OPALCO

Board Meeting - August 2015

Integrated Resource Plan (IRP)

IRP Objectives and Strategy

Typical planning horizon of 20 years

Objectives

- Maintain BPA as our long-term power provider
- Target zero load growth
- Ensure continuing safe, reliable and stable grid operation as intermittent local renewable energy sources are added
- Minimize environmental impact (reduce carbon footprint)
- Increase sustainability for critical services

Load and Resource Trends

Composition of both loads and resources will evolve significantly over the next 20 years, challenging the reliability of the distribution system.

Load

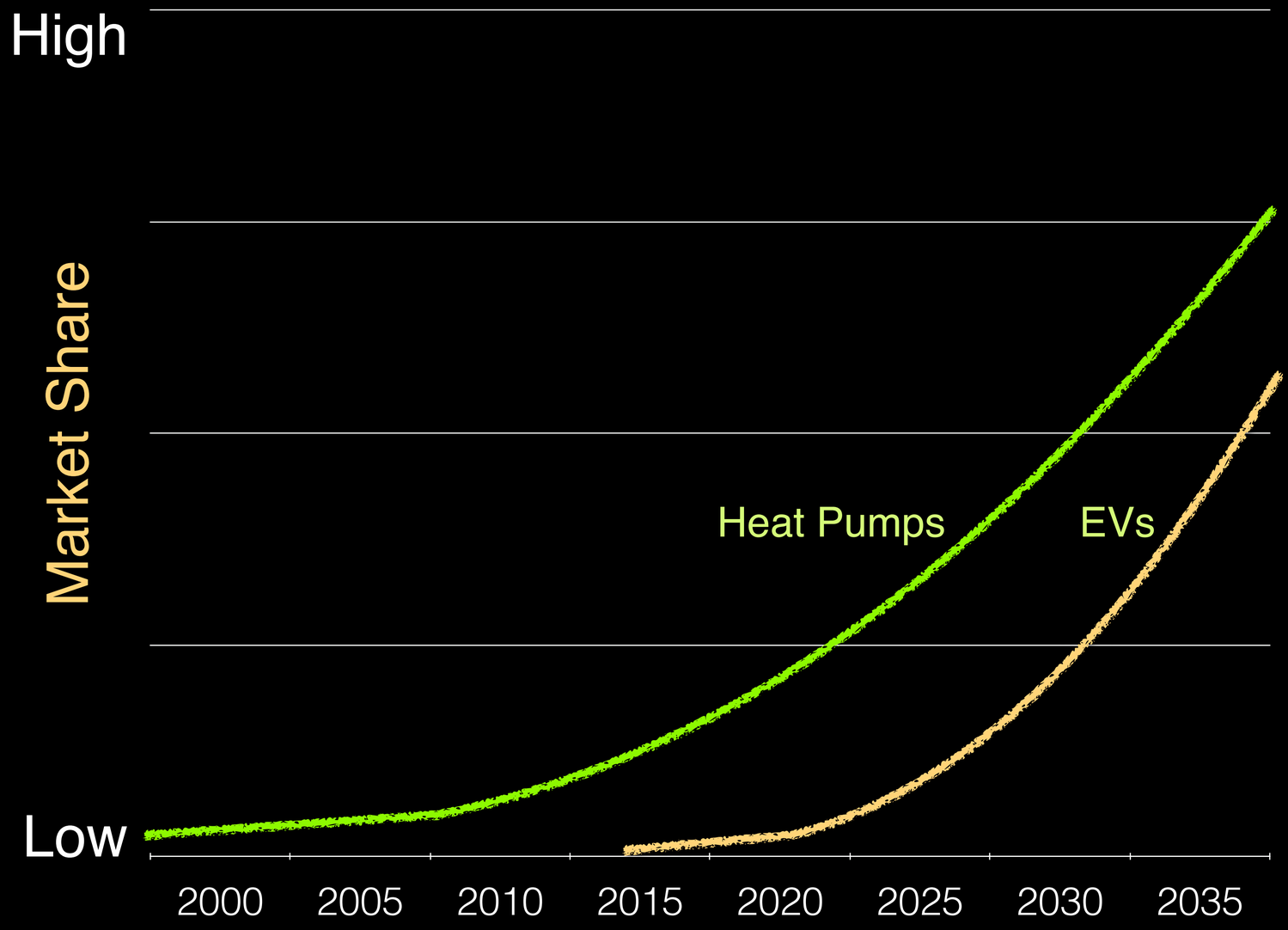
- Smarter and more efficient appliances
- Fuel shifting from fossil to electric
- Increased use of air conditioning
- Influx of electric vehicles

Resources

- More Local
- More distributed
- More intermittent

Load Overview

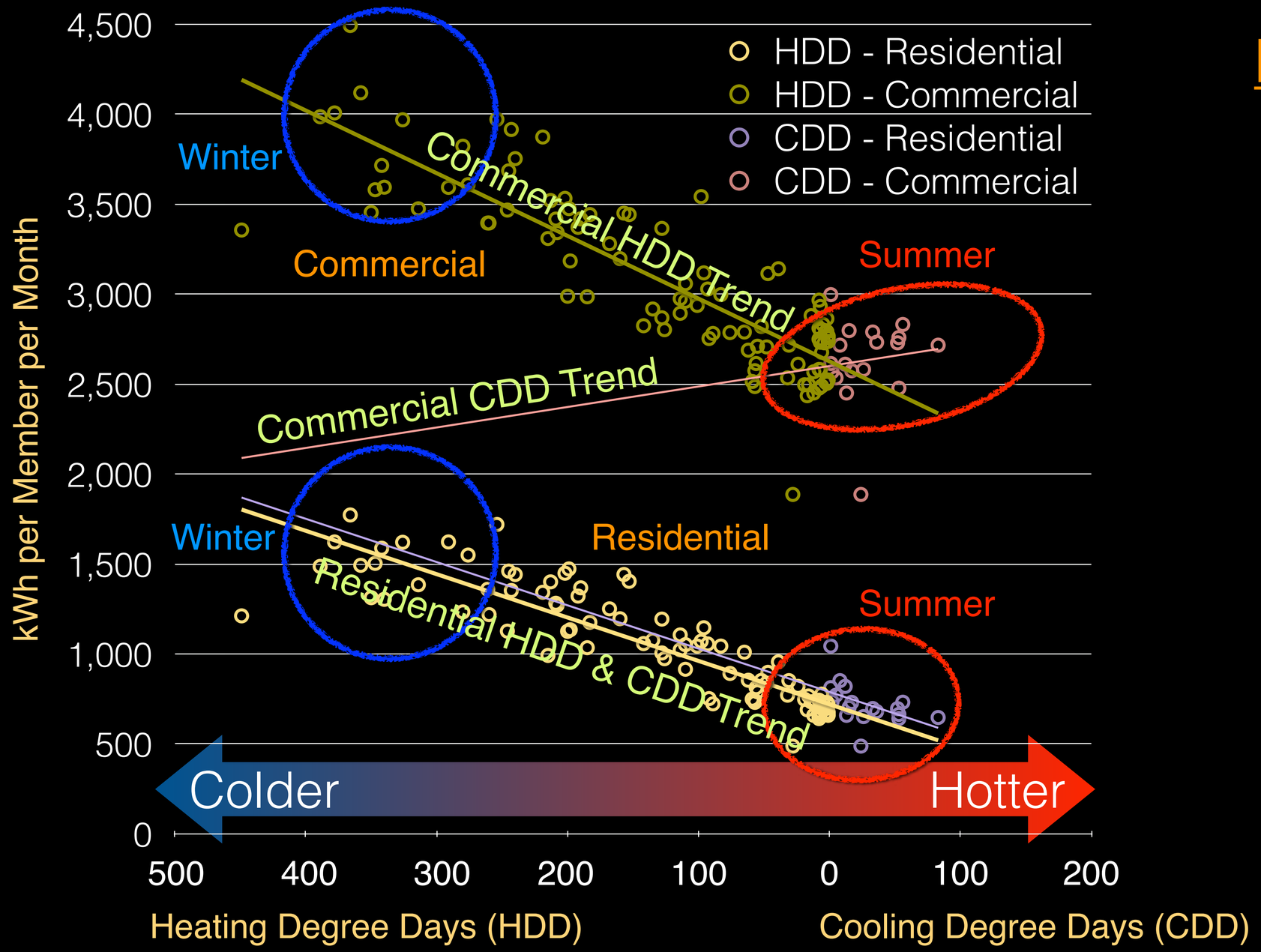
Electric Load: Representational SJC Load Trends



Market Drivers

- Steady warming trend
- Fossil fuel carbon tax
- Electricity lower cost and cleaner than fossil fuels
- Shift from propane and heating oil furnaces to heat pumps
- Increasing use of heat pump air conditioning feature
- EV V2G technology allows two-way energy flow, enabling sales of kWh back to grid by member during periods of peak demand

