Integrated Resource Planning

Board discussion on Planning Objectives, Load Resource Balance,
Resources to Consider, and Potential Portfolios

June 2015

The Utility Generation Balancing Act

- Utilities must consider each of the three key factors when planning resources

Themes

More local
More distributed
More intermittent
More need for storage
More integrated with grid-control devices

More efficient
Smarter
Fuel shifting from fossil fuel to electric
Increased use of air conditioning
Transition of transportation to EVs
Wise use of all energy.

Managing increasingly distributed diverse and intermittent energy sources for increased reliability.

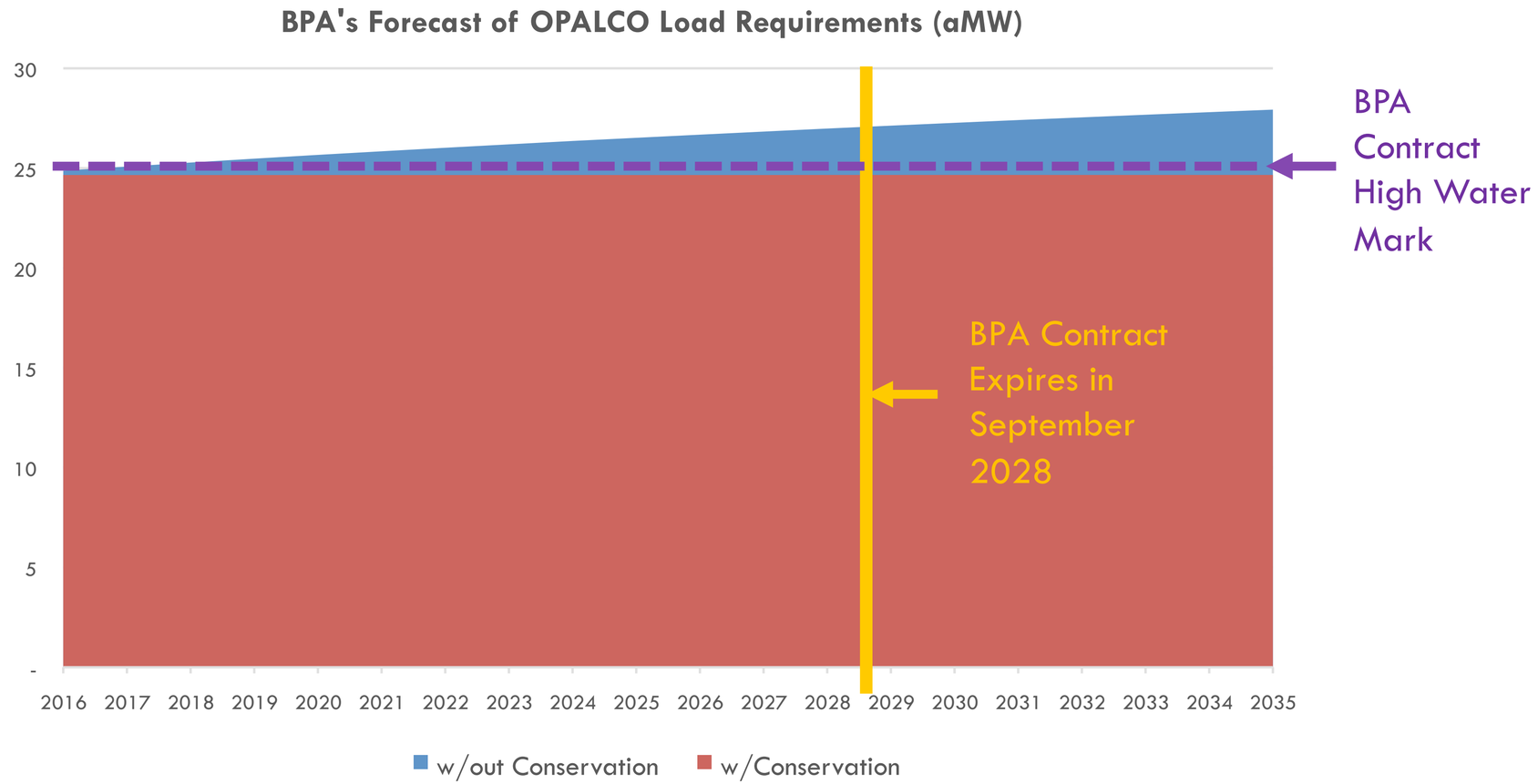
Load	Comments
Heating: Conventional	biggest single use of energy
Heating: Heat Pump	decreases winter load
Cooling: AC, Heat Pump	increases summer load
Water Heater: Conventional	
Water Heater: Heat Pump	decreases year-round load
Lighting: Conventional	
Lighting: LED	decreases year-round load
Pumps	
Agriculture: e.g. Pot Growers	
Electronics	
Electric Vehicles: Personal, Fleet	good candidate for TOU night charging
EV Charging Stations: Community	lower cost cleaner alternative to fossil fuel
EV Public Transit, EV ZipCars	support car sharing and walk on ferry tourism

