

# NIST Transactive Energy Research and the NIST TE Challenge

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# NIST collaborating with others to lay the foundation for TE

- **NIST-SGIP coordination** via the SGIP TE Coordination Group (TECG):
  - TECG coordinating with TE Challenge team to develop a use case set that will support groups trying to understand the scope of TE.
  - The SGIP DRGS is working on renewables integration and microgrid design and interactions with the grid. These are key use cases for TE.
- Advancing key **standards** supporting TE:
  - Energy Interoperation, OpenADR, FSGIM and Green Button
- Developing **research** capabilities in the NIST Net Zero house and SG Testbed:
  - Energy management research in the NZ house
  - OpalRT for precision timing research in SG Testbed
  - Gridlab-D/NFS—co-simulation capabilities to support TE
- **NIST TE Challenge**



# Advancing our understanding of “TE”

- SGIP TCEG analysis of TE landscape:
  - TE encompasses time horizons from forward capacity markets to real-time ancillary services
  - TE includes actors in all SG domains as market participants
  - TE covers diverse business functions: DER integration, balancing supply and demand, managing distribution system power flows and power quality.
- Transactive Energy is characterized by:
  1. the continuous flow of real-time value information,
  2. dynamic negotiation of "value," and
  3. use of that value in decision making for operations.
- TE Challenge: Team efforts are supporting better understanding of TE.



# NIST TE Modeling and Simulation Challenge for the Smart Grid



- TE Challenge goals and timeline
- Current activity: team projects and plans
- Next Phase of Challenge



# TE Challenge Goals



1. **Tools**—Develop/enhance modeling and simulation tools and platforms for TE evaluation. Advance standards interoperability and application.
2. **Understanding**—demonstrate how different TE approaches can improve reliability and efficiency of the electric grid to address today’s grid challenges.
3. **Scenarios**—develop a set of scenarios that can serve as ongoing reference points for modeling and simulation.
4. **Community**—develop the TE community—working together and sharing data.
5. **Progress**—make progress toward successful utility TE pilots: modeling and simulation advancements as well as communications with utilities, regulators and policymakers.
6. **Communicate**—provide a stage for teams to present the exciting work they’ve accomplished.

→ **Deliver value to utilities, regulators and policy makers in understanding, testing, and applying TE to meet today’s grid challenges.**





# Timeline

- [TE Challenge Preparatory Workshop](#), Mar 24-25— demonstrated TE community agreement on the vision for the TE Challenge
  - Identified grid challenges and gaps in modeling and simulation for TE
- Summer 2015: TE Challenge [website](#) and Collaboration site: <https://pages.nist.gov/TEChallenge/>
- Kickoff Meeting ([webcast and presentations](#)), Sep 10-11, 2015 for vision setting and team formation.
- Interim Meeting ([webcast and presentations](#)), Dec 3-4, 2015, for coordination and team building.
- Summit at [TE Systems Conference](#) (Portland), to present Phase I work completed and in progress.
- Phase I Summit and Phase II Kickoff, Sep 20-21, 2016 at NIST



# Timeline

- Summer 2016: Completion of Phase I team efforts, focus on Co-simulation platform architecture.
- September 20-21: Phase I Summit at NIST to present results and advance Phase II plans.
- Fall 2016: implementation of basic components of a co-simulation platform tool set, with parallel recruiting of participants.
- January, 2017 formal TE Simulation Challenge Phase II Launch.
- Collaboration site: <https://pages.nist.gov/TEChallenge/>
  - JOIN US!

## NIST Transactive Energy Challenge



Exposing Powerful Techniques for Transactive Energy

### What is the TE Challenge?

Transactive Energy (TE) refers to techniques for managing the generation, consumption, or flow of electric power within the electric power system through the use of economic or market-based constructs while considering grid reliability constraints. As the electric grid transforms to integrate more wind and solar energy and to give customers more choice and control in their use of energy, the concept of transactive energy is likely to play a key role. Members of NIST's Smart Grid Team have been working closely with the Department of Energy to understand TE's potential and to support utilities, technology developers and policy makers. The TE Challenge will bring researchers and companies with simulation tools together with utilities, product developers, and other grid stakeholders to create and demonstrate modeling and simulation platforms while applying transactive energy approaches to real grid problems.

- Utilities are concerned about the impact of dynamic pricing and markets on grid stability
- Researchers are interested in the development of economic and grid models for the new complex grid
- Venfors are looking for how to use developing modeling tools to guide technology design and implementations



#### Learn

TE Challenge Introduction, Timeline, and Benefits for Participation



#### Tool Chests

Co-sim Platforms, Simulation Tools, Data Sets, Baseline Scenarios



#### Community

Teams involved in the TE Challenge



#### Join

Register for the TE Challenge!



