DOCKETED	
Docket Number:	19-MISC-01
Project Title:	Distributed Energy Resources (DER) Roadmap
TN #:	227379
Document Title:	Presentation - CEC DER Research Roadmap - Public Workshop #1
Description:	N/A
Filer:	Liet Le
Organization:	Navigant
Submitter Role:	Public
Submission Date:	3/20/2019 4:19:05 PM
Docketed Date:	3/20/2019

CEC DER RESEARCH ROADMAP

Public Workshop #1

MARCH 25, 2019

NAVIGANT

LOGISTICS AND ANNOUNCEMENTS

- If there's an emergency and we need to evacuate the building, please follow the CEC staff to Roosevelt Park, which is across the street diagonal to the building.
- For comments, please speak into microphones, introducing yourself and organization.
- Workshop is being recorded and transcribed. These will be added to the Docket No. 19-MISC-01 and posted online.

WI-FI

Network: Energy_Guest

User: Guest

Password:

AGENDA

Timeslot	Item
10:00 AM	**Welcome, Housekeeping, and Workshop Outline** ▪ Logistics and Introductions
10:15 AM	**Review of Project Scope and Schedule** ▪ Project Context ▪ Project Team ▪ Objectives ▪ Scope and Timeline ▪ Technical Advisory Committee (TAC) ▪ Stakeholder Participants
10:45 AM	**Technical Assessment Overview** ▪ Technical Assessment Scope ▪ Topic Areas ▪ Metrics ▪ Barriers

AGENDA (CONTINUED)

Timeslot	Item
11:00 AM	**Technical Topic Areas Session One** ▪ Review of Topic Summaries ▪ Distributed Energy Storage ▪ Smart Inverters
12:00 PM	***LUNCH BREAK***
1:15 PM	**Technical Topic Areas Session Two** ▪ Vehicle Grid Integration ▪ DER Management System Integration ▪ DER Planning Integration
2:30 PM	***BREAK***
2:45 PM	**Technical Topic Areas Session Three** ▪ Grid Optimal Load Assets ▪ Grid Communications
3:30 PM	**Open Questions and Answers**
4:15 PM	**Wrap Up and Adjournment**

NAVIGANT

PROJECT CONTEXT: DER ACTIVITIES AT THE ENERGY COMMISSION (PARTIAL LIST)

Research

- Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation, EPIC contract
- Vehicle-Grid Integration Roadmap, collaboration among Energy Commission, CPUC, CARB, and CAISO to update the 2014 VGI Roadmap
- Various projects resulting from EPIC solicitations, including:
  - GFO-16-309 (Solar +)
  - GFO-17-302 (Advanced Microgrids)
  - PON-14-301 (Microgrids and EV Charging)

Other DER-Related Activities

- Solar, Inverter, and Storage equipment lists; Renewable Energy Division
- Title 24 Building Standards; Efficiency Division
- Annual Demand Forecast (including DER forecasts); Energy Assessment Division
- Alternative and Renewable Fuels and Vehicle Technology Program; Fuels and Transportation Division

Source: CEC Staff

PROJECT TEAM

Organization	Individuals
Navigant Consulting	Karin Corfee, *Managing Director* James Hansell, *Associate Director* Vania Fong, *Consultant*
California Energy Commission	Angie Gould, *Technical Lead* Liet Le, *Contract Agreement Manager* Eric Ritter, *Technical Advisor*
Gregg D. Ander, LLC	Gregg Ander, *Managing Director*
Gridworks	Mathew Tisdale, *Executive Director* Andrew Spreen, *Project Manager*
Redhorse Corporation	Bill Gary, *Principal Analyst* Andrew Greenwood, *Principal Analyst* John Bly, *Principal Analyst*

OBJECTIVES OVERVIEW

KEY PROJECT OBJECTIVES

- Identify, describe and prioritize key RDD&D needs to efficiently transform the electric system to enable high penetrations of DER

