

# RATES REVIEW: LONG RANGE CAPITAL PLAN

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OPALCO

Board Meeting Work Session

March 2018

# Rates Review: Timeline

✓	February 2018	Strategic Long Range Vision
✓	March 2018	Long-Range Capital Projects Plan work session
	May 2018	Long-Range Financial Plan equity, cash, debt
	June 2018	Cost of Service Analysis (COSA) part 1
	August 2018	Cost of Service Analysis (COSA) part 2
	September 2018	Rate Structure Review supporting COSA
	October 2018	Rate Structure Approval



Between now and 2040, the world will spend over...

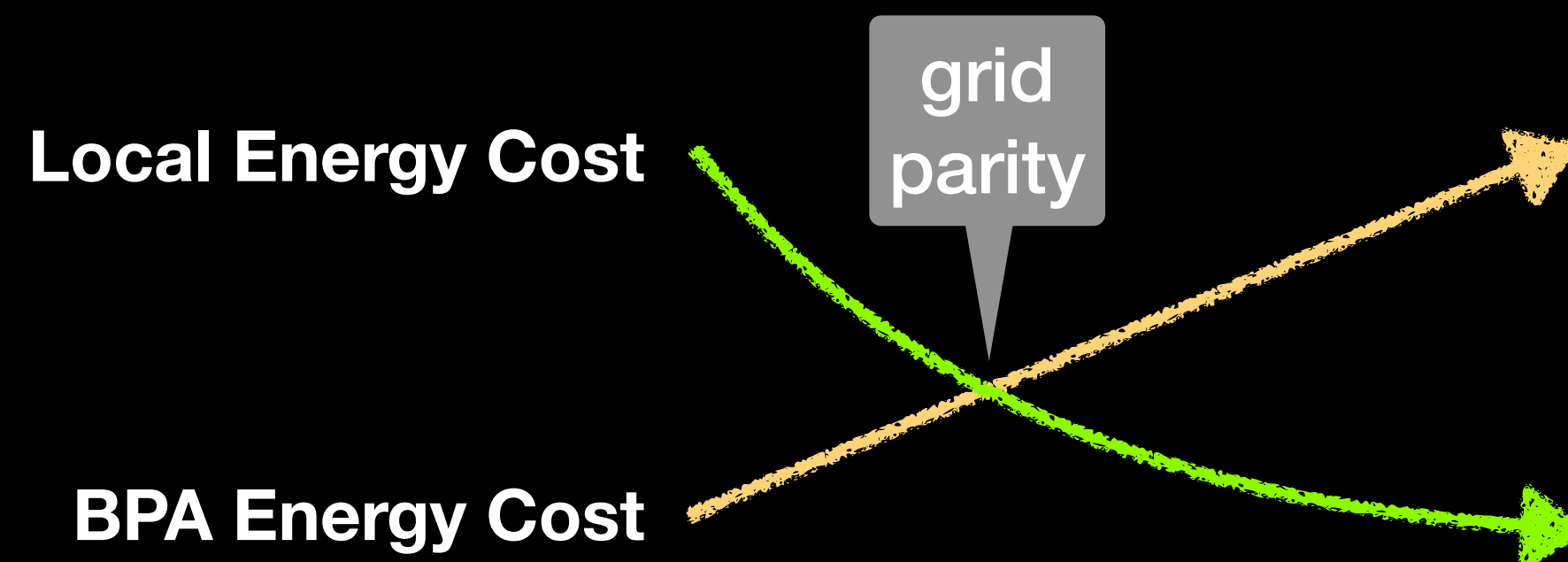
\$20 Trillion on **Energy** Infrastructure

\$10 Trillion on **Telecom** Infrastructure

*As with the world, OPALCO is ahead of the curve with both energy and communications*

# LRP Options: Business as Usual or Local Energy Resilience

- Continue BPA/Mainland Power Purchase
  - Financial trajectory: extreme burden
- Develop Our Own Local Energy Resources
  - As local energy resources approach grid parity and technical viability
  - ... increase local energy resilience
  - ... that helps moderate rising power cost





# LRP Options: Continued Commitment to Fuel Switching

- Electrification of Transportation and Heating
  - Helps members reduce TOTAL energy bill by over \$1,000 per year
  - Keeps energy dollars more local
  - Increases electric system efficiency, keeping costs lower per unit
  - Reduces dependance on propane and gasoline from mainland

