Grid Modernization LABORATORY CONSORTIUM

Project 5. Grid Services & Technologies Valuation Framework

Grid Services and Technologies Valuation Framework

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Grid Services and Technologies Valuation Framework

- Currently many valuation processes are being used
  - Different technologies (solar, wind, hydro, storage, EE, nuclear, smart grid)
  - Different users (DOE, utilities, regulators, consumers)
  - Different value streams (energy, capacity, ancillary services, T&D impacts, environmental)
  - Different metrics (affordability, sustainability, reliability, security, flexibility, resiliency)
- Lack of underlying framework
  - Prevents comparison or consolidation
  - Causes duplication of effort
  - Leads to conflict over “correct” method, uncertainty in any results

Grid Modernization Project

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Project 5. Grid Services & Technologies Valuation Framework

- Three-year project comprising seven national laboratories:
  - Oak Ridge, Pacific Northwest, National Renewable Energy, Argonne, Lawrence Berkeley, Los Alamos, Sandia

- Includes a stakeholder advisory group including policymakers, regulators, industry, and advocacy groups.
- Two key dimensions to the project:
  - **Advance the science** to develop a clear, consistent, transparent, and flexible **process for identifying and weighing the values** of different technologies and grid services
  - Develop the process in an open manner with **participation** of industry, regulators, and interest groups to ensure a robust, **well-accepted** process

Interdependencies of GMLC projects

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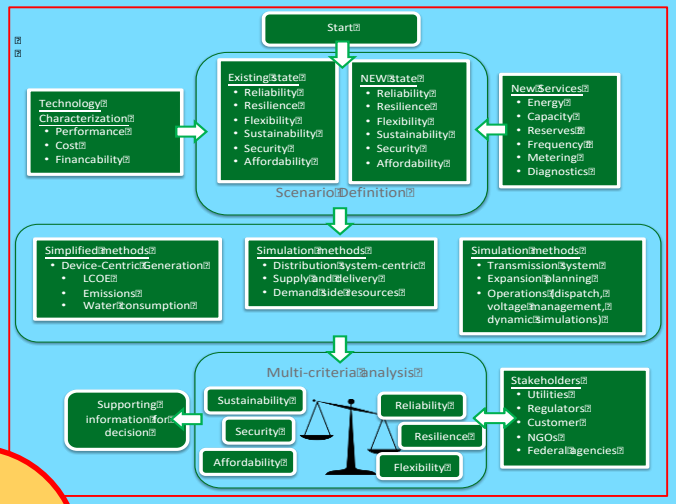
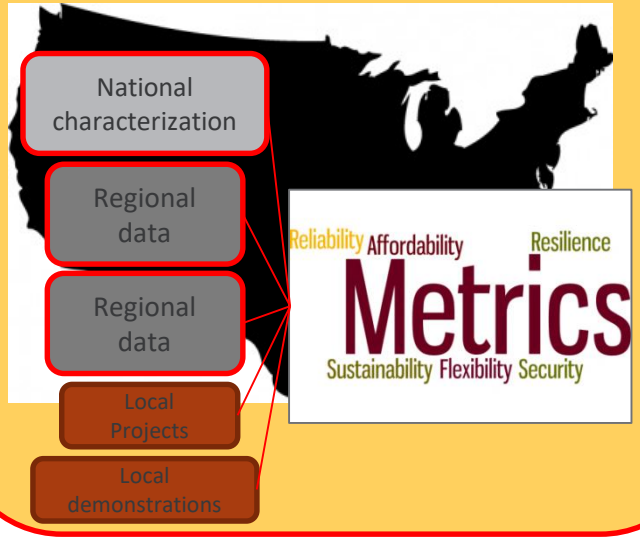
Grid metrics
for domain of interest

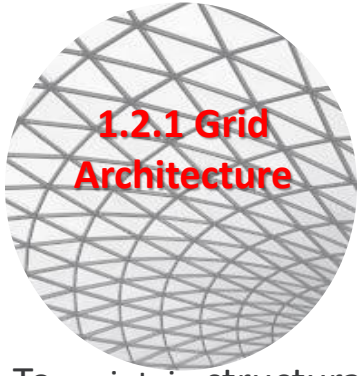
Definition of services
- defaults valuations

