# "Economics of Grid-Supported Electric Power Markets: A Fundamental Reconsideration" *

## Power Seminar, ECpE Department, Iowa State University, Ames, IA
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**Abstract:** This presentation first highlights four conceptually-problematic economic presumptions reflected in the DAM/RTM two-settlement system at the core of current U.S. RTO/ISO-managed wholesale power markets operations that are hindering the smooth transition of these markets to decarbonized grid operations with numerous diverse participants. The key problematic presumption is the static conceptualization of the basic transacted product as grid-delivered energy (MWh) competitively priced at designated grid delivery locations during successive operating periods, supported by ancillary services. The reality is far more daunting: U.S. RTOs/ISOs are fiduciary "conductors" tasked with orchestrating the availability and subsequent possible dispatch of increasingly diverse dispatchable power resources to service the just-in-time power demands of increasingly diverse customers while meeting just-in-time power requirements for reliable grid operation. Thus, U.S. RTO/ISO-managed wholesale power markets must operate as flexibility-support mechanisms.

The presentation then briefly reviews an alternative conceptually-consistent "Linked Swing-Contract Market Design" that appears well-suited for the scalable support of increasingly decarbonized grid operations with increasingly diverse participants. This design entails a fundamental switch to a dynamic insurance focus on advance reserve procurement permitting continual balancing of real-time net load. Reserve consists of the guaranteed availability of diverse power-path production capabilities for possible RTO/ISO dispatch during future operating periods, offered into RTO/ISO-managed linked forward reserve markets by means of two-part pricing swing contracts in firm or option form.


**Short Bio:** Leigh Tesfatsion received the Ph.D. degree in economics from the University of Minnesota, Minneapolis, in 1975, with a minor in mathematics. She is Research Professor of Economics, Courtesy Research Professor of Electrical & Computer Engineering, and Professor Emerita of Economics, all at Iowa State University. Her principal current research area is grid-supported electric power market design supported by the development of computational platforms permitting the systematic performance testing of these designs. She is the recipient of the 2020 David A. Kendrick Distinguished Service Award from the Society for Computational Economics (SCE) and an IEEE Senior Member. She has served as guest editor and associate editor for a number of journals, including the *IEEE Transactions on Power Systems*, the *IEEE Transactions on Evolutionary Computation*, the *Journal of Energy Markets*, the *Journal of Economic Dynamics and Control*, the *Journal of Public Economic Theory*, and *Computational Economics*.

* Leigh Tesfatsion (2023), E-Filed Comments (with Attached Supporting Document), submitted 14 January 2023 for U.S. FERC Docket No. AD21-10-000: Modernizing Wholesale Electricity Market Design, Accession #20230117-5051. (EFiledComments,pdf,1.4MB)

# Key Discussion Points

**1. Role of RTOs/ISOs [1, Sec. 1]:** RTOs/ISOs are ***fiduciary "conductors"*** tasked with orchestrating the availability and subsequent possible dispatch of increasingly diverse dispatchable power resources to satisfy the just-in-time power demands of increasingly diverse grid-connected customers while meeting just-in-time power requirements for reliable grid operation.

**2. Grid-delivered energy (MWh) is not a commodity [1, Secs. 1, 3.4.3]:** A ***commodity*** is an asset *A* with a standard unit of measurement *u* such that, conditional on location and time**, each** *A*-trader considers **all** *A*-units *u* available for trade to be *perfect substitutes* (economically equivalent). However, for an RTO/ISO, power producer, or power customer, the marginal cost (MC) or marginal benefit (MB) of a "next" energy unit *u** (1MWh) available for grid-delivery at a grid location *b* during a future time-period T will typically be indeterminate in advance of actual delivery because the flows of power (MW) that can implement delivery of *u** (1MWh) at *b* during T can take a multitude of differentially-valued forms.

**3. Day-Ahead Market/Real-Time Market (DAM/RTM) Two-Settlement System Is conceptually problematic [1, Secs. 3-4]:** This system, at the core of all current U.S. RTO/ISO-managed wholesale power markets, is meant to mimic the operations of a collection of competitive commodity spot-markets for determination of competitive (MC=MB) per-unit prices LMP(*b*,T) ($/MWh) for energy (MWh) conditional on grid location *b* and operating period T. However: **(3.1)** grid-delivered energy does not function as a commodity within grid-supported electric power markets; **(3.2)** DAMs/RTMs are forward markets, not spot markets; and **(3.3)** the basic transacted product in U.S. RTO/ISO-managed wholesale power markets is physically-covered insurance to protect against volumetric grid risk for future operating periods, not grid-delivered energy. This insurance product needs its own special type of forward market design, with supply offers taking the form of two-part pricing insurance contracts.

**4. Linked Swing-Contract Market Design [2]:** This conceptually-consistent alternative design is well-suited for the scalable support of increasingly decarbonized grid operations with increasingly diverse types of participants. The design consists of a linked collection of RTO/ISO-managed forward reserve markets M(T) for future operating periods T, where ***reserve for T*** consists of the guaranteed availability of power-path production capabilities in advance of T for possible RTO/ISO dispatch during T to protect against volumetric grid risk. Each ***reserve offer*** submitted by a dispatchable power resource *m* to a forward reserve market M(T) for a future operating period T is a two-part pricing insurance contract in firm or option swing-contract form that permits *m* to ensure its revenue sufficiency.

**5. Gradual Transition from current RTO/ISO-managed market operations to Linked Swing-Contract Market Design operations is possible [2, Ch. 16]:** Key design differences involve product definitions, settlement rules, and contract forms, not real-time operations; and these design differences can be introduced gradually.

## REFERENCES:

**[1]** Leigh Tesfatsion (2023), **"Economics of Grid-Supported Electric Power Markets: A Fundamental Reconsideration,"** Econ WP No. 22005, ISU Digital Repository, Iowa State University, Ames, Iowa. **https://www2.econ.iastate.edu/tesfatsi/EconomicsGridSupportedPowerMarkets.ISUDR22005.LTesfatsion.pdf**

**[2]** Leigh Tesfatsion (2021), **A New Swing-Contract Design for Wholesale Power Markets**, 20 Chapters, 288pp., John Wiley & Sons, Inc. (IEEE Press Series on Power Engineering), Hoboken, New Jersey, USA. **(Book Review, pdf)**, **(Presentation, Slide-Set, pdf)**, **(Wiley/IEEE Press Book Flyer, pdf)**.