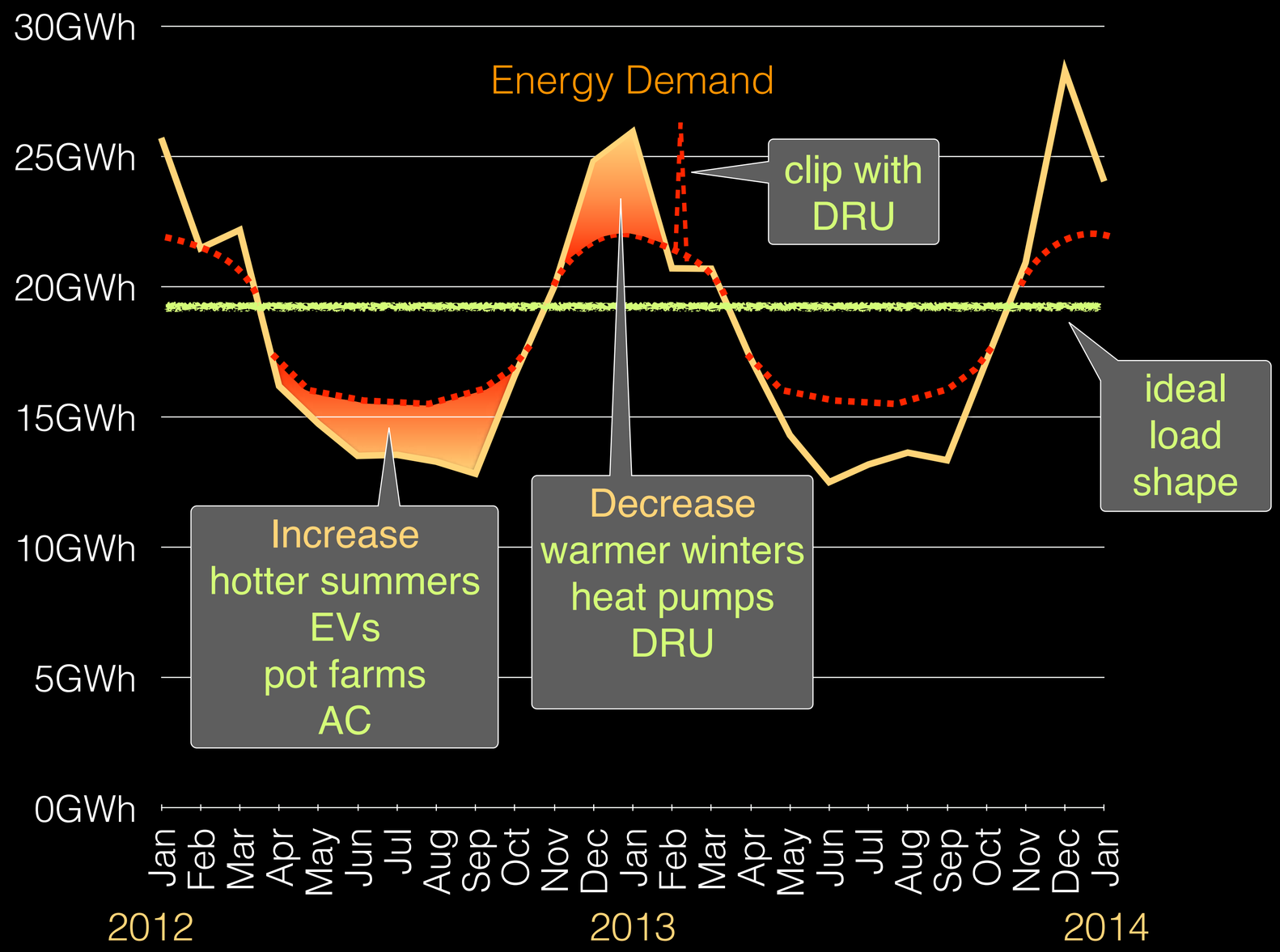
Seasonal Energy Consumption Patterns: Warming Trend Implications



Headline

- Warming trend will reduce HDD in winter and increase CDD in summer.
- When members upgrade or replace their heating, they often go with a heat pump.
- In addition to heat pumps having the lowest cost of operation, compared to propane and fuel oil, they are the only heating solution that includes built in air conditioning
- As summer heat intensifies over the coming decades, we expect air conditioning use to increase.
- With SJC above average senior population, increased comfort during extreme cold and hot days may be a factor.

OPALCO Seasonal Load



Source: OPALCO

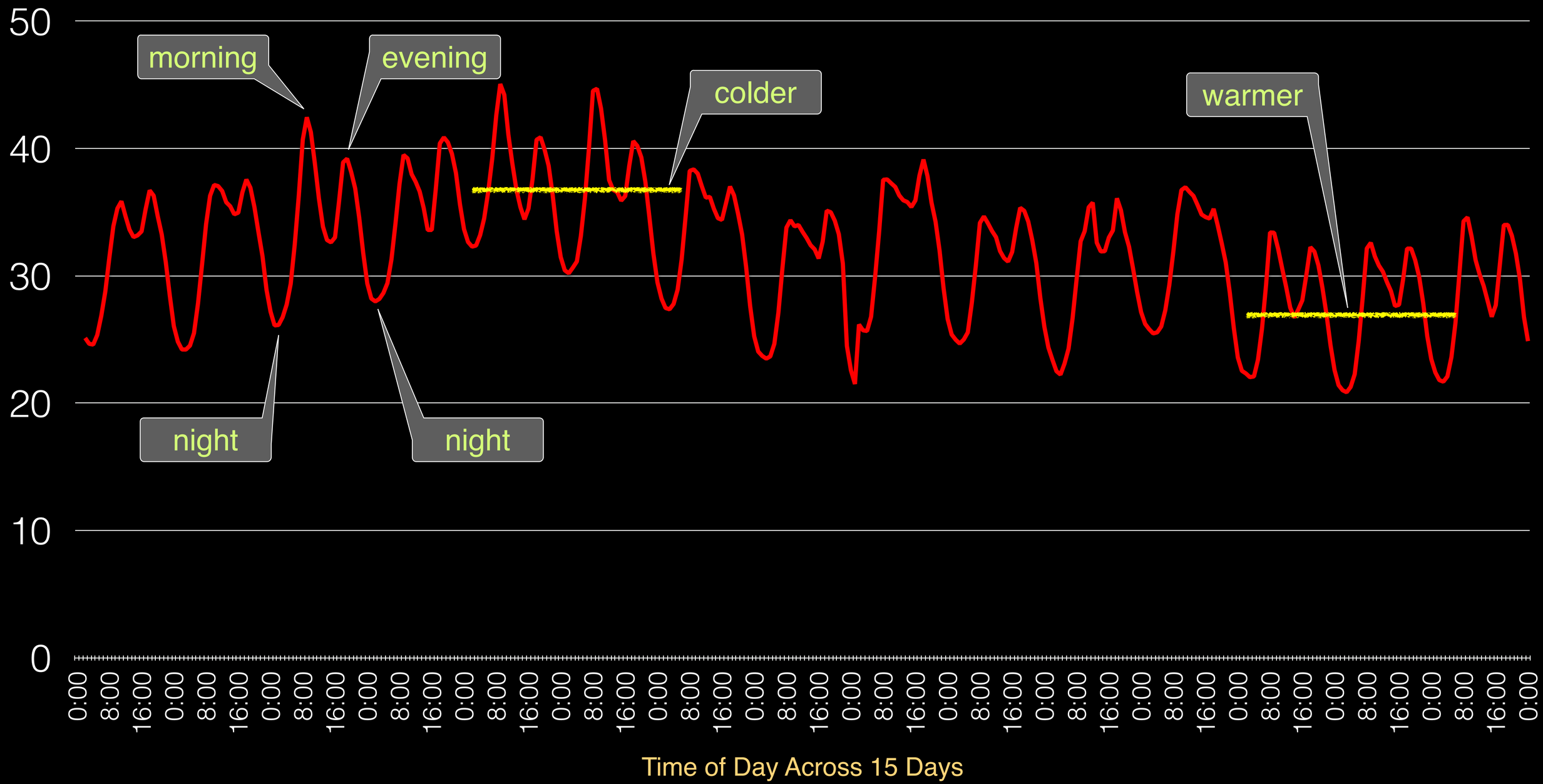
Headline

- Fuel shifting helps increase electric use and keep rates low.
- Education, heat pumps and DRUs help reduce waste, improve efficiency, and keep member costs low

