Co-optimization of Transmission and Other Resources: A Case Study of the Eastern Interconnection

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Research Question

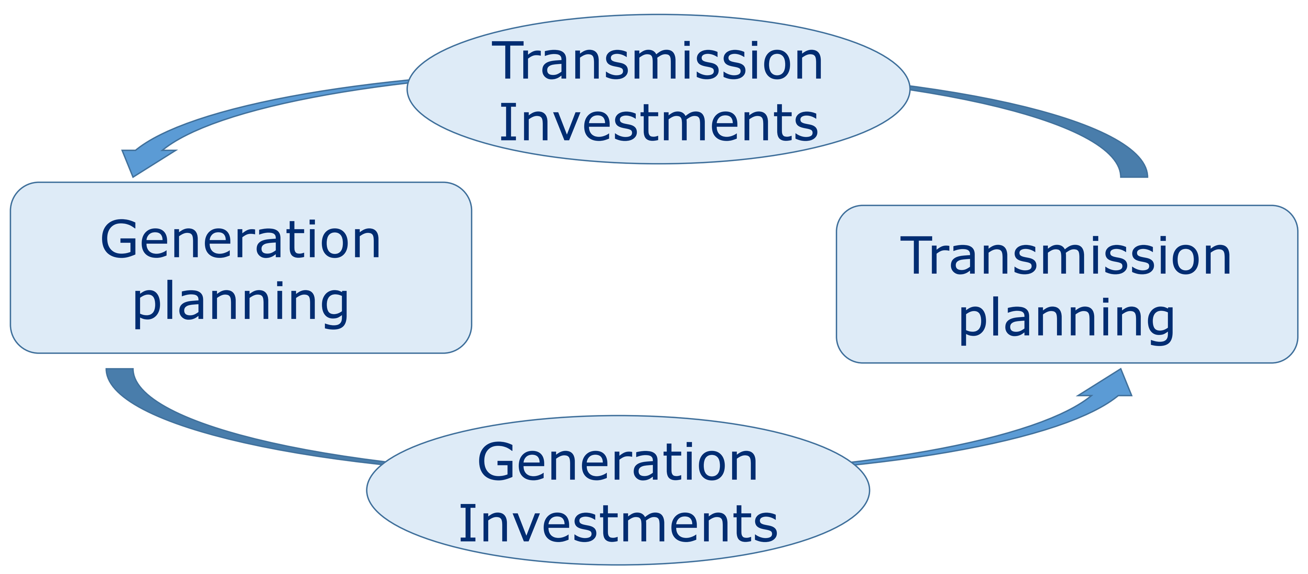
- How do different transmission planning approaches affect integration of renewables and system costs?

Motivation:

- Traditional transmission planning approaches are usually reactive to generation plans/projections and ignore the response of generators to transmission expansion
- Wind has geographically diverse quality and shorter construction time compared to transmission lines

Planning Approaches

- Coordination of generation and transmission planning through ***iterative implementation*** of both, feeding of each with the latest investments from the other:

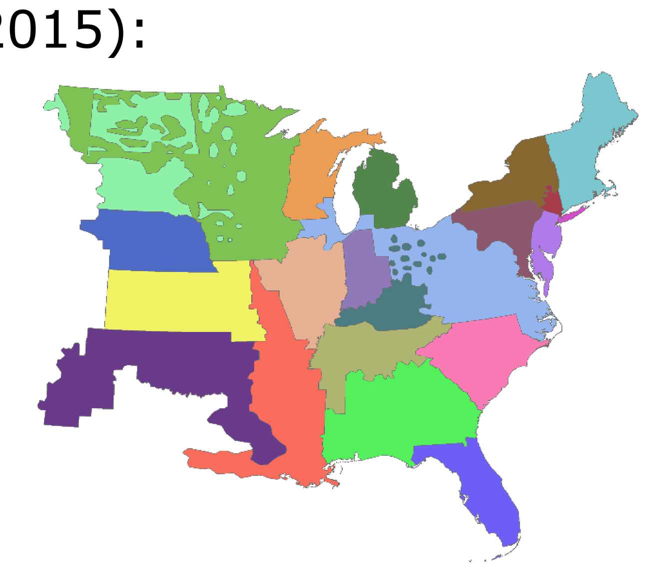


- ***Integrated co-optimization*** of generation and transmission planning is also proposed. A proactive planner could plan transmission using co-optimization and trigger/ facilitate generation investments found by the co-optimization solution

