Tracking Long-term Utility Planning Assumptions and Procurement Decisions

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IRP Contemporary Issues Technical Conference

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Agenda

- Resource Planning Portal (RPP)
  - Conception
  - Main components
  - Key statistics
- Existing research applications
  - Comparing planning and procurement
  - Trends in market transactions
- Future research
  - Regional resource adequacy assessment

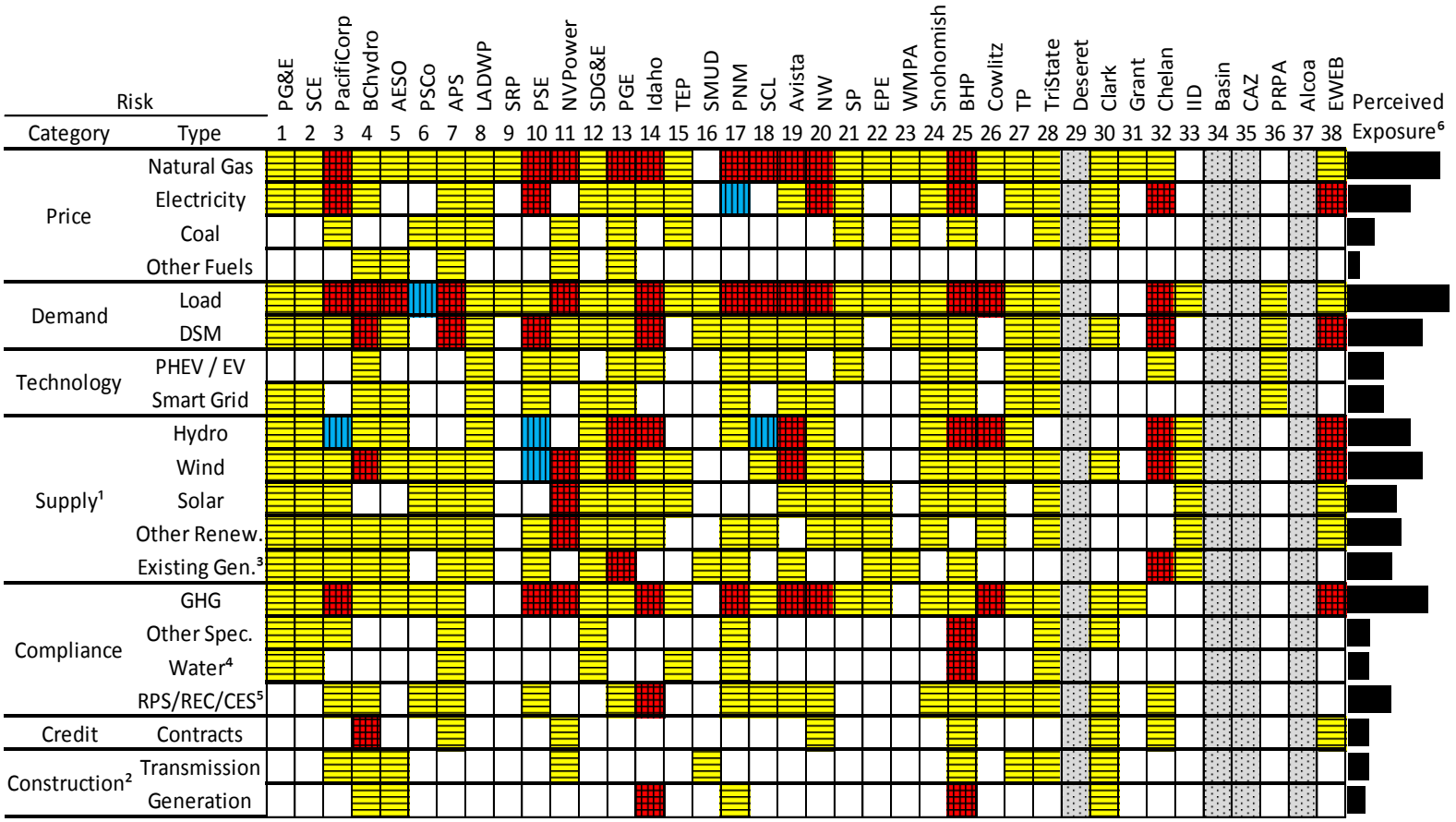
RPP Origins: Wilkerson et al. (2014)

- Comprehensive review of Western U.S. integrated resource plans (90% of Western U.S. elec. sales)

- Evaluate plant retirements; load, DSM, and generation mix forecast; risk categories and assessment techniques.

- Reported inconsistency and lack of clarity in information included in IRP:
  - Nominal vs available capacity
  - Real vs nominal dollars for fuel, carbon, and capital costs
  - Proprietary forecast data for fuels, electricity, or others
  - Absence of DSM data, especially for smaller LSEs

RPP Origins (cont.)



key:
- Scenario or Sensitivity Analysis
- Probabilistic Analysis
- Scenario/Sensitivity and Probabilistic
- Not identified in plan
- Plan not available
- Aggregate of perceived exposure to risk

notes:
1. All LSEs considered traditional future generation resources, so not summarized here
2. Risk to construction time or cost overruns
3. LSE considered changes to existing generation such as early retirements or upgrades
4. Risk to water contamination or exceeding use limits
5. LSE considered some form of energy mix compliance or credit including Renewable Portfolio Standards, Renewable Energy Credits, Clean Energy Standards, Installed Tax Credits, Production
6. Data bar is sum of counts for the number of LSEs that addressed risk in their portfolios. One count for the use of Scenario or Probabilistic Analysis; two counts for those that considered both.

Resource Planning Portal

Resource Planning Portal is a free, web-based tool that allows users to:

(1) Input long-term electric utility planning information in a consistent format

(2) Benchmark planning assumptions across jurisdictions and load serving entities (LSE) and

(3) Visualize and output results in a standardized format for deeper analysis.

Landing page: http://resourceplanning.lbl.gov

The Resource Planning Portal is a web-based tool that allows users to:

1. Input electric utility planning information in a consistent format
2. Benchmark planning assumptions across jurisdictions
3. Output results in a standardized format for deeper analysis.

- Standardized Data Entry
- Compare Long-term Electric Utility Planning Assumptions
- Learn More/Contact Us

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The Resource Planning Portal was funded by the National Electricity Delivery Division of the U.S. Department of Energy's Office of Electricity (OE) Delivery and Energy Reliability under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.