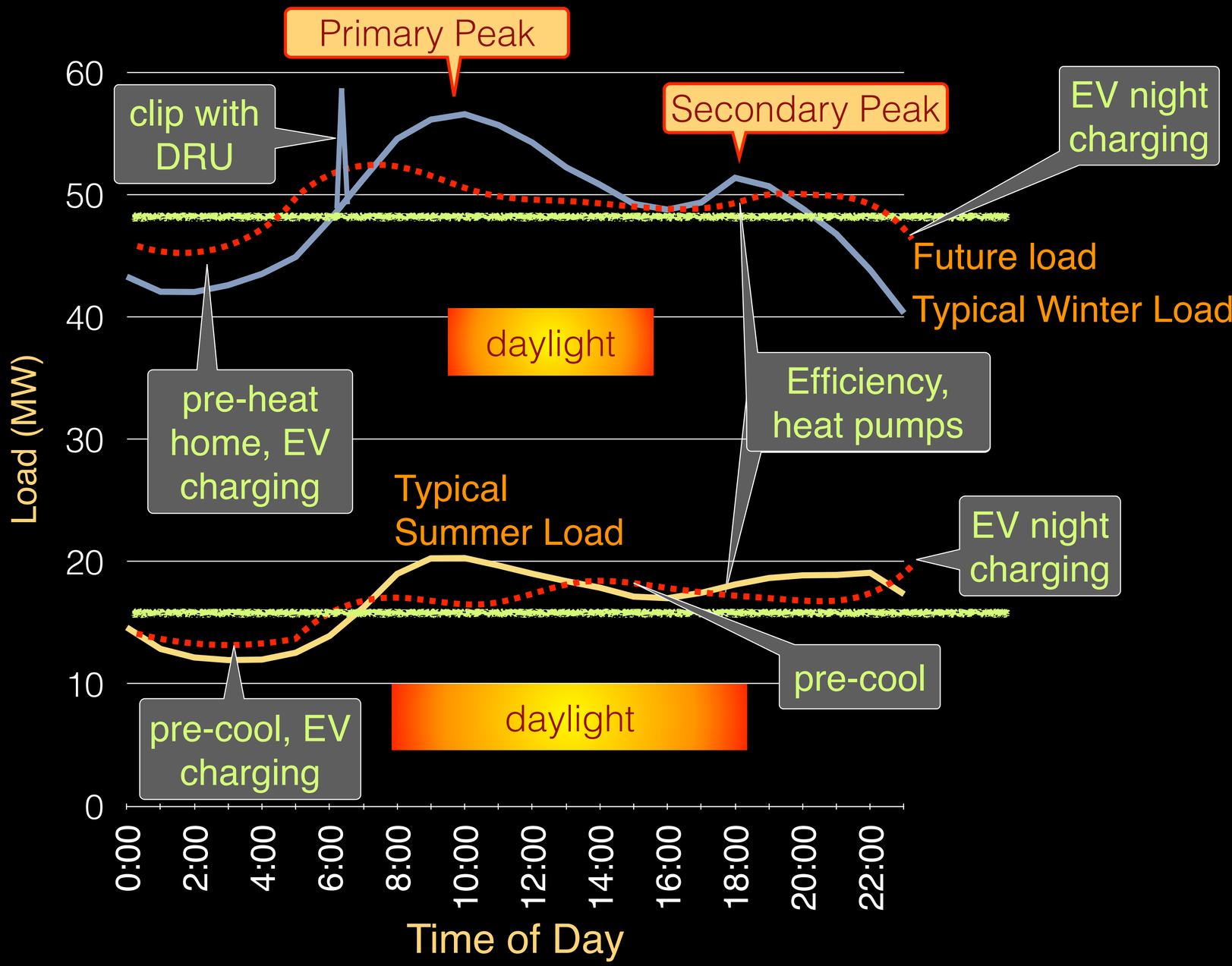
Notes

- Reducing peak reduces demand charge - use education, DRUs and pumped hydro to reduce peaks
- EVs, AC, fuel shifting increase use and headroom - use EE&C, education and local renewables to counter load increases.
- Optimize Tier 1 headroom to get most bang for the buck, and offset it with local renewables.

Typical OPALCO Hourly Winter Load / Demand (MW)



OPALCO Daily Load



Headline

- Fuel shifting helps increase electric use and keep rates low.
- Education, heat pumps and DRUs help reduce waste, improve efficiency, and keep member costs low

Notes

- Reducing peak reduces demand charge - use education, DRUs and pumped hydro to reduce peaks
- EVs, AC, fuel shifting increase use and headroom - use EE&C and education to counter load increases.
- Optimize Tier 1 headroom to get most bang for the buck, and offset it with local renewables.

Resource Overview

Resources for Consideration in IRP

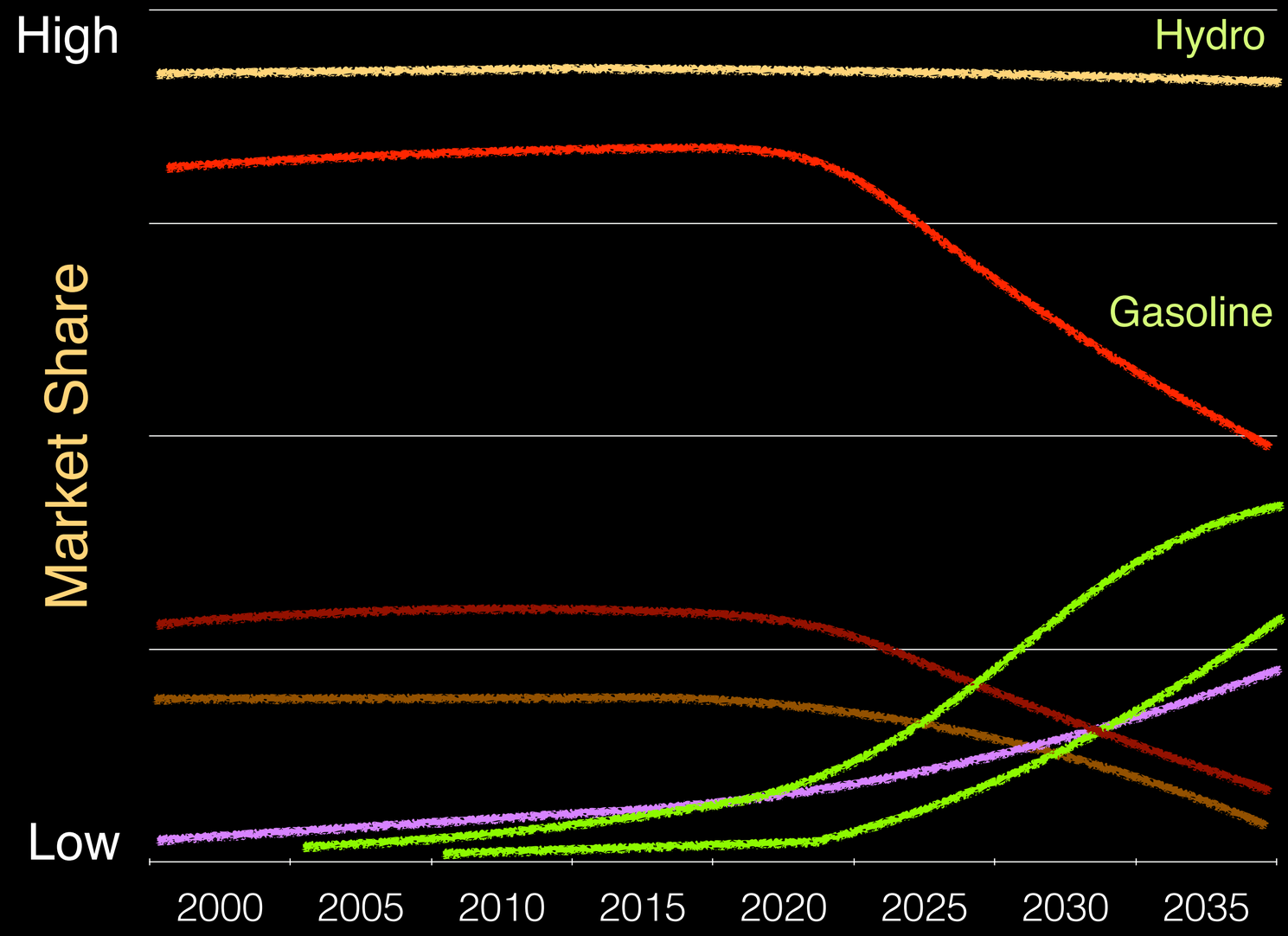
When considering new resources the resource characteristics of most concern should be:

- Reliability, safety, affordability, diversity, impact on carbon footprint, location (local or mainland), load matching, efficiency, manageability and potential for community participation.

- Resources that should be considered in the IRP include: conservation, wholesale market, natural gas-fired resources, regional wind, out-of-region wind, wastewater biomass, geothermal, landfill gas, solar, micro hydro, tidal, wave, woody debris biomass, manure (farm) biomass, pumped hydro and batteries.

