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Illustrative Use Cases within Transaction-Based Framework for Energy Ecosystem

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Purpose of Use Cases

- Illustrate transaction-based energy concepts
- Identify technical requirements
- Recognize barriers
- Highlight potential benefits to participating stakeholders

Use Case Template

Main Sections	Sub-Sections
Type of Transaction	
Brief Description (NIST 1.3)	
Narrative (NIST 1.4)	What is being transacted?
	Why is it being transacted?
	How is it being transacted?
	What is the timescale of the transaction?
Actor/Stakeholder Roles (NIST 1.5)	Who is transacting?
	Who is the market maker?
	Who else needs to be notified or acknowledge a transaction has been made?
	Are there other transactions associated with this?
Information Exchanged (NIST 1.6)	How is the transaction verified?
	How is the transacted commodity measured and verified?
Activities/Services (NIST 1.7)	What equipment and technology is required?
	What is the benefit for the building?
	What is the benefit for the grid?
	What is the benefit for renewables?
	What is the benefit for energy efficiency?
Current Examples of this Transaction	

Use Cases to be Discussed

High-level overview of End-User Services use cases for today's discussion (following slides):

- Diagnostic and automated commissioning services
- Tenants contracting within building/campus owner for energy
- Transactive control for large commercial building HVAC systems
- Coordinating demand response, distributed generation & storage in microgrid

Diagnostic and Automated Commissioning Services

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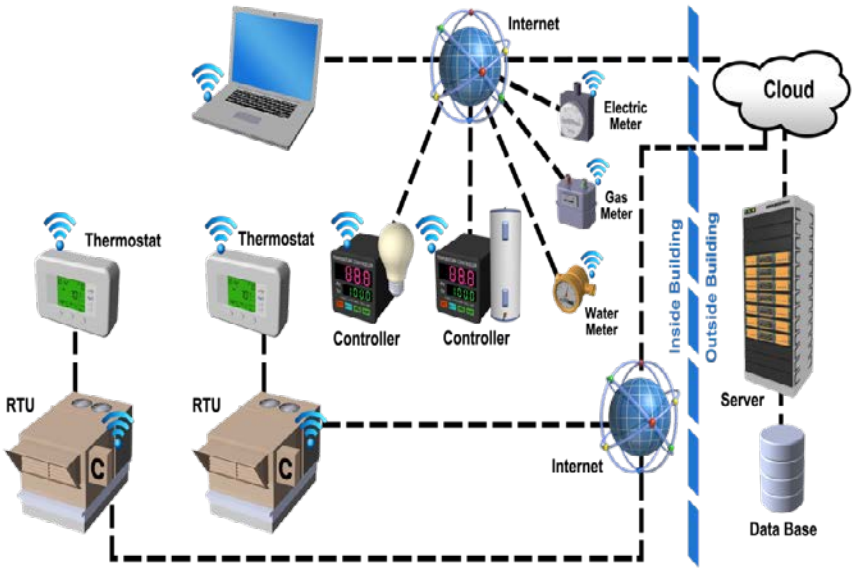
Approach

- Customer signs up with service provider (SP)
- Data streams sent from building management system (BMS) to SP
- Diagnostic/commissioning information delivered by SP to customer electronically
- Customer pays for services provided or optionally problems identified/fixed



Technology requirements

- Web applications
- Map data streams to diagnostic procedures

Expected outcomes

- Energy and operating cost savings
- Efficient buildings

Tenant Contracts with Building Owner for Energy

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Approach

- Owner allocates tenants / divisions allowance on energy bill
- Tenants receive penalties if exceed allowance
- Owner broadcasts dynamic rate to BMS / energy management system (EMS)
- Markets used for tenants to buy surplus allowance from others

Technology requirements

- Wide-area network (WAN) & local-area network (LAN)
- BMS / EMS
- Tenant-level sub-metering or non-intrusive load monitoring