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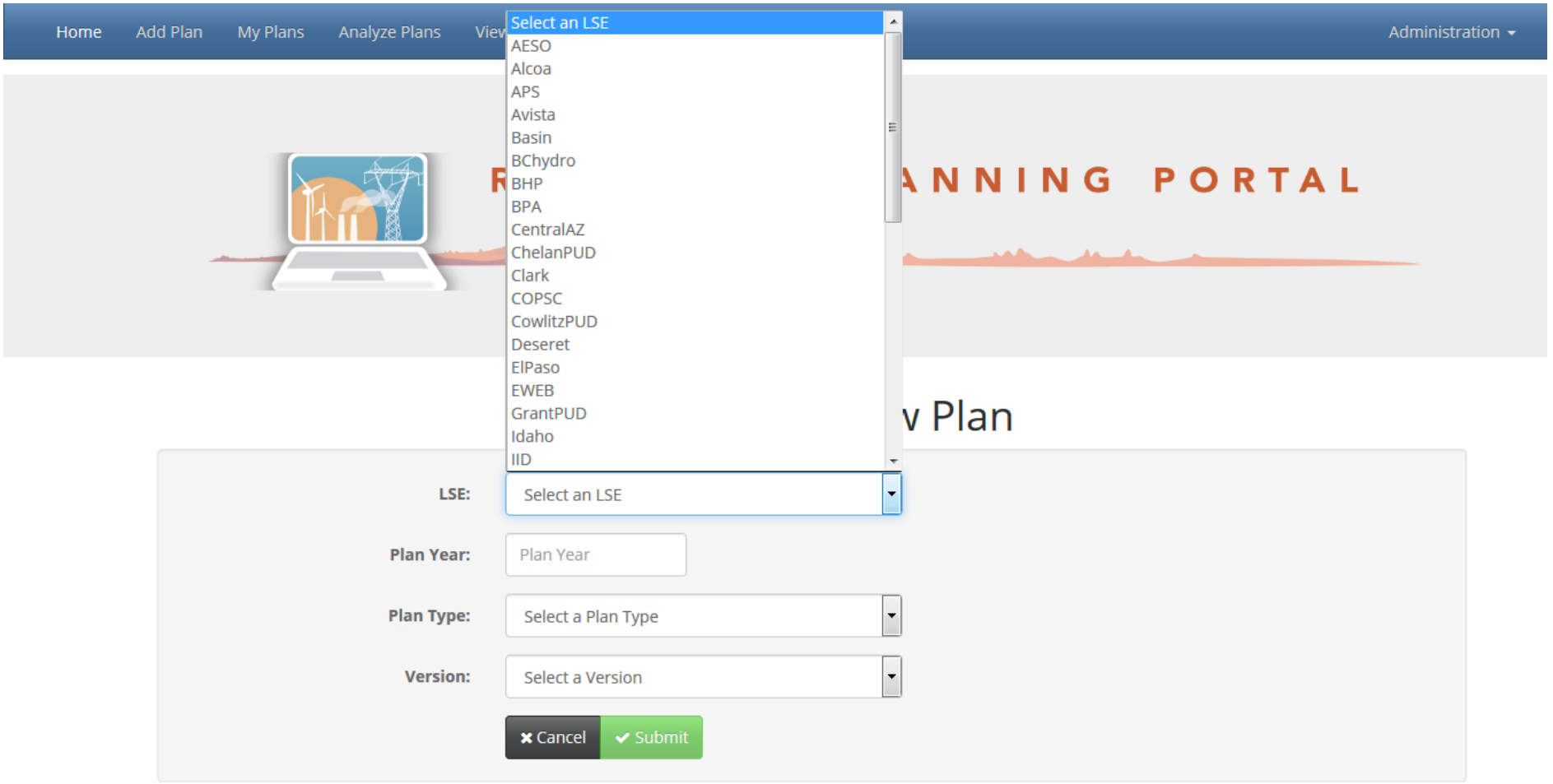
Entering a new plan



Input plan - Data entry

1. Basic Plan Information
2. Load Forecasts and DSM
   - I. Base Case and Load Forecast
   - II. Energy Efficiency Program Savings
   - III. DR Peak Demand Reduction
3. Power Plants and Contracts
   - I. Energy Production Forecasts
   - II. Plants
   - III. Contracts
4. Transmission, Distribution and Storage
5. Fuel and Environmental Assumptions
   - I. Fuel Price Assumptions
   - II. Fuel Purchase Agreements
   - III. Carbon Price Assumptions
   - IV. Other Assumptions
   - V. New Generation Capital Costs
6. Loads and Resources
7. Files/Reference

Basic Plan Information

LSE	APS
Plan Year	2014
Published Date	04/01/2014
Plan Type	Integrated Resource Plan (IRP)
Version	Original
Forecast Horizon	15
General Comments	Attachments hold relevant information. They start from p. 198 in the general document. Analysis ranges from 2014 to 2029
Status	✔ Database is up-to-date

Save Changes | Cancel Changes

Input plan – Load and DSM forecasts

Back to List

1. Basic Plan Information
2. Load Forecasts and DSM
   - I. Base Case and Load Forecast
     - a. Energy (GWh)
     - b. Peak Demand (MW)
   - II. Energy Efficiency Program Savings
   - III. DR Peak Demand Reduction
3. Power Plants and Contracts
4. Transmission, Distribution and Storage
5. Fuel and Environmental Assumptions
6. Loads and Resources
7. Files/Reference

Base Case Load Forecast Energy

Source Attachment C.1(B) p. 245-252

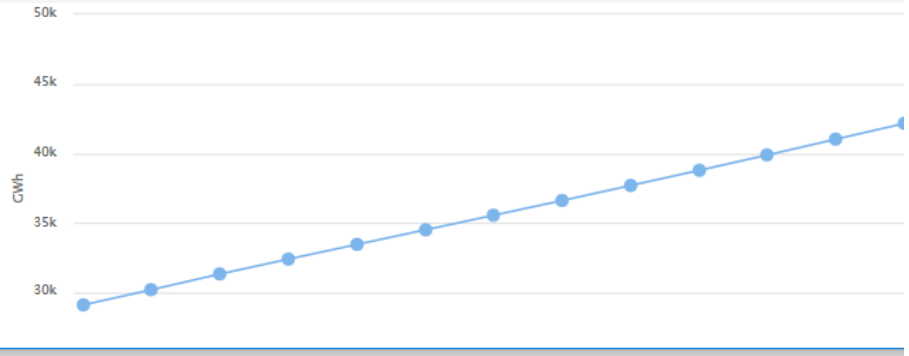
Notes Annual Energy Consumption Prior to EE/DE

