

Your DER Integration Planning Toolkit

Nadav Enbar
Principal Project
Manager, EPRI

Grid Evolution Summit
July 27, 2017



A National Town Meeting

Session Objectives, Panelists, and Agenda

Panelists will explore short- and long-term locational planning and load forecasting approaches along with their associated tools and methodologies. Interactive discussion and brainstorming will identify the changes necessary to evolve future grid planning.



Erik Gilbert
Director, Grid
Modernization
Navigant Energy



Jeff Ressler
President, Software
Services
Clean Power Research



Soorya Kuloor
CTO, Advanced Grid
Analytics
Landis+Gyr



Elaine-Sisson Lebrilla
Renewable Energy
Program Manager
SMUD

- 45-60 minute panel discussion
 - Mix of presentations and roundtable dialogue
 - Interactive polling and audience participation (specific topics)
- 15-20-minute audience Q&A (broad topics)
- Recap of day: key takeaways, knowledge gaps, next steps

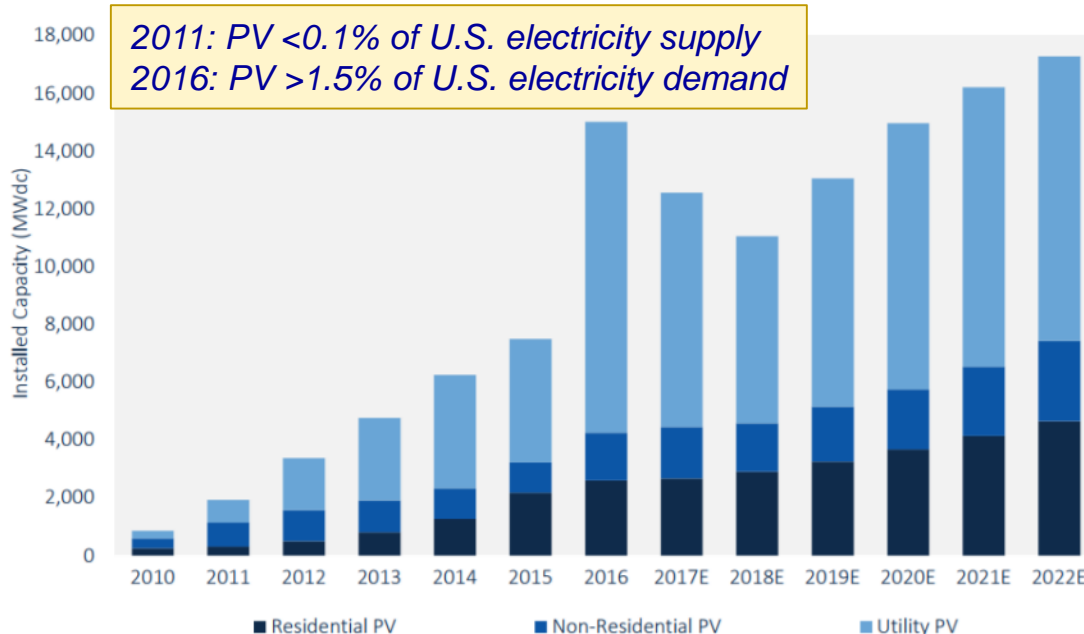
Setting the Context: The Genie's Out of the Bottle

What is the cumulative installed capacity of solar in the U.S. today?

- Answer (as of 1Q17): **44.7 GW**
- 2015: **29.9 GW**
- 2012: **11.4 GW**
- 2007: **4.4 GW**

Time to new installation:

- 2016 – 1-2 minutes
- 2015 – < 2 minutes
- 2014 – 2.5 minutes
- 2013 – 4 minutes
- 2004 – 2 hours



Source: GTM Research / SEIA

Cumulative Systems Installs

Q4 2016	1,300,000+
2013	475,000
2011	225,580
2009	96,500
2007	48,800
2005	21,150

Source: SEIA / SEPA

Setting the Context: It's the Economics, Stoopid

On average, how much does solar cost in the U.S. today?