- Pacific Northwest Generating Cooperative (PNGC)

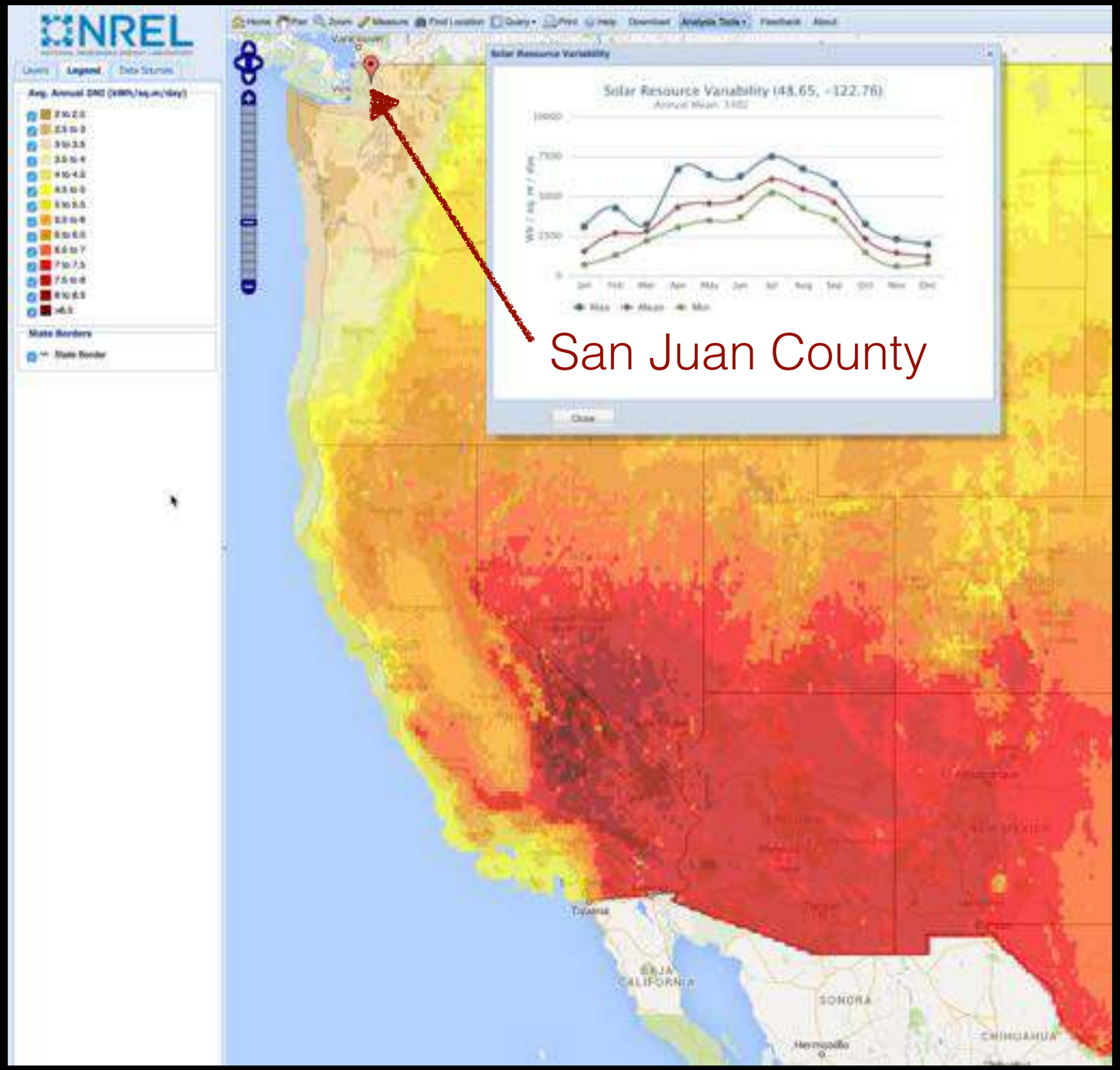
Energy Sources: Representational NW and SJC Fuel Mix Trends



Market Drivers

- Fossil fuel carbon tax
- Fuel shift from fossil to renewable energy
- Increasing local distributed generation
- Reduced snowpack

Solar Energy

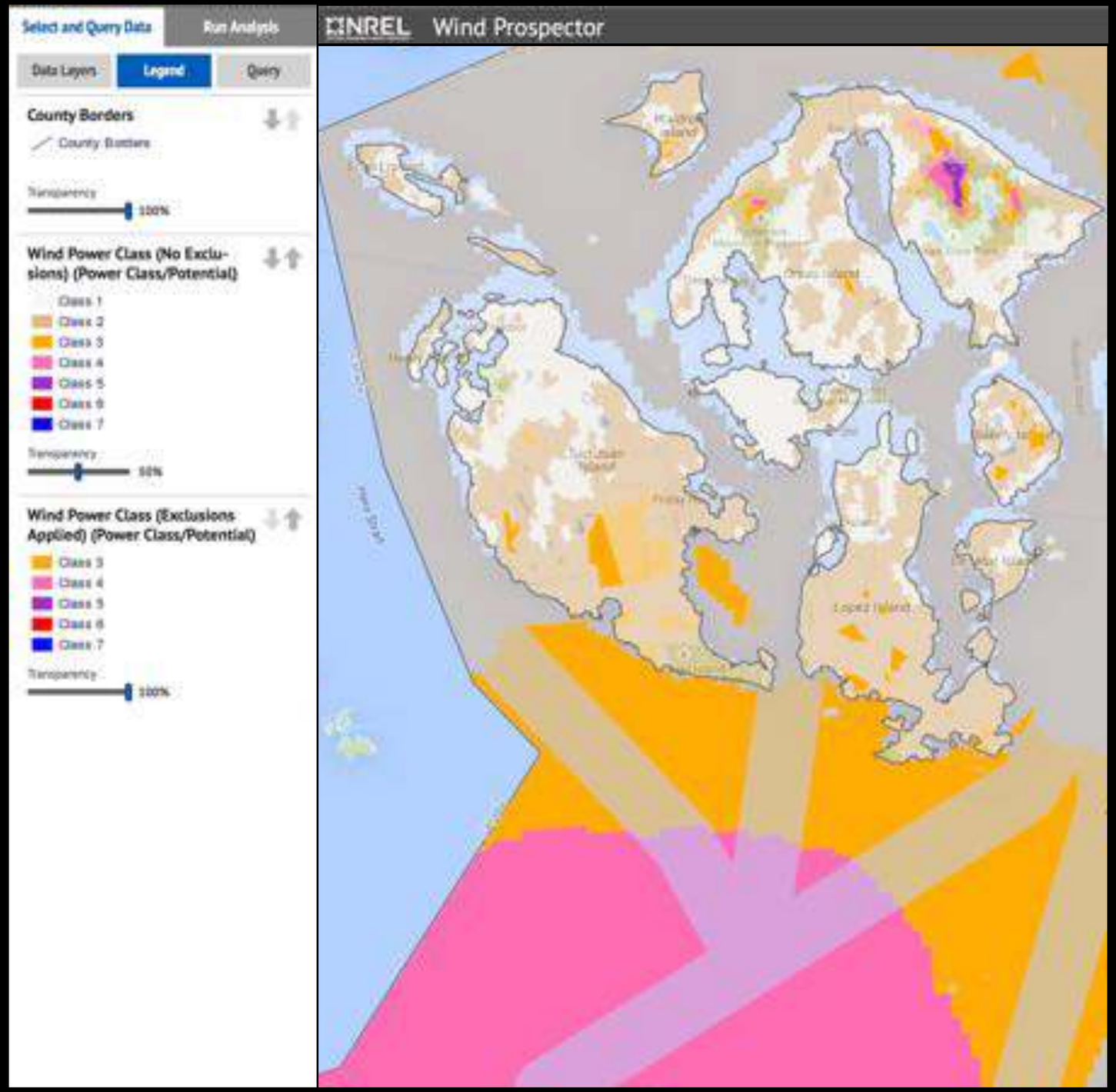


Headline

- Our summer solar insolation is similar to Las Vegas or Hawaii winters.
- Our winter insolation is less than 20% of our summer.
- But our winter load is 200% of our summer load.

