PNNL-SA-103079

2014 Smart Grid R&D Program Peer Review Meeting

Architecture & Standards – GWAC Transactive Energy

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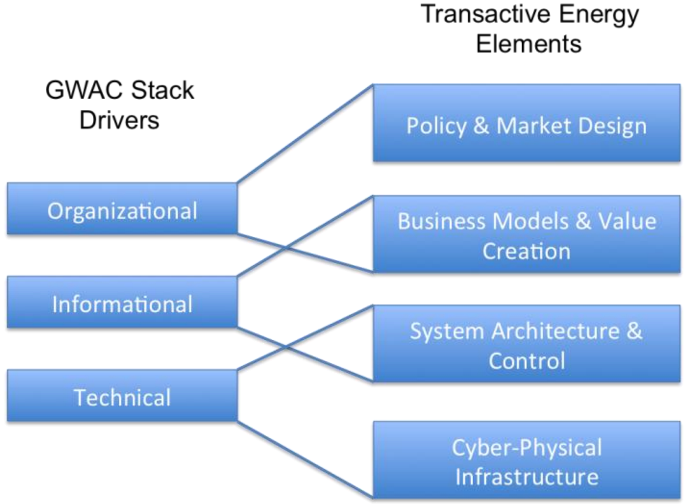
GWAC – Transactive Energy

Objective

Build on previous interoperability efforts to define and advance transactive energy technology activities to address current and emerging problems in end-to-end grid integration of distributed energy resources.



Life-cycle Funding Summary ($K)

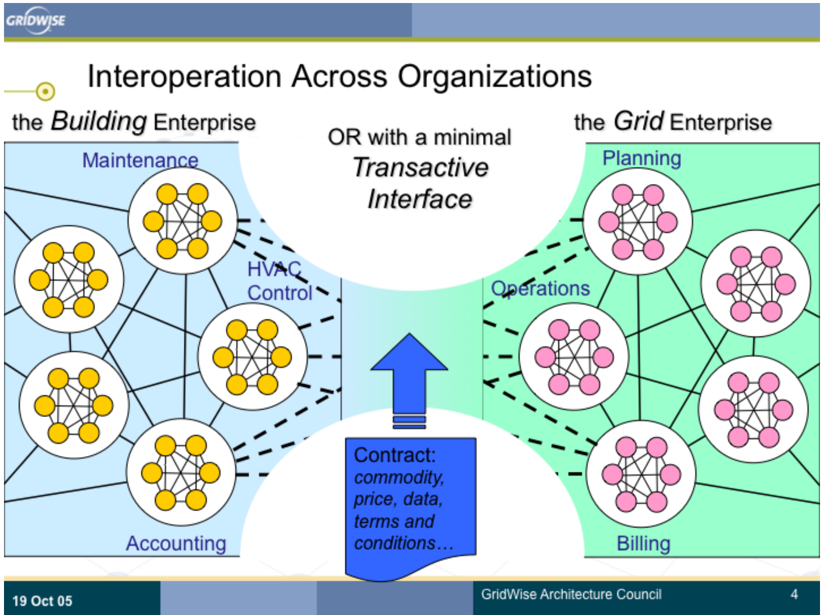
Prior to FY 14	FY14, authorized	FY15, requested	Out-year(s)
$5960K	$475K	$600K	$2400K

Technical Scope

- Build on previous interoperability efforts
- Align stakeholders on a vision for electric system interoperation between system generation, the delivery infrastructure, and end-use systems
- Develop a transactive energy framework to facilitate integration of distributed energy resources with grid operations
- Work with and educate industry on smart grid value propositions and implementation roadmaps

Building on smart grid interoperability

- Interoperable smart grid deployments enable
  - Information flow and availability
  - Ability to engage intelligent devices
- The "smart" in smart grid comes from creating applications that do something with the information and devices

