The Economics of Transactive Energy

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Outline

- Motivation: what does transactive technology make possible?
  - Reduces the transaction costs that can prevent mutually-beneficial exchange
- Conceptual-theoretical economic framework for transactive energy networks
- Movement toward a distribution platform
- Modeling and simulation methodologies
- What questions should we prioritize?

New, different consumer value propositions-1

- … because the value proposition is not only the kwh
- Product differentiation
  - Making more money by selling less power is possible
  - Conservation, satisfying green preferences
  - Examples
    - TOU
    - Dynamic pricing
      - Time differentiated: RTP, CPP, PTR
      - Green/grey mix
    - Service bundles – home entertainment, home security, home health care
    - Price discrimination's mutual benefits to consumers and producers
    - Apps – innovation at the edge of the network
- Digital transactive technology enables automation – reduces transaction costs

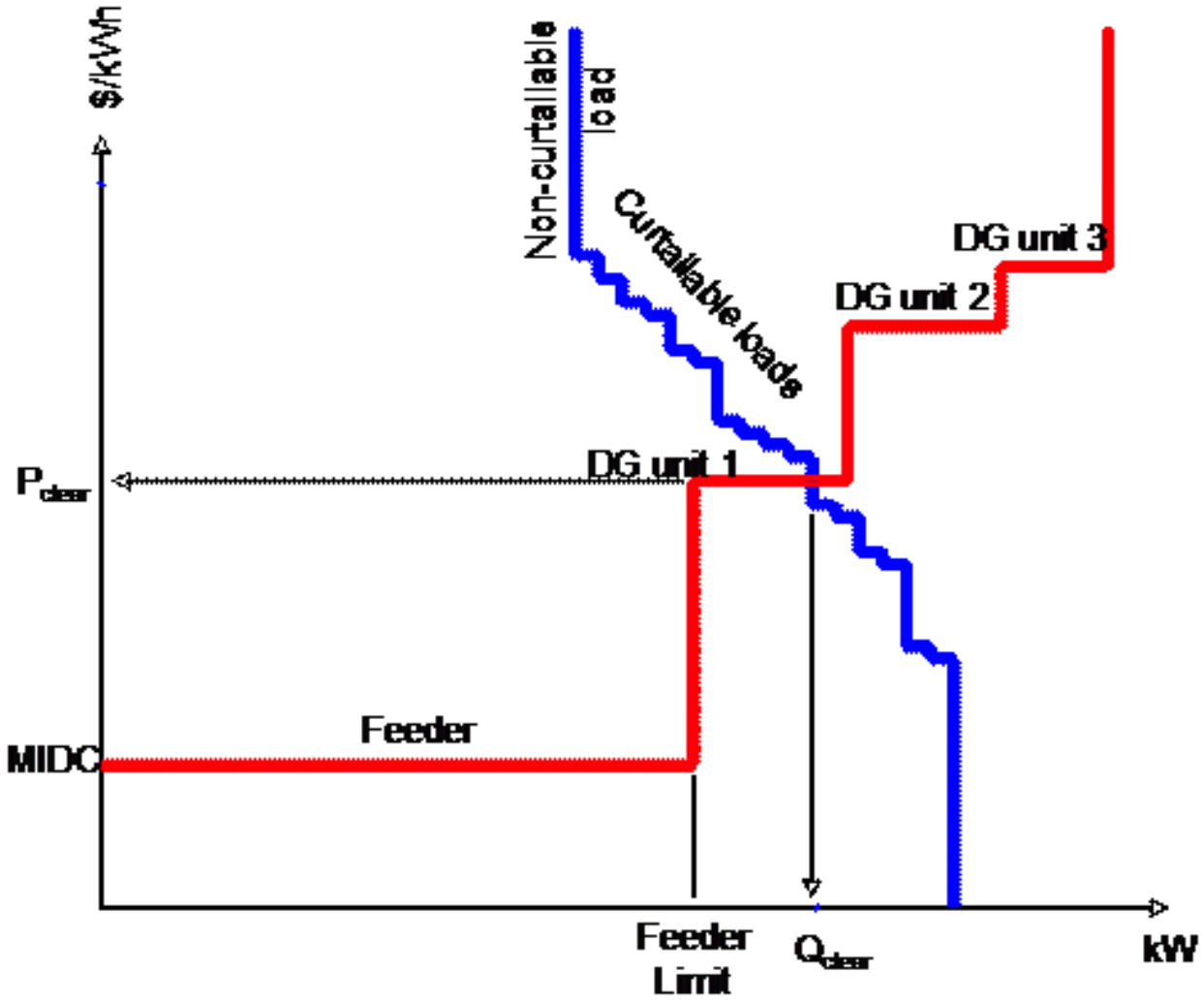
New, different consumer value propositions-2

- Small-scale DER interconnection
  - Examples: residential solar, electric vehicles
  - Market-connected DER as a network of distributed storage
- Microgrids
- Agent heterogeneity: scale, location, identity
  - Agents can be buyer or seller depending on context, prices, opportunity costs at that time and place with that local knowledge
- Reliability/supply security as a differentiated product, not a uniform administrative definition