Status ✔ Database is up-to-date

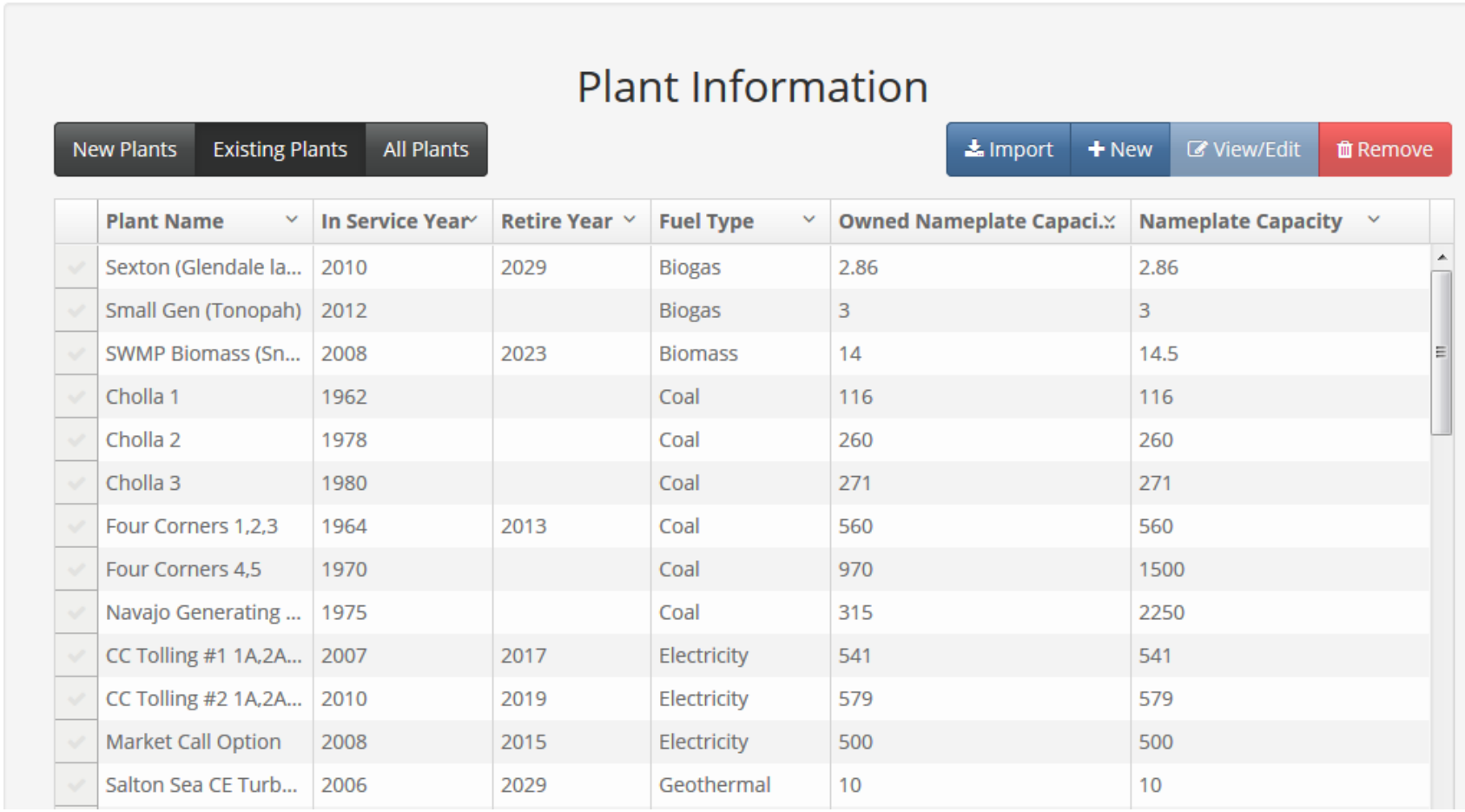
Save Changes | Cancel Changes

Yearly Forecast Data

Year	GWh
2017	29,134.877
2018	30,230.315
2019	31,358.51
2020	32,427.163
2021	33,480.136
2022	34,527.609
2023	35,577.46
2024	36,634.146
2025	37,713.144



Input plan – Supply side resources



Plant Information

New Plants | Existing Plants | All Plants

Import | + New | View/Edit | Remove

Plant Name	In Service Year	Retire Year	Fuel Type	Owned Nameplate Capaci...	Nameplate Capacity
Sexton (Glendale la...	2010	2029	Biogas	2.86	2.86
Small Gen (Tonopah)	2012		Biogas	3	3
SWMP Biomass (Sn...	2008	2023	Biomass	14	14.5
Cholla 1	1962		Coal	116	116
Cholla 2	1978		Coal	260	260
Cholla 3	1980		Coal	271	271
Four Corners 1,2,3	1964	2013	Coal	560	560
Four Corners 4,5	1970		Coal	970	1500
Navajo Generating ...	1975		Coal	315	2250
CC Tolling #1 1A,2A...	2007	2017	Electricity	541	541
CC Tolling #2 1A,2A...	2010	2019	Electricity	579	579
Market Call Option	2008	2015	Electricity	500	500
Salton Sea CE Turb...	2006	2029	Geothermal	10	10

Input plan – Costs and environmental assumptions

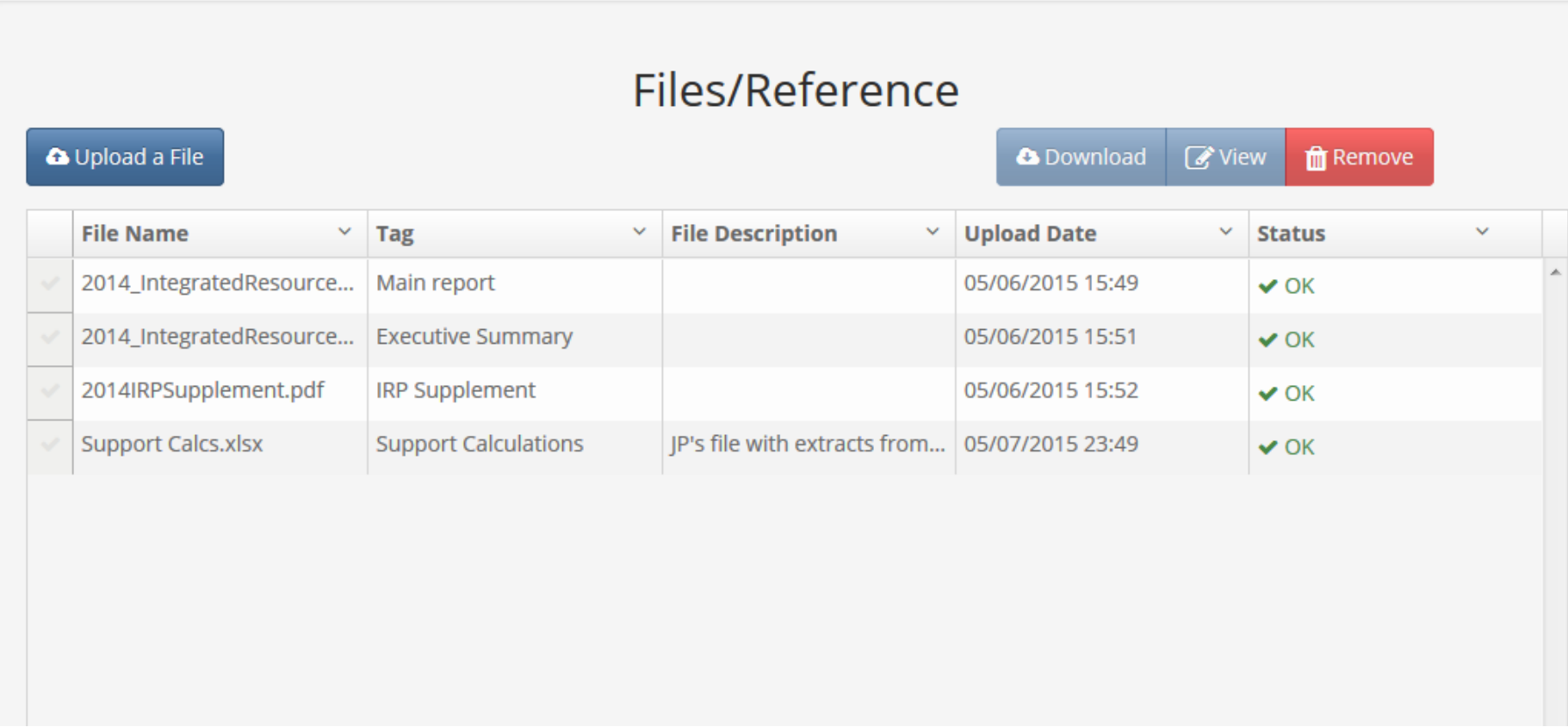
1. Basic Plan Information
2. Load Forecasts and DSM
3. Power Plants and Contracts
   - I. Energy Production Forecasts
   - II. Plants
   - III. Contracts
4. Transmission, Distribution and Storage
5. Fuel and Environmental Assumptions
   - I. Fuel Price Assumptions
   - II. Fuel Purchase Agreements
   - III. Carbon Price Assumptions
   - IV. Other Assumptions
   - V. New Generation Capital Costs
6. Loads and Resources
7. Files/Reference

