

# Testing the Reliability of Wholesale Power Market Designs

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An Iterative Participatory Modeling (IPM) Approach

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# What is Agent-Based Computational Economics (ACE)?

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- ◆ **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](http://www.econ.iastate.edu/tesfatsi/hbace.htm)
- ◆ **ACE Website**  
[www.econ.iastate.edu/tesfatsi/ace.htm](http://www.econ.iastate.edu/tesfatsi/ace.htm)

# Four Main Strands of ACE Research

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- ▣ **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

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

**Junjie Sun**

**Economics Ph.D. student, ISU**

and

**Leigh Tesfatsion**

**Professor of Economics and Mathematics, ISU**

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

January 2006 (Work in Progress)

(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

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- 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)

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- ◆ 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