

# GRID MODERNIZATION INITIATIVE PEER REVIEW

## Project 1.2.4: Grid Services and Technologies Valuation Framework

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# Valuation Framework

## High Level Summary



### ***Project Summary***

Development 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.**

### ***Value Proposition***

- ✓ **Valuation drives investments**—from equipment purchases to rate-making to multi-billion dollar research portfolios
- ✓ **But... current approaches are difficult to directly compare and reconcile**
- ✓ **Decision makers** need information they can **reliably interpret and compare**

### ***Project Objectives***

- ✓ **Produce a framework—not a new model:** a systematic approach to conducting, and interpreting valuation resulting in...
- ✓ ...increased **transparency in modeling assumptions and methods** used in evaluating grid technologies and services
- ✓ ...the ability of stakeholders to identify **value beyond monetary savings and costs** (sustainability, reliability, etc)
- ✓ ...**useful and used guidance** for the broad range of valuation applications
- ✓ ... the **foundation of reaching a long-term vision** of improved, broadly consistent valuation practices

### *Project Participants and Roles*

#### **Laboratories**

ORNL – Project manager

PNNL – Review state of valuation (+1)

ANL – Taxonomy and glossary (+1)

NREL – Test cases

LBNL – Review and taxonomy support

SNL – Framework development support

LANL – Framework development support

#### **Industry**

NARUC – partner supporting Stakeholder

Advisory Group engagement

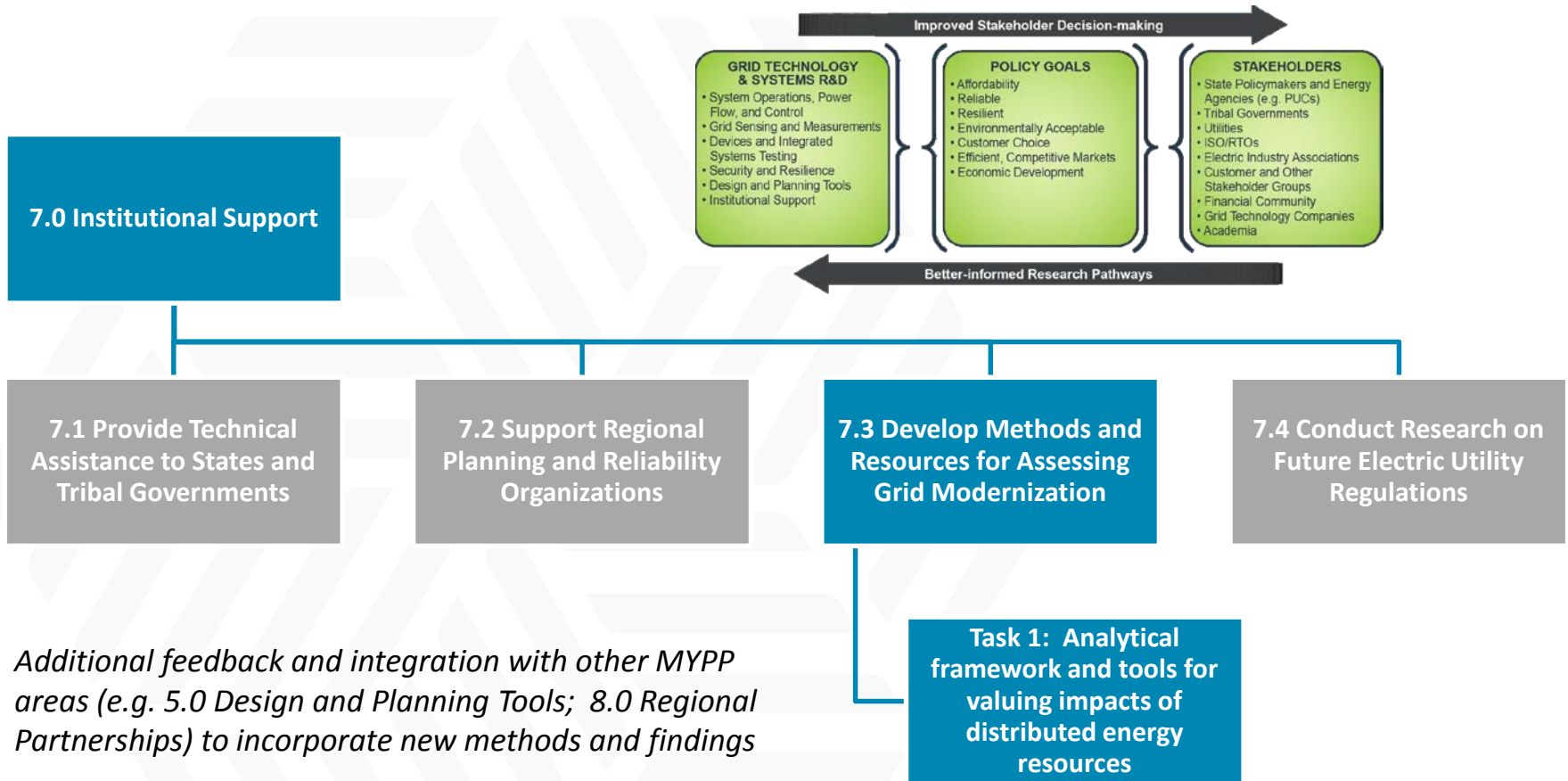
#### PROJECT FUNDING

Lab	FY16 \$	FY17\$	FY18 \$
ORNL	375k	355k	415k
PNNL	200k	175k	205k
NREL	95k	200k	170k
ANL	155k	85k	60k
LBNL	105k	50k	60k
SNL	40k	80k	60k
LANL	30k	55k	30k
<b>TOTAL</b>	<b>\$1M</b>	<b>\$1M</b>	<b>\$1M</b>

*The project leverages the diverse expertise of the National Laboratory system to address the breadth of challenges in creating a transparent process of valuing technology, policy, and service impacts to the grid*