KEY WORKSHOP OBJECTIVES

- Solicit stakeholder input on the draft Technical Assessment document

KEY PROJECT OUTCOMES

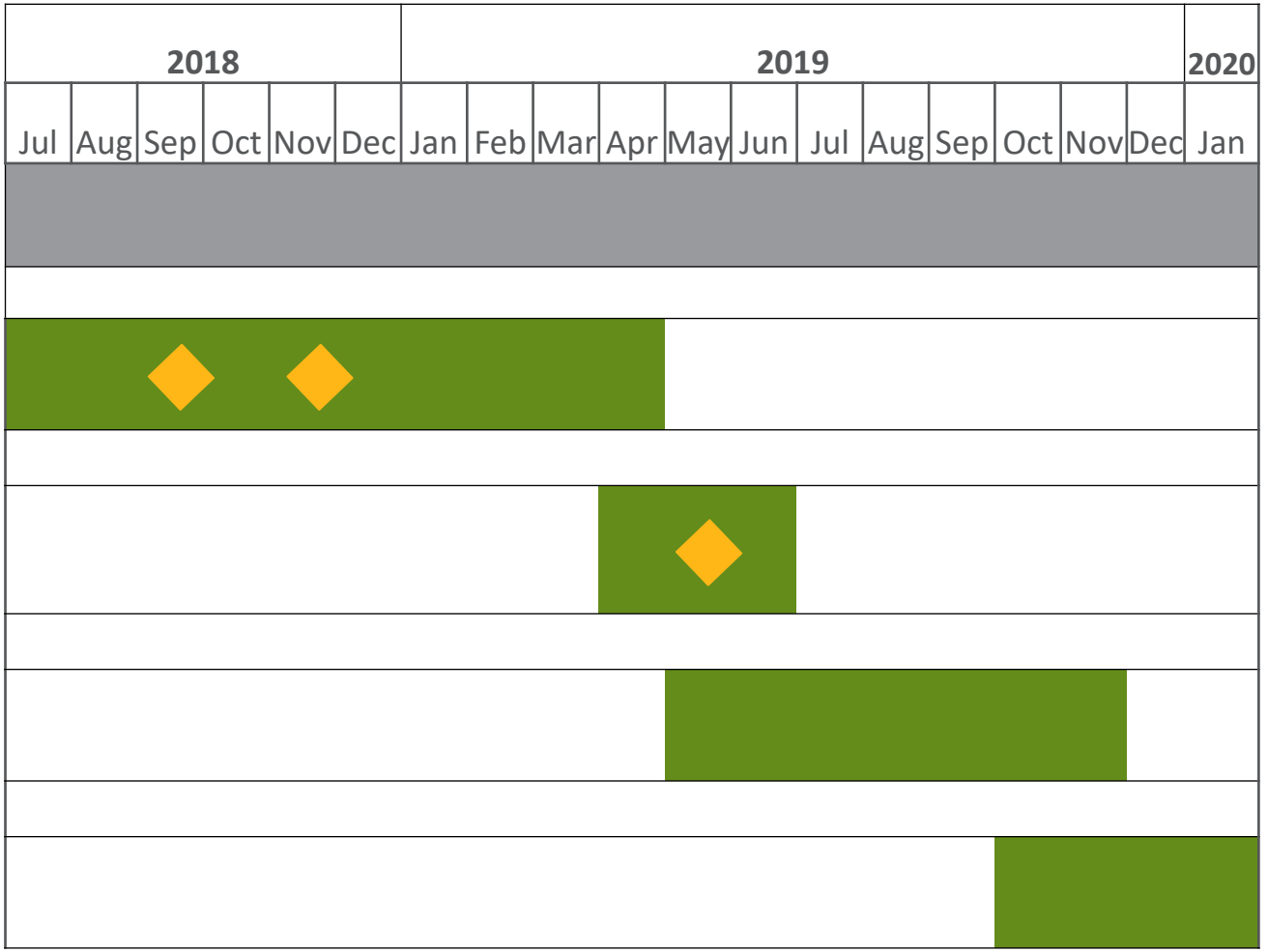
- Optimal deployment of EPIC funding in the short, medium and long term
- Engagement of a broad set of stakeholders
- Develop documentation for rationale and benefits of EPIC RDD&D

KEY WORKSHOP OUTCOMES

- Sharing of Technical Assessment
- Verbal & written comments

RESEARCH ROADMAP: TIMELINE

Denotes TAC Meeting



NAVIGANT

TECHNICAL ADVISORY COMMITTEE (TAC)

Individual	Affiliation
Brian McCollough	CEC
Noel Crisostomo	CEC
Gabe Taylor	CEC
Mark Esguerra	PG&E
Vibhu Kaushik	SCE
Jill Powers	CAISO
Mary Ann Piette	LBNL
David Chassin	SLAC
Stephanie Chen	Greenlining Institute
Kathy Wells	Lancaster Choice Energy
Rachel Kuykendall	Sonoma Clean Power
Alan Dulgeroff	SDG&E

STAKEHOLDERS AND EXPERT INTERVIEWS (PARTIAL LIST)