Case Study: EI

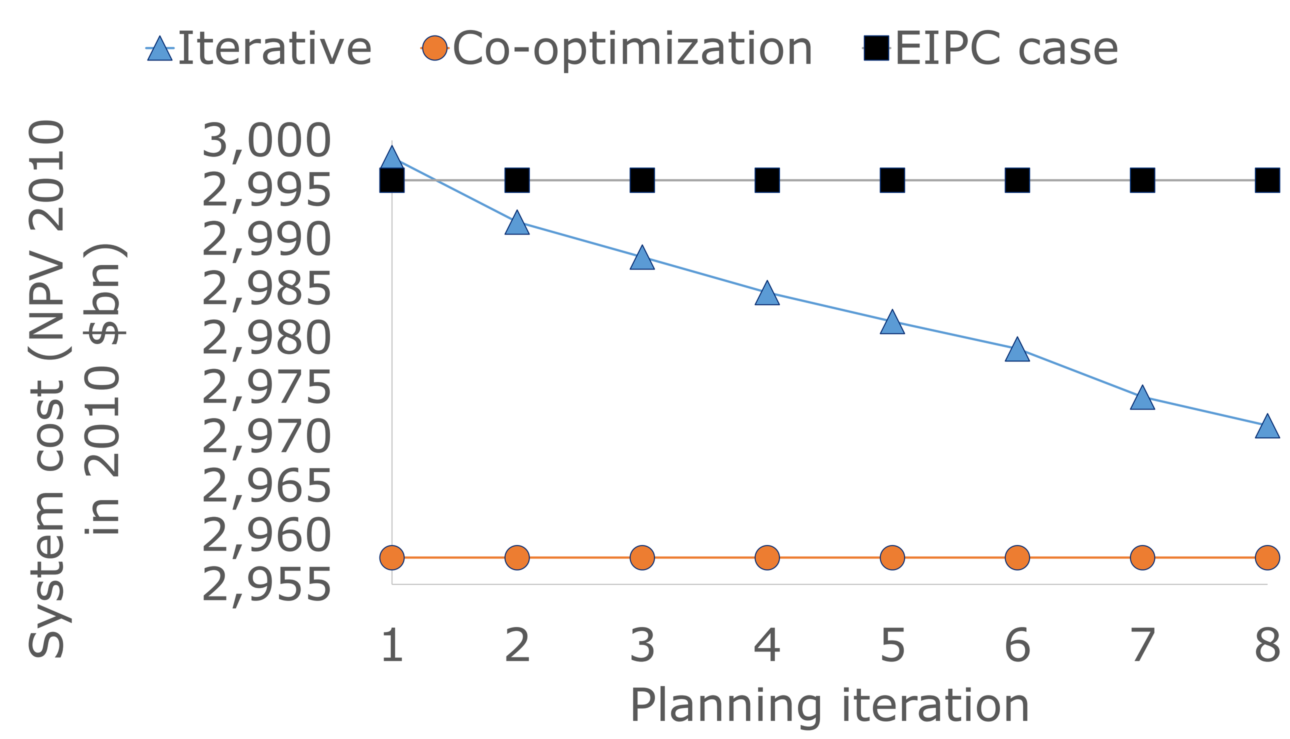
- In 2011, Eastern Interconnection Planning Collaborative (EIPC) developed high level, strategic transmission expansion plans for the Eastern Interconnection (EI) using heuristics for various scenarios
- Scenario simulated : high carbon tax (~27$/tn in 2015 to 140$/tn in 2030) for 20 years horizon under 3 approaches (Energy Exemplar, 2015):

1. generation-only planning given the transmission investments identified by EIPC
2. iterative approach
3. integrated co-optimization