1.2.4: Grid Valuation Framework



1.1 Metric Analysis





To maintain structural consistency

1.4.2 Testing for grid services from devices

Devices
- Appliances
- HVAC
- Vehicles
- Storage
- PV/inverter
- Electrolyzers

Services
- Peak Mgt
- Capacity
- Energy
- Ancil. Serv.
- Voltage
- Frequency

Grid Services and Technologies Valuation Framework Schedule

- Five Main Tasks
  1. Long-Term Vision
  2. Stakeholder Advisory Group
     1. Annual meetings
     2. Periodic webinars and updates
     3. Website for information
  3. Comparison of Existing Valuation Approaches
     1. Review of existing studies and literature
     2. Identify commonalities and gaps
  4. Draft Framework
     1. Taxonomy/Glossary
     2. Decision Process Framework
  5. Case Studies
     1. Bulk power
     2. Distributed power

Long-term Program Vision

Develop a valuation framework that will allow electricity-sector stakeholders to conduct, interpret, and compare valuation studies of existing and emerging grid services and technologies with high levels of consistency, transparency, repeatability, and extensibility.

- Identify a **comprehensive strategy for valuation** that can encompass **any components** of the grid, incorporating the **institutional and market contexts.**
- Develop a valuation process to **support stakeholder decision-making** through **identification**, **examination** and **comparison**
- Create a **common valuation language** and **generally accepted standards** for valuation methods and assumptions

Stakeholder Advisory Group provides insights to the team

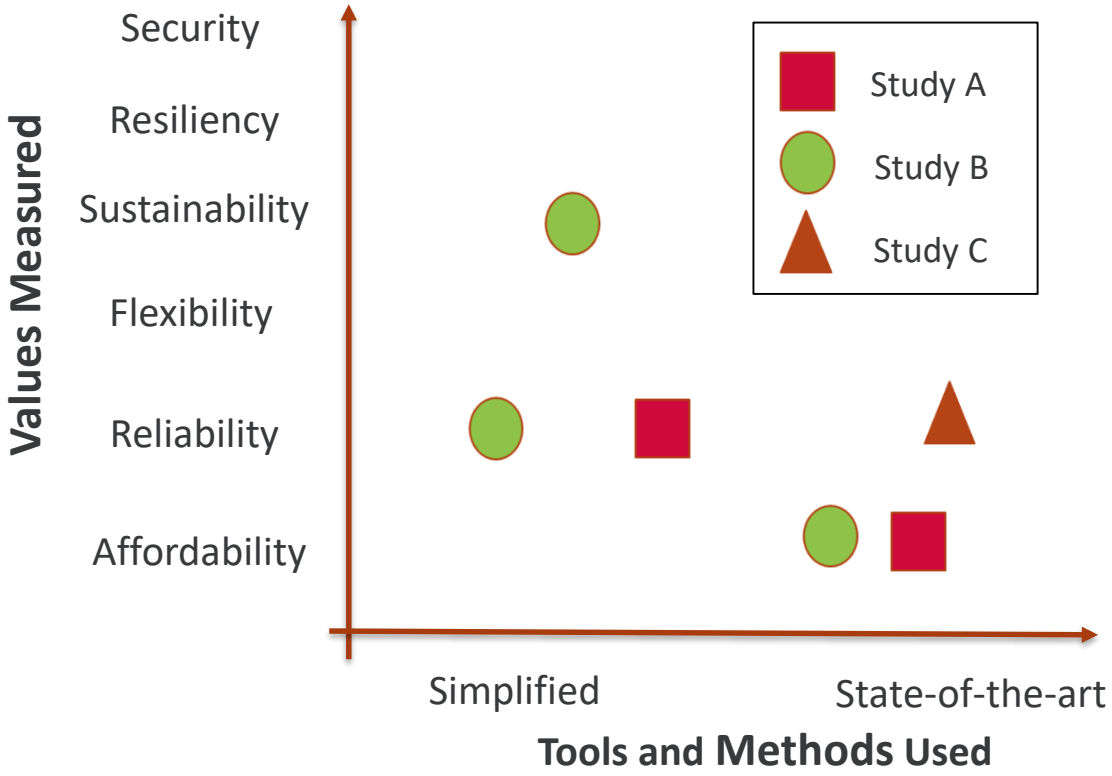
- Goals – guidance and feedback from a broad stakeholder community who are both interested and technically engaged in cost-benefit analyses and valuation.
- Proposed group is to have 15-20 senior personnel from six sectors:
  - Regulators/legislators
  - Utilities
  - Consumer/Environment groups
  - Grid RTOs/ISOs
  - Developers/Suppliers
  - Researchers (Economics, Energy)
- Interaction
  - One annual in-person meeting; the first in-person meeting held September 26-27 in Golden, CO at NREL.
  - Bi-monthly/quarterly electronic meetings/webinars to discuss the progress of the valuation decision process and to provide input and recommendations on that process.
- Two case studies are planned for the project and we hope to use group members' projects as the basis for each.