Source: NREL

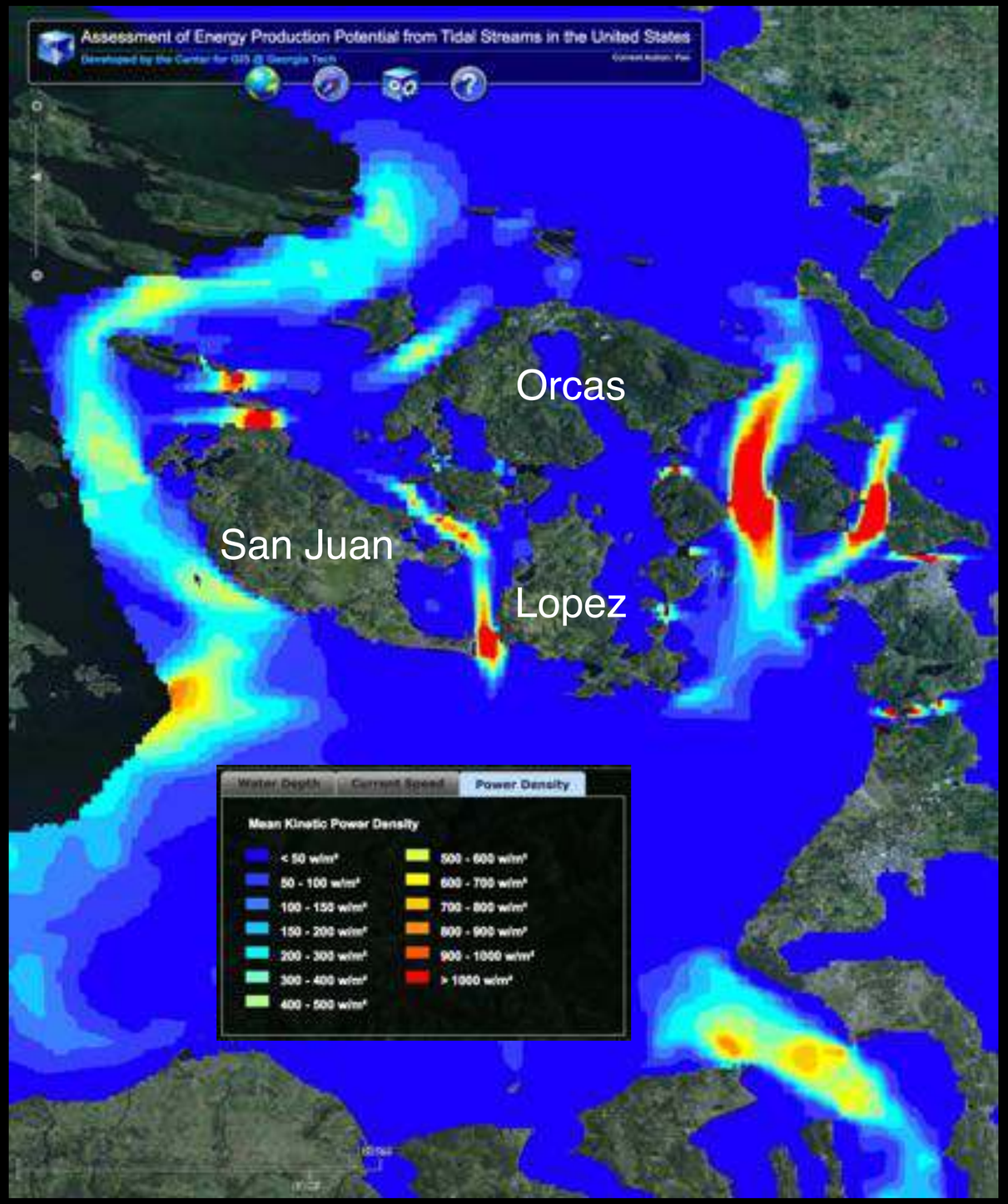
Wind Energy



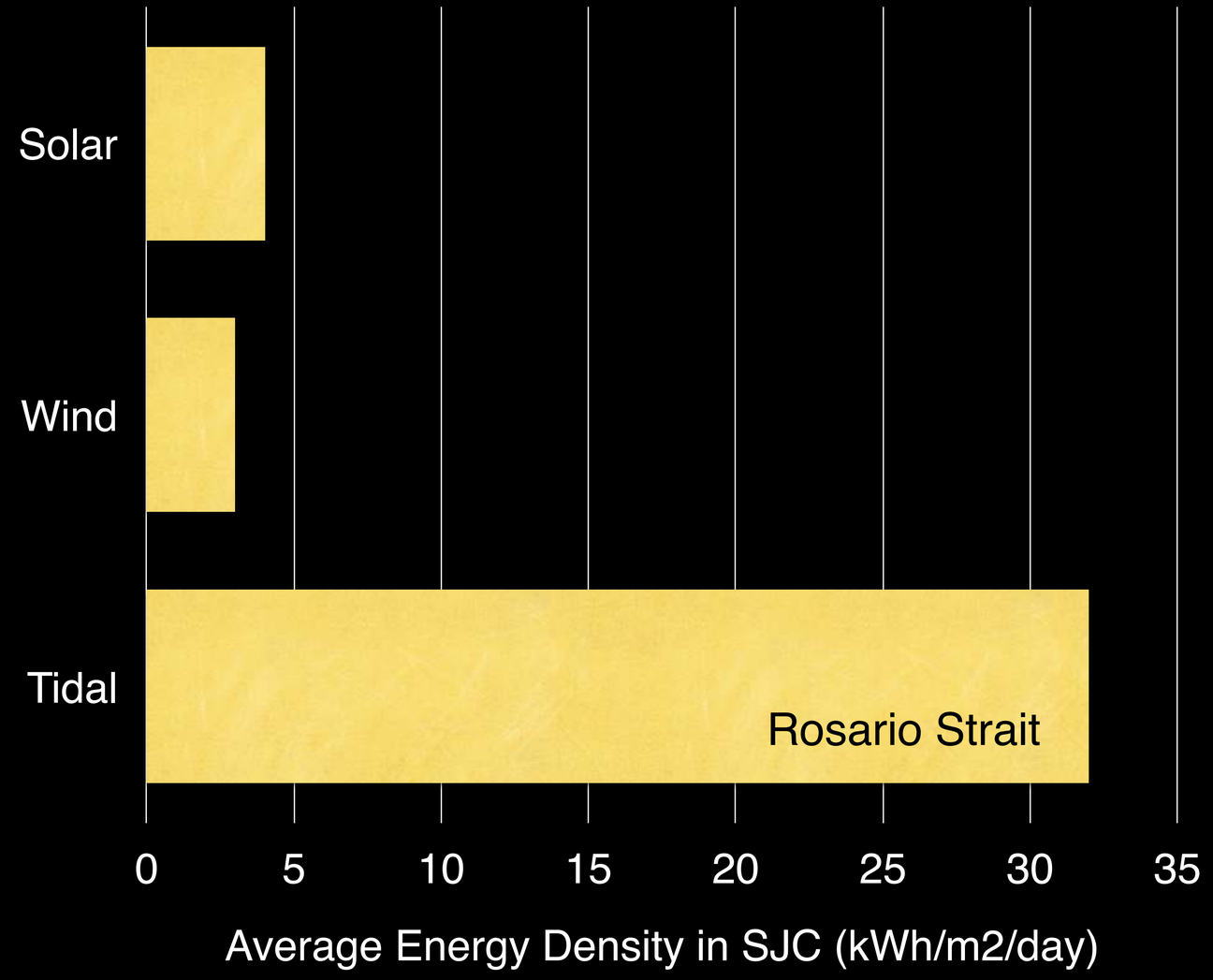
Headline

- On-shore versus off-shore
- Many small versus a few large wind generators

Source: NREL



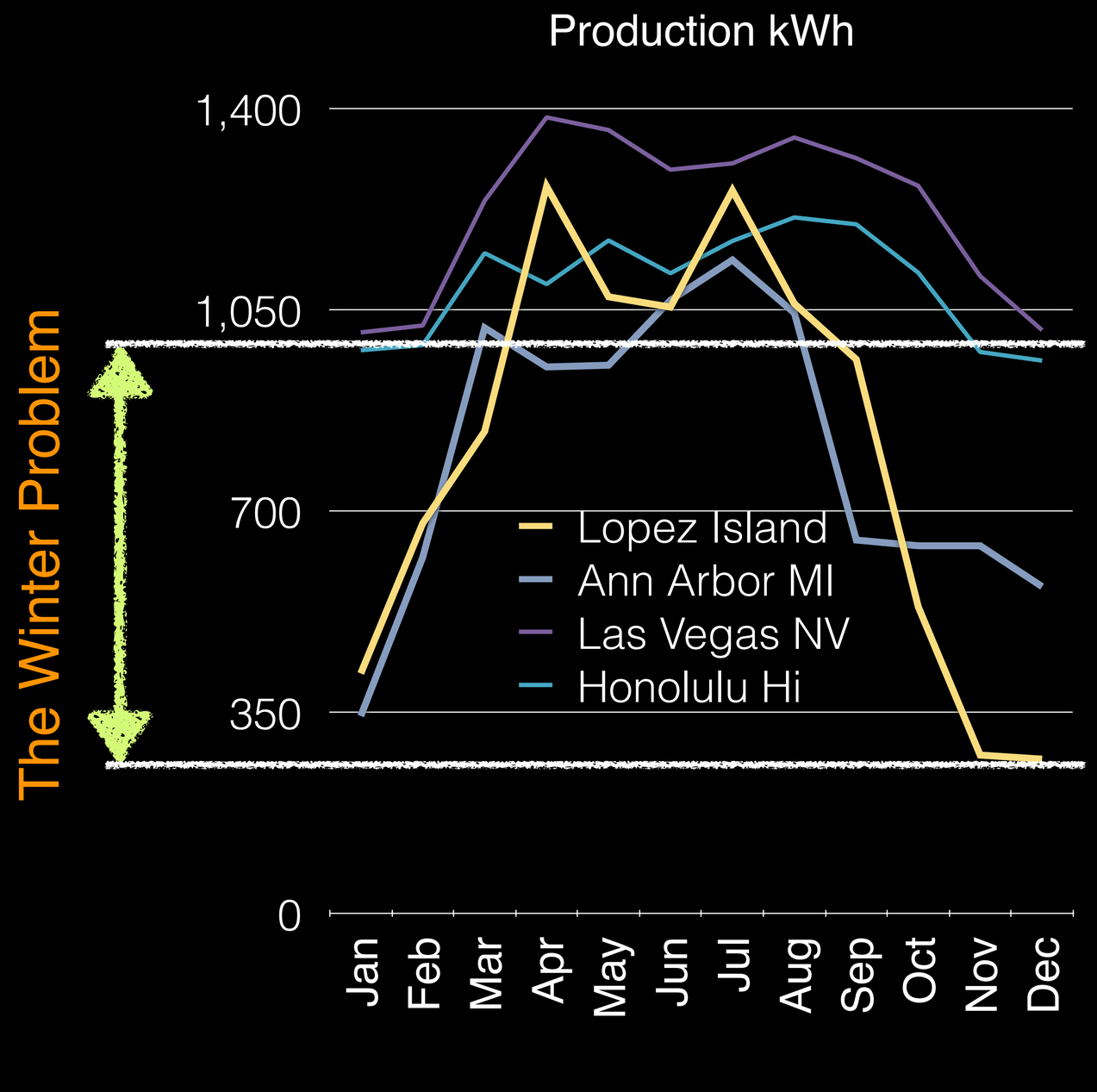
Tidal Energy



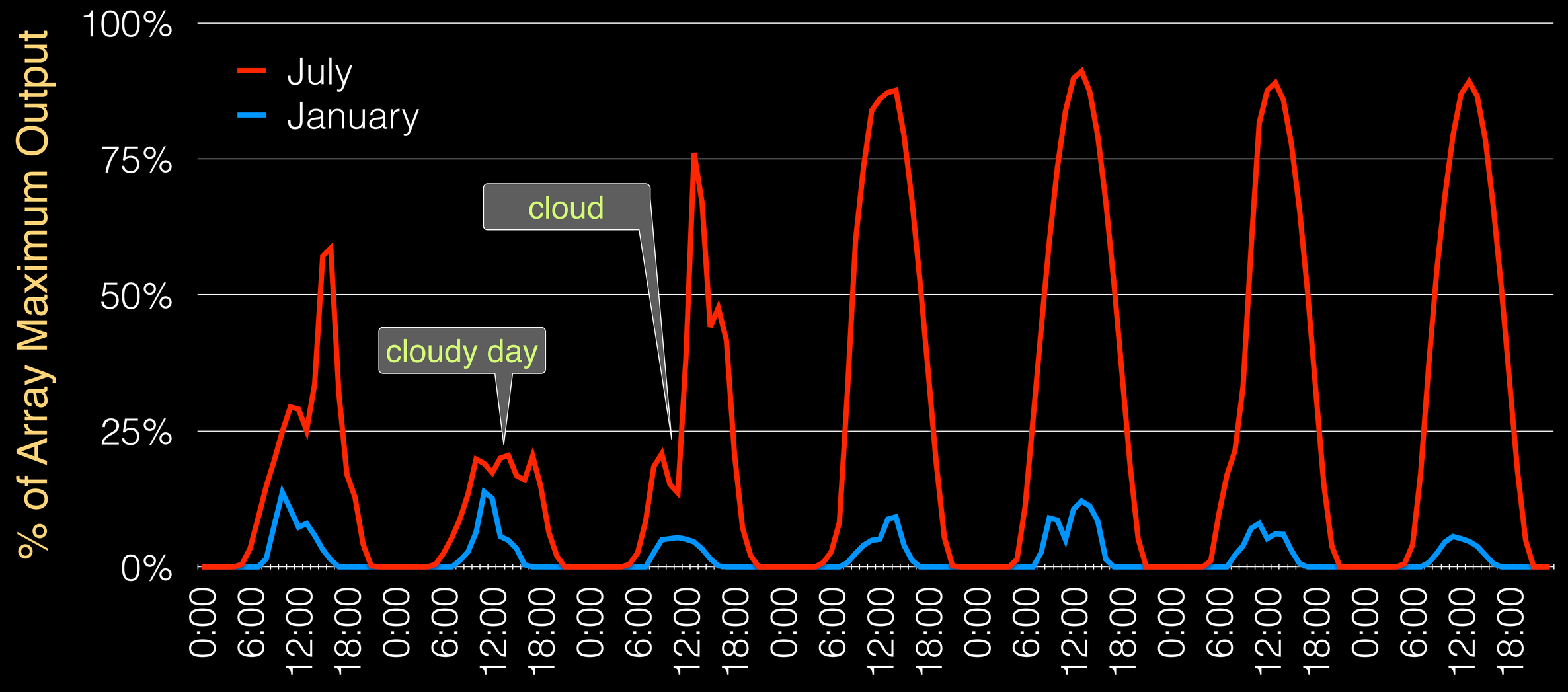
Source: NREL

SJC solar insolation, compared to other places?

Month	Lopez Island	Ann Arbor	Las Vegas	Honolulu HI
Jan	418	344	1011	980
Feb	679	620	1023	989
Mar	839	1019	1240	1149