- Answer (as of 3Q16):
 1. Residential: \$2.98/W_{dc}
 2. C+I: \$1.69/W_{dc}
 3. Utility (Tracking): \$1.21/W_{dc}
 4. Utility (Fixed): \$1.09/W_{dc}



Source: GTM/SEIA, *U.S. Solar Market Insight*, 4Q16

Note: National Average Turnkey PV Installation / EPC Price (\$/Wdc)

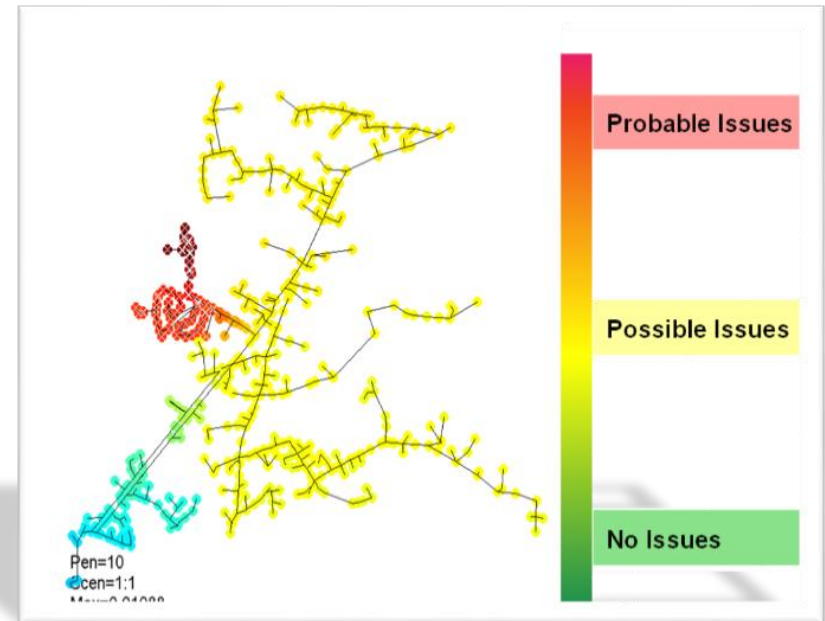
PV Price	Residential	Commercial	Utility-Scale
2009 Price	~\$8/W	>\$5.50/W	>\$3.50/W

Source: EPRI, BNEF

Setting the Context: The Impact of Time, Location, Customer Adoption/Usage of PV on the Grid

Which factor has the most significant impact on distribution system value?

- A. Feeder Characteristics**
- B. Location** (*Guided vs. Unguided Deployment*)
- C. PV Penetration** (*High vs. Low*)
- D. Scale** (*Rooftop vs. Centralized*)



Answer: It depends

Setting the Context: DER as a Game Changer

DER as a catalyst: two-way power flows introducing challenges to existing utility planning approaches.

- DER operation not uniform across the system.
 - Production curves dispersed, influenced by factors not connected to loads.
- Spatial granularity required in forecasts. But how much?
 - What is the sweet spot between data granularity and forecast uncertainty?
 - Should load forecasts be at the same level of granularity as DER forecasts?
 - What are the data requirements/needs?
 - What tool capabilities are needed?
- Utility load forecasting as more art than science

EPRI Research: Preliminary Industry Survey Results

Survey Method / Objectives

- Identify approaches / tools / methodologies used today
 - Current forecasting of DR, EE, and DER
-
- What information informs today's forecasts?
 - Future Needs for Improved Load Forecasting
 - Data Needs and Sources
 - Customer Segmentation
 - Opportunities for Improvements