New Generation Capital Costs

+ Ne

Resource	Time Money Value	Capital Cost	Fixed Cost
Geothermal	Real Dollars	4880	83
Solar - DG	Real Dollars	3870	26
Solar - DG	Real Dollars	2696	26
Solar - PV	Real Dollars	2098	25
Wind	Real Dollars	2250	40
CCCT	Real Dollars	965	5.18
SCCT	Real Dollars	1073	5.5

Upload IRP documents

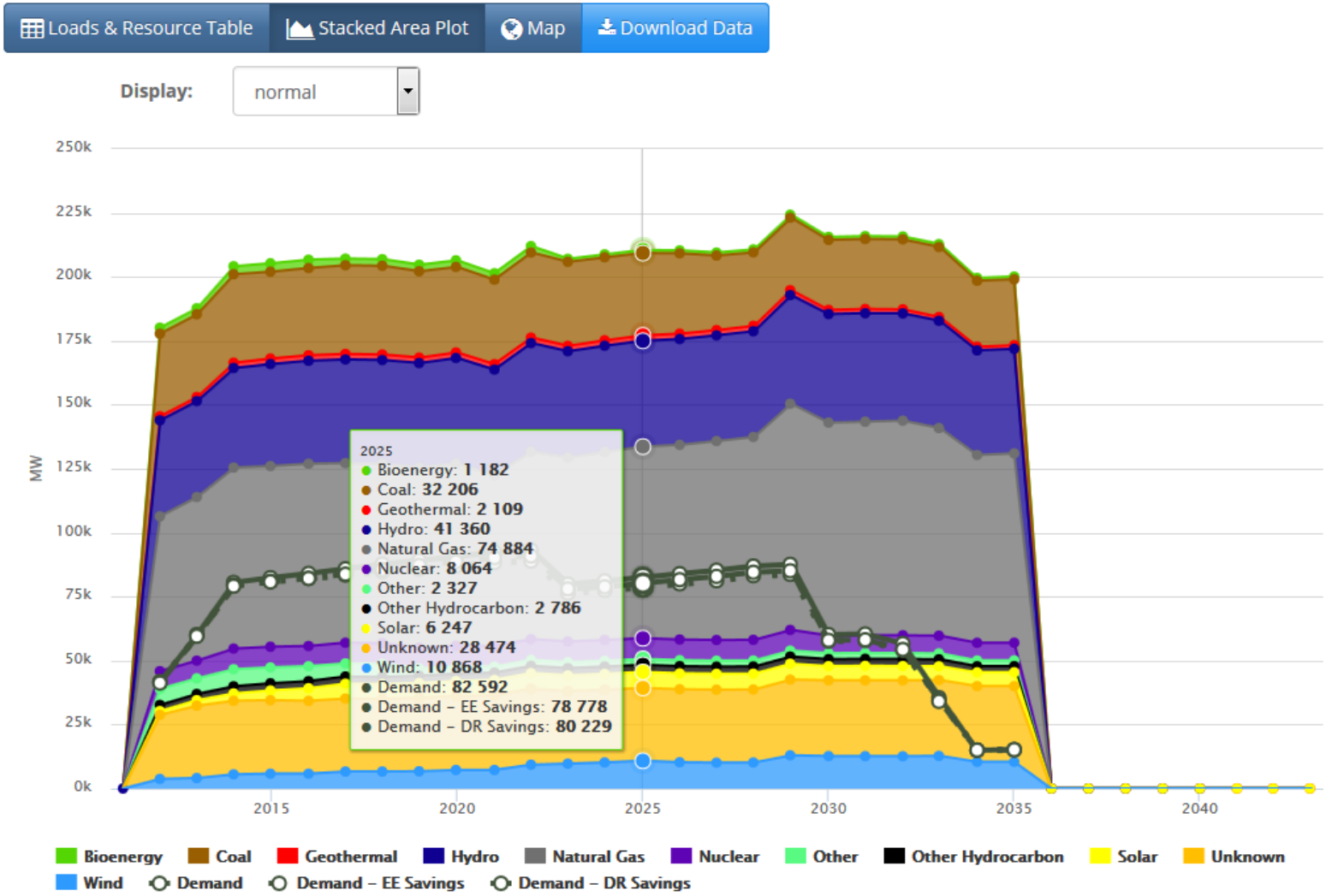


View/download data—loads and resources (L&R) table

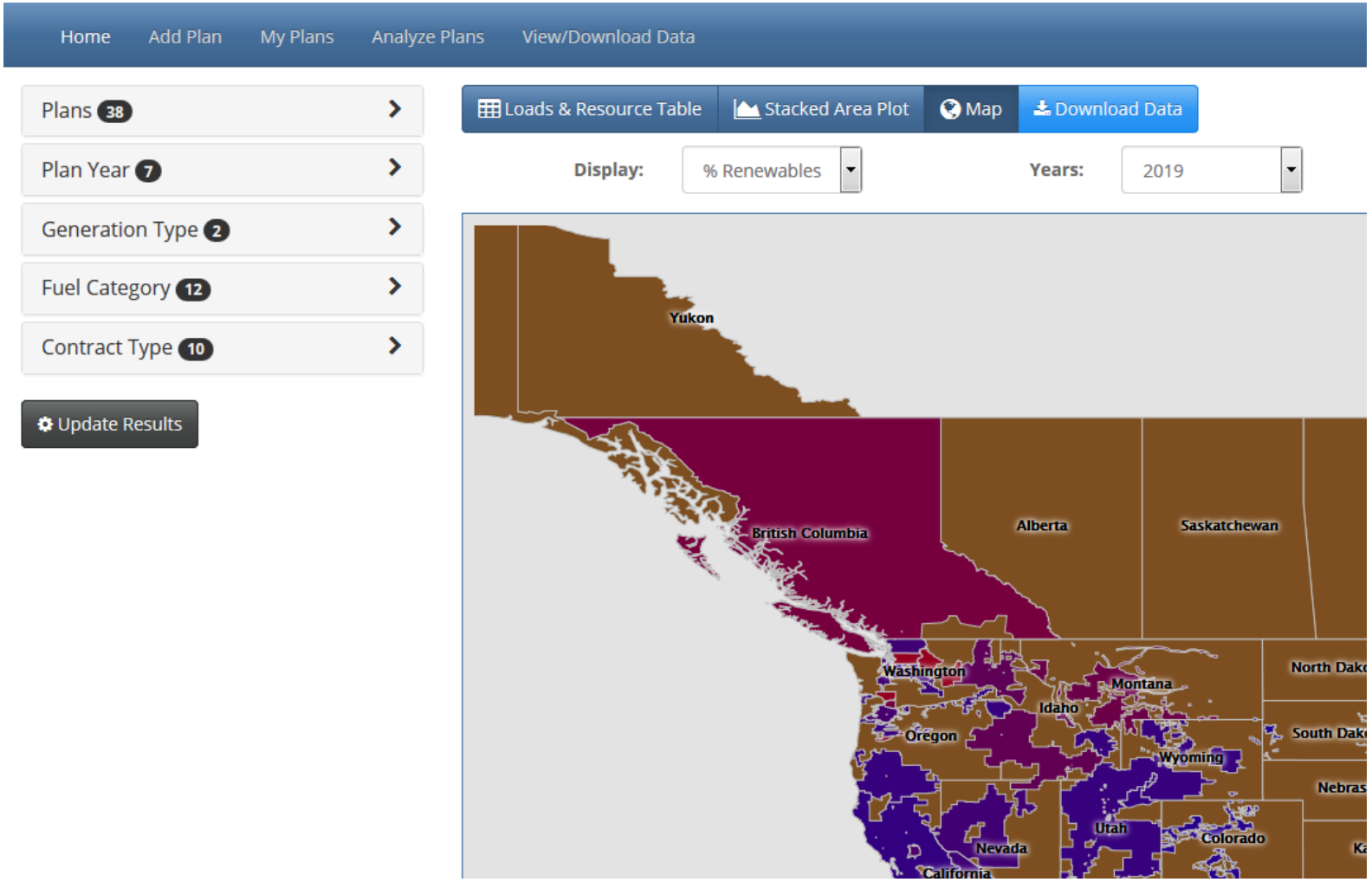
Loads and Resources

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	202
Loads Requirements (MW)	**0**	**0**	**7,146**	**7,292**	**7,573**	**7,881**	**8,180**	**8,481**	**8,772**	**9,071**	**9,373**	**9,671**	**9,965**	**10,260**	**10,558**	**10,8**
Savings (MW)																
Energy Efficiency	0	0	109	267	434	594	738	877	1,008	1,096	1,130	1,174	1,230	1,264	1,307	1,3
Demand Response	0	0	21	21	26	26	26	26	51	76	126	151	176	175	200	2
Total Savings	**0**	**0**	**130**	**288**	**460**	**620**	**764**	**903**	**1,059**	**1,172**	**1,256**	**1,325**	**1,406**	**1,439**	**1,507**	**1,5**
