Project Work Statement

Sponsor

Eastern States Interconnection Planning Council

The Value of Co-optimization in Electric Power Planning

Participants

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Any apparent association of this work to the real EISPC is fictional, and the sole purpose of this work is a class exercise

1 Background

The Eastern States Interconnection Planning Council (EISPC) is a collaborative organization for the Eastern AC Interconnection. Through it, state and Federal organizations work to improve coordination amongst states and to develop better planning tools. EISPC facilitates interconnection wide planning decisions that will improve the robustness of the interconnection by making use of industry leading tools and expertise.

2 Problem Statement

Using a co-optimization process that models the behavior of generators and transmission operators could reduce total system costs for both market participants. There are two major issues that confound interconnection wide transmission planning efforts. The first is that organization of utilities transmission organizations in the United States. Traditionally in the utilities were vertically integrated publicly regulated monopolies. This allowed a utility to coordinate investments in generation and transmission. Under this type of organization there is little incentive for a utility to invest in transmission with a neighboring utility as their monopoly guaranteed that a utility could always afford to build the necessary generation capacity within their own network.

During the 90s deregulation of the power sector made it possible to break a utilities monopoly on generation. Under this model transmission would remain a monopoly operated by an independent system operator (ISO). ISOs operate a transmission network for a region and are nearly all non-profit. Generation is no longer a monopoly and utilities can either provide for themselves or buy from competitive independent generators. Under an ISO there is significantly more investment in transmission and interconnection as utilities will buy the cheapest available power in the system regardless of where it is produced. Making these interconnection decisions is complicated because the transmission planner, the ISOs, no longer coordinate with generation planers, utilities and independent producers.

An additional challenge to transmission planners is the expansion of renewable energy. Renewable generation has grown rapidly over the past decade and will continue to do so, with growth projections by the International Energy Agency in excess of 40%, due to declining costs, government regulation, and economic incentives. [1] In many cases the best quality renewable resources are located far from the areas of high demand, and would require significant investments in transmission to become viable.

Currently the US electric network is made up of a mix of deregulated power pools and vertically integrated monopolies. Transmission planning is not preformed with appropriate considerations for the value of co-optimization. Under existing planning process transmission planning is preformed under the assumption that generation remains constant. Ignoring the generation planning process may result in the construction of lines that turn out to be unnecessary as well as limit the construction of inexpensive renewables. This will result in higher costs to all parties involved. This project will demonstrate that co-optimizing transmission investment decisions can reduce the total cost of building and operating an electric power system.

3 Approach

Using the 13 bus McCalley network reduction of the United States transmission planning decisions will be modeled using the Hobbs and Van der Weije 2011 co-optimization model.[2, 3] Model inputs including inputs sourced from the Energy Information Agency, independent system operators, and the National Renewable Energy Lab will be spatially aggregated using ArcGIS to function with the 13 bus network model. Co-optimization will be compared with individual optimization, which will be modeled using a modification of the Hobbs and Van der Weije model. In this generation will be optimized assuming fixed transmission, then transmission will be separately optimized with fixed generation. A simulation of this electric power system and its operation costs will be preformed before a total cost of not co-optimizing is reported.

4 Milestones

We have the following major deadlines:

- Work Statement due date, Oct 24, 2012,
- Progress Report due date, Nov 5, 2012,
- Final Presentation due date, Nov 6, 2012,
- Final Report due date, Nov 30, 2012.
- Final Deliverables due date, Dec 7, 2012

5 Deliverable

5.1 From Team to Sponsor

The following outputs are expected from this project:

- Co-optimization model adapted to a 13 bus US network
- Appropriate parameters and constraints by region
- A simulation based model for independent transmission optimization
- Cost comparison between the two methods
- R packages used to analyze optimization results
- Documentation of methods and tools used
- Technical report and presentations summarizing the work

5.2 From Sponsor to Team

In order for our project to be of successful one, we will need:

- Relevant data to the model (provided by sponsor as of 10/23)
  - Physical network properties
  - Generation and transmission costs
  - Electric power demand
  - Renewable resource availability
- Computing resources
- Timely responses to inquiries
- Familiarity working with large data sets

References

[1] International Energy Agency. Iea sees renewable energy growth accelerating over next 5 years. *IEA*, 2012. ⟨http://www.iea.org/newsroomandevents/pressreleases/2012/july/name,28200,en.html⟩. Accessed October 23, 2012.

[2] B. Hobbs, H. Van der Weije. *Planning electricity transmission to accommodate renewables: Using two-stage programming to evaluate flexibility and the cost of disregarding uncertainty.* ⟨http://www.eprg.group.cam.ac.uk/wp-content/uploads/2011/01/Binder11.pdf⟩. Accessed September 28, 2012.

[3] McCalley et al. Transmission design at the national level: Benefits, risks and possible paths forward. *PSERC*, 2012.

Provided information about the network model required by EISPC for evaluation of optimization methods.