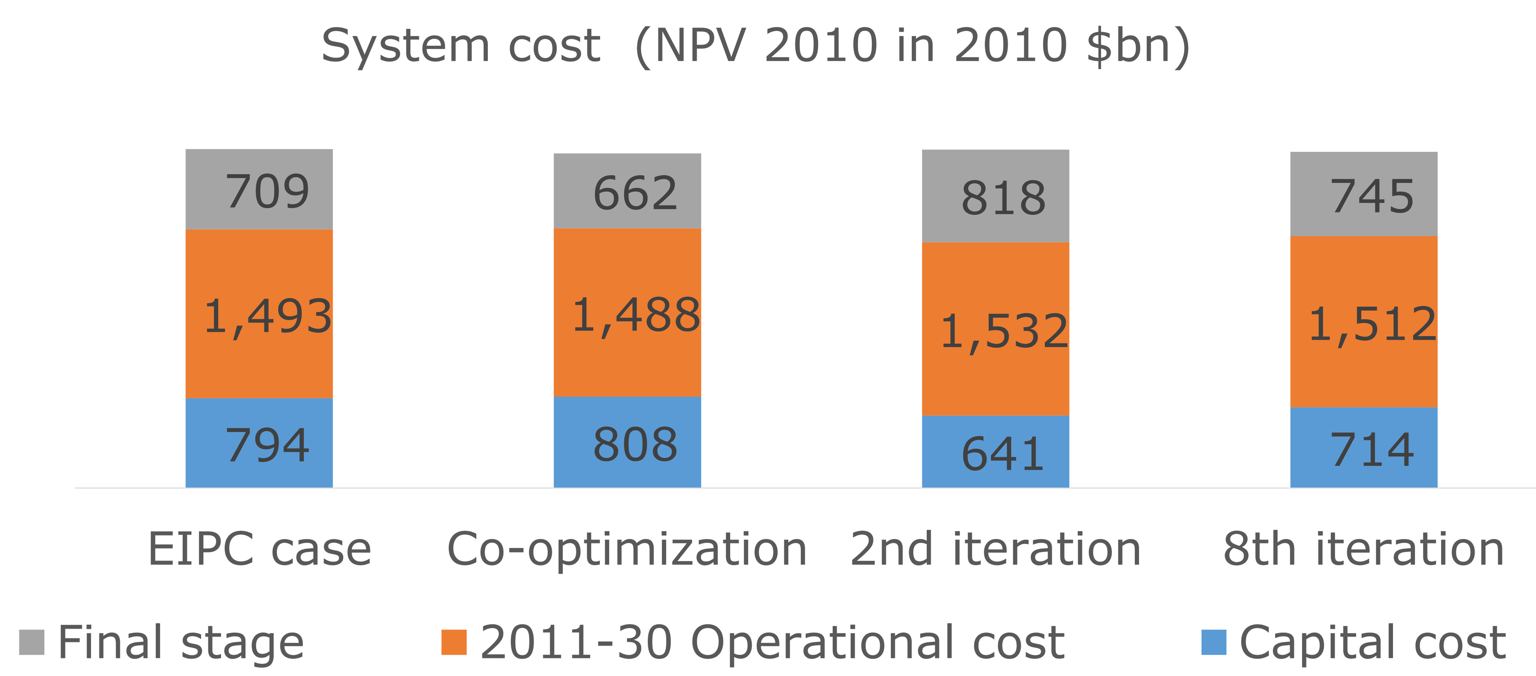


Results

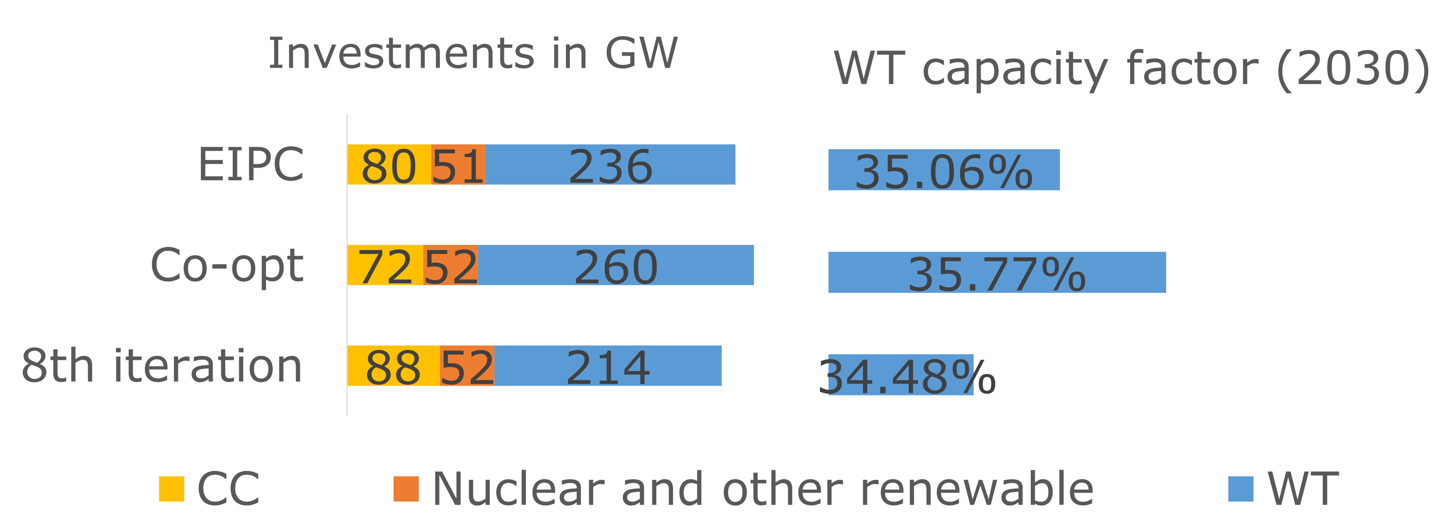
- **Co-optimization lowers system cost**



