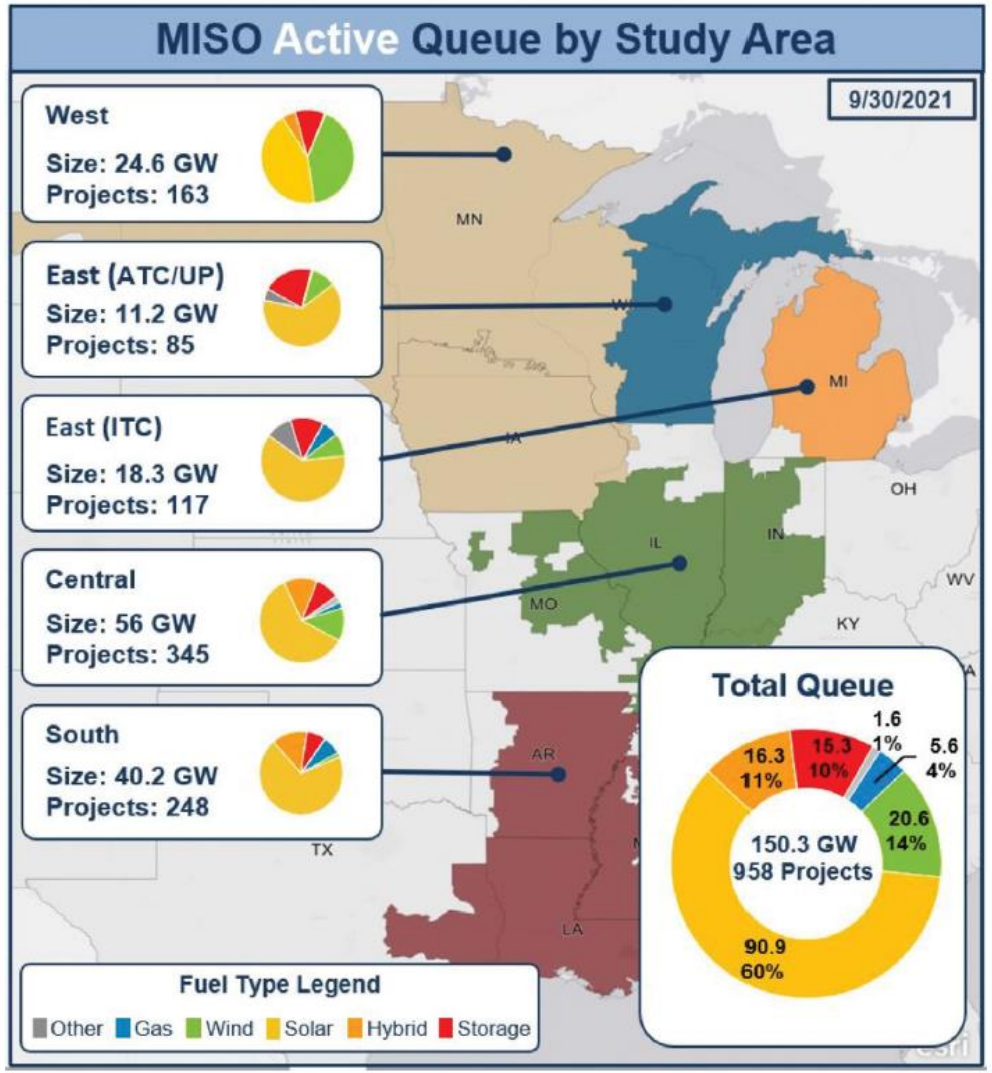
Some Interconnection Process History

- FERC order 888 and 889 in 1996 required public utilities to provide Open Access in a comparable basis to the service they provided themselves
- FERC order 2000 in 1999 encouraged creation of ISOs/RTOs (MISO 2001, PJM 2002, etc.)
- FERC order 2003 created proforma LGIP and LGIA
- Interconnection requests for renewable energy projects started ramping up significantly after 2005
- RTOs/ISOs/Utilities were using the FERC proforma LGIP serial process until it became unmanageable due to the large number of projects in the queue
- RTOs/ISOs/Utilities have proposed various queue reforms to speed up the process. Some have worked better than others
- FERC order 845 - additional reforms to improve interconnection processes