Conceptual-theoretical framework

- Market design for a retail market
  - Who can exchange – what entities can buy/sell?
  - How do they exchange – units, definition of the item being bought/sold
  - Time delimiters matter in electricity
  - Elasticity is dynamic, not static, and a function of enabling technology

Example: Olympic Peninsula retail double auction



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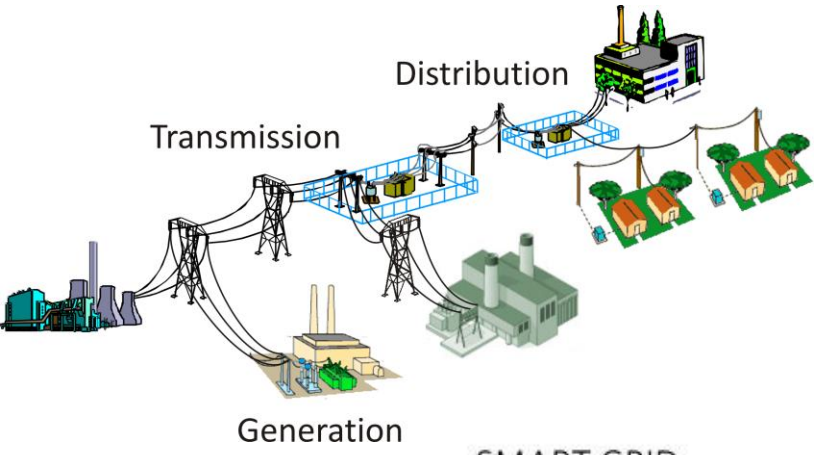
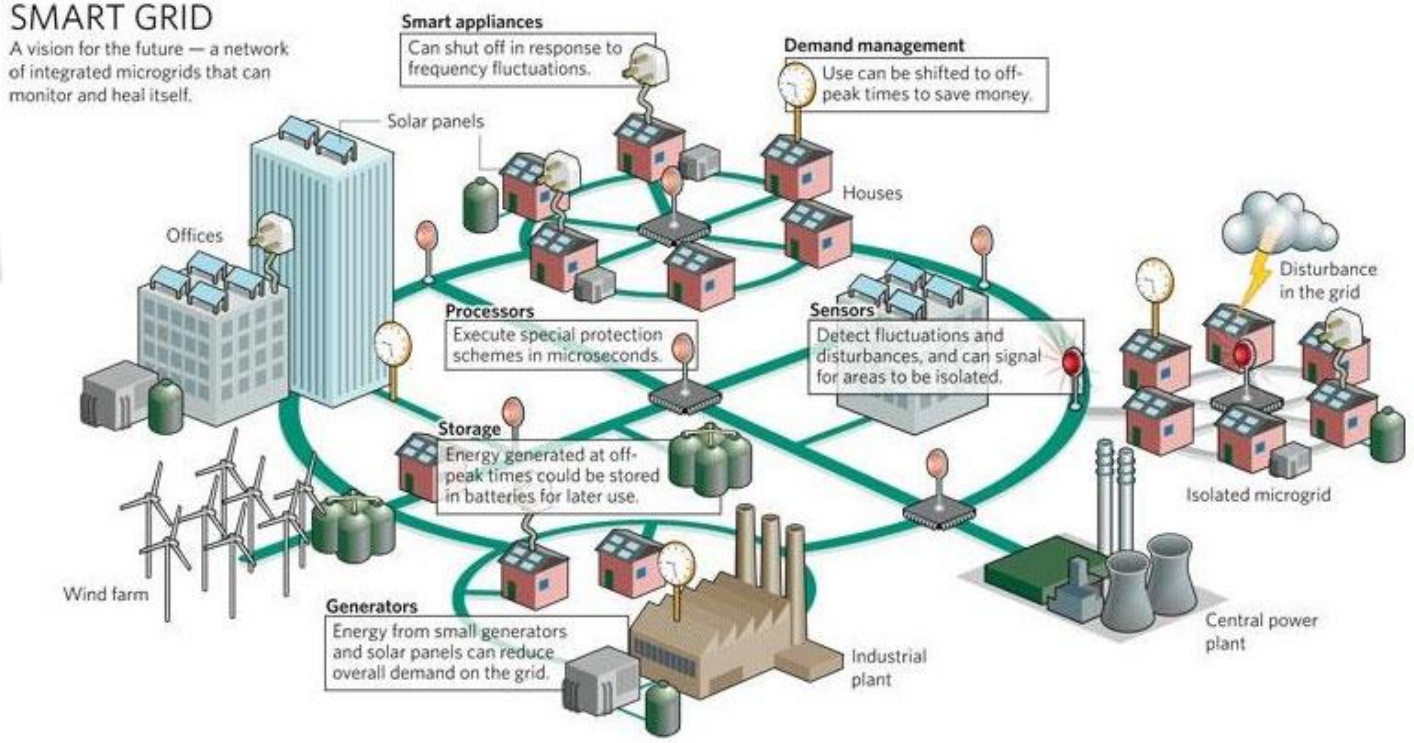
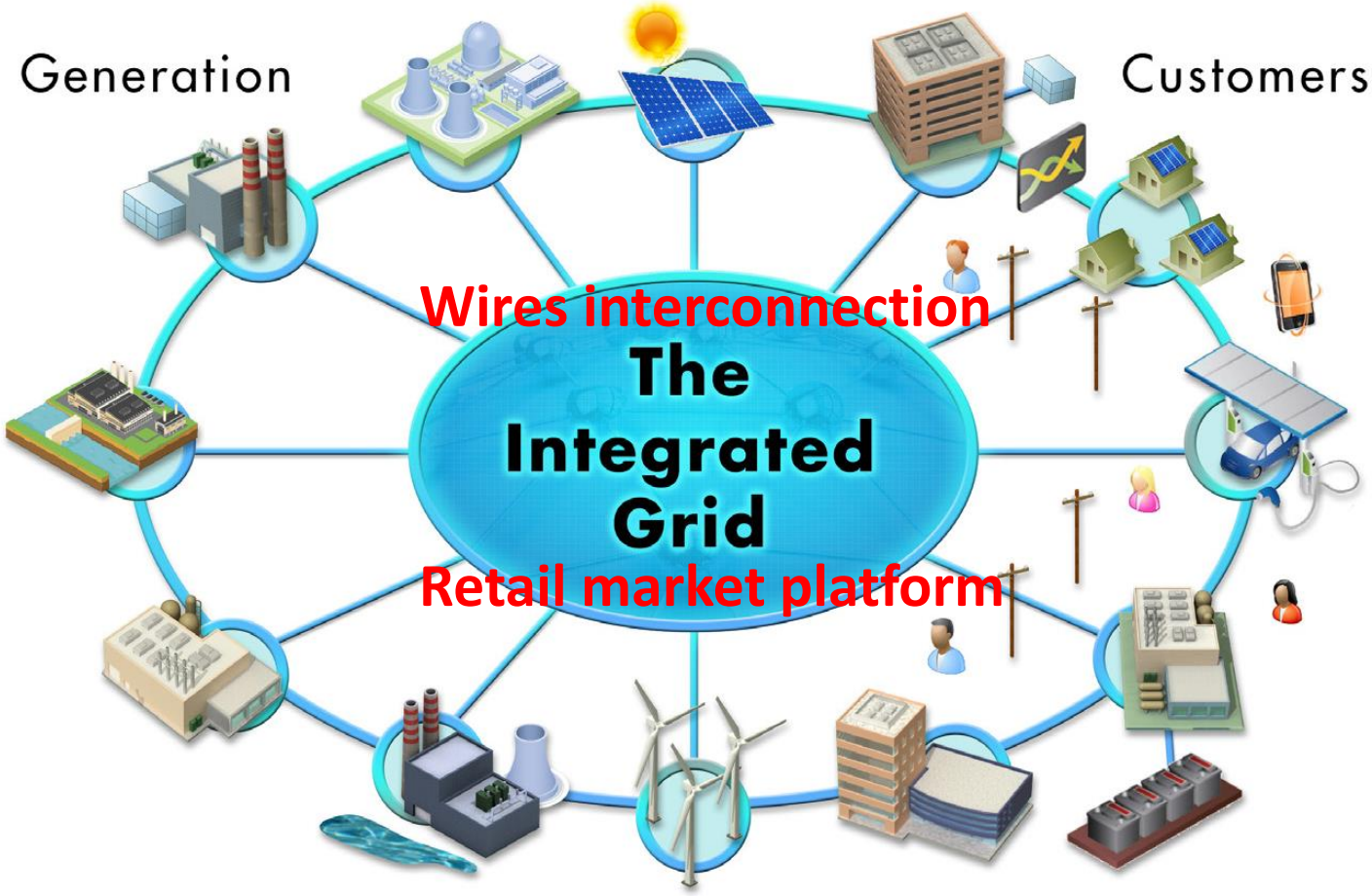
  - What are the transactional boundaries of the distribution company?

Digital innovation at the edge of the network





A techno-economic electricity distribution platform



Source: EPRI (2014), p. 31

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- Regulatory economics
  - Institutional design for regulating a 21st century distribution company
  - Evolve from rate determination to consumer protection and market monitoring

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- Computer simulation
  - Closed system (but not always), equation based
  - Often used to simulate a formal theoretical equilibrium model
  - Can use experiments and ABM to improve the model

Some questions to prioritize

- How engaged are consumers under different market designs and with transactive technologies?
- What are the implications of automation for price elasticity of demand in retail markets?
- What effect does incumbent vertical market power have in transactive retail markets?
- What are the economic implications of designing a transactive platform for the interconnection and exchange of distributed energy?