Questions:

Are rebates for heat pumps adequate? Should we be rebating to encourage fuel switching from fossil fuel to electric?

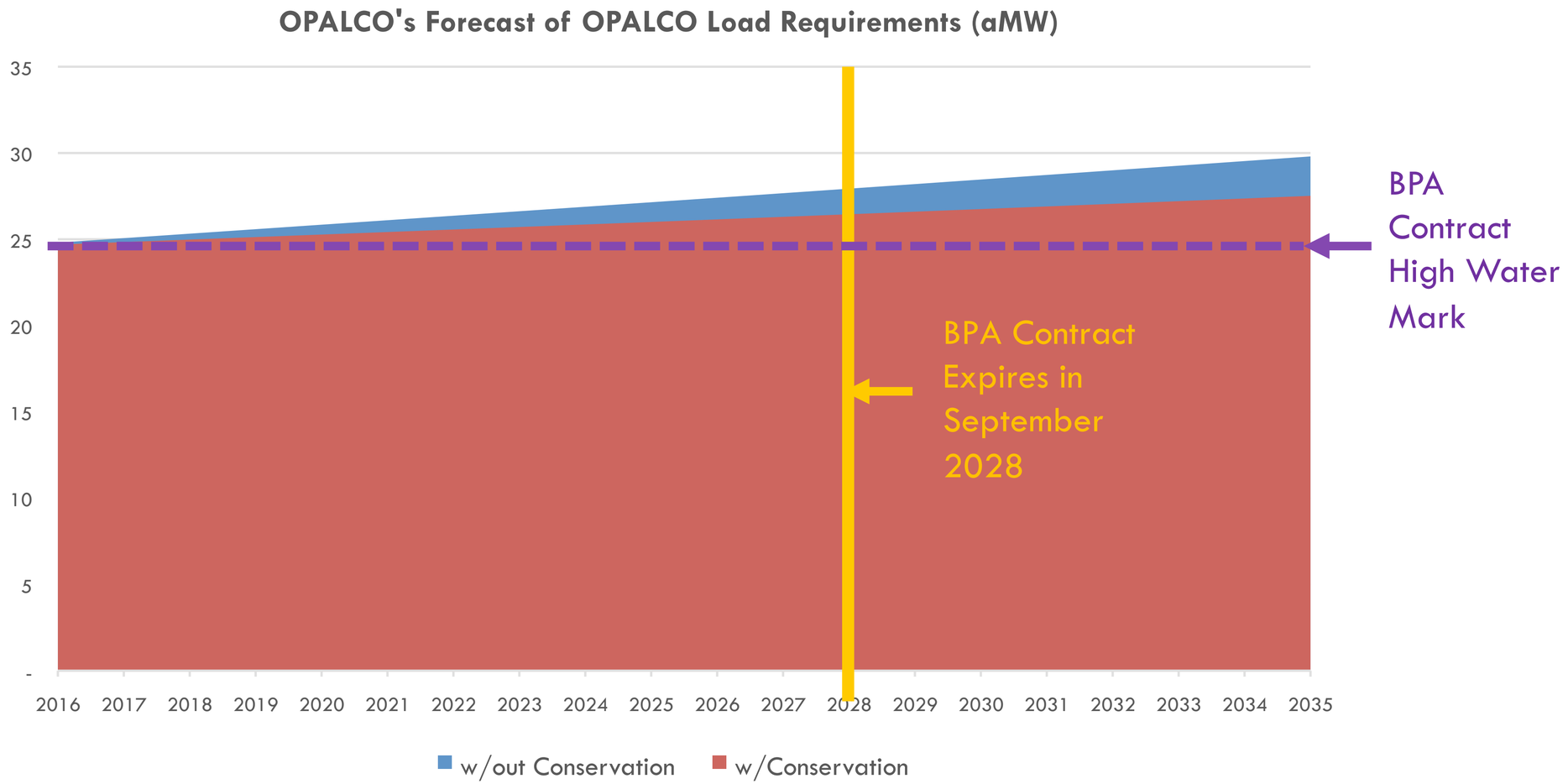
BPA's Load Forecast with and without Conservation

- Conservation is the first resource deployed



Note: Loads net of conservation flat at 24.7 aMW; less than OPALCO's contract high water mark of 25.1 aMW in all years (conservation is keeping OPALCO below it's HWM).