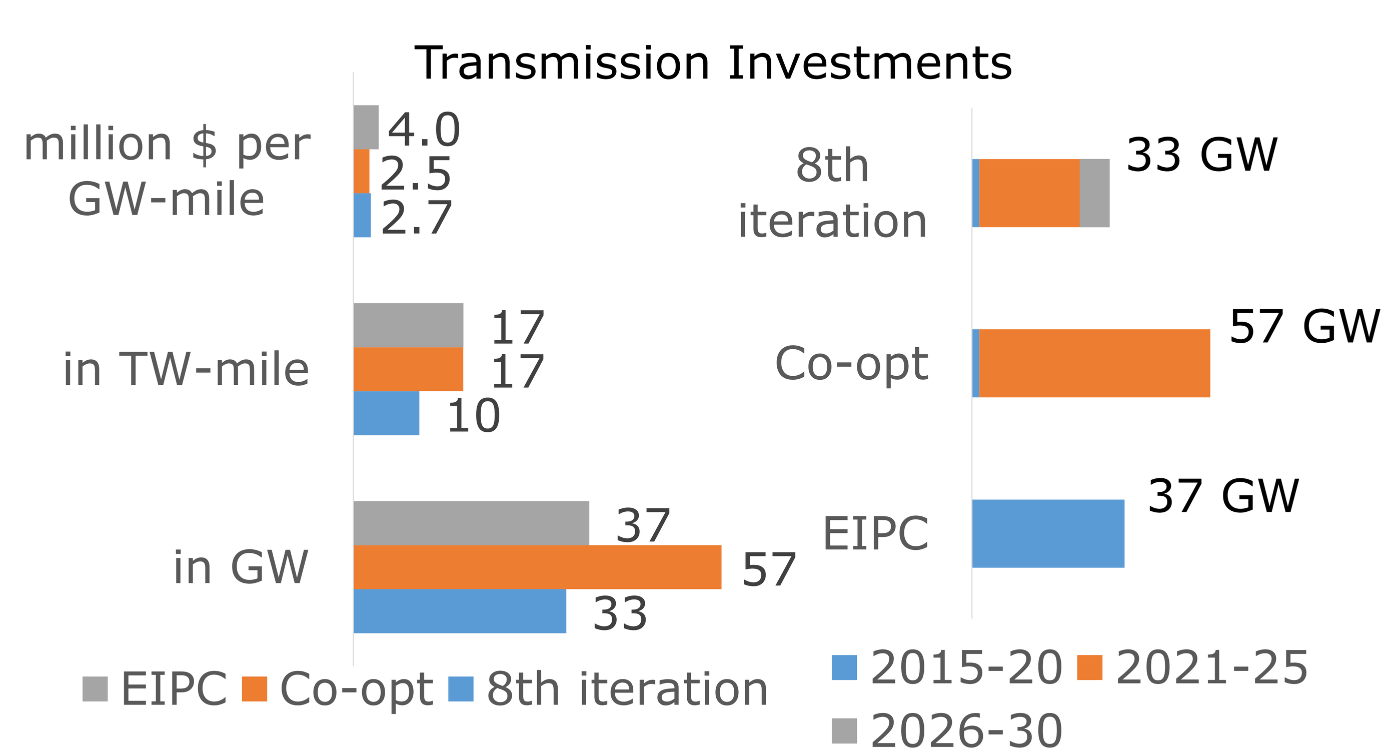
- **Investments go up, operational expenses decrease as total cost improves**