Apr	1265	951	1385	1095
May	1073	954	1363	1171
Jun	1055	1067	1294	1114
Jul	1258	1137	1305	1170
Aug	1061	1045	1350	1211
Sep	964	650	1314	1199
Oct	534	640	1266	1115
Nov	276	640	1109	977
Dec	269	569	1015	962
Total	9691	9636	14675	13132
	100%	99%	151%	136%



Solar: Hourly Solar Irradiance Data kW / m² for 2012

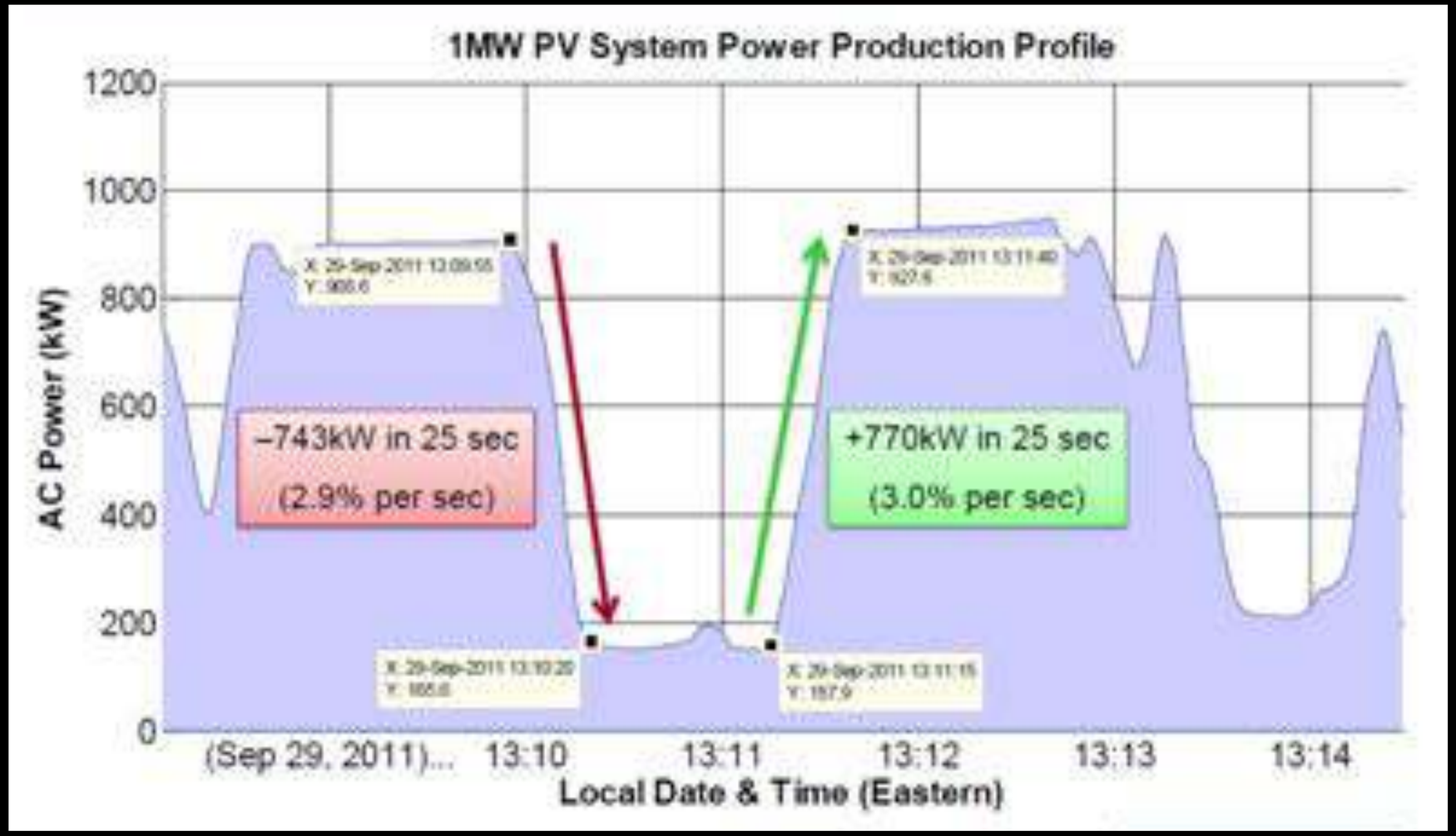


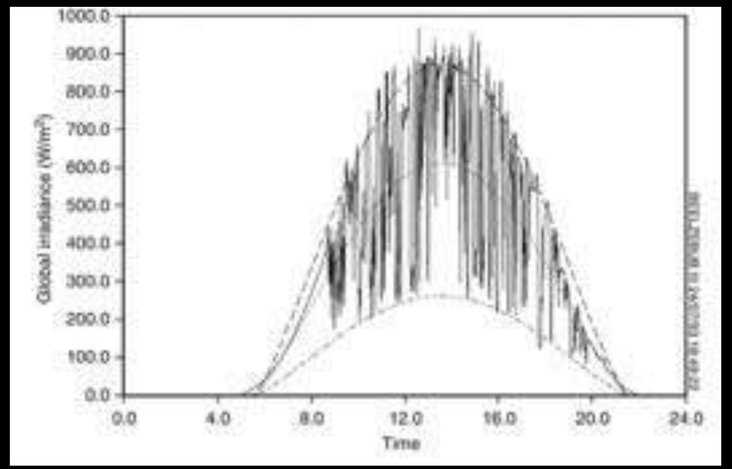
Summer	Jul 1	Jul 2	Jul 3	Jul 4	Jul 5	Jul 6	Jul 7
Winter	Jan 1	Jan 2	Jan 3	Jan 4	Jan 5	Jan 6	Jan 7