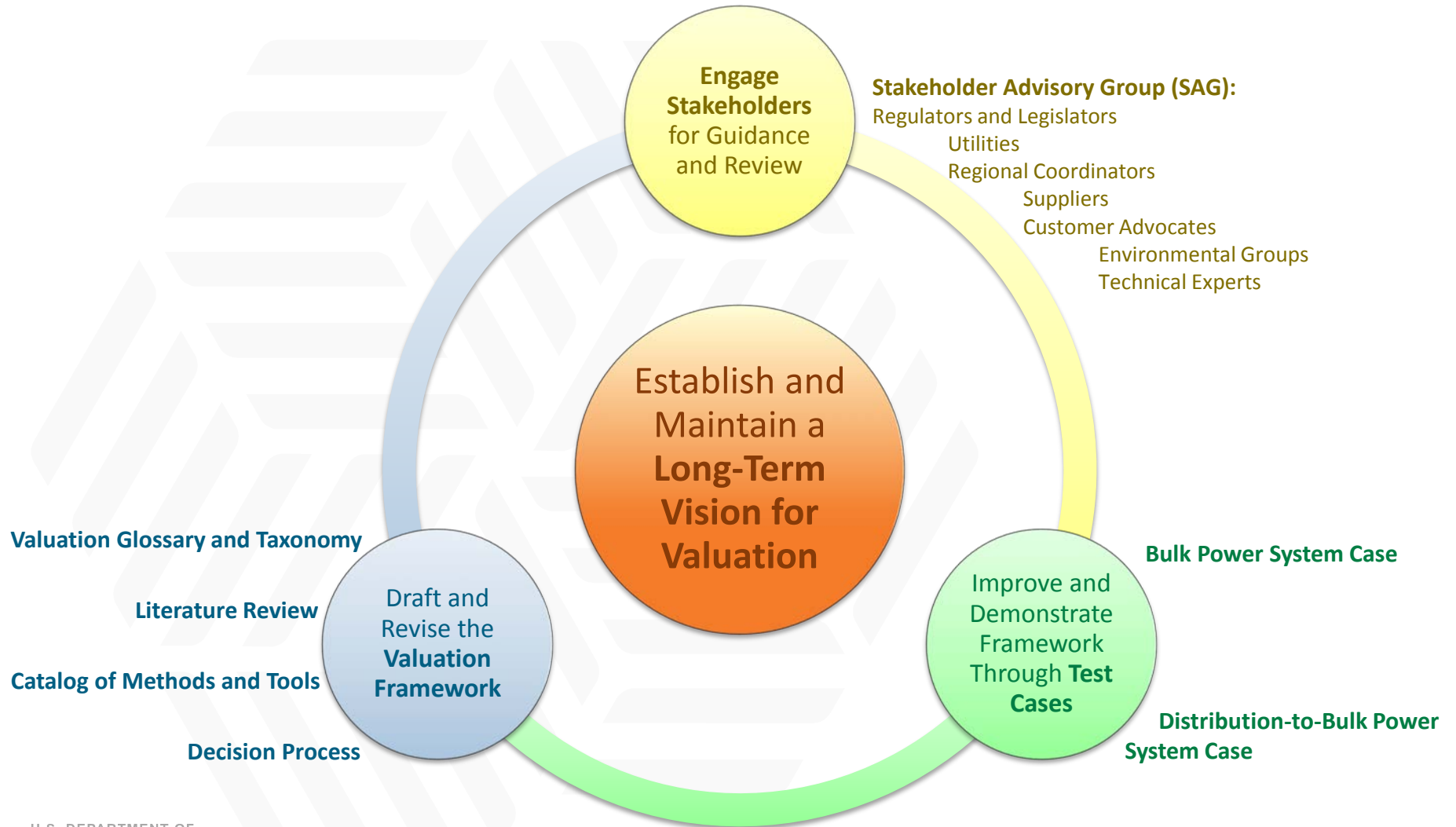
# Valuation Framework

## Relationship to Grid Modernization MYPP



*Additional feedback and integration with other MYPP areas (e.g. 5.0 Design and Planning Tools; 8.0 Regional Partnerships) to incorporate new methods and findings*

# Valuation Framework Approach



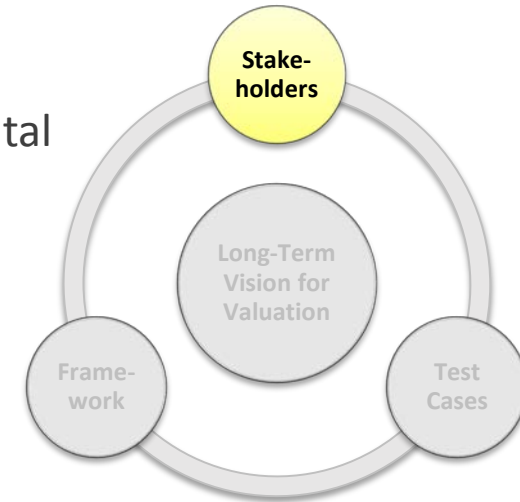
# Valuation Framework

## Accomplishments to Date: Drawing Value from the Advisory Group

### *Identifying stakeholder needs—and practical outputs*

One-on-one and group conversations with SAG have been instrumental in shaping what the project should produce:

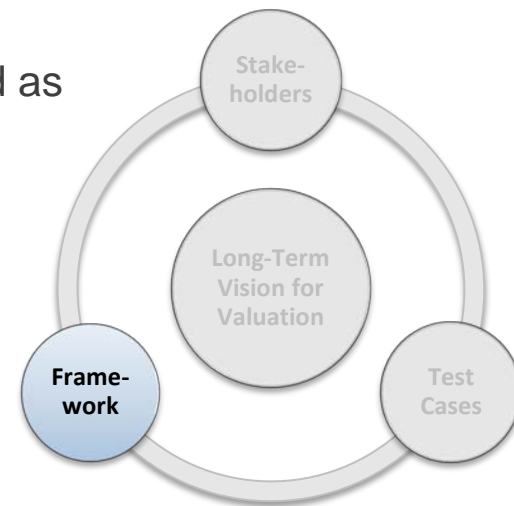
- Guidance
  - Stated need from SAG members to understand systematically how to work through valuation problems
  - DOE and Laboratory neutrality and expertise is valued along multiple dimensions
- Don't take simple products off of the table—*"I need a Valuation Checklist"*
- Project additionally viewed as a learning opportunity to some—teaching mechanism to others
- Valuable input to other project tasks



# Valuation Framework

## Accomplishments to Date: Assessing the Current State of Valuation

- ▶ Primary focus of value estimates centered on affordability defined as (Benefit/Cost); reliant on simplified calculation methodologies
- ▶ Next most frequent valuation category includes sustainability as expressed in GHG emissions; typically monetized via regulatory costs or social cost of carbon
- ▶ Reliability value not estimated, but used as requirement in many valuations
  - E.g. as *constraint* and not *objective* in modeling
- ▶ Value of resilience only discussed in context of microgrids; Flexibility value discussed qualitatively; Security value only mentioned
- ▶ Emphasis placed on traditional monetized cost and benefits; formal (or even informal) multi-objective analysis is limited
- ▶ Treatment of uncertainty is highly varied