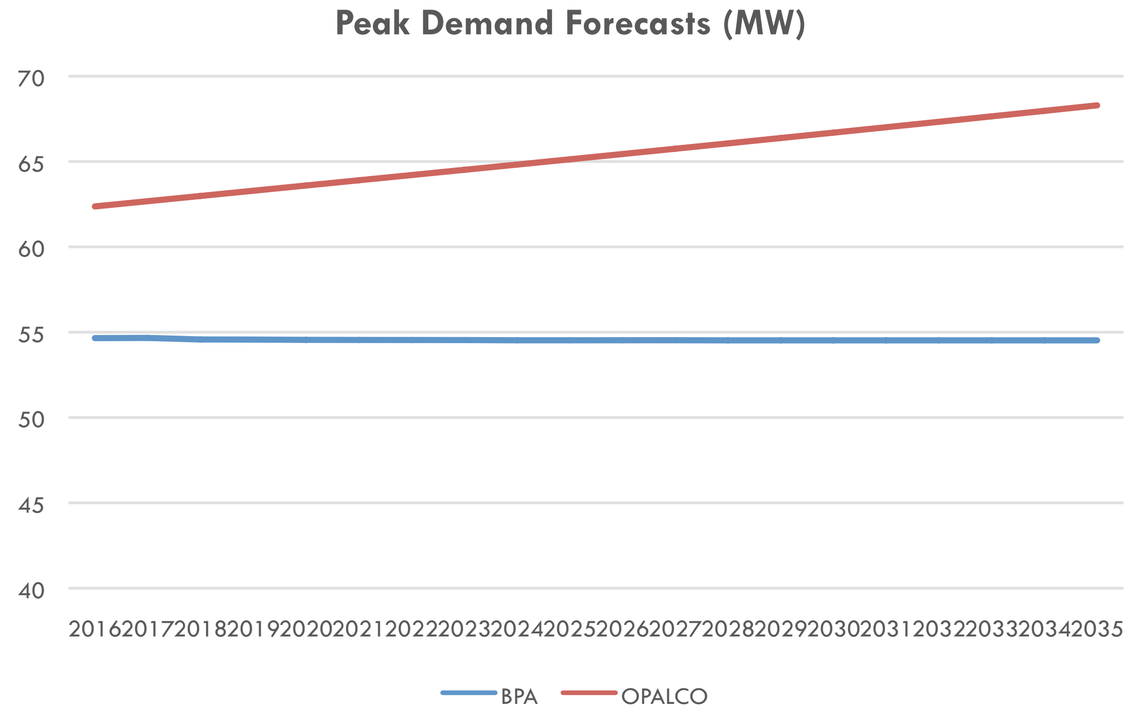
OPALCO's Load Forecast with and without Conservation



Note: Conservation assumed to be 1,000 MWh per year per OPALCO report; loads greater than CHWM beginning in 2019.

Load Forecasts – Peak Demand

- BPA's forecast of OPALCO peak demand includes no growth and annual load factor of 45%
- OPALCO peak demand forecast includes annual growth rate of 0.44% and annual load factor of 40%



Note: All-time peak demand was 66.8 MW in 2008. BPA load forecast report shows 2009-14 average annual peak demand of 59.6 MW – projected annual peak demands of 55 MW lower than history would suggest.

Load Forecasts (cont'd)

- Uncertainty related to Load Forecast
  - Climate Change Impacts
  - Electric Vehicles
  - Customer Owned Resources
  - Energy Efficiency
  - Economy
  - Long-term trend of average use
  - Changes in appliance stock
  - Changes in commercial activities

