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Valuation of Transactive System: Initial Approach Ideas

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Presentation Outline

- Valuation of transactive systems: Overview
- Review of existing DER valuation approaches
- High-level approach for valuation of transactive systems
  - Components of the valuation methodology
  - Process outline
- Project plan and timeline
- Key questions for valuation of transactive systems

Overview

- Background: A transactive mechanism is a means to engage and coordinate DER interactions with the grid
  - Dynamic locational information used as signal to engage resources
  - Information from resources informs about their availability, flexibility etc.
- Objective: Compare the value achieved using transactive design with,
  - Other transactive designs
  - Centralized control mechanisms
  - Other distributed control mechanisms
- Approach: Main considerations in the valuation process,
  - Amount of value unlocked and accessed by coordination of DERs
  - Deployment and implementation costs
  - Complexity of mechanisms
    - Risk vs reward trade-off

Summary of Current Activities

Many studies consider benefits, costs and operational impacts on grid from renewables, storage and other DERs

	ACEEE	AEEI	CSIRO	E3	EPRI	LBNL	Navigant	NREL	PNNL	RMI
Benefits/Costs of Renewables			✔					✔		✔
Renewable Integration Impacts				✔	✔			✔	✔	✔
Benefits/Costs of Storage			✔					✔	✔	✔
Storage Integration Impacts								✔	✔	✔
Benefits/Costs of DERs		✔								✔
DER Integration Impacts			✔			✔	✔			✔
Benefits/Costs of ICT	✔									
Benefits/Costs of DR						✔	✔			
Future Grid Scenarios			✔	✔				✔		✔
Transactive Systems									✔	

Valuation of Transactive Systems: High-level Approach

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I. Identify the relevant future grid composition scenarios
   - Assumes mix of renewables and distributed energy resources
   - Defines reference and test cases – coordination mechanisms

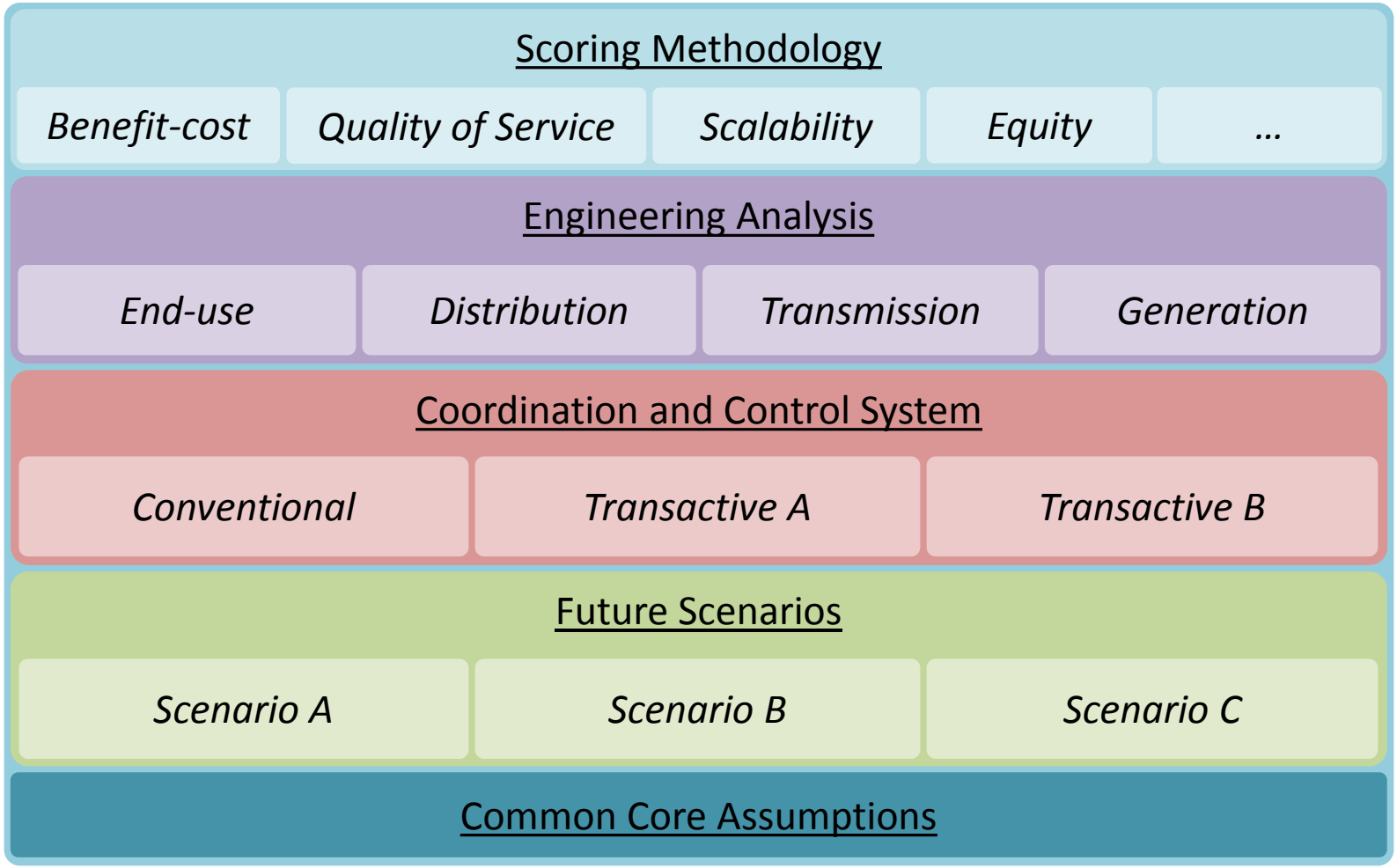
II. Identify long-term planning and operational requirements
   - How: Engineering analysis based on future grid scenarios
   - Answers: How the future system will be built