Issues that affect current interconnection processes

- **Studies are taking several years to complete (queue delays)**
- **Large number of projects, later withdrawals, and restudies that are time consuming**
- **High costs of network upgrades, in some cases base case overloads are assigned to generators**
- **Grid enhancing technologies (DLR, power flow control, etc.) are not seriously considered as potential mitigation options by RTOs/ISOs/Utilities**
- **In some cases, affected system upgrades costs are unknown at the time of interconnection agreement execution. Queue priorities issues**
- **No accountability for RTOs/ISOs/Utilities if timelines are not met**
- **RTOs/ISOs/Utilities being understaffed**

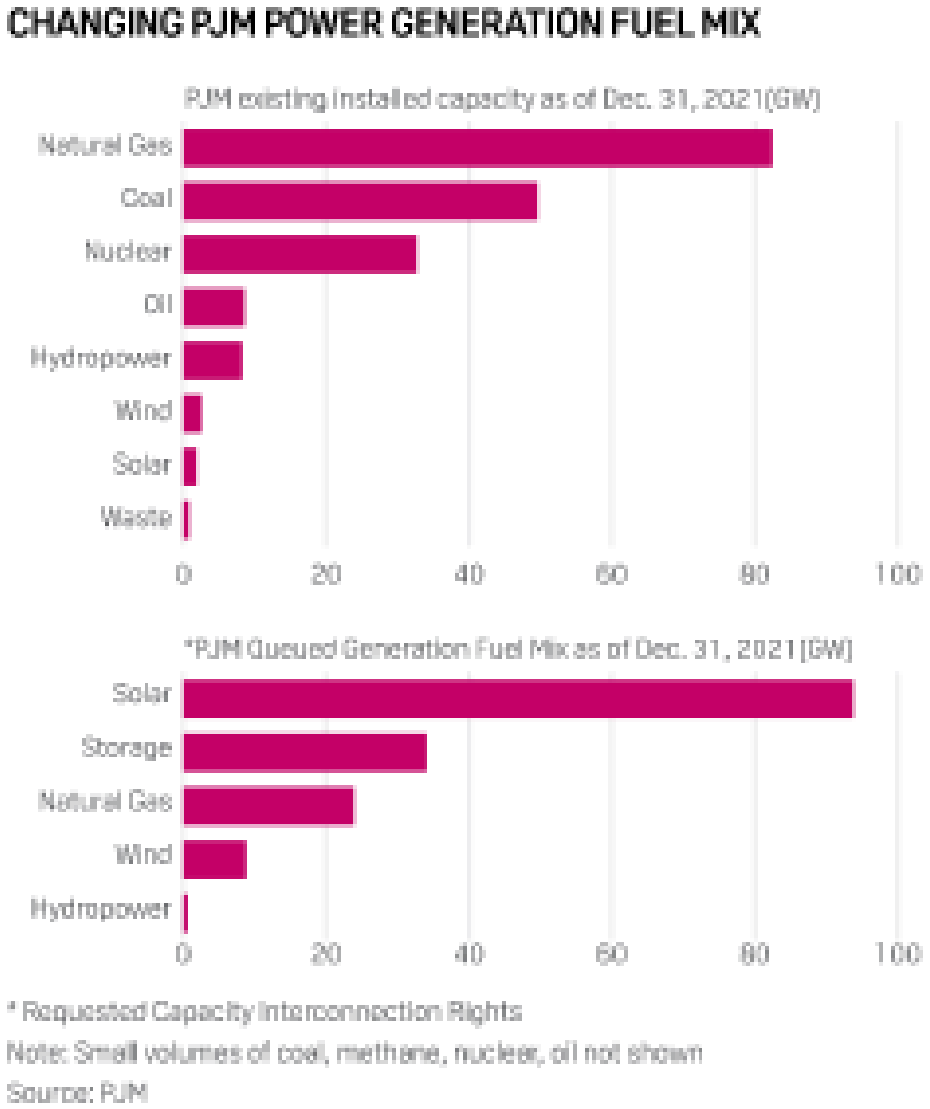
Large Number of Projects in the Queues (MISO Example)



In 2021, MISO's interconnection queue process received record generation capacity requests to connect to the transmission system.