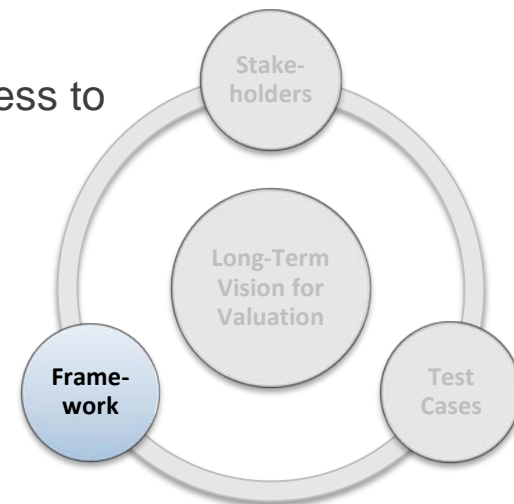
# Valuation Framework

Accomplishments to Date: Abstracting for extensibility; outlining the framework decision process



The “framework” is ultimately systematic guidance and a decision process to construct and interpret valuation studies based on **key questions**:

1. **Why** are we conducting a valuation study?
2. **Who** are the stakeholders (and what do they care about)?
3. **What** is being measured?
4. **How** are we measuring it given resource constraints?
5. **How will metrics be used** to inform decision making?
6. **What matters** to support the ultimate decision (transparency and uncertainty)?



- Reliability
- Resilience
- Flexibility
- Sustainability
- Security
- Affordability
- Economic Impact

	Simple	Complexity	Involved
<b>Accuracy</b>	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



# Valuation Framework

## Key Project Milestones



Milestone (FY16-FY18)	Status	Due Date
Stakeholder Advisory Group workshop is held	Initial workshop held. Engagement is ongoing: members involved individually on an ad-hoc basis and collectively on a quarterly basis	10/1/16
Draft framework completed	Literature review executed 1/17. Draft framework completed and undergoing heavy revision and population	4/1/17
Test case applying framework to bulk system power issue is completed	Test-case subject and approach undergoing finalization	10/1/17
Second Draft of framework is issued encompassing lessons learned from test case		4/1/18
Final framework encompassing lessons learned from second test case is completed and issued		10/1/18

# Valuation Framework

## Response to December 2016 Program Review



Recommendation	Response
<p><i>The principle investigator (PI) mentioned the need to develop <b>generally accepted valuation principles analogous to principles in more mature area (like accounting)</b>. DOE agrees with that approach.</i></p>	<p>These “GAVP” principles are an <b>essential component of the Long-Term Vision</b>.</p>
<p><i>As mentioned in the meeting, developing a framework for valuation is extremely important. <b>The value of this project is enabling an “apples to apples” comparison of valuation studies across a range of regions</b>. At the Annual Peer Review, please demonstrate this capability.</i></p>	<p>Regional differences and future impacts are key design considerations; the project will <b>demonstrate both capabilities in the project’s test cases</b>.</p> <p>However, the framework initially developed under this project will allow apples-to-apples understanding of why differences exists—<b>true comparative ability is a long-term goal—requires “GAVP”</b></p>
<p><i>Please <b>develop an approach that takes into account both regional differences and future impacts on value</b> must be addressed by this model.</i></p>	
<p><i>While the project has a strong technical resource committee, <b>other important stakeholders were mentioned in the meeting that should be included if possible (e.g. RMI, E3)</b>.</i></p>	<p>Outreach to these stakeholders is ongoing.</p>
<p><i>Please <b>coordinate closely with other partnership projects like 1.3.5 and 1.3.10</b>.</i></p>	<p>Coordination with these projects is ongoing (see next slide). Insights from these specific projects and others (e.g. NY REV) will be essential at document <b>cutting edge practices for distribution-scale valuation</b></p>

# Valuation Framework

## Project Integration and Collaboration

- ✓ **Project 1.1: Foundational Analysis for GMLC Establishment/Analysis** – Collaborate and use the metrics developed to capture the different value categories.
- ✓ **Project 1.2.2: Grid Architecture** – Utilize a compatible process with the architecture defined in this project to ensure interoperability, transparency, and a rigorous discipline.
- ✓ **Project 1.4.2: Definitions, Standards and Test Procedures for Grid Services** – Collaborate with this project in defining a standard set of grid services to ensure interoperability and coherence.
- ✓ **Support and draw from other GMI R&D activities:**
  - ✓ Incorporate new modeling approaches from broad array of valuation-related projects
  - ✓ Glossary of terms useful to provide common language for grid modernization
  - ✓ Valuation process provides insights into value