Climate Change

Near-term warming trend, but potential for reversion to the mean

It's all about the winter…

Bill = Rates x Weather

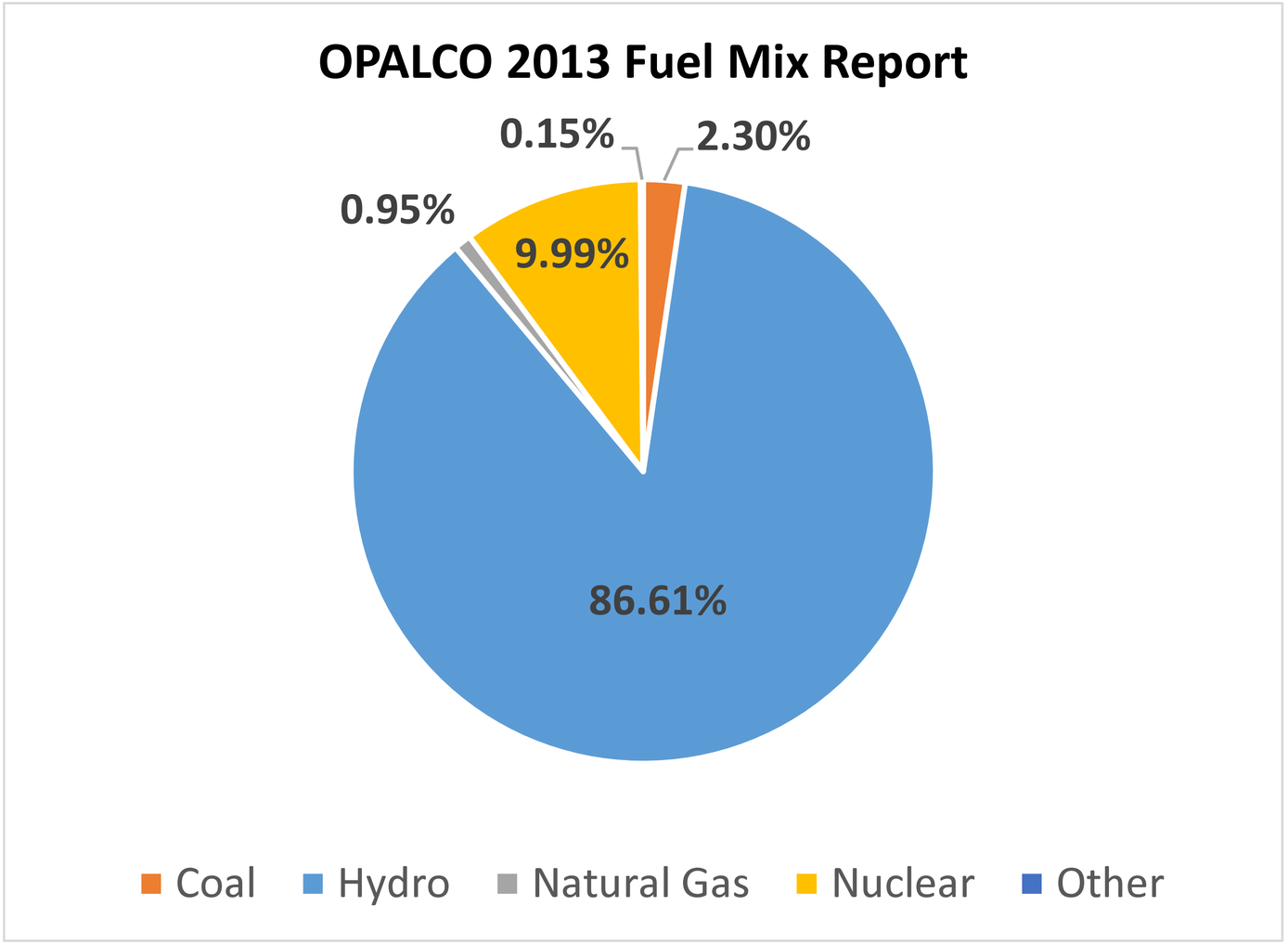
EES Commentary

- Load forecast suggest minimal to no growth - BPA (flat), OPALCO (+.5%),
- Until at least 2028, you have resources to meet load
  - little need for additional resources
- You have some time to figure out what the future is going to look like and how to respond
- Explore the pros and cons of the issues and potential portfolios

Source	Production	Storage	On Demand	Load Fit
BPA … hydro WA rank: 1	205,000,000		✔	✔
Energy Efficiency… WA rank: 8	1,418,000		✔	✔
Solar: Personal, Community,… WA rank: 26	624,723		✘	✘
Micro-Hydro	142,027			✔
Wind: Personal, Community,… WA rank: 7	5,167		✘	✔
Tidal			✘	✔
Biogas			?	?
Anaerobic Digester			?	?
Pumped Hydro		✔	✔	✔
Electric Vehicles - V2G: Personal, Fleet		✔	?	?
Demand Response		✔	✔	✔
Battery: Personal, Community,…		✔	?	✘
Micro-Grids		?	?	?