Today we look at alternatives to invest co-op capital in anticipation of increased automation and local renewables (solar, wind, tidal)

*OPALCO's IRP and LRP provide a strong strategic path to increased local **energy** and **communications** resilience.*

To walk that path requires:

- ➔ long range financial planning,
- ➔ financial and engineering expertise, and
- ➔ steady commitment

# OPALCO's Long Range Plan (LRP): Elements

*The LRP spans 2018 to 2040*

## Load Growth Change

- Population
- Fuel Switching (electrification of fossil heating and transportation)
- Efficiency (conversion from standard electric heating to heat pumps)
- Climate change impact
- Demand (managed with DRUs, storage, and rates)

➡ *Shifting load shape provides challenges and opportunities*

## Resources

- BPA
- Solar - community/utility and rooftop/personal
- Storage
- Tidal
- Other (wind, biomass, barrage, etc.)
- Implications as we transition to local resources that are “free” fuel, but capital expensive
- Grid Modernization Roadmap

➡ *The resource mix is becoming more local and diverse and - properly engineered and managed - resilient, and affordable*

## LRP Finance

- LRP Capital Projects
- Grants
- Equity strategy - submarine cable management innovation

➡ *There are significant opportunities to manage cost and maintain healthy co-op revenues*



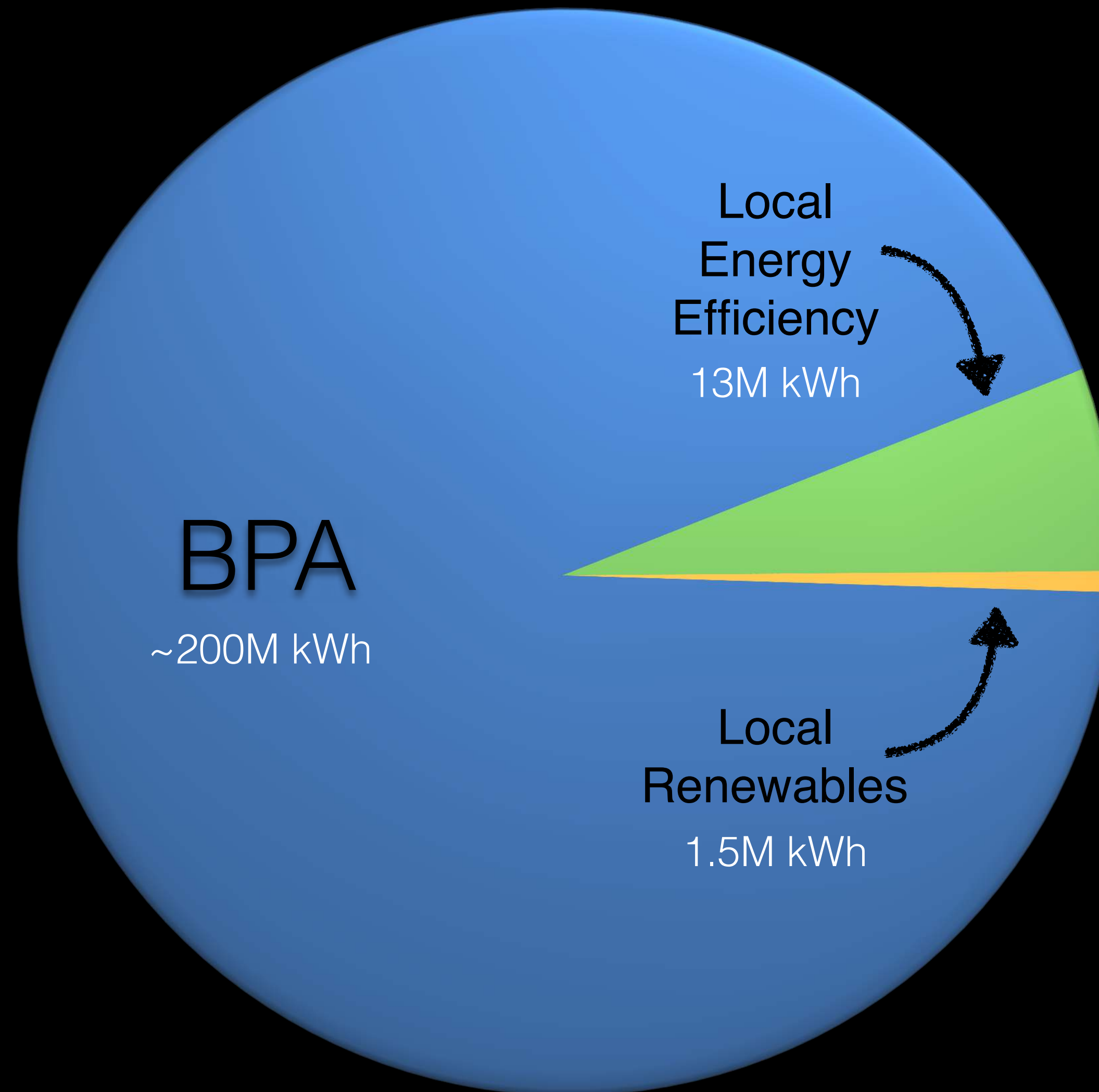
# Global Uncertainty and Risk: Increasing need to be self reliant