Solar Variability

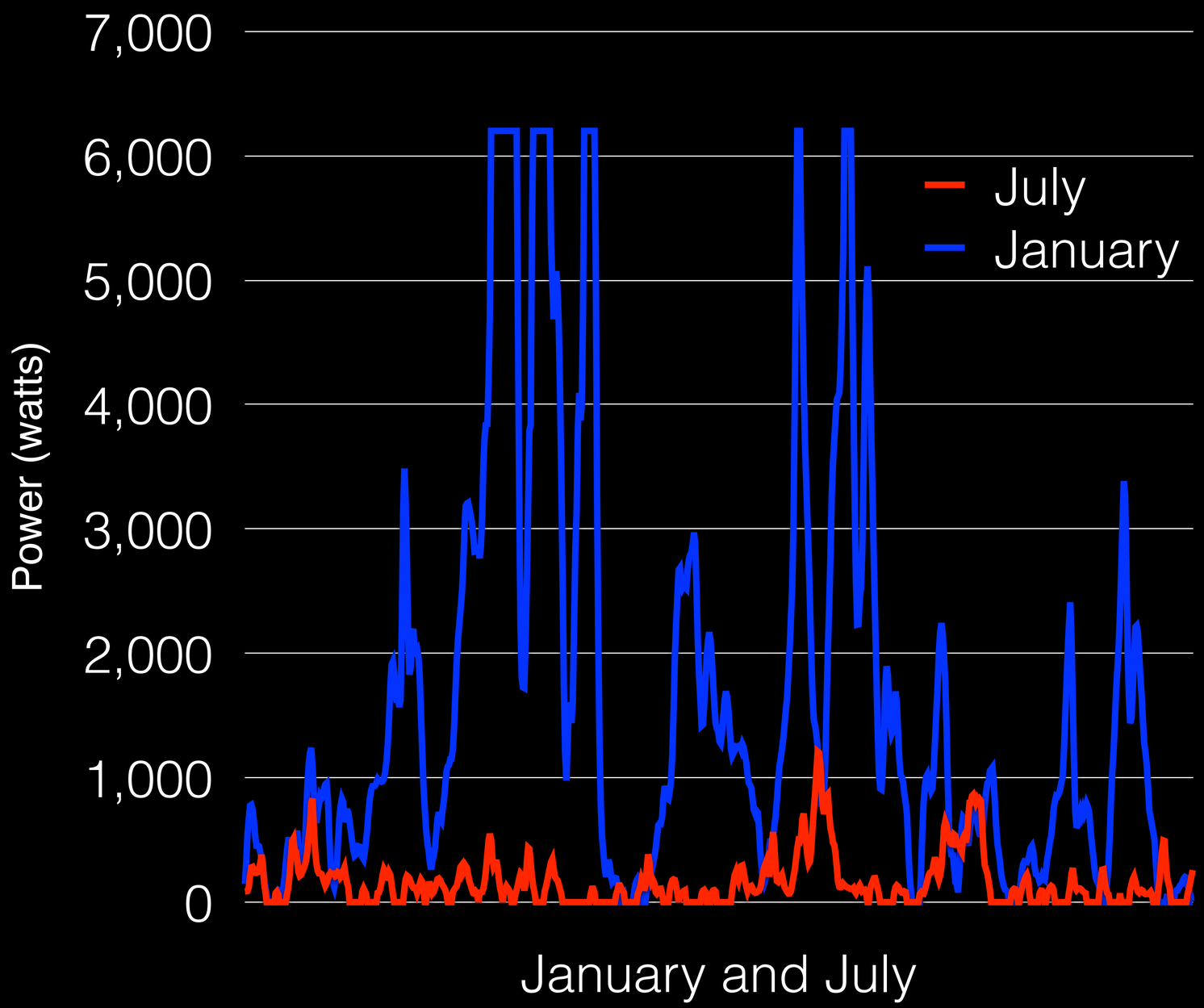
Hourly, Sub-Minute

Like driving behind somebody who is constantly slamming on the breaks.





Wind: Calculated Performance - mast height 50m - 2014 wind data



Headline

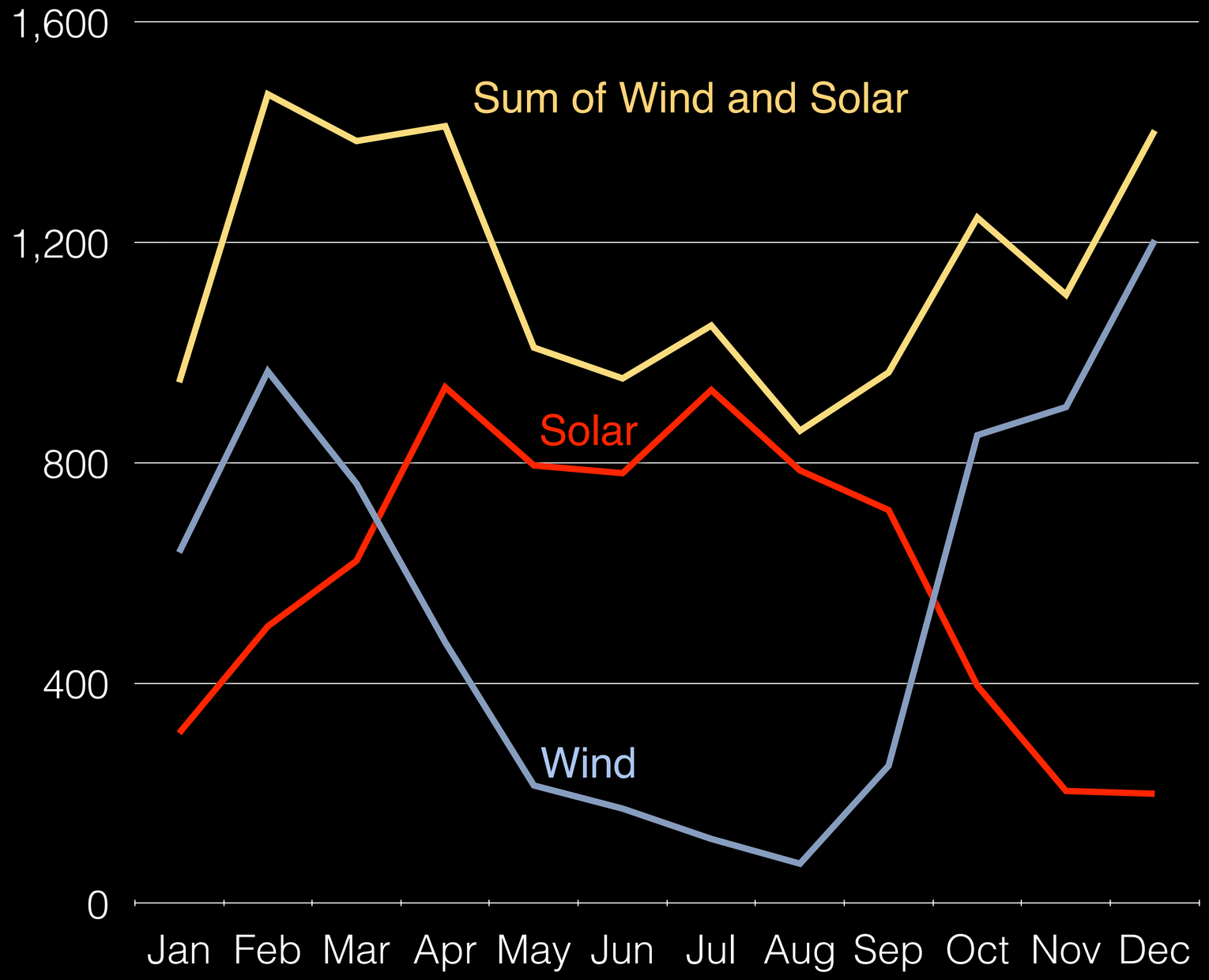
- Winter output more closely matches OPALCO member load
- As with solar, highly intermittent, but slower transitions than solar