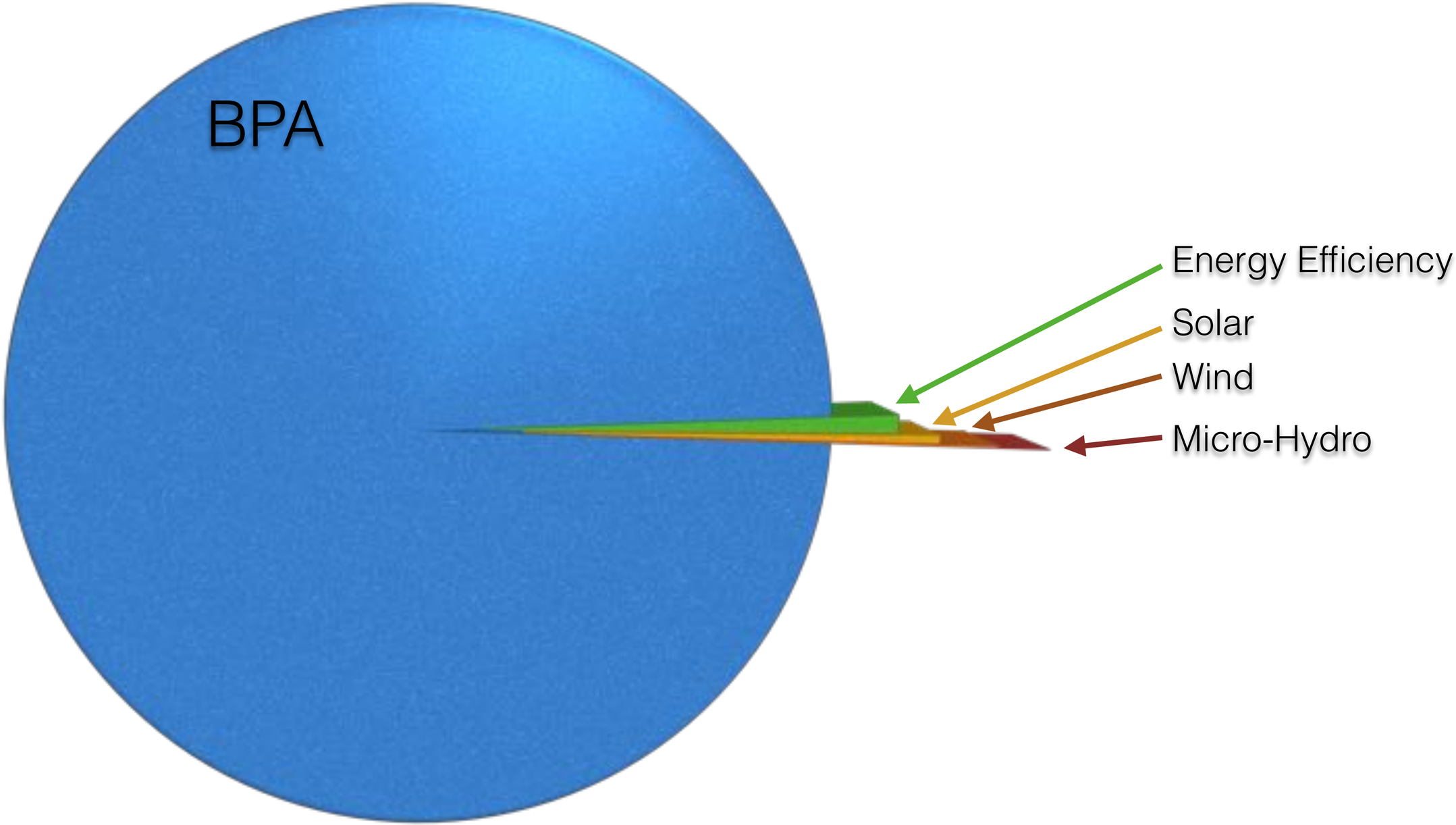
Questions: What problems are we trying to solve? Should OPALCO be incentivizing Energy Efficiency differently from BPA? Are we paying too much for some things and too little for others? How to encourage innovation and proliferation of sources that match demand and load profiles? What is value of source across time of day and time of year? Cost of source expansion? Who pays? How to maintain reliability as intermittent sources increase?