Research	Industry	NGO or Government

Smart Inverter Working Group

(ADD SLIDE RE: TECH ASSESSMENT RELATIVE TO BROADER ROADMAP EFFORT)

Technology Assessment

Technology Review

- Baseline description
- Summary of research

Success Factors

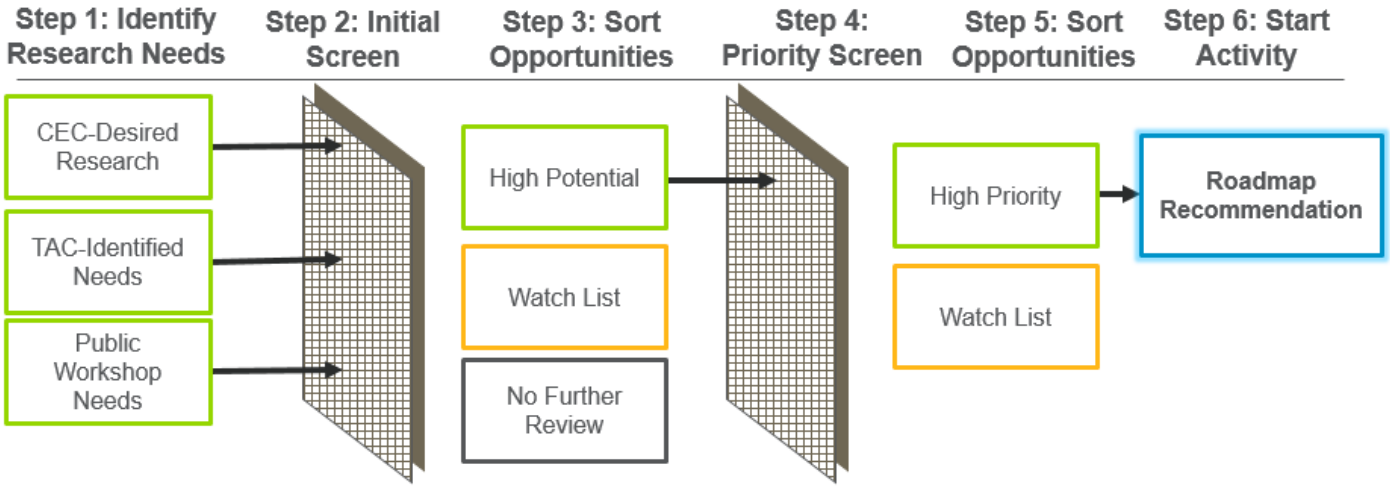
- Current Market Participation
- Policy Drivers
- Barriers

Identified RDD&D Needs

- Short-term
- Medium-term
- Long-term

TODAY'S WORKSHOP

Research Roadmap



TAC Screen Criteria:

- Appropriate for this roadmap?
- Widely commercialized technology?
- Performance improvement potential
  - Limited market application?
  - Economic trajectory?
- Existing utility activity?
- Covered elsewhere?

Priority Screen Criteria:

- Impact
- Fit with Policy Goals
- Need for EPIC Involvement
- Level of Risk to EPIC mission
- Level of Required Investment
- Partnership Opportunity

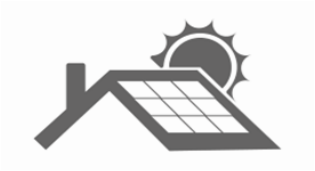
NAVIGANT

TECHNICAL TOPICS

DER Functional Technology

Electric Vehicle Integration and Smart Charging

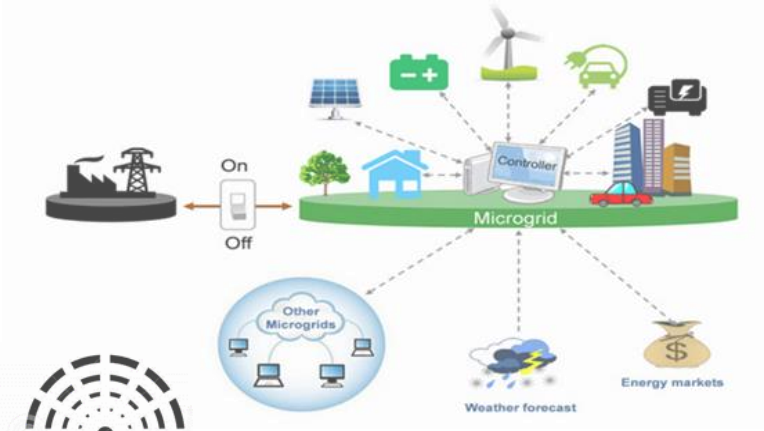
Grid Optimal Load Assets



Smart Inverters & Grid Edge Control

Energy Storage

DER Enabling Technology



DER Aggregation as Non-Wires Alternative

Distribution Grid Communications

Distribution Grid Management

NAVIGANT

GRID MODERNIZATION METRIC CATEGORIES

Reliability

Uninterrupted delivery of electricity with acceptable power quality in the face of routine uncertainty in operation conditions.