Expected outcomes

- Cost savings for tenants / building owners
- Smart buildings

Transactive Control for Large Commercial Building HVAC systems

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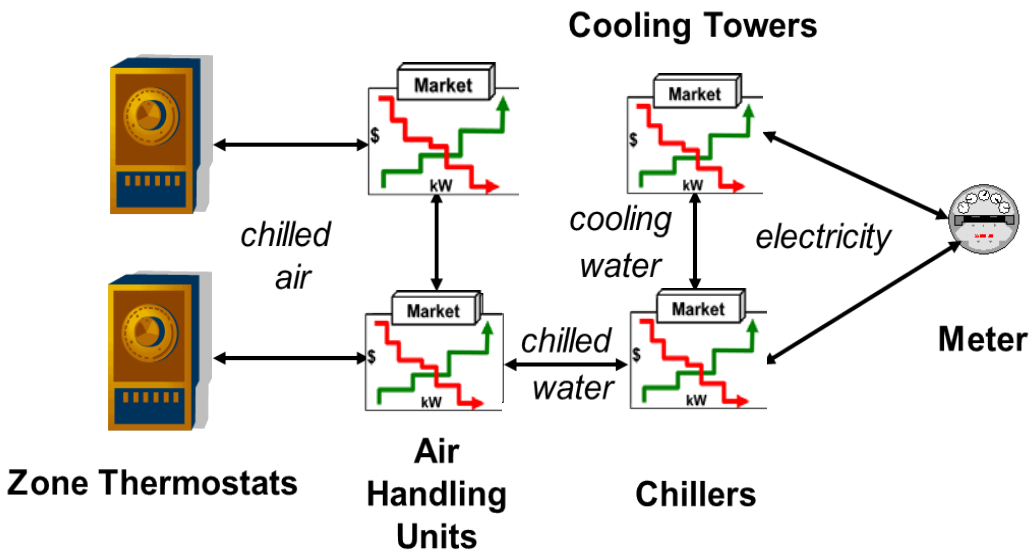
Approach

- Building operator sets up transactive energy markets
- Markets enable peer-to-peer energy transactions between HVAC components
- Pseudo-transactions
- Energy purchases mapped & billed to tenants



Technology requirements

- Intuitive user interfaces to interpret needs / preferences
- Sub-metering of electricity, fluid flows and temperatures
- BMS / EMS

Expected outcomes

- Cost and energy savings
- Smart buildings

Coordinating Demand Response, Distributed Generation & Storage in Microgrid

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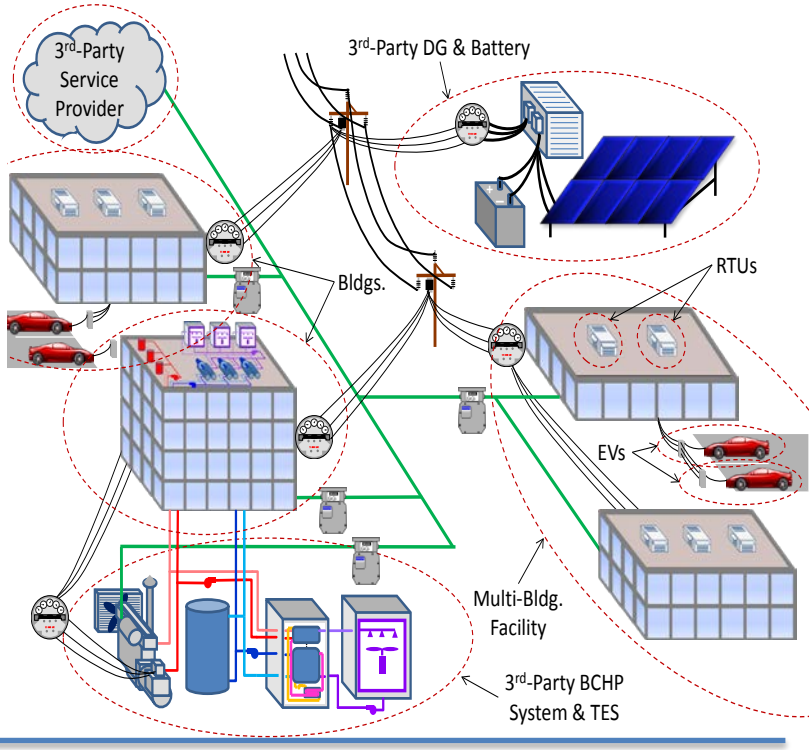
Approach

- Microgrid Operator (MO) manages energy trading
- Transactive energy market set-up
- Allow parties to submit supply / demand bids
- Consumers notified of real-time price cleared
- Parties billed / credited monthly based on energy sold / purchased



Technology requirements

- Interval metering
- WAN / LAN
- BMS
- User interface

Expected outcomes

- Cost savings
- Smart buildings
- Efficient use of resources
- Large-scale integration of renewables

Final Thoughts on Use Cases

- Illustrative set of use cases, designed to visualize range
- Most are conceptual – details not fully worked out! – R&D is needed to:
  - Define how transactions will occur
  - Verify and quantify claimed benefits
  - Design appropriate market- or incentive-based mechanisms for use cases
- Use cases related to power grid are more mature
- Consumer services use cases (i.e., buildings), are needed!