OPALCO's Current Fuel Mix



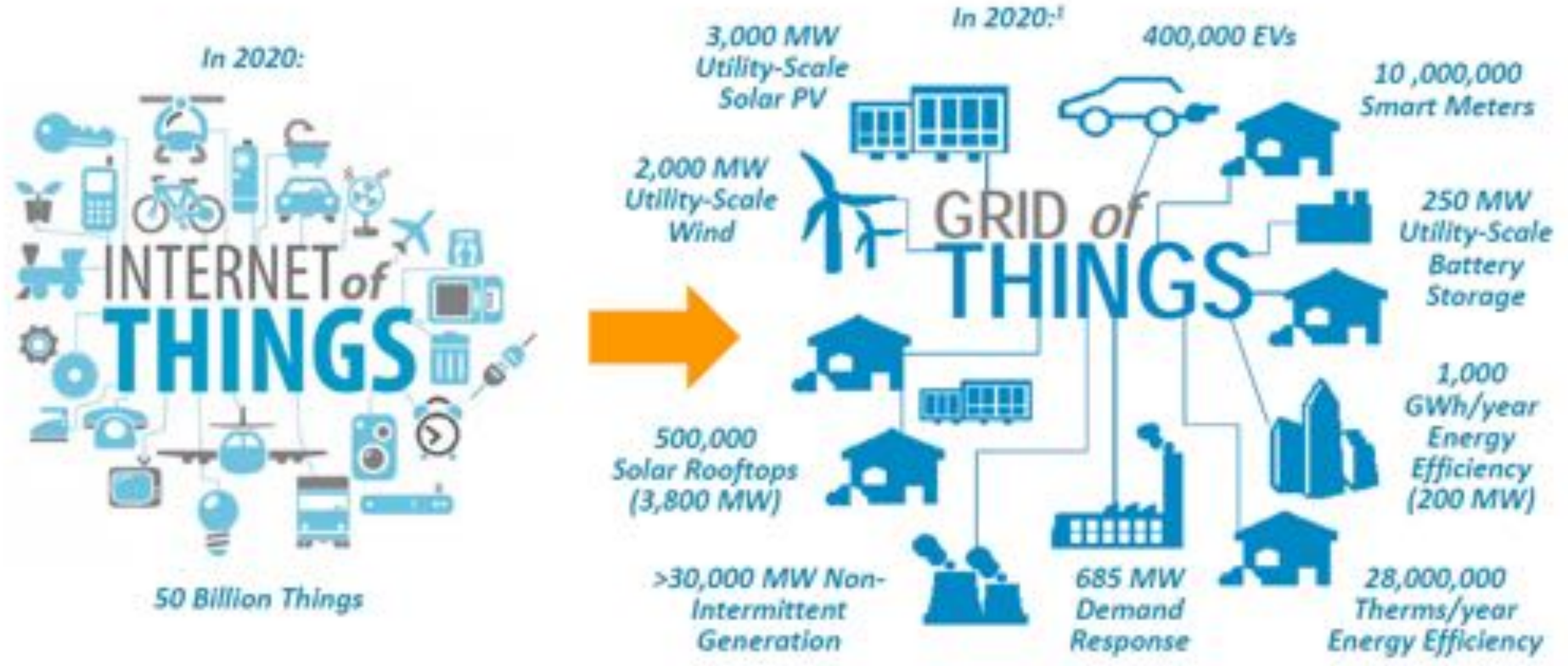
Note: Coal is attributed to the market purchases BPA makes on behalf of its priority firm customers (including OPALCO).

OPALCO Energy Sources: 2014



The Utility of the Future

The Grid of Things: the always there, always on platform that enables all the products and services customers need to engage with and use energy



Discussion

Resource Objectives Examples

Reliable
Safe
Affordable
Diverse
Lower Carbon Footprint
Local
Load Matching
Efficient
Manageable
Community Renewables

IRP Time Horizon

Typical IRP time horizon: 15 to 20 years

Strategic Drivers

What are the “top 5” most critical issues facing OPALCO during the IRP time horizon