Status

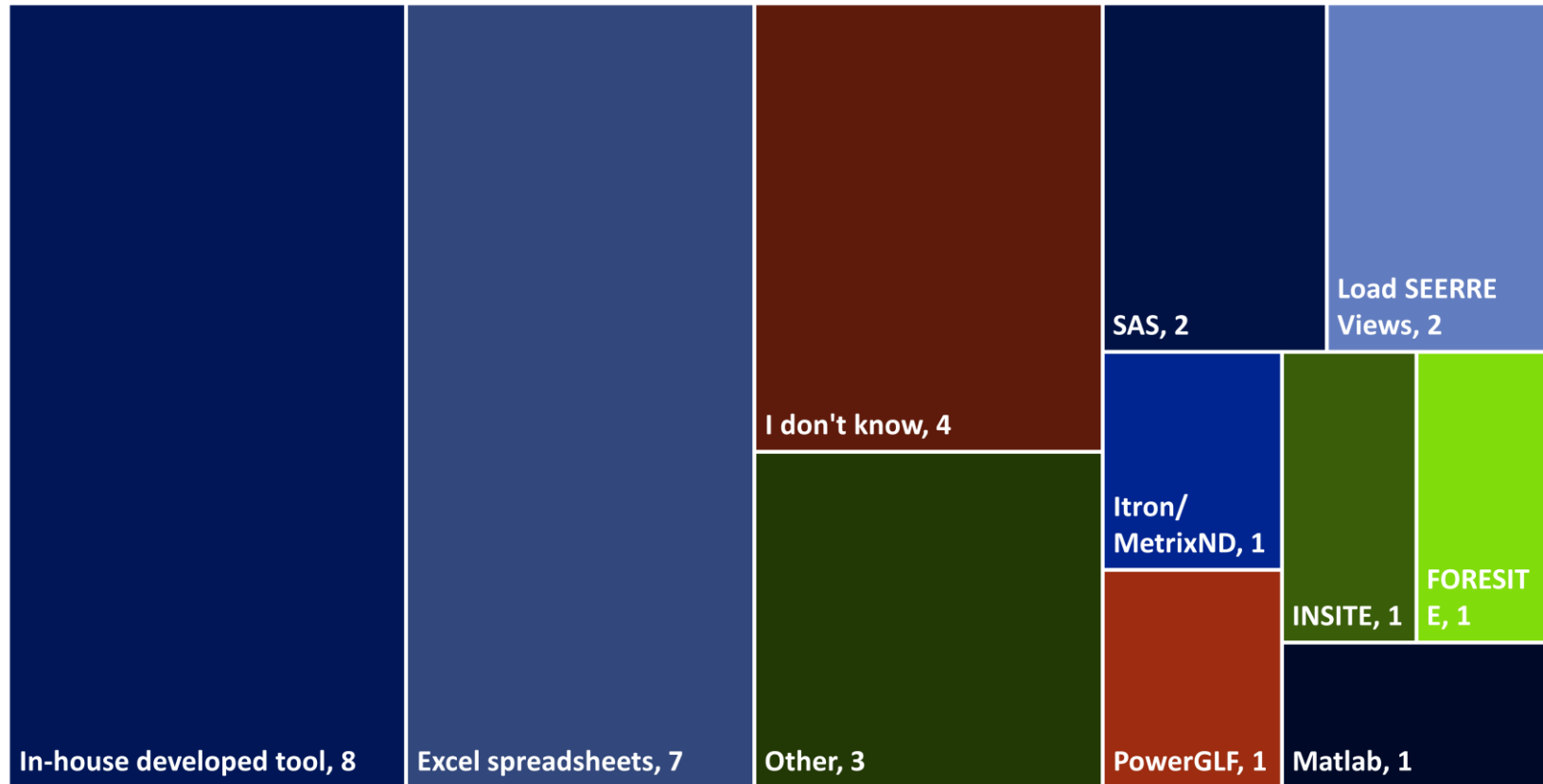
- 39 questions
- 21 utility responses
 - Domestic, international; IOU's, Muni's