Resiliency

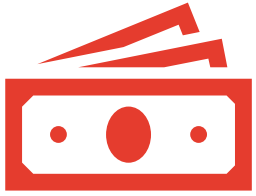
The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions, including deliberate attacks, accidents, or natural disasters.

Flexibility

Ability of the grid to respond to future uncertainties that stress the system in the short term and may require adaptation in the long run.

Sustainability

The operation of the power system in a manner that contributes to the reduction of pollutants, considering environmental, social and economic factors.



Affordability

The ability of the system to provide electric service at a cost that does not exceed customers' willingness and ability to pay for those services.

Security

The ability to resist external disruptions to the energy supply infrastructure caused by intentional physical or cyber attacks or by limitation of access to critical materials.

Source: Grid Modernization Laboratory Consortium (DoE) Metrics Analysis

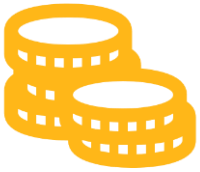
GRID MODERNIZATION BARRIER CATEGORIES

Cost

The component, production or operational costs of the resource are above what is required for adoption.

Uncertainty

Limited information on the immediate or future performance of the resource restricts potential uses.



Valuation

The resource is not adequately compensated for benefits it is providing to the power system.

Coordination

Complexity of the interactions between various participants in the ownership and utilization of the resource limits adoption.

Capability

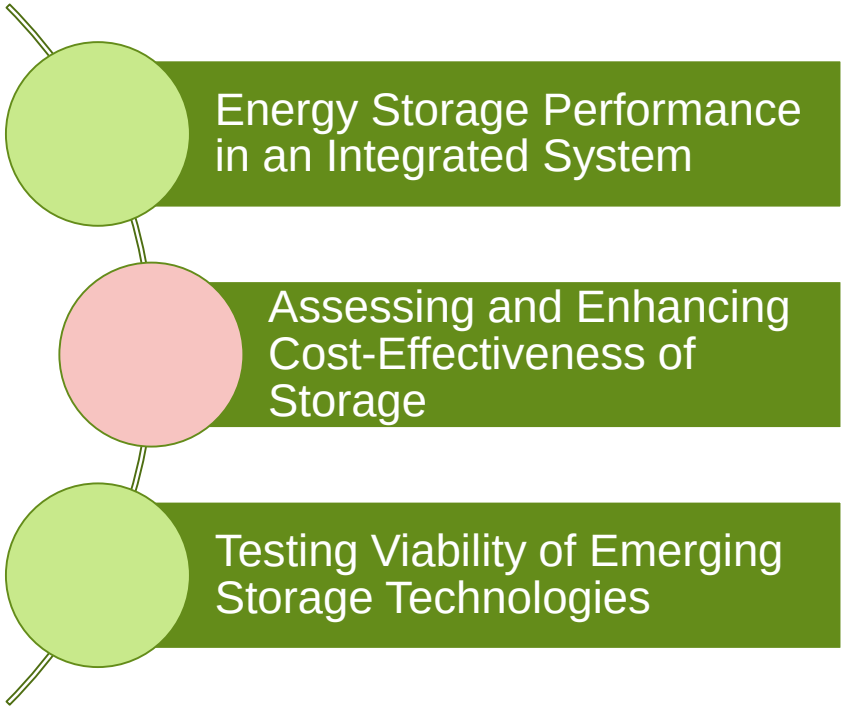
The performance characteristics of the technology are not sufficient to replace existing solutions.