Current Stakeholder Group

Name	Position	Organization
Michael Bailey	Senior Engineer, System Adequacy	Western Electricity Coordinating Council
Betsy Beck	Director, Transmission Policy	American Wind Energy Association
Denis Bergeron	Director of Energy Program	Maine Public Utilities Commission
Gary Brinkworth	Director of Technology Innovation	Tennessee Valley Authority
Lilian Bruce	Strategic Research	Electric Power Board, Chattanooga
Ed Finley; Alt. Kim Jones	Chairman	North Carolina Utilities Commission
Ryan Hanley; Alt. Rohan Ma	VP of Grid Engineering Solutions	Solar City
Ben Hobbs	Director – Environment, Energy, Sustainability & Health Institute	Johns Hopkins University
Val Jensen	Senior VP of Customer Relations	Commonwealth Edison
David Kolata	Executive Director	Citizens Utility Board
Ron Lehr	Consultant	Western Clean Energy Advocates
Jonathan Lesser	President	Continental Economics
Enrique Mejorada	Director of Energy Policy Modeling and Analysis	Pacific Gas & Electric
Jeff Morris	Representative	Washington State Legislature
Bernard Neenan	Technical Executive	EPRI
Matthew Shuerger	Commissioner	Minnesota Public Utility Commission
Tom Sloan	Legislator	Kansas State Legislature
J. T. Smith	Director, Policy Studies	Midcontinent ISO
Nick Wagner	Commissioner	Iowa Public Utility Commission
David Whiteley	Director	Eastern Interconnection Planning Council

Literature review identifies values, methods, and technologies studied

- Landscape diagram shows areas of focus and gaps
- Studies may focus on one or more values
- Methods can be simple or detailed for different values
- Other dimensions could include technologies or stake-holder perspectives



Taxonomy provides a Valuation Common Language

- Valuation study results are based on the input assumptions and models used.
- Currently, details are rarely released, resulting in:
  - Lack of assurance in fidelity of results
  - Lack of understanding on limitations of the analysis
  - Inability to compare results from different sources
- A common language or taxonomy is needed on:
  - Glossary of terms used in the framework
  - The set of basic assumptions needed for analysis
  - Methodological process or tools used
- As these become Generally Acceptable there will be more confidence in results.

Valuation methods are based on needs, purposes, and resources of the user

- Technology screening or policy analysis will have different data needs than do rate-setting or investment decisions

	Simple	**Complexity**	Involved
Accuracy Coarse	Purpose: Screening Data required: Low		Purpose: Multi-region evaluation of technologies and services Data required: Geographic or technology high
Precise	Purpose: Single Project developer Data required: High for project, low for rest of grid		Purpose: Rate-setting, major project construction decision Data required: High

Process uses Decision Tree Metaphor

- User approaches the decision tree with their own perspective and questions
- Based on scope, focus, and resources available, user defines what values are important to study
- Branches represent the metrics to be analyzed
- Offshoots of branch represent different sub-metrics examined by methods and tools