Final survey results will be published in end-year deliverable

Preliminary Result

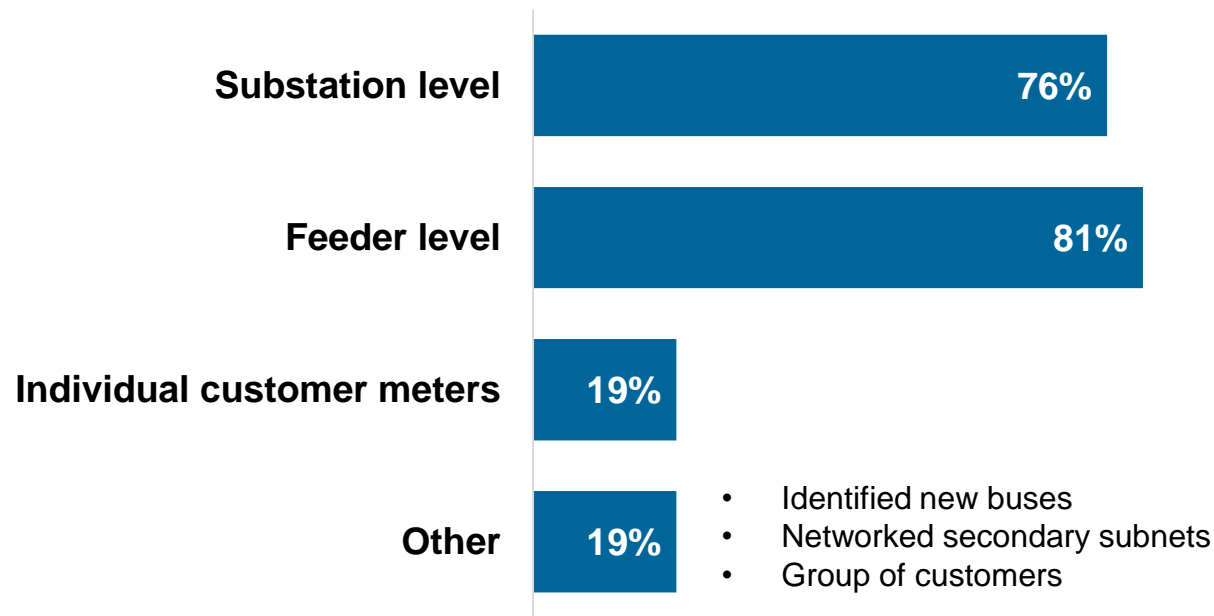
What Load Forecasting Software Do You Use?



Majority use in-house tools

Preliminary Result

What Levels Is Forecasting Performed?



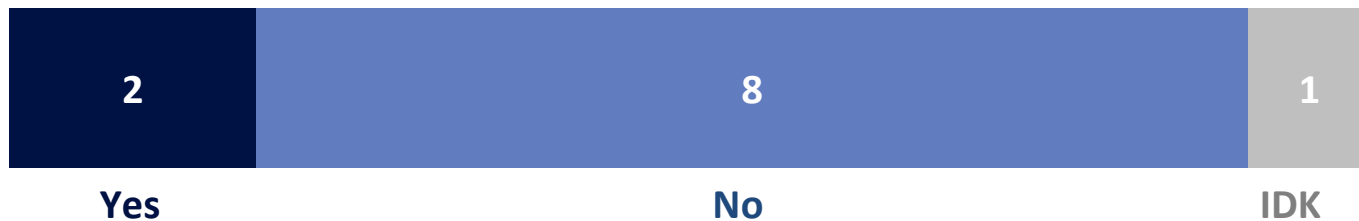
Many utilities perform forecasts at multiple levels, with the majority performing feeder level

Preliminary Result

How Satisfied Are You with the Current Level of Your Forecast Accuracy?