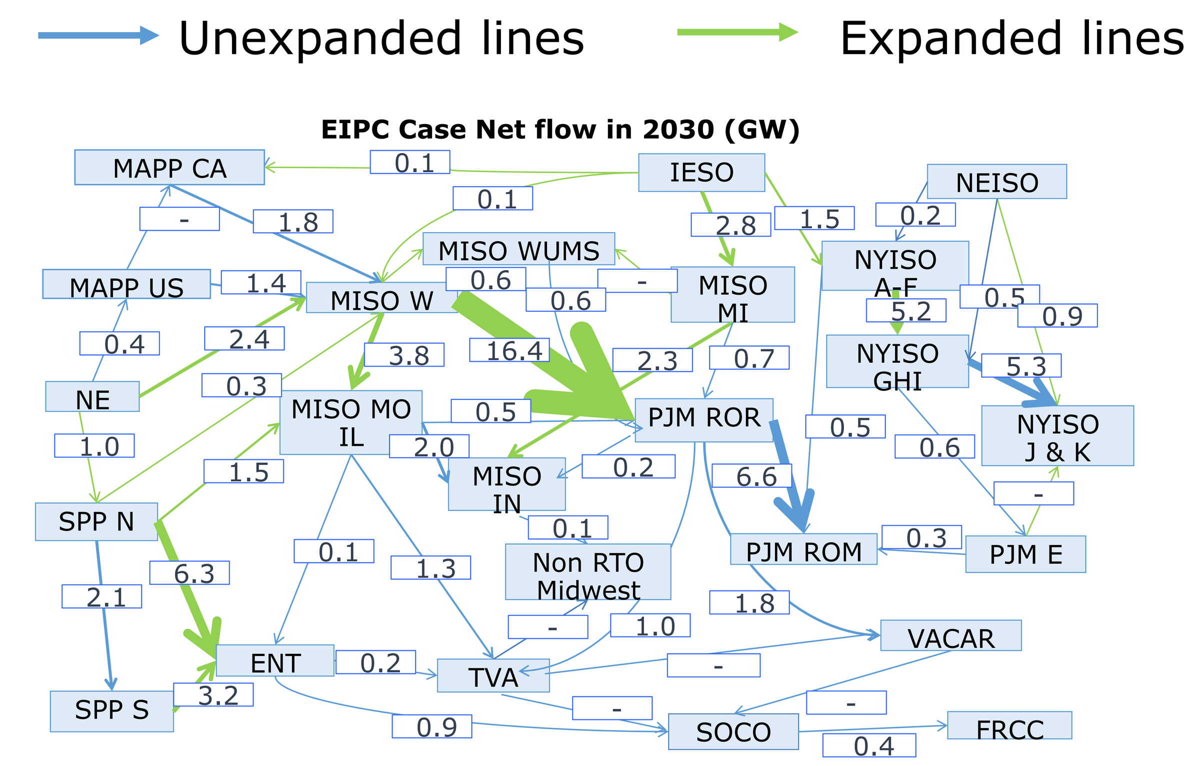
- **Co-optimization integrates more wind**

