NextGrid Working Group 5
Summary of current state of play/ideas that are on the table
14 June 2018

What is the objective of WG5?

- Stated mission from ICC: "This working group will consider methods to increase customer access to new technologies and stimulate distribution-level market participation. It will explore market-based platform transactions that the grid can enable and will also study ways to enhance consumer access to Illinois' competitive retail markets."
- Explore what it means for there to be more effective decentralized retail electricity markets in Illinois
  - What can people accomplish using decentralized retail markets?
  - What functions do markets have to perform and enable people to perform?
  - What design principles to evaluate design elements can we derive from those functionality requirements?
  - What market rules do those functionality requirements imply?

Fleshing out "why markets", and in particular, why transactive (retail + automation) markets

- Consumer value propositions – customer access to new technologies and distribution-level market participation
  - Choice and individual control to enable people to realize their individual, subjective values – e.g., reduce energy costs, reduce carbon footprint, increase local/community engagement
  - Access to dynamic prices means access to cheap overnight energy and ability to reduce consumption in expensive periods, especially with technology for automation
  - Combines retail market participation and generation of price signals with digital automation of responses to market price signals
  - Opportunity to transact in retail markets induces producer innovation, development of new products and services, and those that benefit consumers will survive and thrive
  - Examples/use cases
    - Homeowner on RTP with two-way programmable thermostat and a user interface to translate thermostat settings into bid prices/willingness to pay
    - Renter can set bid prices/willingness to pay and use price signals to control AC or refrigerator, to save money and energy
    - Homeowner with solar PV can set automated bid price to buy from retail supplier when solar quantity low, set automated offer price to sell when solar quantity high, and the difference is stored in their battery; smart inverter is home energy management system
    - EV owner can set automated bid price to buy when charging, set offer price to sell when price is high enough and car not in use
  - Within buildings (commercial, office, multi-unit dwellings), can be used as an energy management strategy – think of designing an apartment building as a microgrid with each renter as a market participant with transactive enabling technology
- System value propositions
  - Market coordination through autonomous generation of and response to price signals

    - Basic theory of transactive energy: use the organic incentives facing individuals in markets, harness the self-organizing aspects of markets through negative feedback effects to create economic value and maintain system balance
    - Increased capacity utilization reduces overall costs and resource use
    - Market coordination yields physical coordination and balancing
    - Autonomous transactive response increases elasticity of demand, controlling price spikes in both retail and wholesale markets, and thus reducing prices for all customers, not just those who choose RTP contracts
    - Creates more possible value propositions for DERs, increasing incentives to invest in DERs, which can reduce emissions
    - Aligns economic and environmental incentives by making opportunity costs more transparent and salient
- Conceptual/theoretical foundations of market value propositions
    - Coordination in a complex system
    - Diversity – people have heterogeneous preferences and opportunity costs, and *only they know them*!
    - Social learning
    - A price is a signal wrapped in an incentive
    - We can't "get prices right", but we can establish an institutional framework to enable participants to create value through exchange
    - Prices emerge out of that process and communicate valuable information about those preferences and opportunity costs
    - These processes can yield the best *feasible* static and dynamic efficiency

Most important outcomes that retail markets should enable

- Static efficiency: improved allocation and coordination, lower transaction costs, better temporal matching price and cost
- Dynamic efficiency: innovation in products, services, business models
- Market participation: visibility, predictability, liquidity
- Architectural: reliability, interconnection, automation, speed & flexibility, resilience, privacy, cyber security

Important design principles

- Low entry/participation barriers (including access to information)
- Customer-focused simplicity, transparency, flexibility, ease of use for end users
- Increased welfare of participants and non-participants, consumer protection
- Market-based, with the utility being market-agnostic
- Information access with privacy and security
- Ability of market to evolve, not foreclosing future changes and innovation
- Technology neutral
- Full cost recovery for utilities

Behavioral aspects of transactive energy – data from pilots (Olympic Peninsula, AEP Columbus)

- Customers overall save money and reduce energy use (leading to reduced emissions under certain conditions)
- Customers followed a “set it and forget it” strategy
- Customers expressed high satisfaction with pricing and technnology in post-project surveys
- Consistent with Jessoe & Rapson (2014) on how timely information affects household energy consumption

Work still to do in transactive energy

- Field experiments at larger scales and with heterogeneous DERs
- Modeling of system behavior under different assumptions about customer behavior and different combinations of elasticity of demand and supply
- Lab/field experiments on distributional impacts when implemented in socio-economically diverse markets
- Research on barriers to adoption (Chassin slide 12)
- Better set of use cases
- Consumer awareness and education (Illinois a leader in this with ISEIF)