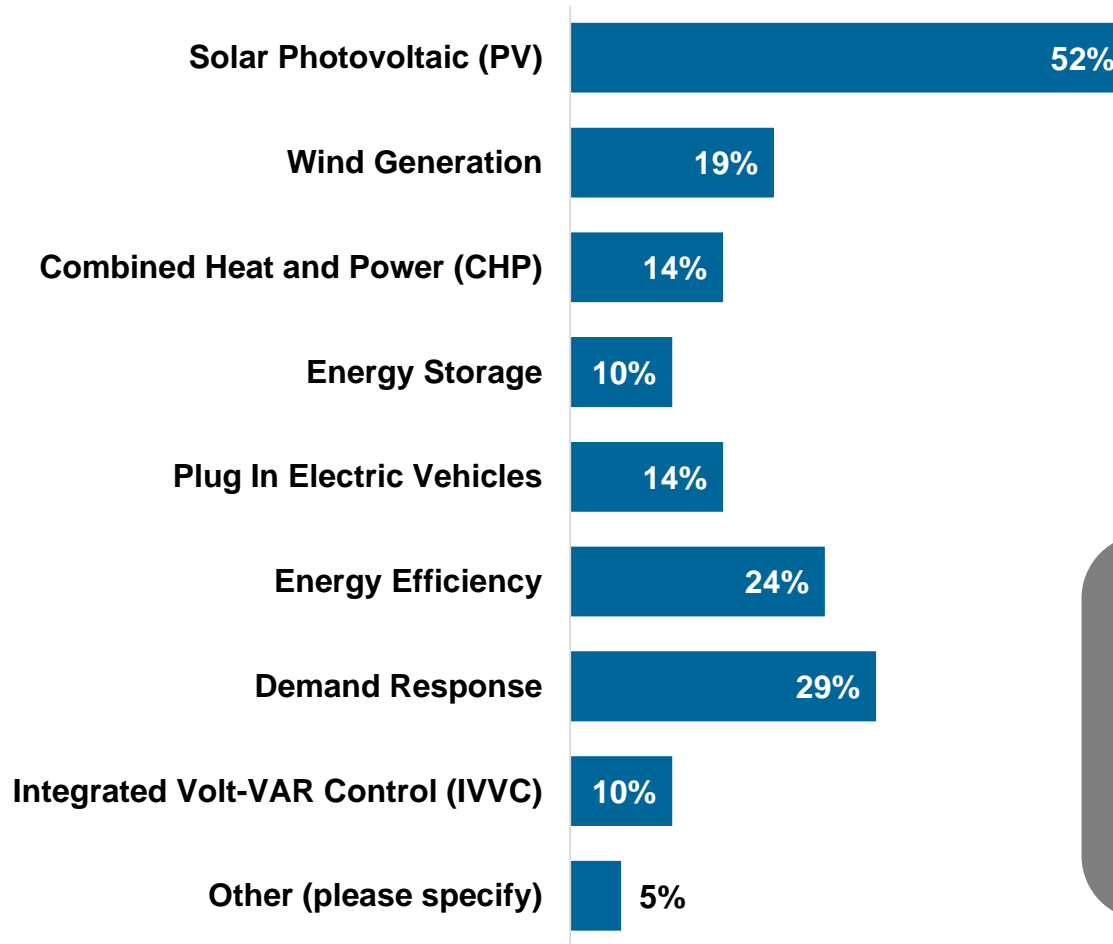


Are there any efforts to verify past mid-term forecasts? Verify implies "checking the mid-term forecasts with the actual mid-term values"



Preliminary Result

Do Your Forecasts Account for Existing DER and Other Factors?

