Decision Models for Bulk Energy Transportation Networks

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Overview

• Logistics
• Meeting, connecting, learning
• Summary of our goals
• Issues and directions
Logistics

• NSF Program Director Kevin Tomsovic has confirmed project is coming, $500k of it comes from engineering directorate.

• Meet again next week, same time, place?

• Have not yet applied for REU (waiting for project to officially come), but have advertised.

• Be thinking about attracting the right student

• Funding opportunities this fall: EPRC and PSerc
Meeting, Connecting, Learning

“Reach out” to the familiar & close first

Infrastructure:
- ISU Heat Plant (ISU - Randy Larabee)
- City of Ames (Ames - Merlin Hove)
- MidAmerican Energy (Des Moines - Alan O’neal)
- Alliant Energy (Dubuque - John Weyer)
- IAMU (Ankeny - Bob Hauch)
- Union Pacific (Omaha - ?)

Markets:
- MISO (St. Paul/Carmel – Dale Osborn/Paul Gribik)
- PJM (Philadelphia - Ott/Ford)
- Iowa utility board

- Will try and set up meetings ISU and Ames
- Field trip to MEC Trading Floor this Friday
- Spring 2006 meeting at ISU…
- Fall 2006 meeting at MISO…
Meeting, connecting, learning

Discussion items for interacting with industry:
1. Describe the processes by which decisions are made to
   a. sell, buy, and transport raw fuel
   b. sell, buy, and transport electricity in bilateral markets and in spot markets
   c. sell and buy emission allowances
   Also, describe the information flow of the above processes.
2. What kind of failures in your system are of concern and which ones would you expect to have the largest impact?
3. What kind of simulation models exist for production and transportation of natural gas and of coal?
4. What kinds of simulation tools are available for trading of emission allowances?
5. What data can be made available to us?
6. Would you be interested in employing one of our students for a summer or a semester?
7. ....
Summary of our goals

(1) What energy flow patterns would yield significantly improved energy system performance? What operational production and/or transportation changes need to be made to realize these improvements?

(2) What infrastructure weaknesses exist? What infrastructure enhancements would realize the most performance benefit?

(3) How well can we predict the influence of market design changes on energy system performance?

Fig. 1: Gas, Rail, and Electric Transportation Systems
Issues and Directions

“Steve and Leigh will be discussing the project with Dan Krier, with intention of involving Dan in it. Dan’s expertise lies in the area of organizational sociology and may be able to provide assistance in this area.”

One vision here is that this effort will result in a description/depiction, a clear articulation of the “other flows” in the US energy system:

- Information and decision
- Money

Most ISOs seem to be trying to achieve some level of transparency in what they do via dissemination on their website:

- [www.pjm.org](http://www.pjm.org) is probably the very best for information
- [www.midwestiso.org](http://www.midwestiso.org) is getting better.

Also, [www.caiso.com](http://www.caiso.com), [www.iso-ne.com](http://www.iso-ne.com), [www.ercot.com](http://www.ercot.com), [www.nyiso.com](http://www.nyiso.com)
Issues and Directions

“A discussion ensued about integrating the behavioral models with the structural models. The group will need to eventually think through both the conceptual design but also the software implementation. Key to this effort will be the ability to maintain flexibility/modularity in the software, so that what we do today will retain its relevance for the future. It may be that the model development procedure is as important, or more so, than the model itself, in order to have some level of permanency in our work.”

Integration:

- Software Integration: Flexibility/modularity and also “code interchangability.”
  ➔ Should we consider commercial platforms?

- Conceptual integration:
  ➔ Structural and behavioral models
    - Behavioral models produce price/quantity bids which are entered to a global energy market “auction” system,
    - Fuel price and availability is produced by global optimization which then provides information that behavioral models use when developing price/quantity bids to electricity markets
  ➔ There may be other models necessary as well
Issues and Directions

The group discussed the multiplicity of possible objectives in optimizing the bulk energy production and transportation system and noted that reliability can be modeled in the objective function or as a constraint.

“Modeling” reliability is one perspective.

Related is “assessing” reliability

• Computing reliability indices
• Identifying “weak” topologies
• Identifying sequences (dependencies)