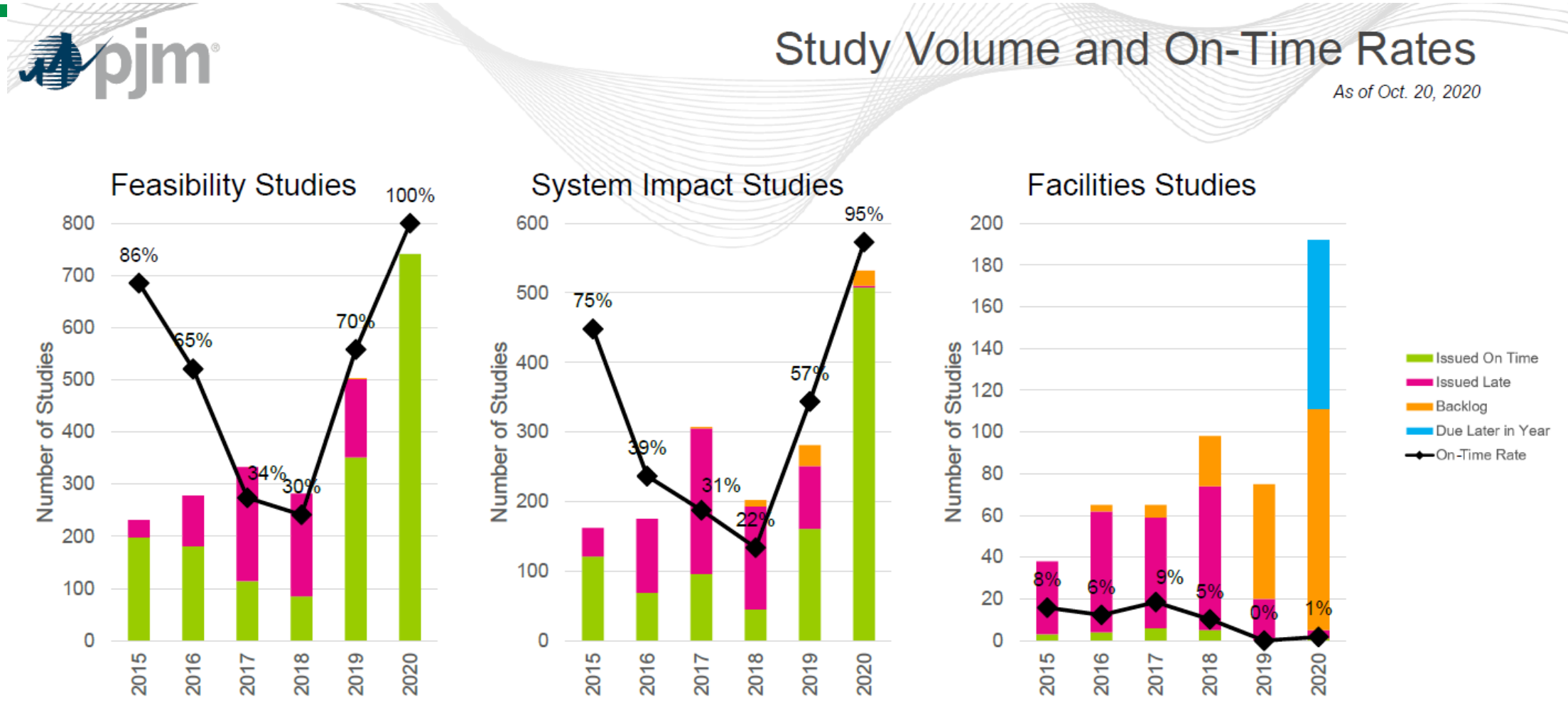
SOURCE: MISO MTEP21

Changing Fuel Mix (PJM Example)