Potential Structure for Technology Valuation Process

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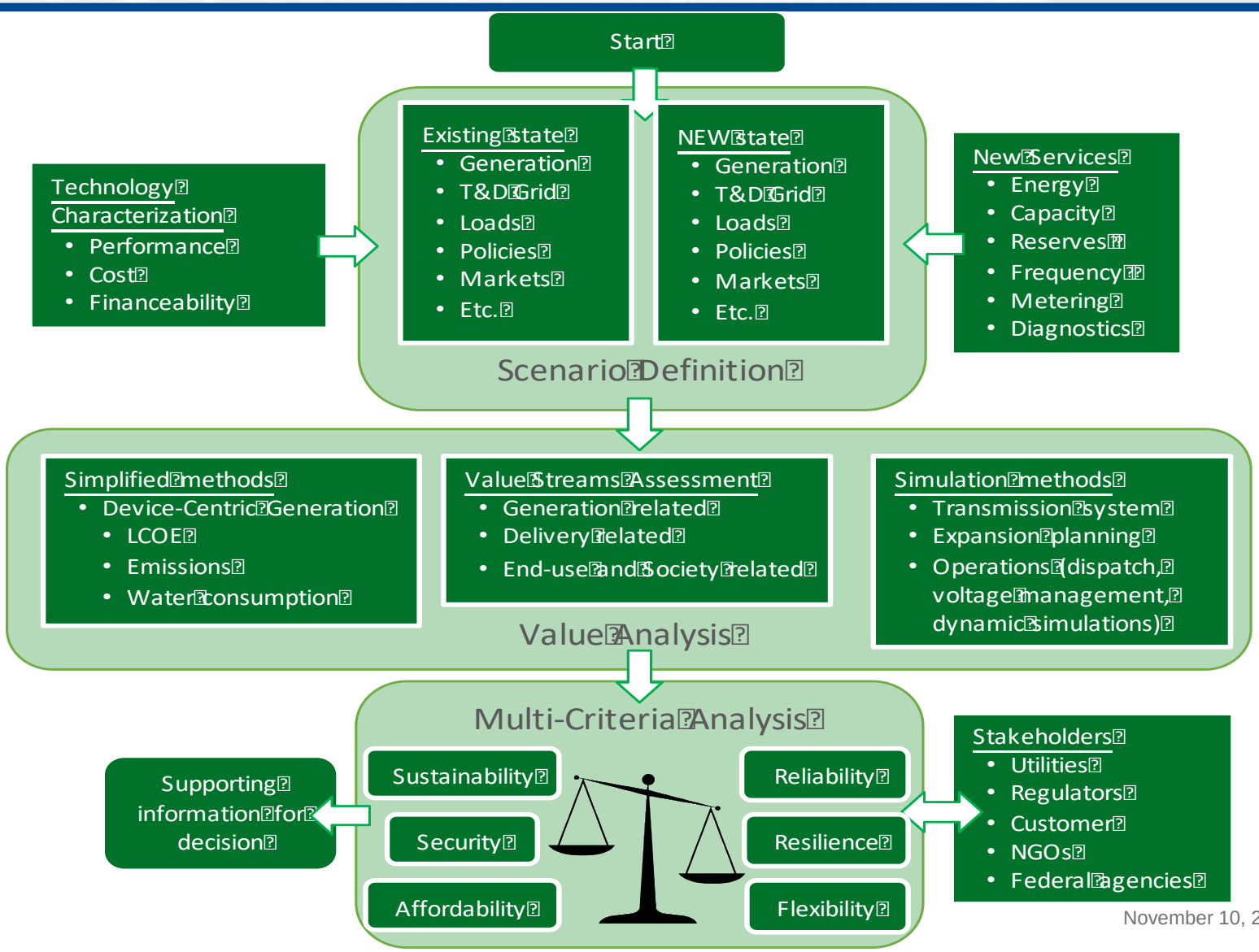