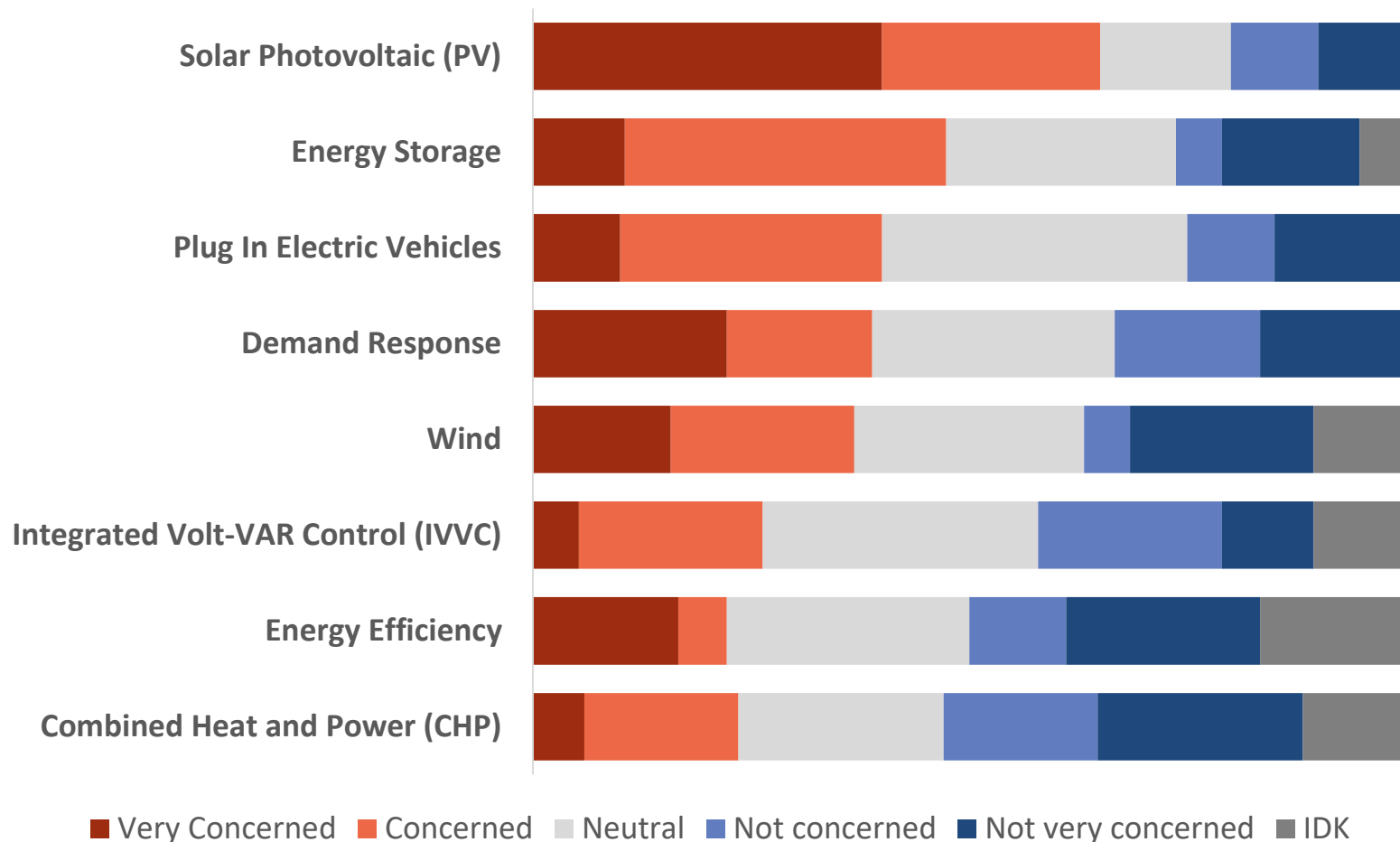


**6 participants do not
include DER**

**None of the participants
account for every factor**

Preliminary Result

What Is Your Level of Concern Regarding Your Ability to Forecast the Following Technologies:



Preliminary Result

What is the Effect of DER on Changes in your Forecasting Methods?



Note: One respondent declined to answer.



Together...Shaping the Future of Electricity