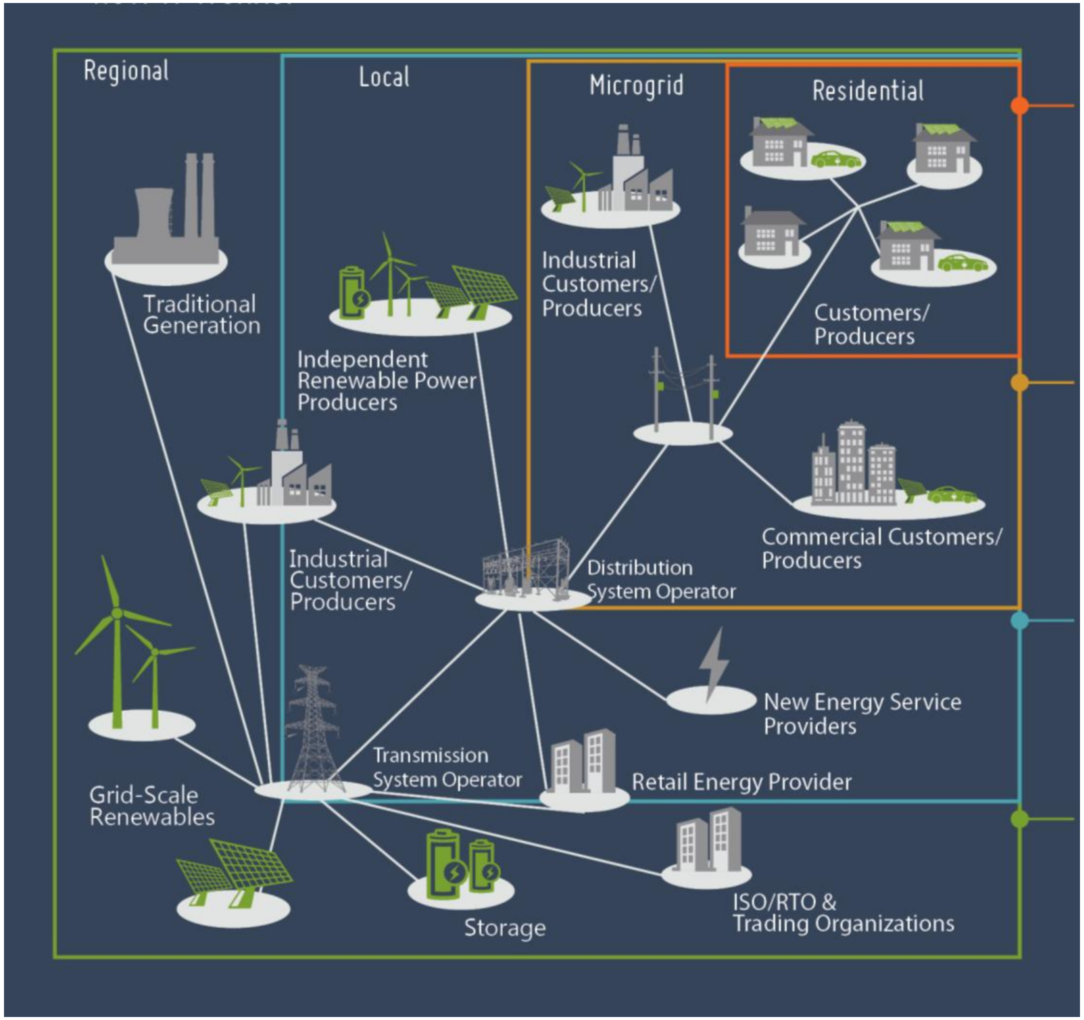


- GWAC focus on framing the problems associated with transactive energy build on the Council's earlier interoperability focus

Motivation for Transactive Energy

The changing nature of the electric power system:

- Increased penetration of distributed energy resources
- Increased variability
- Intelligent devices – internet of things becoming our reality



TE responds to the need to manage such a system

Approach

- Engage the community of stakeholders
- Define the problem – TE is not an end unto itself
- Build the community
  - Technology community
  - T & D community
  - Vendor community
- Identify the gaps in understanding and technology
- Frame a path forward

Key Problem: Definitions

- Earlier workshops in 2011 and 2012 had crafted a definition that generated much discussion
- 1st International Conference and Workshop on Transactive Energy included workshop sessions to discuss TE in terms of:
  - Policy & Market Design
  - Business Models and Value Realization
  - TE Management Architecture
  - TE Functional Requirements
  - Cyber-Physical Infrastructure
  - TE End-to-End focused on facility to grid
  - TE applied to buildings and facilities

Updated Definition of TE

“A set of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter.”