### Communications/Workshops/Visibility:

August, 2016: DOE Electricity Advisory Committee

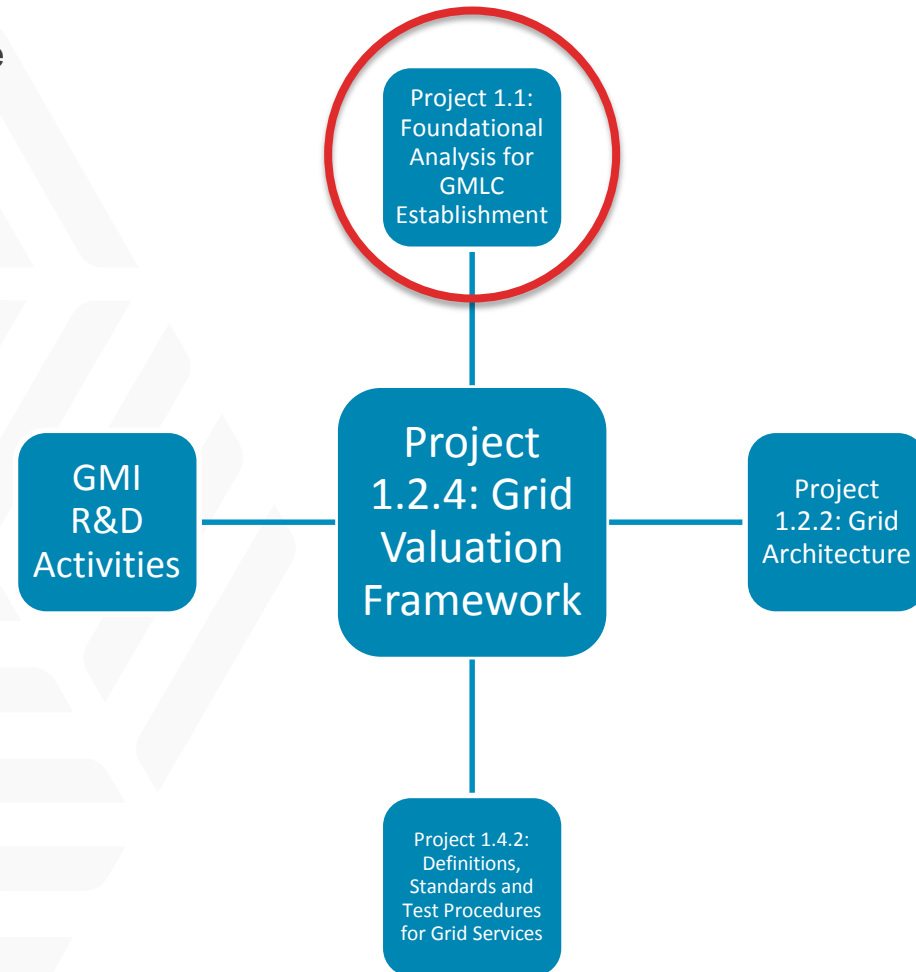
September, 2016: SAG Kick-off Meeting

November, 2016: DOE Go/No-Go

January, 2017: NARUC “Valuing Baseload” Workshop

January, 2017: SAG Update Webinar

February, 2017: NARUC Rate Design Subcommittee



# Valuation Framework

## Next Steps and Future Plans

### ► Immediate—(5/2017)

- Add detail to framework and solicit feedback from SAG
- Finalize first test case subject and approach (bulk power system)

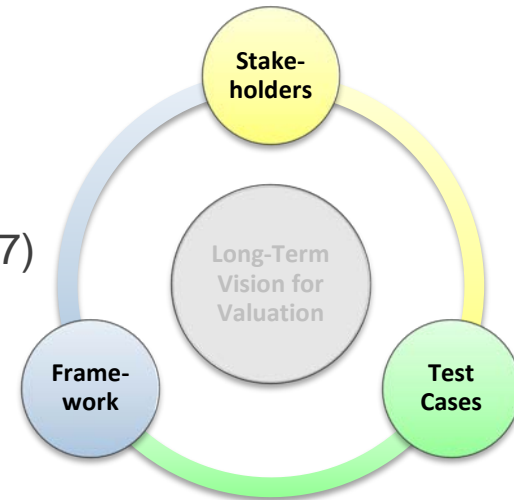
### ► Mid-Term: execute test case at bulk power system scale (10/1/2017)