Potential Portfolios

See next slide

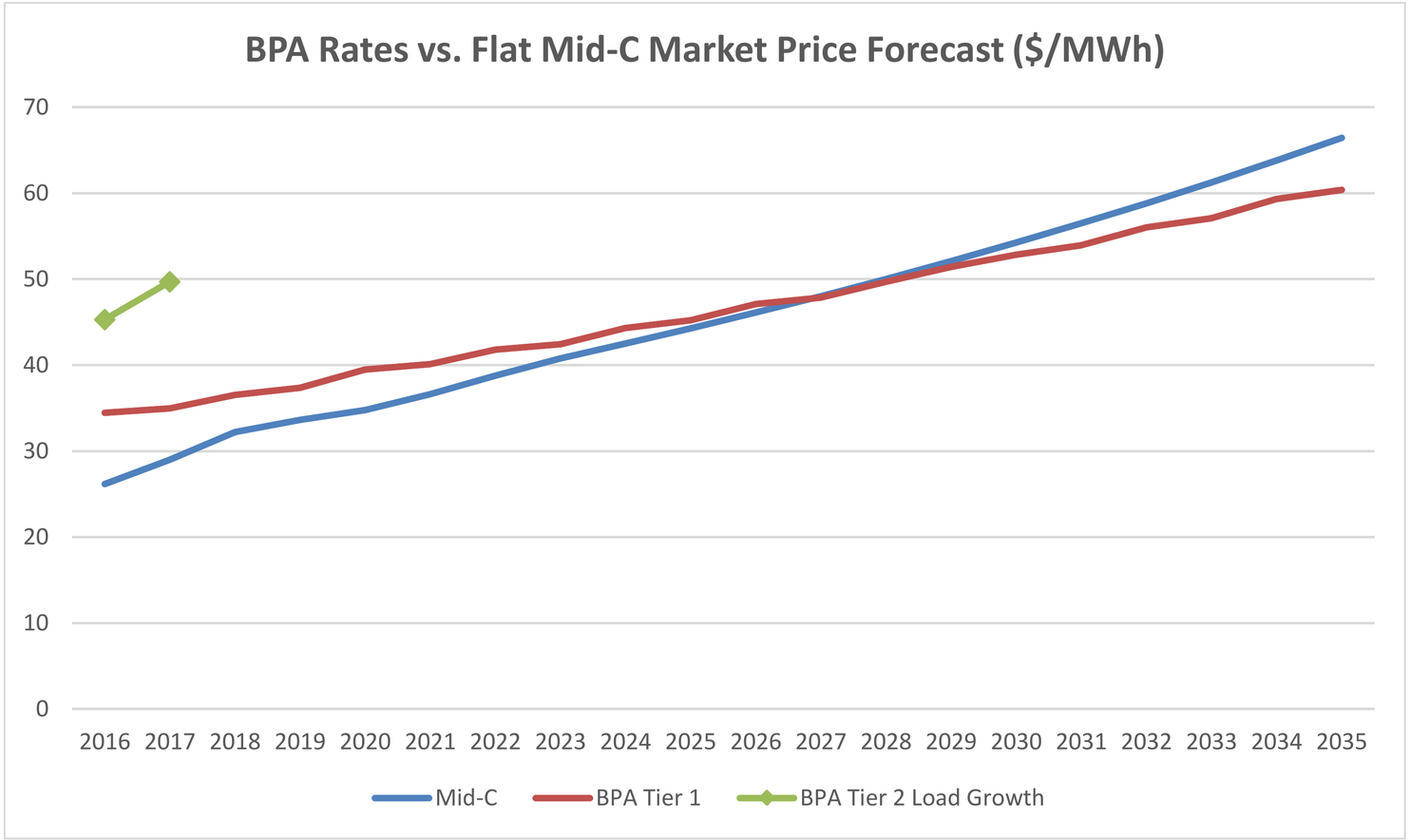
Next Step: Potential Portfolios

- Low Load Forecast Portfolio
  - BPA load forecast
  - High conservation
  - High growth in net metering connections
  - Low growth in electric vehicles
- High Load Forecast Portfolio
  - OPALCO load forecast
  - Low conservation
  - Low growth in net metering connections
  - High conversion of propane heat to electric heat
    - Mix of heat pumps and baseboard consistent with current mix
    - Include estimated impact on CO_2 emissions
  - High growth in electric vehicles