And ten attributes:

Architecture	Extent
Transactions	Transactive parties
Interoperability	Temporal variability
Value discovery mechanism	Assignment of value
Alignment of objectives	Stability

Key Problem: Engaging the stakeholders

- Steady expansion of participants at GWAC workshops
- TE Conference & Workshop followed by Transactive Energy Framework Document – with articles in key publications such as EnergyBiz targeted to utility executives
- GWAC meetings hosted by stakeholders such as PJM and Cal-ISO
- Collaboration with SGIP
- Targeted material:
  - Policymaker white paper(s)
  - TE Info-graphic
  - TE Principles
  - Presentations, e.g., to DOE-OE Electricity Advisory Committee, NARUC

TE Principles (V1.0)

Highly automated coordinated self-optimization	Transactive energy systems should provide for non-discriminatory participation by qualified participants
Transacting parties are accountable for standards of performance	Transactive energy systems should be observable and auditable at interfaces
Maintain system reliability and control while enabling optimal integration of renewable and distributed energy resources	Transactive energy systems should be scalable, adaptable and extensible across a number of devices, participants and geographic extent

Principles: High level requirements for TE systems that provide an additional point of reference for communicating with stakeholders and identifying common ground within the transactive energy community

Prior-year progress and results

Recent Examples:

1st International Conference and Workshop on Transactive Energy

- Keynotes by FERC Chairman Jon Wellinghoff, NARUC President Phil Jones, Retired BPA Administrator Steve Wright and combined DOE keynote by Roland Risser and Bill Parks
- 160 attendees

FY2014 Performance and Results

- Core Transactive Energy Framework Document – published mid-November 2013
- December 2013 workshop at SCE on TE Conceptual Use Cases – Proceedings completed.
- TE Presentations
  - NARUC – November 2013
  - IEEE ISGT 2014 – February 2014
  - DOE-OE Electricity Advisory Committee – June 2014
- Expanded Transactive Energy Framework – in progress – proposed reschedule to October 2014

FY 2104 Performance and Results, cont.

- Planning for 2nd International Conference and Workshop on Transactive Energy – underway, conference scheduled for Dec. 10 & 11, 2014
- NIST / SGIP Coordination
  - TE Framework rolled out at November 2013 SGIP meeting in Florida
  - Joint SGIP / GWAC / GridWise Alliance white paper on outage response interoperability
  - SGIP – GWAC MOU signed in March 2014
- GWAC face-to-face meetings - ~50 people at each

FY 2015 Plan

- Education of regulators, policy makers and utility decision makers
- Coordination with SGIP, EPRI, EEI and others on related activities
- Planned Meetings and Work Products
  - 2nd International Transactive Energy Conference and Workshop – hold in December and publish proceedings by Feb. 28th
  - Second and Third updates to Transactive Energy Framework – October 2014 (initial “roadmap”) and September 2015 (refined “roadmap”)
  - Collaborate with SGIP Architecture Committee on generic grid service definitions and apply them to transactive energy
  - Ongoing GWAC meetings and workshops

GWAC Members – leverage for DOE

- Mark Knight, CGI – Chair
- Ron Ambrosio – IBM
- Ward Camp – Landis+Gyr
- David Forfia – ERCOT
- Jeff Gooding – SCE
- Doug Houseman – Enernex*
- Mark Kerbel – REGEN Energy*
- Tracy Markie – Engenuity
- James Mater – Quality Logic
- Heather Sanders – Cal-ISO*
- Tom Sloan – State Representative, Kansas
- Jeff Taft – PNNL
- Ken Wacks – Consultant (Sensus)

* - newest GWAC members

- GWAC Members commit to spend 20% of their time on GWAC (>= 2.6 FTE)
- GWAC members are active in other groups, such as: IEEE, SGIP, ISO/IEC, UCAUIG, etc.
- 27 Emeritus members

Collaborations and Tech Transfer

- Transactive Energy Conference
  - Collaboration with Smart Grid Northwest (SGN)and Portland General Electric (PGE)
  - SGN – financial risk
  - PGE – provides the venue at no cost to GWAC (~$50K value)
  - GWAC – responsible for technical content of meeting
- Collaboration with SGIP
- Primary tech transfer is through GWAC publications and presentations, examples:
  - TEC Proceedings
  - Webinars (example – to Smart Grid India Forum)
  - Presentations
    - NARUC
    - IEEE ISGT
    - SGIP
  - GWAC Workshops
- Emerging international collaboration with CSIRO in Australia

Lessons Learned

- Workshop element of Transactive Energy Conference was extremely well received
- Stakeholder engagement critical – always looking for better ways, especially with regulators and executives
- Definition of TE challenging – tension between general definition and definitions based on specific implementations

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