TECHNICAL TOPICS

NAVIGANT

ENERGY STORAGE: OVERVIEW AND METRICS

Research Summary



Storage Metrics	Unit
Installed capacity	MW, MWh
Capacity participating in wholesale markets	MW, MWh
Device cycle life	count
Device efficiency	%
Outage customer-minutes avoided	Customer-minutes

NAVIGANT

ENERGY STORAGE: BARRIERS

- Low energy density
- MUA controls difficult
- Duration limited

Capability

- Capital costs high
- Competition for components

Cost

- Not all benefits compensated
- Artificially low alternate customer costs

Valuation

- Specialized installation and maintenance
- Permitting and safety
- Customer acquisition

Coordination

- Battery life concerns
- Third-party controls visibility

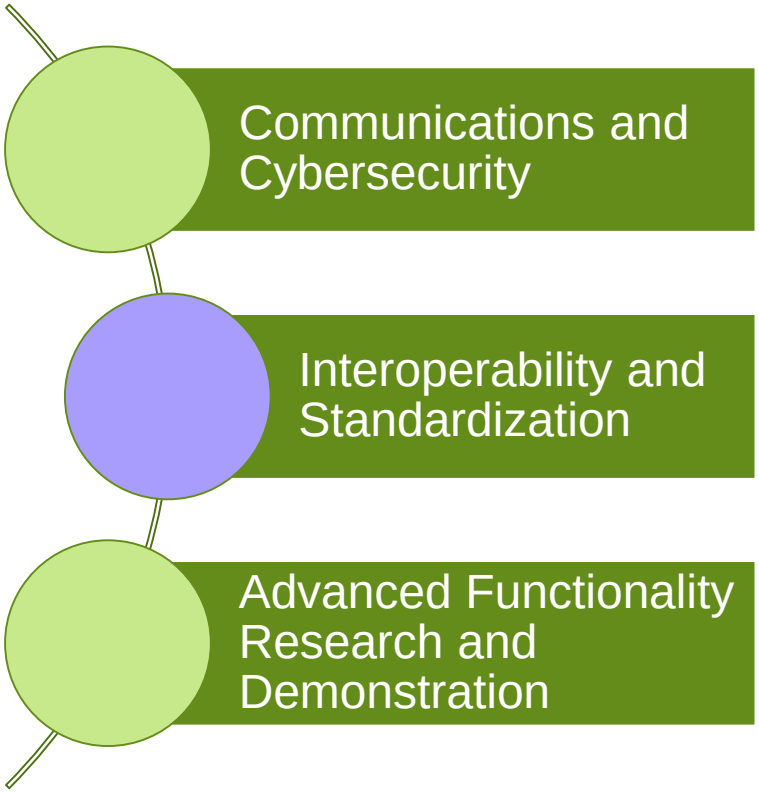
Uncertainty

Guest Speaker

***Jin Noh,** Policy Manager at California Energy Storage Alliance*

SMART INVERTERS: OVERVIEW AND METRICS

Research Summary



Smart Inverter Metrics	Unit
Number of local control signal inputs	count
Number of two-way utility monitoring and control points	count
Number of third-party grid sensors	count
Number of communications-enabled Smart Inverters	count
Installed capacity of communications-enabled Smart Inverters	MW
Number of ancillary device controls	count
Mean reduction in distribution operations (tap changes, cap bank switches)	count
Mean reduction in out-of-range customer voltages	% outlier customer minutes
Maximum power point tracking (MPPT) Tracking Speed	Rate
MPPT - Accuracy	Efficiency
Voltage Range	Volts
AC/DC Conversion Efficiency	%

NAVIGANT

SMART INVERTERS: BARRIERS

- Customer acquisition
- Limited interoperability

Coordination

- Value to customer is uncertain
- Value to utility is uncertain

Uncertainty

- Insufficient utility controls
- Communication unreliability

Capability

Guest Speaker

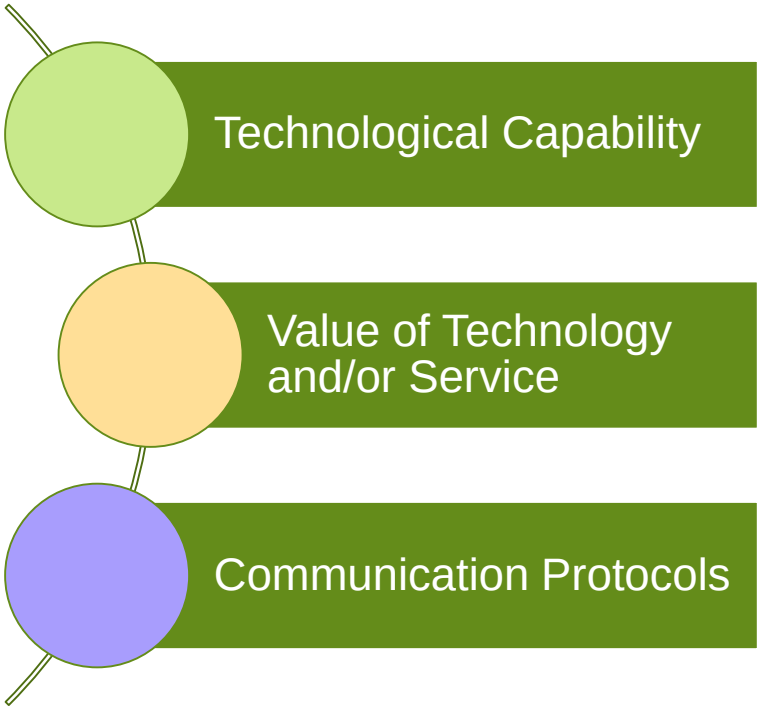
Dr. Aminul Huque, *Principal Project Manager of Integration of Distributed Energy Resources group at EPRI*