III. Identify and quantify value streams based on those requirements
   - How: Economic analysis of building out the future grid system
   - Answers: Value potential based on avoided costs, grid services etc…

IV. Define metrics for evaluation of transactive designs, e.g.,
   - Value accessed, cost of implementation, etc…

V. Identify net-value from individual *stakeholder's* perspective
   - End-user, third-party, utility, system operator, etc..

Valuation of Transactive Systems: Analysis Components



Reference and Test Cases

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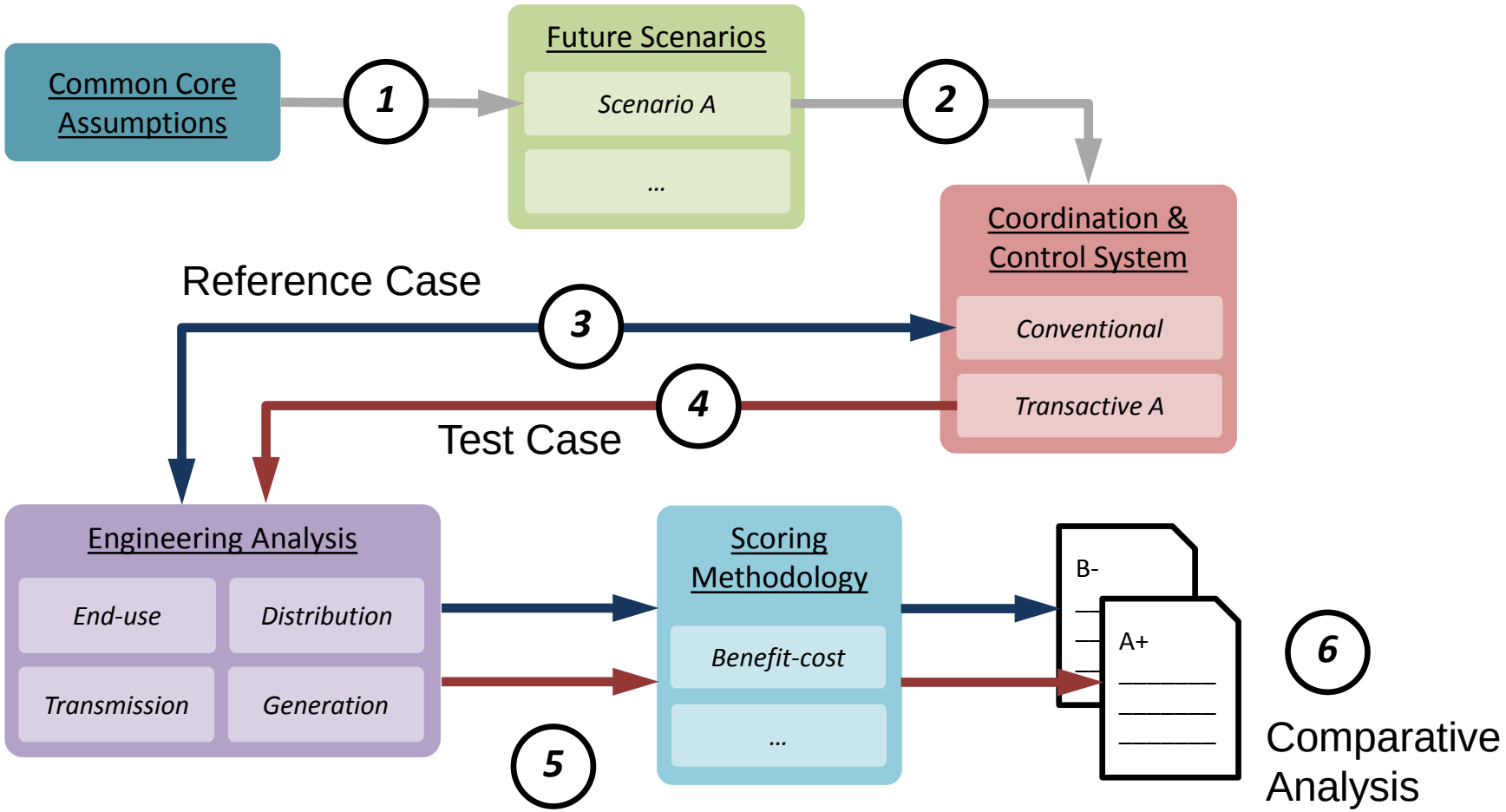
	Reference Case(s)	Test Case(s)
Future grid scenario	Total renewables and mix of renewables (central wind and solar, distributed solar), EVs, other DERs	Same as the reference case
Type of DER engagement	Conventional (DLC), tariff-based "engagement" of roof-top PV	Coordination schemes (TOU, CPP, TS, other distributed) to engage DERs
Grid expansion plan	Required conventional (G+T+D) system upgrades	DER + reference case upgrades (determine avoidable build-out)