SOURCE: PJM 2021 RTEP

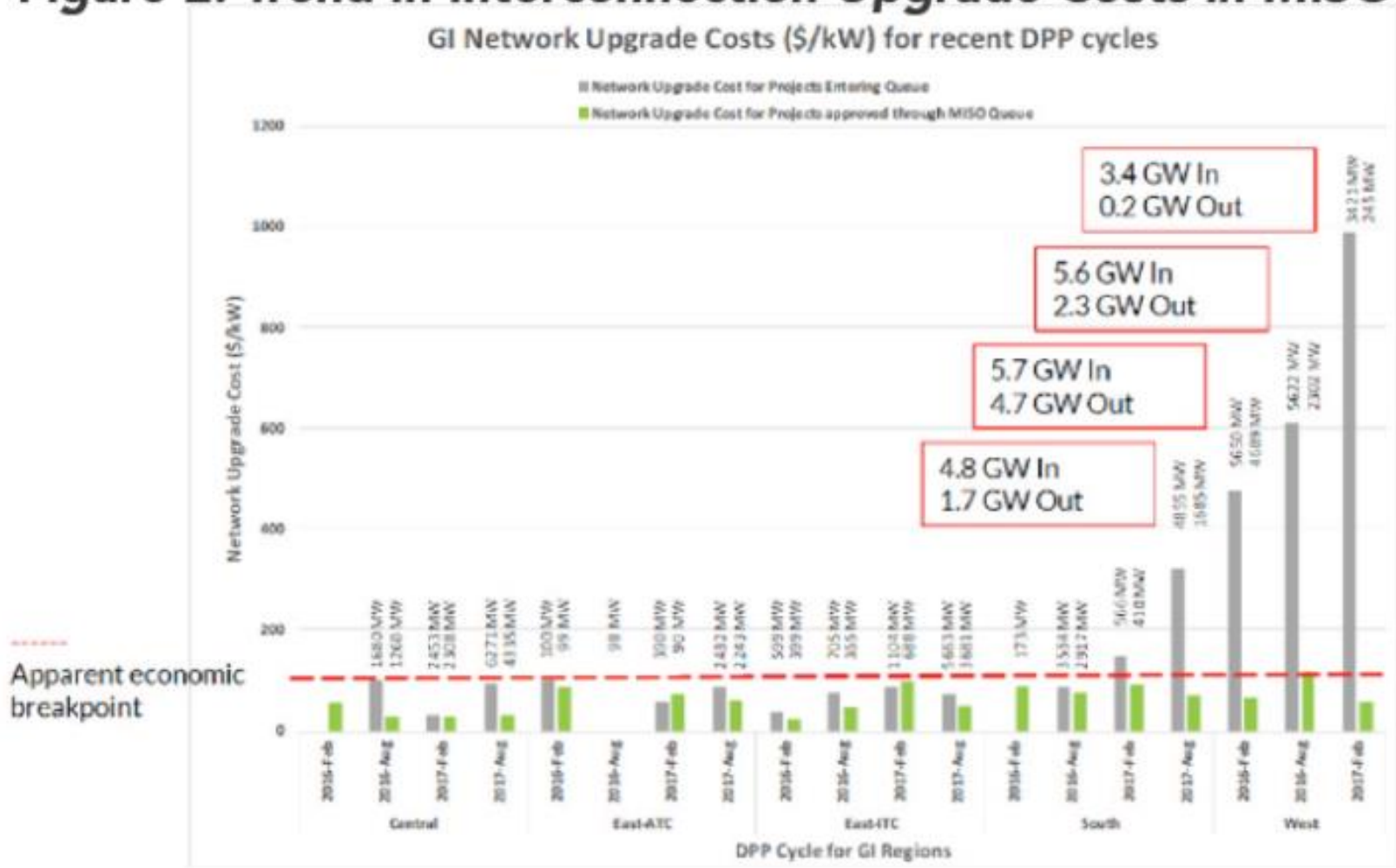
Study Volume and On-Time Rates (PJM Example)



SOURCE: PJM

Network Upgrades Costs are Getting Higher (MISO Example)