LUNCH BREAK

NAVIGANT

ELECTRIC VEHICLES: OVERVIEW AND METRICS

Research Summary



EV Integration Metrics	Unit
Percentage of electric vehicles capable of bi-directional charging	percent
Revenue opportunity available on average in the market per kWh energy for a given vehicle	$/kWh
Average number of electric vehicles plugged in to a charger during peak events	count
Number of chargers currently installed capable of bi-directional charging	count
Maximum MW output of all bi-directionally capable EVs at current penetration as a percentage of current peak.	percent
Maximum MW consumed of all EVs/available chargers at current penetration as a percentage of current peak.	percent

NAVIGANT

ELECTRIC VEHICLES: BARRIERS

- V2G vehicle costs
- V2G EVSE costs
- Incentives needed for multiple stakeholders

Cost

- Not all benefits compensated

Valuation

- Aggregation required for feasible participation

Coordination

- Battery warranty impacts
- Vehicle battery availability

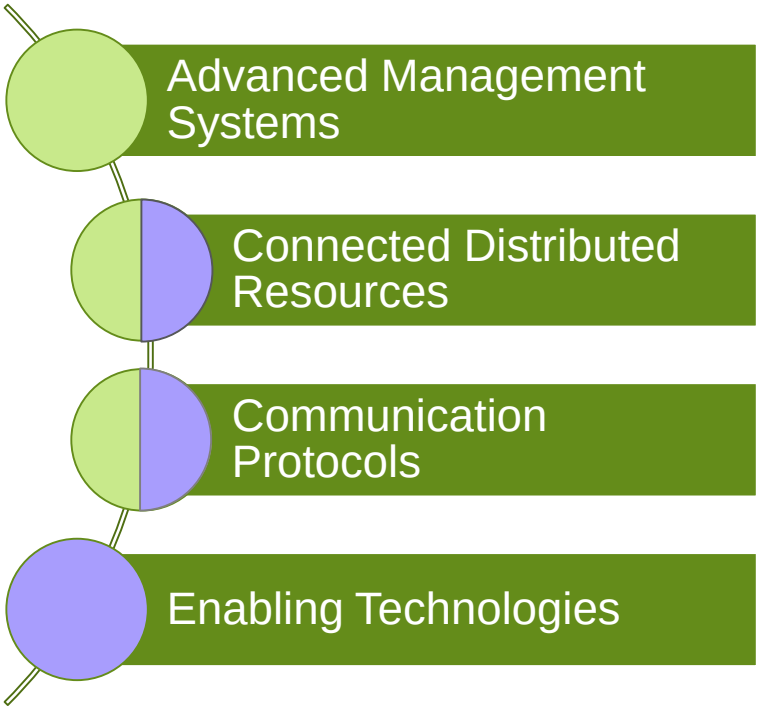
Uncertainty

Guest Speaker

Matt Fung, *Vehicle-to-Grid Integration R&D Lead at CEC*

DISTRIBUTION GRID MANAGEMENT: OVERVIEW AND METRICS

Research Summary



Grid Management Metrics	Unit
Flexible load bids by aggregator/third party	MW/MWh
Total connected devices in territory	count
Number of DER customers participating in grid management	count
Percent distribution load visible to operator	percent
Percent of circuits with automated switches	percent
Data center throughput per connected device	bps/device
Cost-benefit ratio of solutions	Ratio

NAVIGANT

DISTRIBUTION GRID MANAGEMENT: BARRIERS

Cost
- Enabling platform cost allocation

Valuation
- Cost-of-service ratemaking
- Uneven customer reliability value

Coordination
- Integration with conventional grid systems
- Insufficient communications standards
- Impact on critical systems