- SAG Advice: *Don't (and don't appear to) cherry-pick a use-case.*
  - Solution: Tackle a class of Valuation question and systematically evaluate framework against published studies
- Two options currently being discussed: (1) Valuing Nuclear Power (Investment/Divestment/Subsidy); (2) Valuing Grid Storage

### ► Long-Term

- Case 1 leads into Go/No-Go for last phase of project
- Revise framework based on case 1, SAG feedback (Early FY 18)
- Second test case—Distribution System—Likely in depth case with SAG volunteer—test *and* operationalize framework (Mid FY 18)
- Final framework revision (Late (FY 18))

### ► As we round into the final year—planning of **practical outputs and dissemination strategy becomes critical**

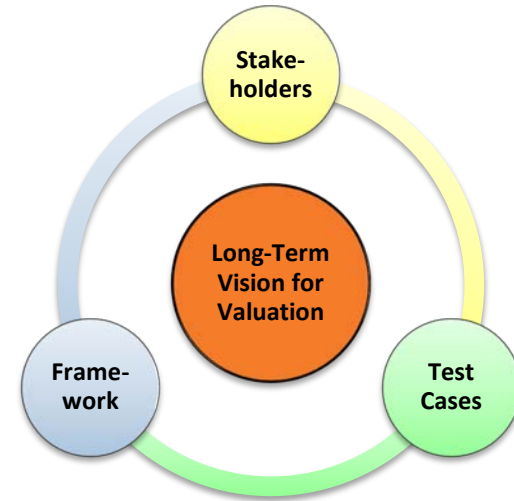


# Valuation Framework

## Defining Success; Ensuring Impact

### Project Objectives

- ✓ Produce a **framework—not a new model**: a systematic approach to conducting, and interpreting valuation resulting in...
- ✓ ...increased **transparency in modeling assumptions and methods** used in evaluating grid technologies and services → A “better way” illustrated through test cases
- ✓ ...the ability of stakeholders to capture **value beyond monetary savings and costs** (sustainability, reliability, etc) → Checklist and other “simple” products in the hands of SAG and others
- ✓ ...**useful and used guidance** for the broad range of valuation applications → Framework itself used by SAG and others—second test case and beyond
- ✓ ... the **foundation of reaching a long-term vision** of improved, broadly consistent valuation practices → Modeling gaps identified; beginnings of “Generally Accepted Valuation Principles” taking shape



# Valuation Framework

## Technical Details: Stakeholder Advisory Group Membership



- ▶ Sectors
- ✓ Regulators/  
Legislators
- ✓ Utilities
- ✓ Regional  
Coordinators
- ✓ Suppliers
- ✓ Customer/  
Environmental  
Groups
- ✓ Technical Experts

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

# Valuation Framework

## Technical Details: Literature Review Content



- *Thirty-eight papers and reports dealing with valuation reviewed*
- *Combined with similar topics into buckets*
- *Numbers refer to number of studies/papers*
- **Technology Portfolios**
  - IRPs (4)
  - Transmission planning (4)
  - Distribution resource planning (3)
- **Policy Options**
  - Net energy metering (4)
  - Rate design (4)
  - Resource adequacy assessment (1)
  - Value of reliability Improvement (1)
- **Individual Technologies or Assets**
  - Distributed PV (4)
  - Nuclear (3)
  - Electric Vehicles (3)
  - Microgrids (2)
  - Storage (3)
  - HVDC line (1)
  - Hydropower (1)

# Valuation Framework

## Technical Details: Literature Review High-Level Findings (numerical)



Metrics	Economic Values: Discounted Cash Flow That Quantifies Net Benefit (Cost/Benefit)					Engineering Values/Methodologies That Determine How Assets are Used	
	COST (Capital)	COST (Operations)	AVOIDED COST (Capital)	ADVOIDED COST (Operations)	Real Option Analysis	Complex System Analysis	Simple Load Balancing (Spreadsheet Analysis)
Reliability	23%	23%	23%	23%	3%	9%	27%
Resilience	10%	10%	10%	10%	0%	2%	10%
Flexibility	13%	13%	13%	20%	0%	3%	17%
Sustainability (GHG)	27%	13%	30%	37%	0%	10%	23%
Sustainability (Air Quality)	13%	13%	17%	23%	0%	3%	17%
Sustainability (Water)	7%	7%	3%	3%	0%	1%	3%
Affordability	100%	100%	100%	100%	7%	22%	77%
Security	3%	3%	3%	3%	0%	0%	3%