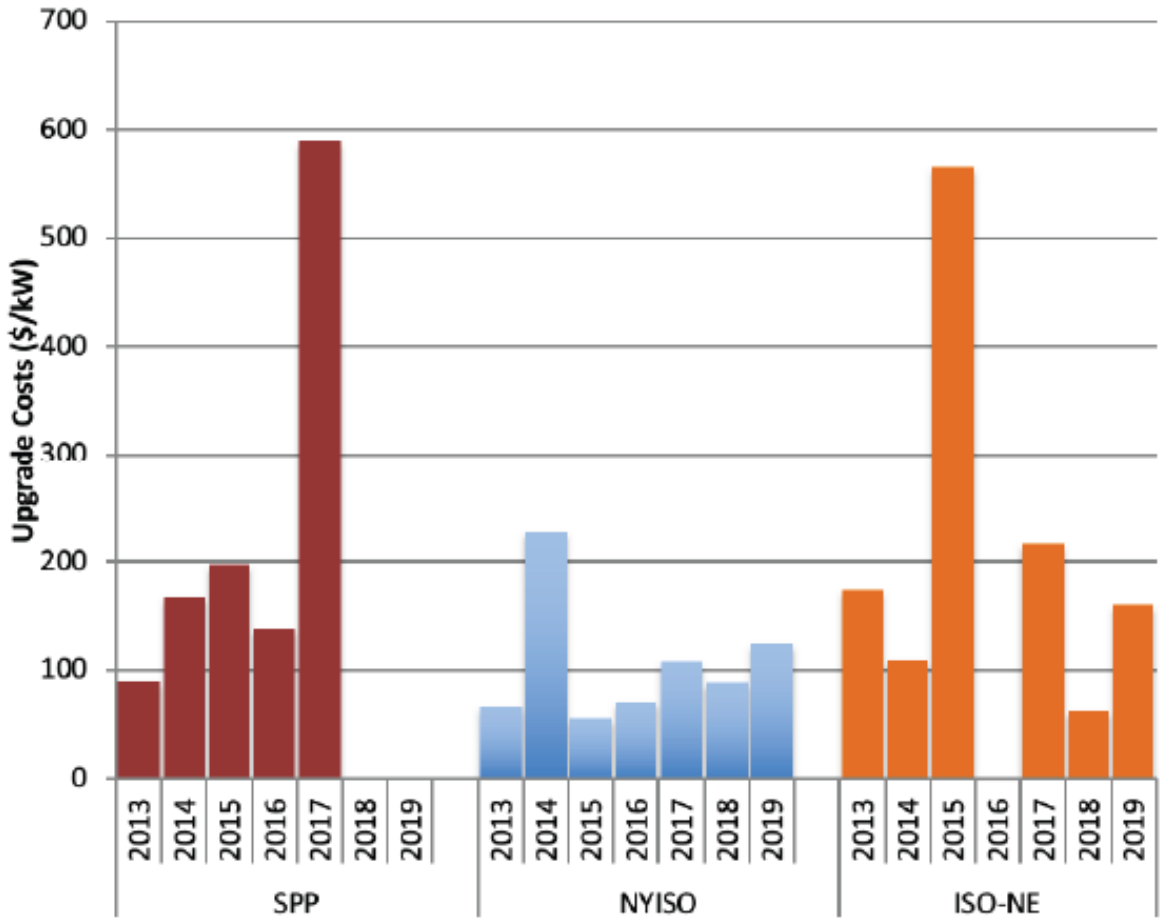
Figure 2: Trend in Interconnection Upgrade Costs in MISO



SOURCE: Americans for a Clean Energy Grid, Disconnected, Jan 2021

Network Upgrades Costs are Getting Higher (SPP, NYISO, ISONE)

Figure 3: Trend in Generator Interconnection Network Upgrade Costs in SPP, NYISO, and ISO-NE ($/kW)



SOURCE: Americans for a Clean Energy Grid, Disconnected, Jan 2021

What can we do to improve interconnection processes?

- **TIMING ISSUES**
  - Studies are taking several years to complete in many regions (queue delays)
  - Large number of projects, later withdrawals, and restudies that are time consuming
  - In some cases, affected system upgrades costs are unknown at the time of interconnection agreement execution. Queue priorities issues

- **POTENTIAL SOLUTIONS**
  - In regions where there are queue delays, consider using interconnection processes similar to those that have proven to reduce the timelines (like the MISO interconnection process, for example).
  - Simplify power system analysis related to interconnection studies (in some regions, too many scenarios and power flow cases are considered). Is there a way to standardize?
  - Better coordination between affected systems and clarity on queue priority
  - Increase number of interconnection staff in RTOs/ISOs/Utilities
  - Hold RTOs/ISOs/Utilities accountable for delays in processing the studies
  - Allow interconnection customers to have the option to use third party consultants where applicable.
  - Avoid “serial” interconnection processes in favor of cluster processes

What can we do to improve interconnection processes?