*increasing extreme weather and national grid politics are driving risk higher*

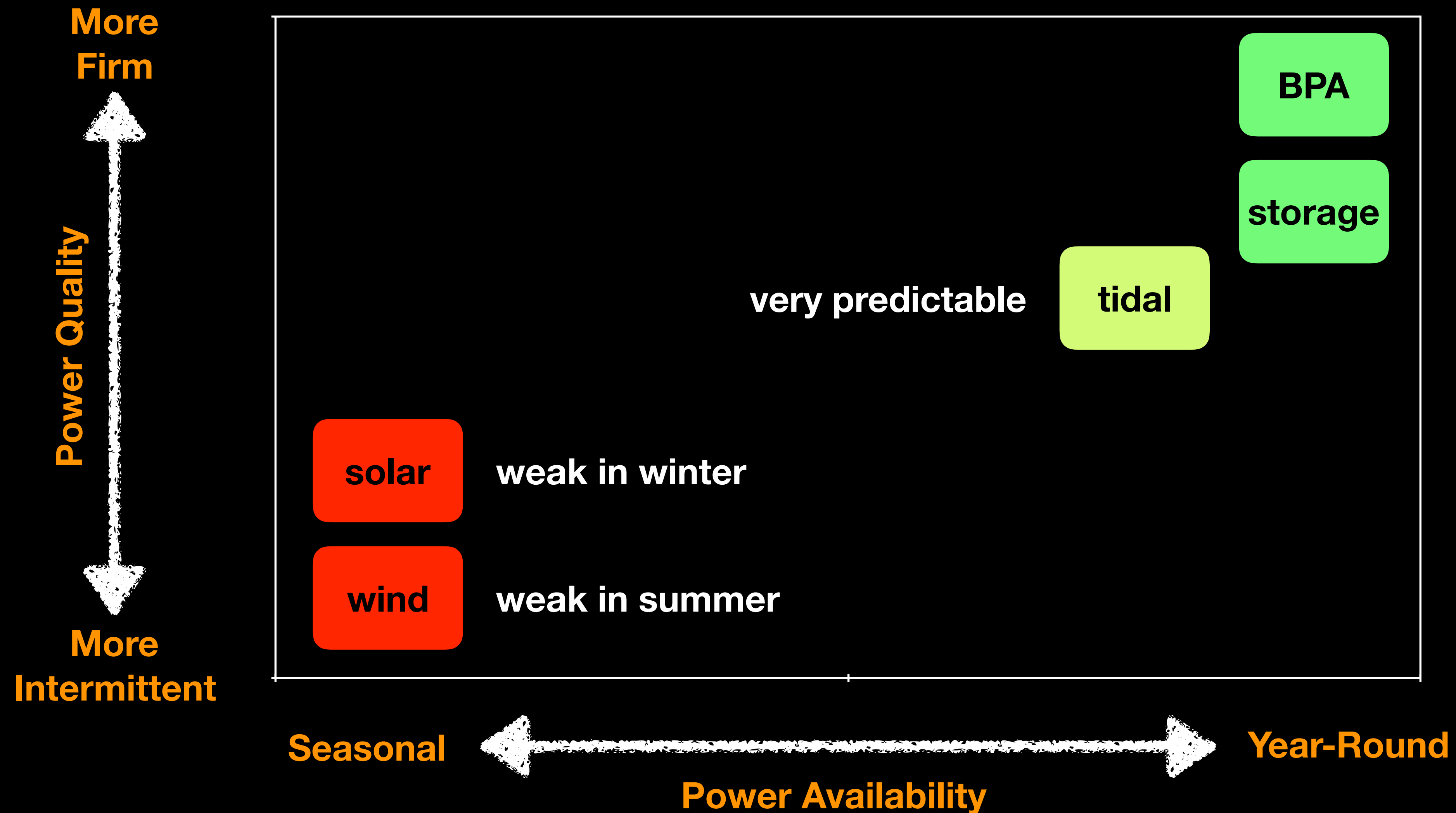
- Mainland may not invest in grid in ways that are in islander interests
- Global warming, extreme weather events becoming more frequent
- The point is: We need be transitioning to a more local and resilient energy grid.