Net Load Requirements	**0**	**0**	**7,016**	**7,004**	**7,113**	**7,261**	**7,416**	**7,578**	**7,713**	**7,899**	**8,117**	**8,346**	**8,559**	**8,821**	**9,051**	**9,2**
Existing Resources																
Bioenergy	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	
Coal	1,522	962	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,932	1,9
Geothermal	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	
Natural Gas	480	480	3,327	3,327	3,327	3,327	3,327	3,327	3,327	3,177	3,177	3,177	3,177	3,177	3,177	3,1
Nuclear	0	0	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,146	1,1
Other	1,620	1,620	2,138	1,638	1,638	1,097	1,097	518	518	0	0	0	0	0	0	
Other	0	0	70	70	70	70	70	70	70	70	70	70	70	70	70	

View/download data: charts



View/download data: maps



RPP statistics

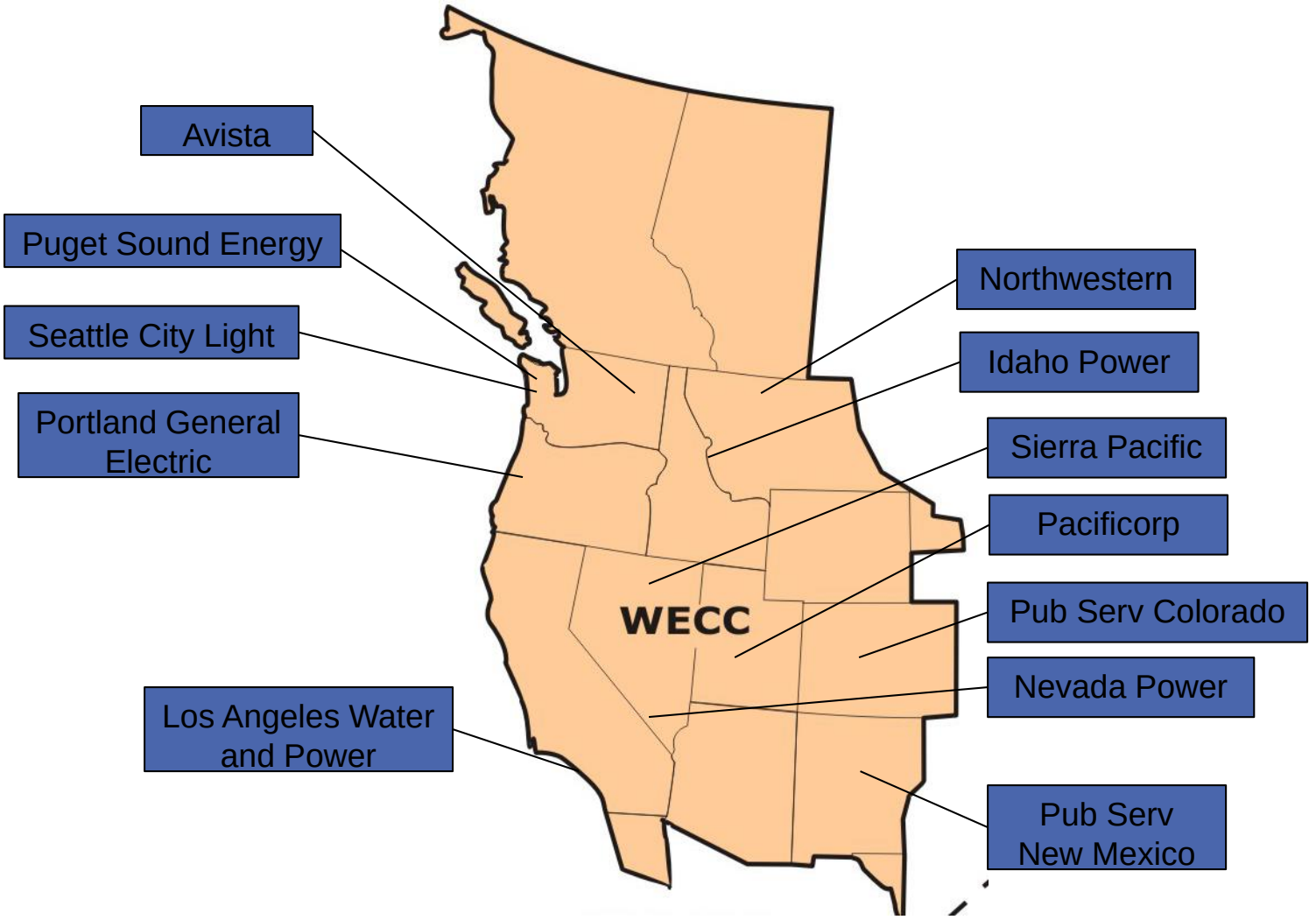
- 126 plans uploaded (goal=150)
  - 2003 to 2018
- Load serving entities:
  - 39 Western
  - 7 Eastern
  - 8 Midwest
- ~1/3 U.S. installed capacity (>340 GW)
- 22% of U.S. electricity retail sales (~820 TWh)
- ~200 registered users

Resource	Capacity (GW)
Coal	79.9
CCCT	68.1
SCCT	65.2
Nuclear	35.3
Hydro	37.3
Wind	14.5
Unknown/Other	9.2
Solar	5.0
Demand Response	8.8

