

Testing the Reliability of Wholesale Power Market Designs

An Iterative Participatory Modeling (IPM) Approach

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What is Agent-Based Computational Economics (ACE)?

- ◆ **Culture-dish approach** to the study of decentralized market processes
- ◆ **Computational study** of economic processes modeled as dynamic systems of interacting agents
- ◆ **ACE Handbook**
www.econ.iastate.edu/tesfatsi/hbace.htm
- ◆ **ACE Website**
www.econ.iastate.edu/tesfatsi/ace.htm

Four Main Strands of ACE Research

- ▣ **Empirical Understanding**
(e.g., possible explanations for macro regularities)
- ▣ **Normative Understanding**
(e.g., market design)
- ▣ **Qualitative Insight/Theory Generation**
(e.g., self-organization of decentralized markets)
- ▣ **Methodological Advancement**
(e.g., representation, visualization, validation)

Real-World Market Design Project

“Dynamic Testing of FERC’s Proposed Wholesale Power Market Design: An Agent-Based Computational Approach”

Junjie Sun

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and

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<http://www.econ.iastate.edu/tesfatsi/DynTest.JSLT.pdf>

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(Extension of earlier project work with Deddy Koesrindartoto
Econ Department, SBM-ITB, Bandung, Indonesia)

Part of a Larger-Scale NSF Project on Integrated Energy Systems

- Jim McCalley, Sarah Ryan, Steve Sapp, and Leigh Tesfatsion, *“Decision Models for Bulk Energy Transportation Networks”*
- **Goal:** Construction of an integrated energy model (electricity, coal, natural gas, water) that permits
 - **comprehensive assessment** of improved production, storage, transportation, and delivery alternatives;
 - **prediction** of the effects of market design changes on energy system performance.
- **Approach:** Use *IPM* to develop a two-layer empirically-based model: an *agent-based market layer* operating over a *transport network layer*.

Iterative Participatory Modeling (IPM)

- ◆ See, e.g., Barreteau et al. (*JASSS* 2003)
- ◆ Stakeholders and researchers from multiple disciplines join together in **repeated looping** through four stages of analysis:
 - Field work and data collection
 - Role-playing games ← **DDDAS Connection**
 - Model development and implementation
 - Intensive computational experiments