Next Step: Potential Portfolios

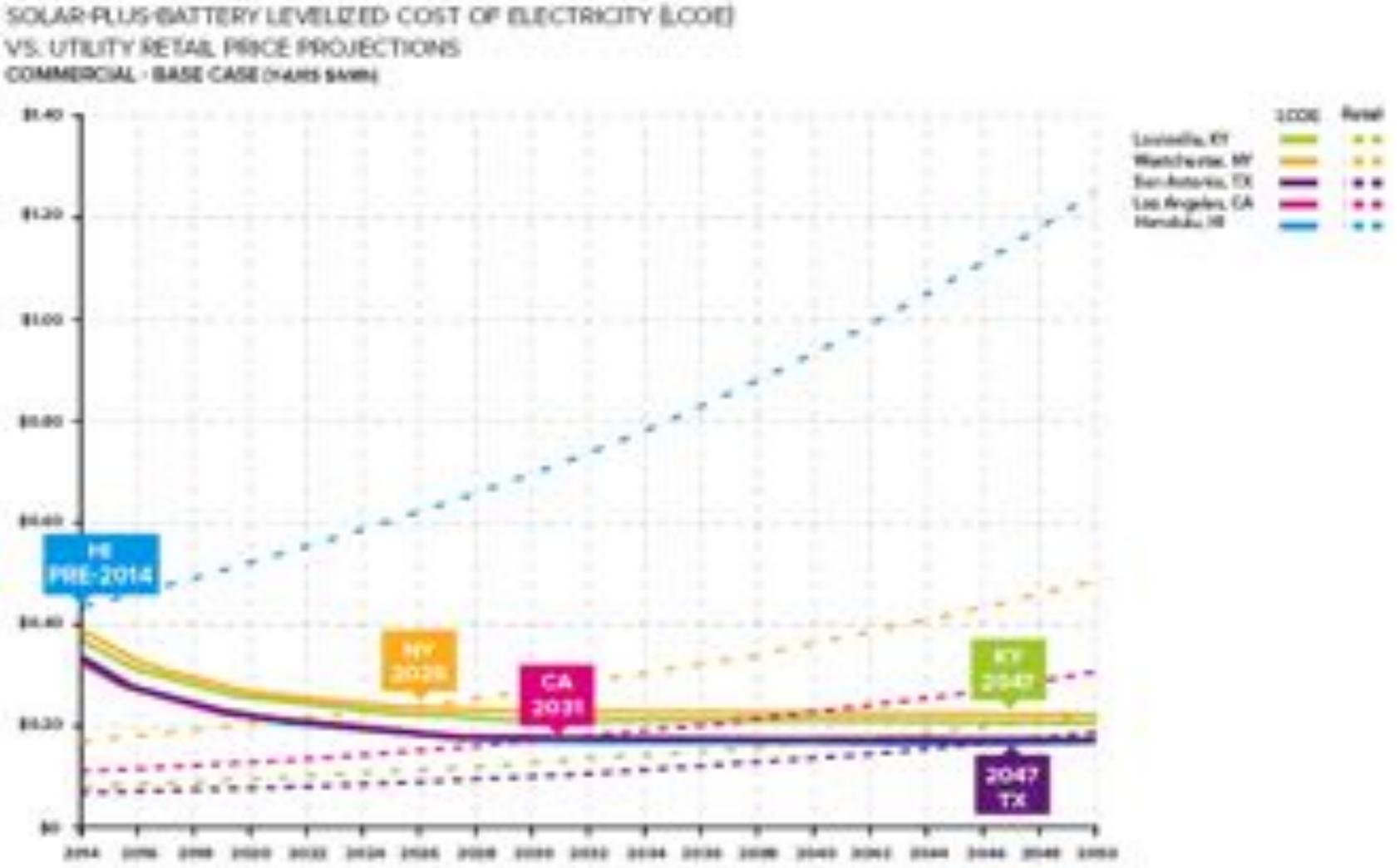
- High Sustainability Portfolio
  - High growth in net metering connections
    - Additional incentives? More MORE?
  - High conservation
    - Pre-pay debit card
    - Smart meters/thermostats and time-of-use rates
    - Grid upgrades to accommodate automated grid?)
  - High demand response
    - Commercial buildings
    - Activate 400+ units included in pilot program
  - Optimistic assumptions regarding local resource development including:
    - Community solar (push community solar…so far mostly schools)
    - Utility-owned solar
    - Local wind projects (Mt. Constitution, other on-shore locations or off-shore?)
    - Local pumped storage (Mountain lake and Cascade lake)
    - Biomass
    - Wastewater Treatment Plants
    - Batteries (paired with solar and stand-alone)

Projected BPA Rates vs Projected Market Prices



- BPA Tier 1 shown above is based on effective cost of serving OPALCO's projected monthly peak demands and energy
- Assumes 6 percent rate increase each two-year rate period (assumes current rate construct extends beyond September 2028)
- Mid-C price forecast shown above is for flat power purchase (not an apples-to-apples comparison)

Levelized Cost of Solar-Plus Battery vs. Retail Rates



Source: Rocky Mountain Institute