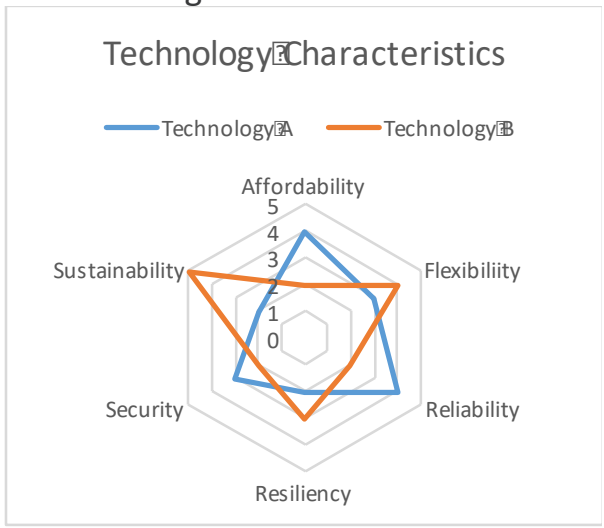
Tools and Methods will measure changes in a variety of metrics

- Tools and methods can encompass computational models, sensor-derived data, surveys, etc.
- Values can be thought of as the changes in metrics between a base and new scenario, or scenarios to capture uncertainty
- A user supplies weighting factors to these changes:
  - Linear (e.g., lowered cost, reduced emissions)
  - Binary (e.g., in or out of compliance)
  - Complex (e.g., reduced risk, required minimum but added value above
- If multiple values are to be considered then the user's relative weighting between them further complicates the final result
  - Trade-offs between values, e.g., cost versus reliability

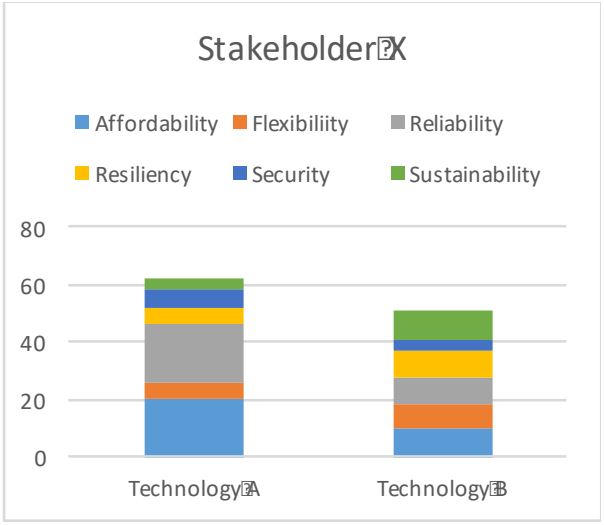
Framework Tools to Compare Multiple Values and Studies

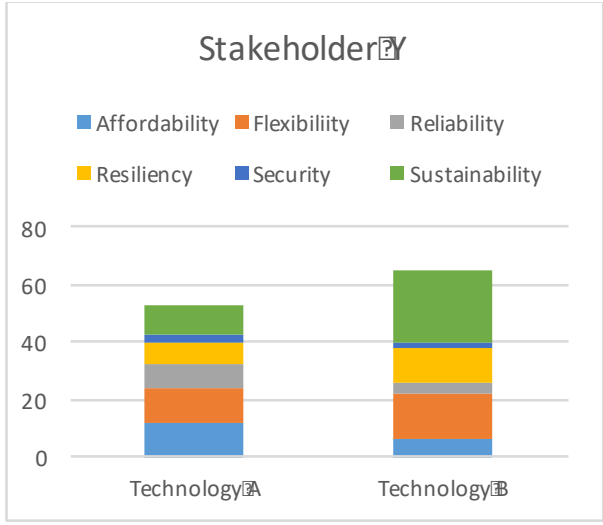
- Create process for multi-criteria assessment using metrics and process from GMLC Project 1
- Technologies will have different strengths that will be weighed differently by stakeholders
- Disaggregation reveals where differences lie

Technologies differ across metrics



Stakeholders differ on weights





Outcomes for 3-Year Project

- A **compendium** of **valuation methodologies and tools** that quantify values of grid-related services and technologies.
- A **common language** used for valuation that can be used GMLC-wide, including living glossary of terms.
- A **valuation framework** that guides stakeholders through a process that identifies a set of different methodologies to quantify values relevant to decision-making, demonstrated through case studies.
- A **key resource** to serve as guidance to stakeholders for grid valuation and to inform the DOE R&D agenda for methods and tool enhancements and development.