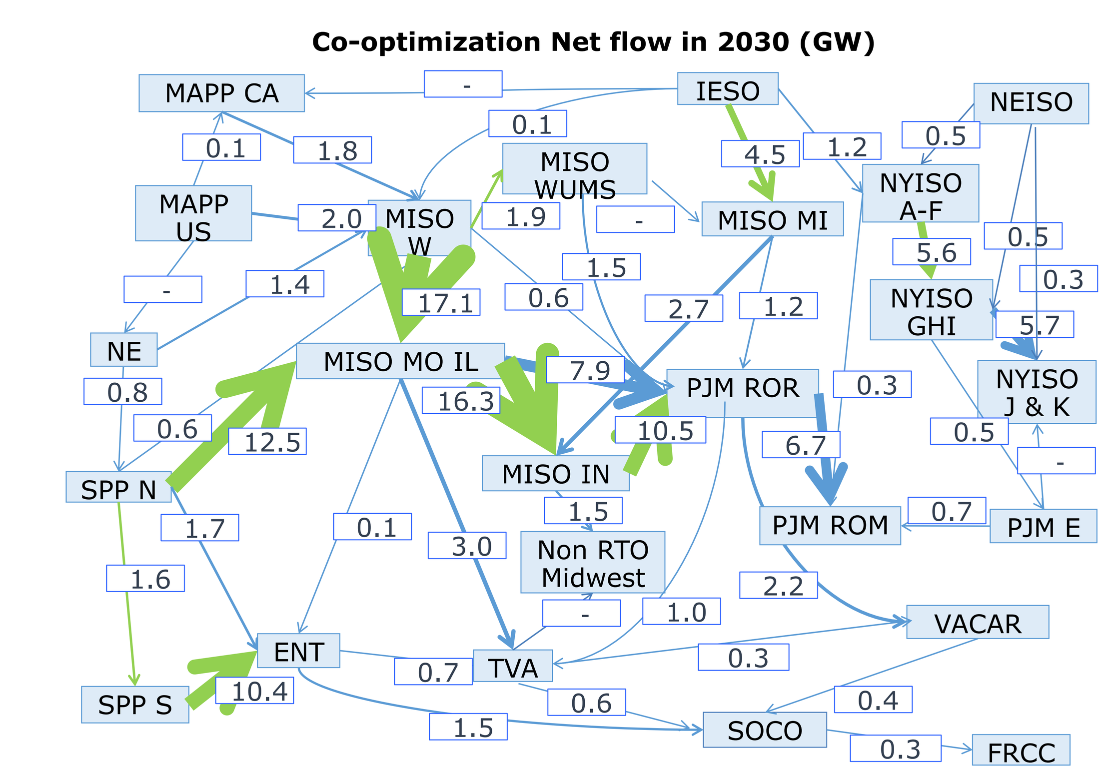


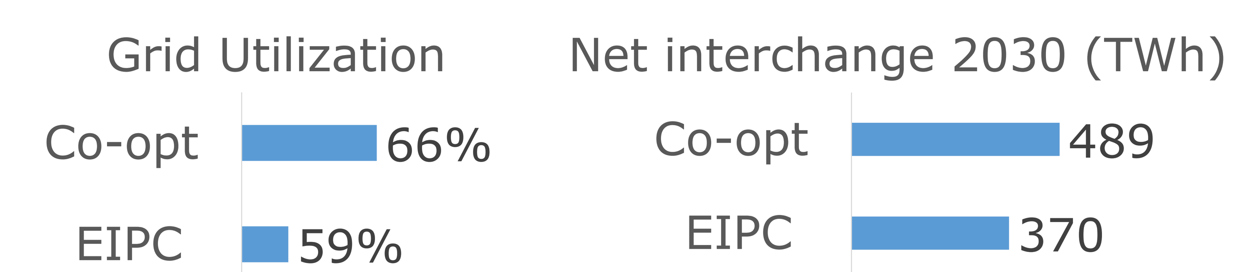
- **Transmission investment: GWs increase but cost decreases due to "cheaper" interfaces, construction deferrals**



- **Co-optimization leads to higher interchange and improved grid utilization**







Conclusions

- Co-optimization achieved ~1.3% savings compared to an optimal generation plan coupled with heuristically-based transmission expansion through increased and more efficient wind investments
- Co-optimization is a time-efficient approach for studying different planning scenarios

Acknowledgments

Authors from The Johns Hopkins University were partially supported by NSF grants IIA 1243482 and ECCS 1230788 and by the National Association of Regulatory Utility Commissioners.

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