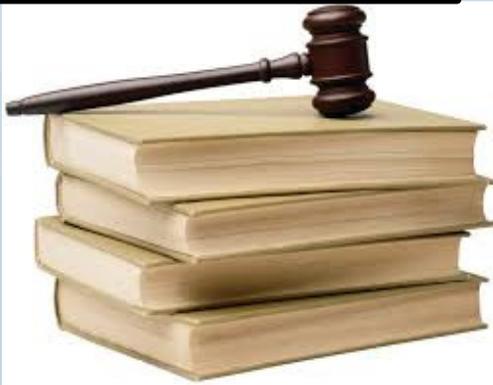
#### Library

Videos, presentations, and documents

# TE Challenge Team Briefs

## TE Regulatory and Business Models

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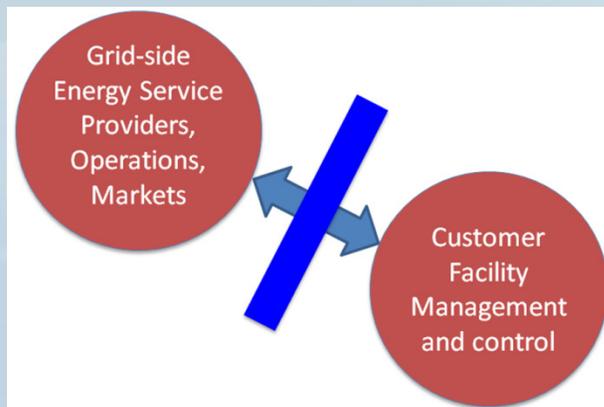
### Goals:

- Define fundamental TE business and regulatory models
- Characterize/define interfaces among the participants (physical/financial)
- Identify legislative and regulatory features applicable to each model

**Deliverables:** White Paper

## Common Transactive Services

2



**Goal:** Align simulations with real TE message exchanges by finding common meanings across environments.

**Deliverables:** White paper



## TE Microgrids Demonstration

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**Goal:** Develop microgrid demonstration and simulations to show potential for energy management within and between microgrids using one or more TE approaches.

**Deliverables:** Demonstration results, TE approach documentation, simulation results

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## Transactive ADR



**Goal:** Advance TE in OpenADR Alliance, leveraging established DR member alliance to create an industry solution for TE.

**Deliverables:** Transactive profile



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## PowerMatcher IoT

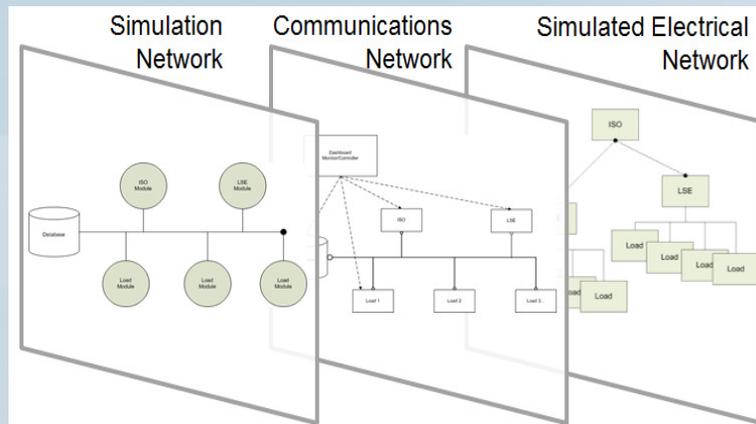


**Goal:** Demonstrate the benefits to the US electric grid of a market approach using PowerMatcher.

**Deliverables:** Demonstration providing loads and DER assembled into a virtual network implementing PowerMatcher bid interactions over XMPP.

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## Co-simulation Platform



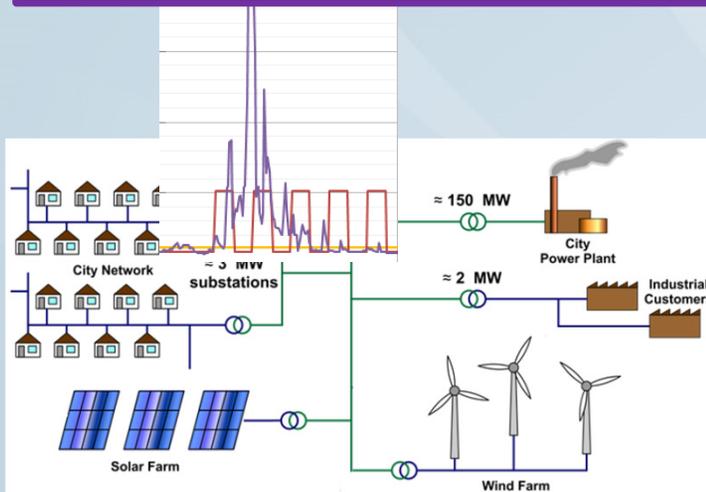
**Goal:** Create an “Open Platform” (extensible and customizable) for integrating and coordinating across a diverse suite of modeling and simulation tools, and conduct integrated experiments.

**Deliverables:** Open platform design and guidelines for use.



## Reference Grid and Scenarios

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**Goal:** Develop reference grid designs, scenarios and interoperability requirements to support testing of TE approaches using different simulation tools while producing comparable results.

**Deliverables:** Reference Grid models for a small set of scenarios.



# TE Challenge Phase II Goals

- Use each team's simulation tools to study TE approaches
- Make use of Phase I reference grid and scenarios for comparability of team results/tools.
- Make use of co-simulation platform to build interoperability and applicability of individual tools to larger TE problems
- Involve universities, vendors, gov't labs
- Continue with community building, demos.
- Continue to focus on delivering value to utilities and others looking to solve grid problems.



# Thank you!

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