- Reference case is a path dependent build-out
- Test cases avoid complexity of path-dependent build-out
- Is this an acceptable simplification?

Valuation of Transactive Systems: Process Outline



- Specification of future grid scenarios
  - System composition:
    - Mix of renewables and conventional resources
    - Mix of distributed energy resources
    - Electric transportation
  - Load growth
  - Fuel prices
  - Environmental regulations
  - Climate, etc….
- Scenario specific value proposition (may) emerge
  - Perform sensitivity analysis based on future scenarios
- Current Activities
  - CSIRO (Carbon, DERs), NREL (Renewables), E3, RMI
  - CA – More than Smart, NY-REV

- Specifies the control and coordination system design
  - Information exchanged → Impacts the required supporting ICT infrastructure
    - Frequency
    - Amount
    - Data type
  - System control and economic architecture
  - Algorithms to engage the resources
  - Types of resources engaged
  - Automation, communications, monitoring systems
- Conventional design applies to reference case(s)
- Transactive designs apply to test case(s)
- Current Activities
  - PNNL (PNWSGD, OlyPen)
  - TeMIX
  - PowerMatcher (TNO)

- Detailed engineering analysis using future grid scenarios, and different control and coordination mechanisms
  - Measures impacts at end-use, distribution, transmission and generation
  - Links operational and expansion planning requirements
    - Informs the system build-out
  - Feeds the scoring metrics for evaluation of transactive designs
- Tools for engineering analysis
  - Transmission and distribution system
  - Communications
  - End-use and DER
  - Market/economic
- System models (T&D) as basis for reference and test cases
  - Existing future-system models - regions? Scale?
- Current activities
  - PNNL (PV integration SCE), NREL (Renewables), LBNL(DERs)
  - EPRI (Integrated Grid), RMI (EDGE), E3

Use data from engineering analysis to compute metrics including stakeholder perspectives

- Benefit-cost analysis (reference vs test case):
  - All relevant stakeholders identified
    - Stakeholder specific list of *elemental* costs and benefits identified
    - Stakeholder interactions identified
    - Map net-value (monetized benefit – total cost) to relevant stakeholders
  - Adopt/adapt existing benefit-cost analysis methodologies
- Other non-monetized metrics (next slide)
- Current Activities
  - NREL (Renewables, Storage), E3, RMI
  - EPRI, AEEI (DERs)

Non-monetized Evaluation of Designs

- Consumer comfort and service impacts
- Equity
- Scalability
- Controllability and stability
- Owner autonomy
- Privacy, security and sensitive information
- Interoperability

How do you measure these?
Are there ways to monetize these?

Project Plan and Timeline

- Sep 2015: Develop/adopt/adapt benefit-cost analysis methodology
  - Second face-to-face meeting
  - Finalize methodology
  - Identify system models for reference and test cases
- Nov 2015: Design reference and test cases
  - Establish simplifying assumptions
  - Identifies a transactive design to test methodology
- Jan 2016: Exercise cost-benefit methodology and final report
  - Present the methodology with simplified test case

Valuation of Transactive Systems: Key Questions

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I. **What are the most relevant future power grid composition scenarios that should be considered?**
   - Informs the reference and test cases we must consider

II. **What are the operational and control objectives for an integrated grid in a high DER scenario?**
   - Informs how the grid will be built in future

III. **How can the value associated with those objectives be quantified and monetized?**
   - Informs the potential value proposition

IV. **What is the relationship between the value of a transactive energy system from an operational perspective and a long-term planning perspective?**
   - Informs the benefit-cost analysis

V. **What are the key *value drivers* for deployment of transactive systems?**
   - Informs the scoring methodology for transactive designs

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Questions?