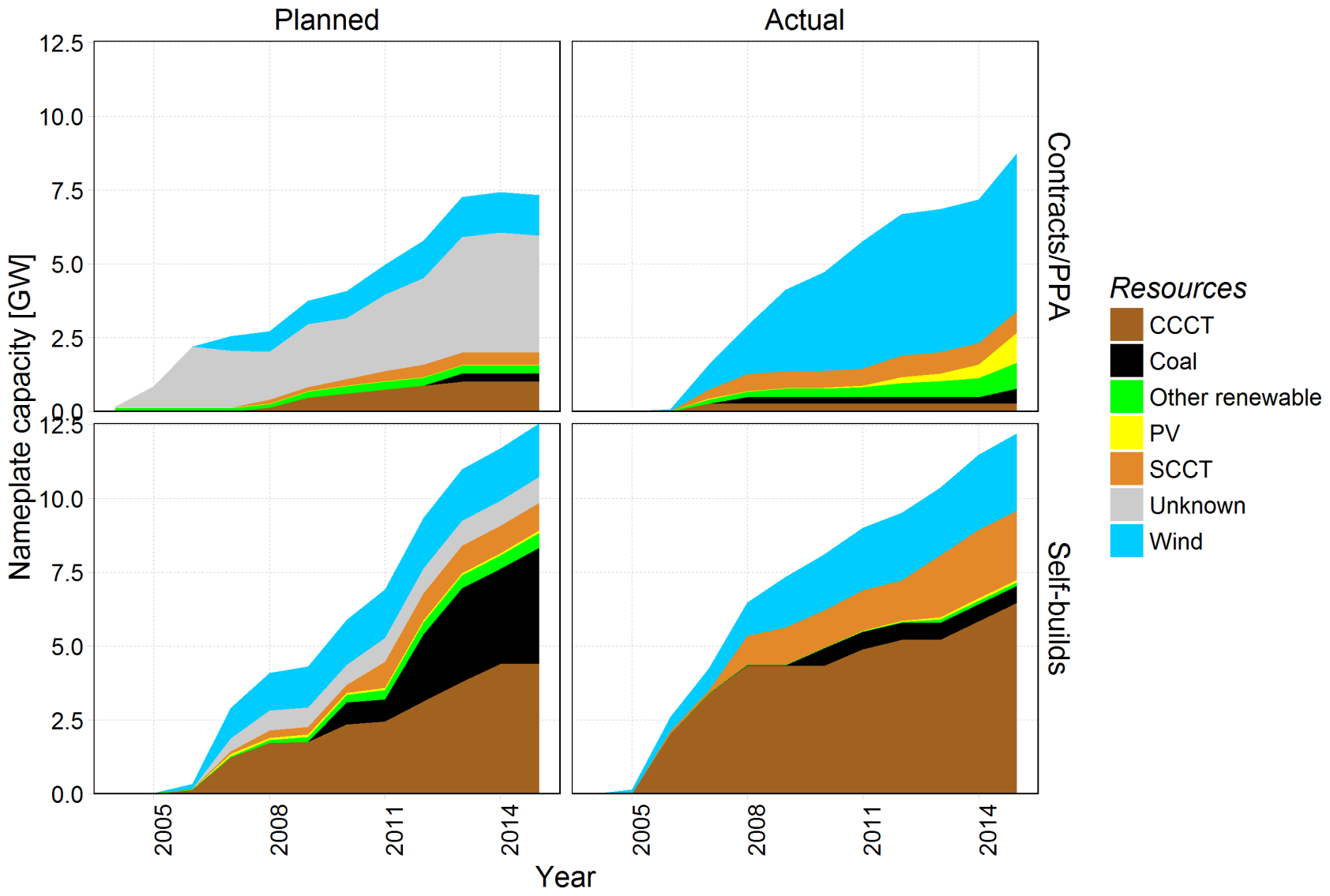
RPP Application: Planning to procurement

- In principle, IRP should lead to affordable and reliable electricity service through cost-effective and risk-managed resource acquisition
- However, this premise has never been tested
- How do planned acquisitions compare to actual procurement?
- If planned and procured capacities are different…
  - Why do they differ?
  - What is the value of IRP?

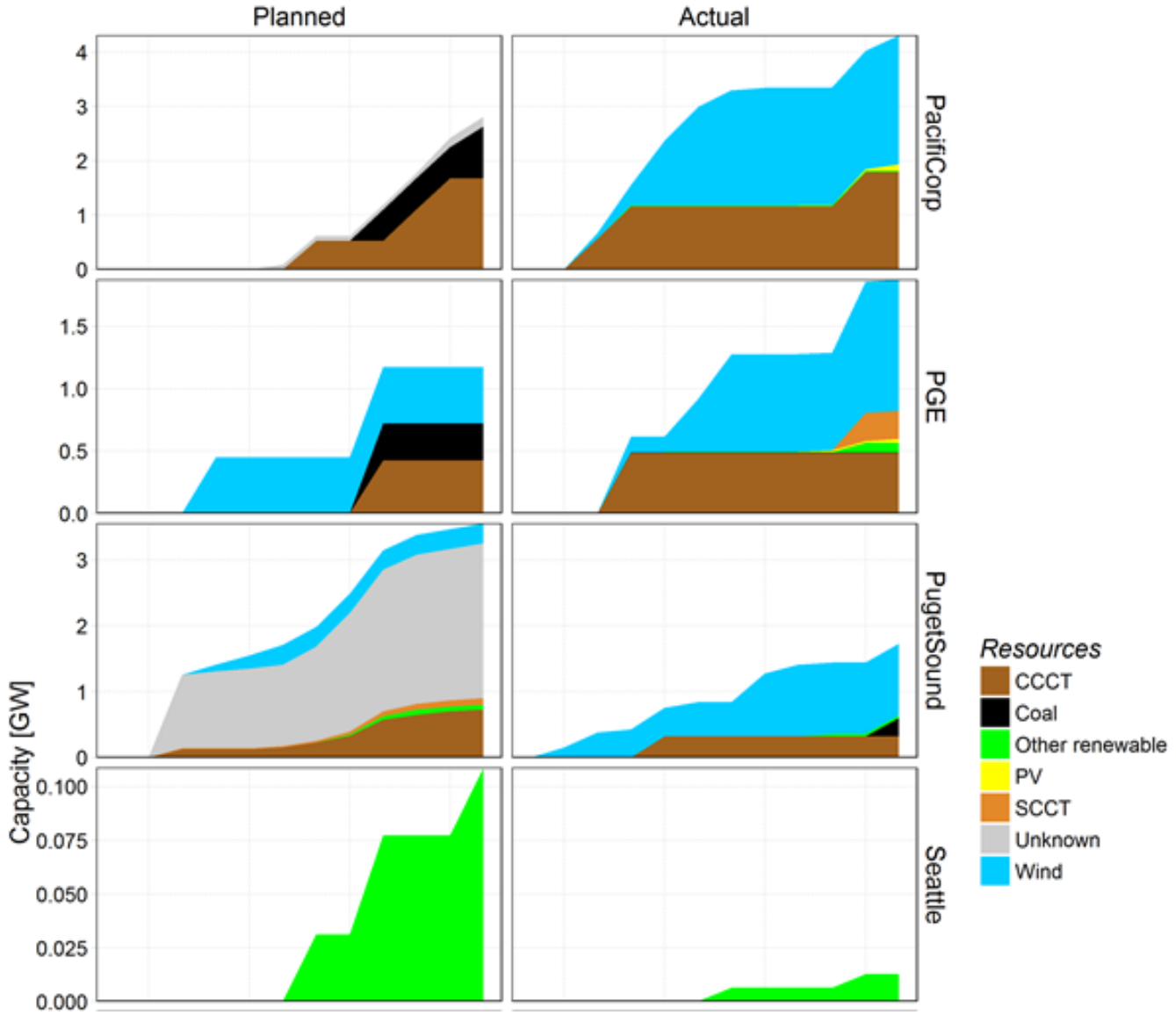
Method, sources, and sample of LSEs



More wind and less coal than originally planned



Larger differences at the LSE level



Differences explained by changing environments

- We find **exogenous** and **endogenous** sources of uncertainty

  - Exogenous: Things generally beyond the control of the LSE
    - Retail choice is a major source of uncertainty for the utility
    - DSM programs performed better than anticipated