Solar + Wind More Closely Matches Seasonal Demand

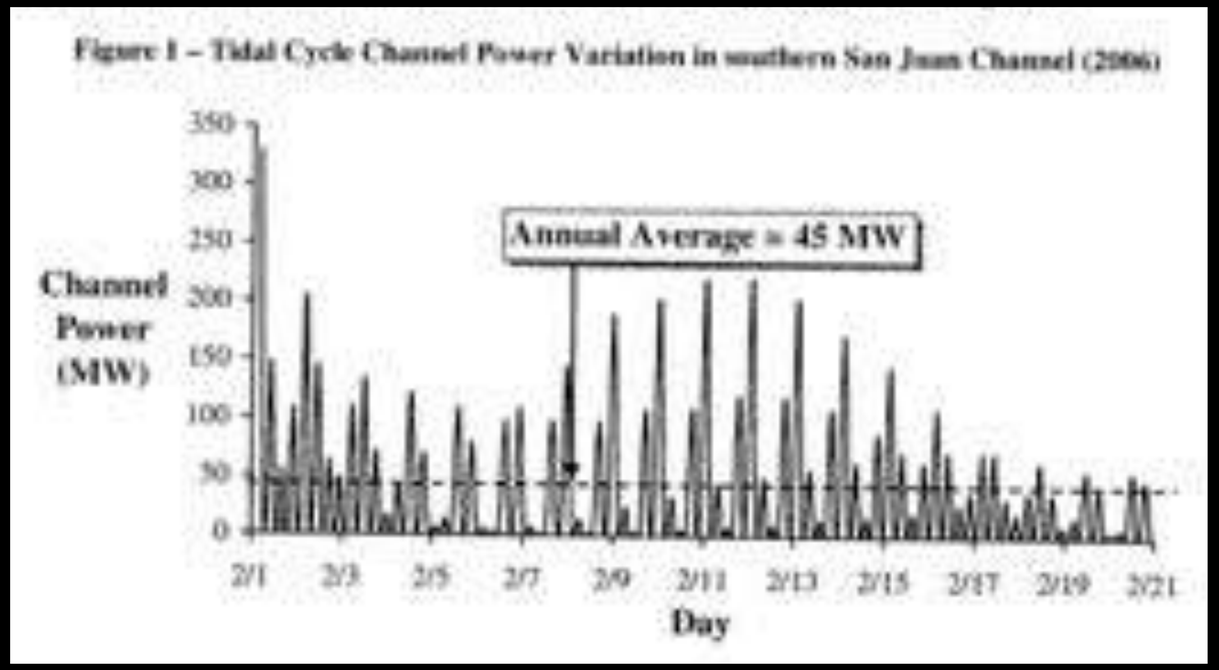
\+

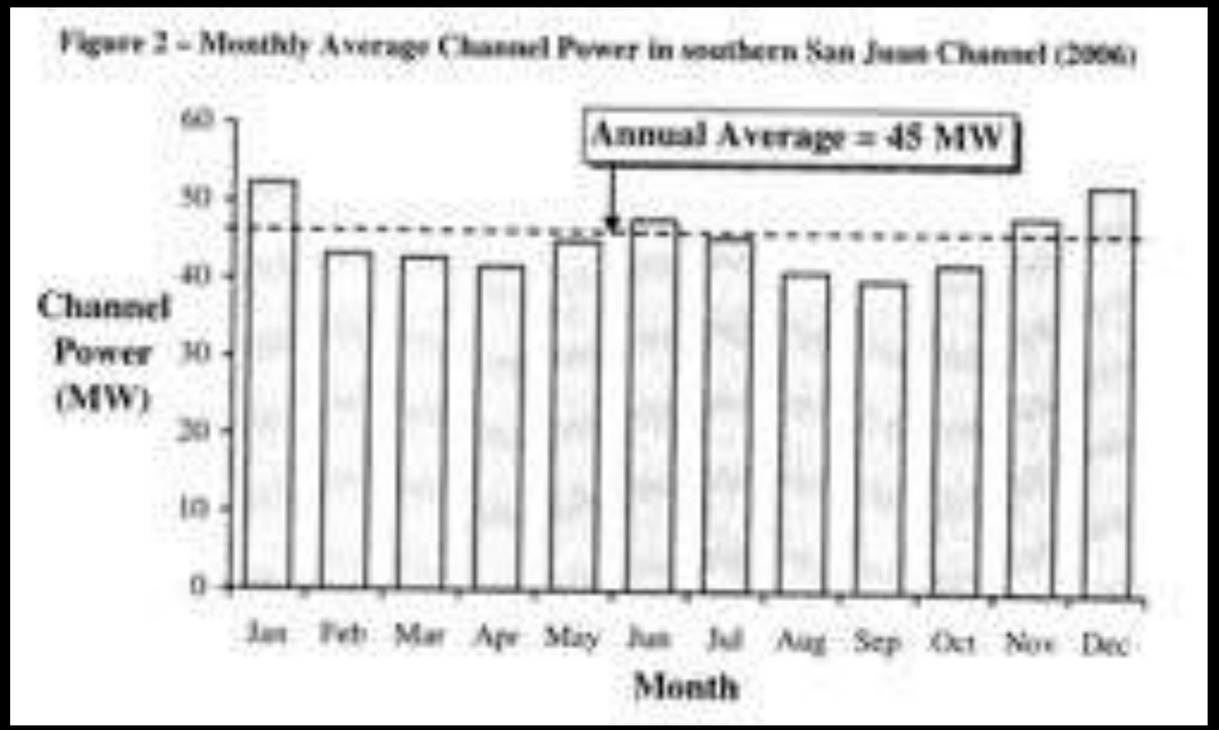
6kW solar = 7178kWh/yr

6kW wind = 6619kWh/yr



Tidal Energy





Headline

- As with solar and wind power, tidal is intermittent
- Unlike solar and wind, tides are very predictable based on solar and lunar cycles
- Typically 4 generation periods per day - ebb, flow, ebb, flow

Incentives

OPALCO should consider providing incentives through rate design that would encourage customers to bring resources on-line that will improve the utility's load/ resource balance and/or help smooth out the utility's net load profile.

- Are existing rebates for heat pumps adequate?
- Should OPALCO provide rebates that encourage fuel switching from fossil fuel to electric?
- How to optimize TOU rates to encourage Electric Vehicle (EV) off-peak charging?
- Should incentives that would encourage the deployment of supply-side resources that improve OPALCO's load/ resource balance should be considered?
- Should OPALCO be providing additional and/or different incentives with respect to energy efficiency?

Four Portfolios Considered

Utilities must balance costs, reliability and environmental impacts when engaged in long-term planning for new resources.

- Base Case BPA load forecast, planned conservation based on the "program" case in the Conservation Potential Assessment (CPA), moderate growth in net metering interconnections and moderate growth in electric vehicles.

- Low Load Case BPA load forecast, high conservation based on the "maximum achievable" case in the CPA, high growth in net metering connections and low growth in electric vehicles.

- High Load Case Load forecast developed by OPALCO staff, low conservation based on excluding the "higher cost programs" from the "program" case in the CPA, low growth in net metering connections, high conversion from propane to electric heat and high growth in electric vehicles.

- High Sustainability Case High growth in net metering connections, high conservation, high demand response and optimistic assumptions regarding the deployment of local resources including community solar, utility-owned solar, local wind projects, local pumped storage, utility-scale batteries and biomass. This case will target a percent of OPALCO load to be served by local resources.

IRP Objectives and Strategy

typical planning horizon of 20 years

Objectives

- Maintain BPA as our long-term power provider
- ~~Target zero load growth~~ (board emphasize revenue generation)
- Ensure continuing safe, reliable and stable grid operation as intermittent local renewable energy sources are added
- Minimize environmental impact (reduce carbon footprint)
- Increase sustainability for critical services

Recommended Strategies

- Optimize BPA power (Tier 1)
- Maximize BPA rebates to our membership
- Incentivize fuel switching for EV, heat pumps and new construction
- ~~Offset new energy load (item 3 above) with efficiency, conservation and local renewable incentives.~~ (based on deletion above, board deleted this item)
- Ensure grid control backbone accommodates emerging smart grid local distributed energy resources and vehicle to grid standards
- Encourage peak load reduction (renewable and demand response)
- Continue to evaluate relationships with strategic resource partners
- Establish prepaid metering program
- Continue education and outreach programs (support above)

IRP Next Steps

A. √ Complete Staff kick-off meeting: November
B. √ Development of Load forecast scenarios: Q1
C. √DevelopmentofBPAPowerSupplymodeling:Q1
D. √PresentLoad-ResourceBalanceandscenariostoBoard:Q2
E. √ Research resource and efficiency options applicable to OPALCO: Q2
F. √ Evaluate strategic alliances with other utilities: Q2
G. Present Recommended Strategies: Q3 (August Meeting)
H. Develop benefit/cost analysis of identified resource and efficiency options: Q3
I. Develop risk analysis: Q3
J. Solidify direction: Q3
K. Draft Report: Q3
L. Present Evaluation results and strategic options for the future: Q3
M. Present Analysis of strategic alliances: Q4
N. FinalizeReport:Q4