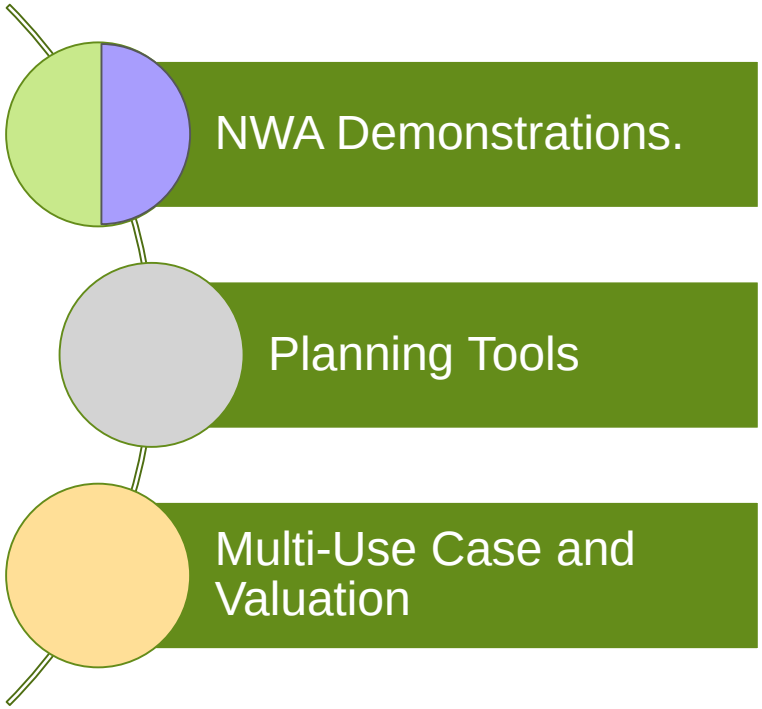
Capability
- Physical network model quality
- Limited DER inclusion
- Limitations of cloud analytics

Guest Speaker

Alex Portilla, *Manager of Grid Innovation at PG&E*

DER AGGREGATION AS NON-WIRES ALTERNATIVE: OVERVIEW AND METRICS

Research Summary



Reliability Metrics	Unit
Granular value of load lost for different times, regions, customer types	$
DER downtime by technology compared to grid-tied counterparts	time
DER downtime by technology for scheduled and unscheduled maintenance	time
Estimated system restoration time following hypothetical significant disturbances	time
Amount of islandable load	MW/MWh
Percentage of clean backup generation as a fraction of all backup generation	%
Total backup generation emissions	Tons CO2

NAVIGANT

DER AGGREGATION AS NON-WIRES ALTERNATIVE: BARRIERS

- Limited regulatory incentives
- Difficult separating value streams

Valuation

- Complex coordination between resource types

Coordination

- DER performance not guaranteed to planner

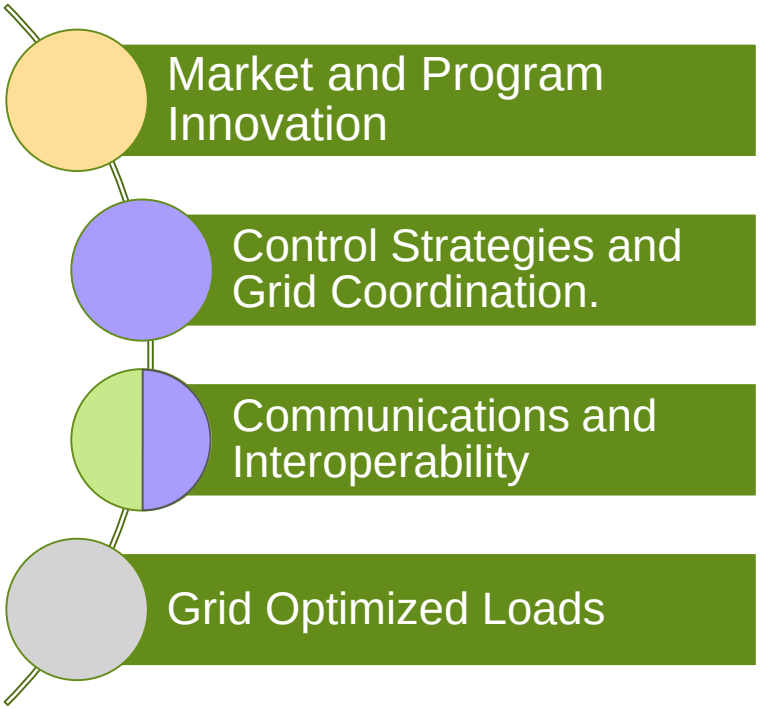
Uncertainty

Guest Speaker

NAVIGANT

GRID OPTIMAL LOAD ASSETS: OVERVIEW AND METRICS

Research Summary



GOLA Metrics	Unit
Device Response Time	time
Load Ramp Speed	%capacity/sec
Data Granularity	Temporal, Geographic
Participation in DR Programs	MW, MWh
DR Enablement Costs	$/customer
Number of Connected Devices	count
Amount of Modifiable Load	MWh
Transaction Costs	$