  - Endogenous: Things that may be influenced by utility behavior or regulator
    - Timing of procurement influenced by uncertain RFP processes
    - Changes in RPS and DSM requirements explain higher acquisition of renewable resources and reduced load growth

Weak link between planning and procurement

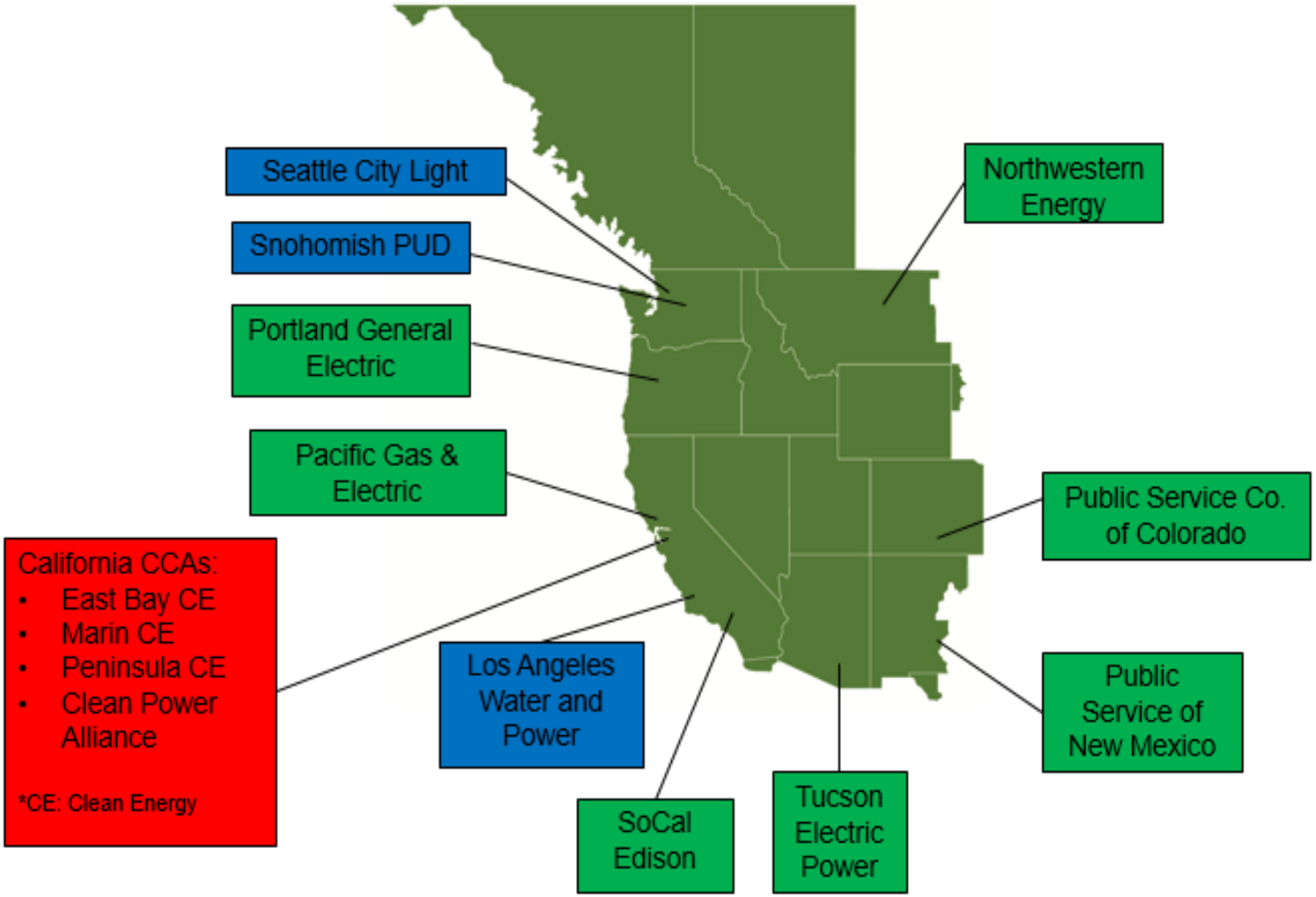
- We find no evidence that risk analysis information developed in selected IRPs was used to inform procurement levels, mix of resources, or buy vs. build decisions

- Value of new information is very high:
  - Simulations/analysis for procurement decisions re-estimated with most recent available information
  - Little or no reference to prior IRP or updated planning results when seeking procurement approval