- **LARGE COSTS AND COST UNCERTAINTY ISSUES**
  - High costs of network upgrades, in some cases base case overloads are assigned to generators
  - In some cases, affected system upgrades costs are unknown at the time of interconnection agreement execution. Queue priorities issues
  - Grid enhancing technologies (DLR, power flow control, etc.) are not seriously considered as potential mitigation options by RTOs/ISOs/Utilities

- **POTENTIAL SOLUTIONS**
  - Coordination between transmission planning and interconnection processes for optimal system expansion. This would prevent transmission “backbone” systems costs being allocated to generators
  - Consider grid enhancing technologies (DLR, power flow control, topology control, etc.) as potential mitigation options
  - Consider new conductor technology such as carbon core conductors.
  - Need to provide cost certainty to interconnection customers at time of IA execution. Queue priorities between affected systems need to be clearly defined.

What can we do to improve interconnection processes?

- **COST ALLOCATION ISSUES**
  - Participant funding, in which the generator pays for all network upgrades in return for either useless credit or no reimbursement, should be eliminated and replaced with a reformed crediting policy.
  - Transmission backbone systems costs are being assigned to generators in many cases

- **POTENTIAL SOLUTIONS**
  - Transmission backbone systems which may be necessary to interconnect and access low-cost renewable generation and which also serve to further increase the reliability of the system, provide significant benefits to load. These upgrades should instead be identified in transmission expansion plans and either paid 100% by load or cost shared with load and interconnection customers.
  - Alignment of the timing and assumptions of the GIP and expansion planning process would allow for consideration of a GIP triggered upgrade in a transmission expansion plan.
  - Interconnection-related network upgrades up to and including the interconnection substation should be the sole responsibility of the generator (or cluster of generators), while upgrades downstream from the substation would be the responsibility of the applicable transmission provider.

What can we do to improve interconnection processes?

- **CAN DISTRIBUTED ENERGY RESOURCES (DER) HELP SOLVE INTERCONNECTION ISSUES AT THE TRANSMISSION LEVEL?**

  - It appears intuitive that DERs can potentially “unload” the transmission system and “help” because they are located where the load is, however:
  - Nowadays, detailed modeling of DERs is not included in transmission planning/interconnection models
  - Need to define the specific parameters of DER resources to be aggregated in transmission planning models
  - Need to consider scenarios that may stress the transmission system due to seasonal variability of DERs and also variability of load
  - Can high penetrations of solar/storage DER affect the stability of the transmission system, given low SCR?
  - There needs to be better coordination between the transmission planning process, transmission interconnection process, and DER distribution planning/interconnection process in order to identify the DER benefits at the transmission level

A Couple of “Real Life” Examples of Issues

- **Issue: The host RTO tendered an interconnection agreement, but affected system studies in a neighboring RTO had not been completed**
- **Outcome: We had to execute the interconnection agreement with significant cost uncertainty and risk, which is an undesirable outcome.**

- **Issue: We proposed a grid enhancing technology as a power flow control device in an ISO and the feedback from the TO was that the technology was not mature enough and therefore was not considered**
- **Outcome: We had to go with a traditional solution that was more costly and with a greater lead time, which is an undesirable outcome**

Summary and Conclusions

- The issues affecting the interconnection processes need to be addressed as a very urgent matter if we want to meet the goals of decarbonization and renewable integration

- Timing issues could be addressed considering the use of methods that have successfully proven to reduce timelines (MISO for example), simplifying the calculations/scenarios, and solving the affected systems issues

- Large costs and cost uncertainty issues could be addressed with better coordination between host RTOs and affected systems and the use of alternative mitigation like GETs. Also, better coordination between the interconnection process and the transmission planning process

- Cost allocation could be addressed by eliminating participant funding and creating a new methodology that allocates costs in a fair way

Thank you