NAVIGANT

GRID OPTIMAL LOAD ASSETS: BARRIERS

- Building control hardware costs
- Lack of financing

Cost

- Value stacking difficult

Valuation

Guest Speaker

***Peter Schwartz,** Building Technology and Urban Systems Division at Lawrence Berkeley National Laboratory*

- Lack of useful grid signals
- Limited interoperability
- Customer acquisition

Coordination

- Value to customer is uncertain
- Value to utility is uncertain

Uncertainty

- Inadequate data synthesis
- Communication unreliability
- Lack of M&V protocols

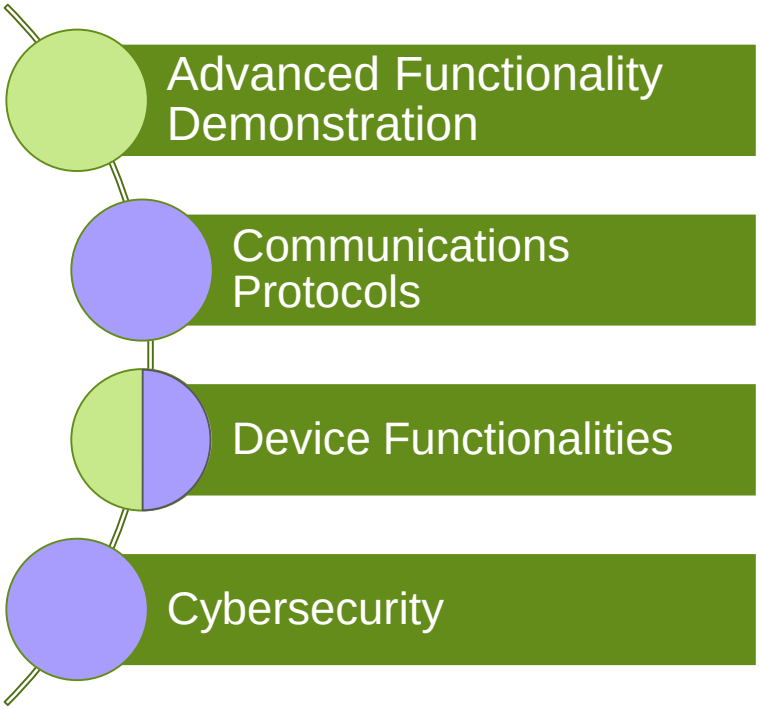
Capability

BREAK

NAVIGANT

DISTRIBUTION GRID COMMUNICATIONS: OVERVIEW AND METRICS

Research Summary



Communications Metrics	Unit
Number of utility SCADA monitoring points	count
Number of two-way utility monitoring and control points	count
Number of third-party grid sensors	count
Number of communications-enabled Smart Inverters	count
Installed capacity of communications-enabled Smart Inverters	MW
Number of communications-enabled Smart Buildings	count
Total load of communications-enabled Smart Buildings	MW
Number of certified devices (OCF, UPnP, AllJoyn)	count
Network cost per customer	$

NAVIGANT

DISTRIBUTION GRID COMMUNICATIONS: BARRIERS

- Assignment of cybersecurity obligations
- Lack of clear architecture

Coordination

Guest Speaker

Vibhu Kaushik, *Director of Grid Technology and Modernization at SCE*

OPEN
COMMENTS

NAVIGANT

CONTACTS

KARIN CORFEE
Managing Director, Navigant Energy Practice
karin.corfee@navigant.com

GREGG ANDER
President and Managing Director, Gregg D. Ander, LLC
gregg@greggander.com

JAMES HANSELL
Associate Director, Navigant Energy Practice
james.hansell@navigant.com

MATTHEW TISDALE
Executive Director, Gridworks
mtisdale@gridworks.org

VANIA FONG
Consultant, Navigant Energy Practice
vania.fong@navigant.com

NAVIGANT

APPENDIX

NAVIGANT