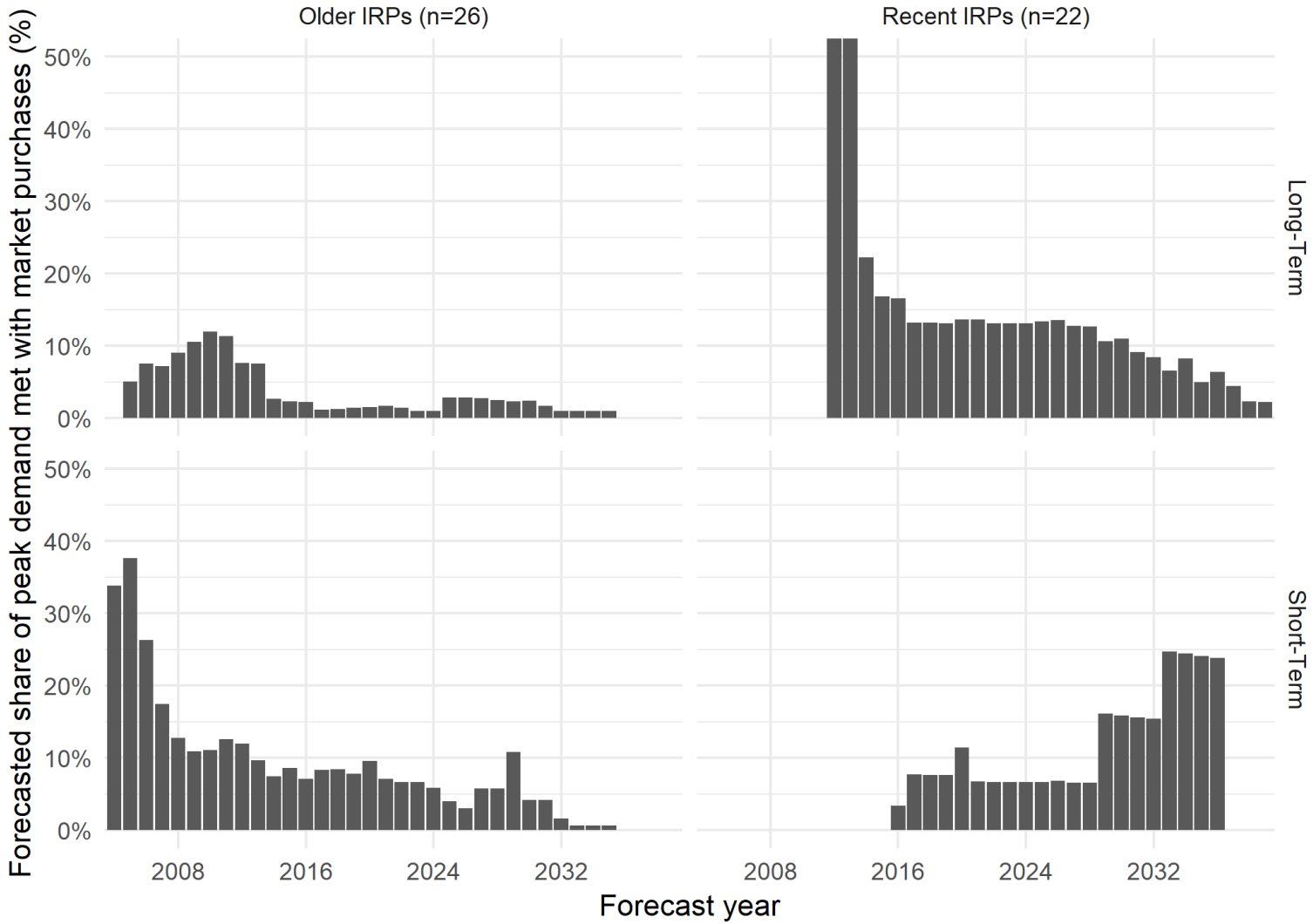
RPP application: Market transactions

- Investigate trends in short- and long-term market purchases by (mostly) vertically-integrated utilities
- Paper studies how market purchases are assessed in IRPs and a quantitative analysis of trends in their use
- For a sample of IRPs, we find that:
  - Sophistication of market assessments vary widely, from a simple spot price forecast to a lengthy regional assessment
  - Two thirds of LSEs do not include short-term transactions in their portfolios; half do not even include them as possible resources.

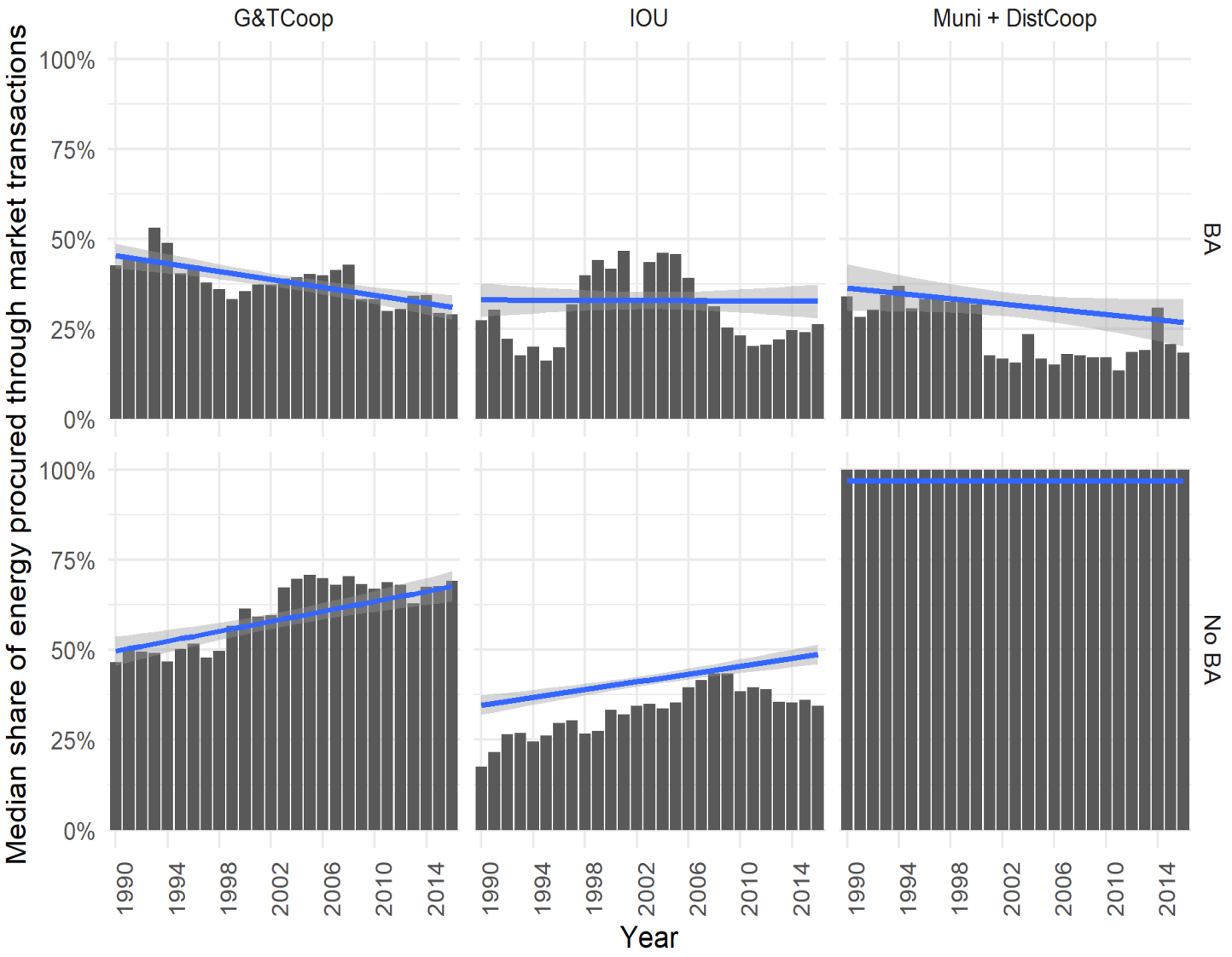
RPP application (cont.)



Forecast use of market purchases in IRP



Actual use of market purchases



Future work: Resource adequacy (RA) in the West

- Interviewees of market transactions paper commented on the need for a regional RA assessment

- In collaboration with Western Interstate Energy Board (WIEB), study will cover:
  - Surveying existing RA modeling frameworks and tools
  - Adapting the RPP to include all required data to perform RA calculations

- Develop an online resource adequacy assessment tool (part of RPP?)

For more information

- Resource Planning Portal:
  - https://resourceplanning.lbl.gov/

- Integrated resource planning research
  - Wilkerson, Jordan, Peter Larsen, and Galen Barbose. “Survey of Western U.S. Electric Utility Resource Plans.” Energy Policy 66 (March 2014): 90–103.
  - Carvallo, Juan Pablo, Peter H. Larsen, Alan H. Sanstad, and Charles A. Goldman. “Long Term Load Forecasting Accuracy in Electric Utility Integrated Resource Planning.” Energy Policy 119 (August 1, 2018): 410–22.
  - Carvallo, Juan Pablo, Alan H. Sanstad, and Peter H. Larsen. “Exploring the Relationship between Planning and Procurement in Western U.S. Electric Utilities,” June 2017.
  - Carvallo, Juan Pablo, Sean P. Murphy, Alan H. Sanstad, and Peter H. Larsen. “The use of market purchases by vertically-integrated U.S. electric utilities”, (forthcoming).
  - Carvallo, Juan Pablo, Sean P. Murphy, Nan Zhang, Benjamin Leibowicz, and Peter H. Larsen. “The economic value of integrating distributed energy resources in electric utility resource planning”, (forthcoming).

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