Local renewable energy pricing is approaching a point that supports that.

# OPALCO Resource Mix: Now



# OPALCO Grid: Local Energy Resource Analysis



# OPALCO Grid: 2040

## Utility-Scale Sources

**Firm**

**BPA**

**storage**

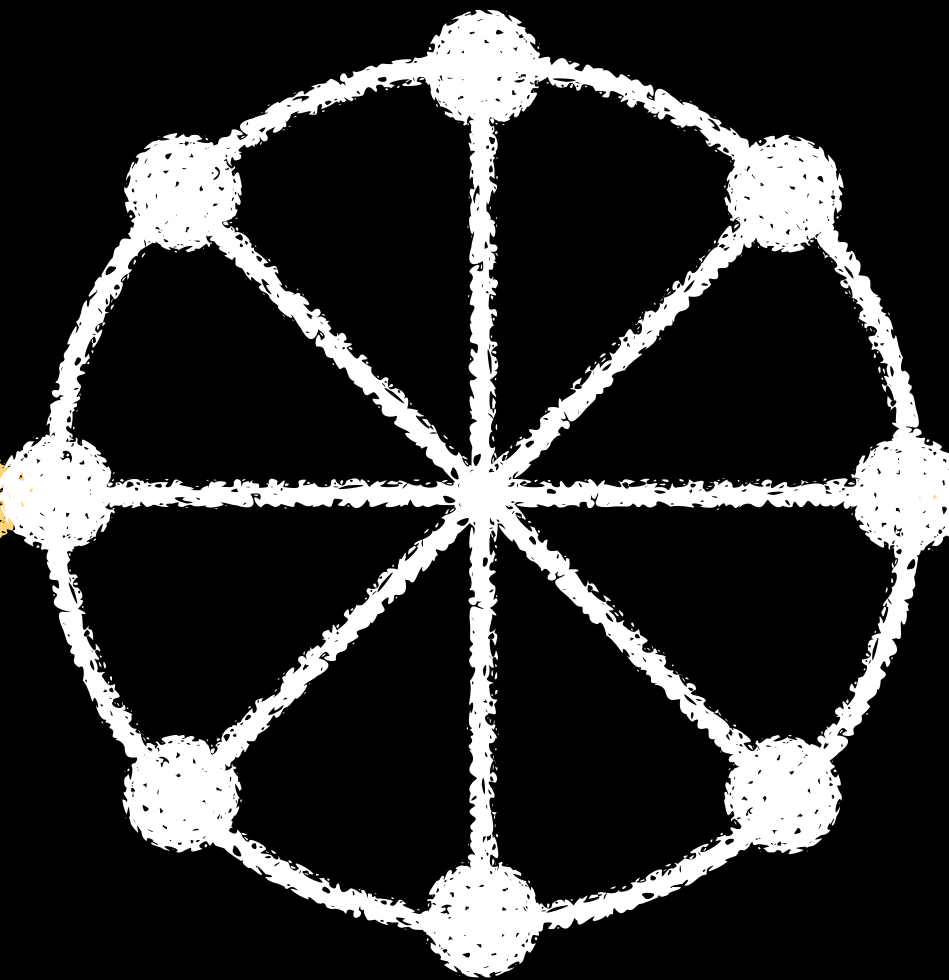
**tidal**

**solar**

**wind**

**OPALCO**

local distributed energy,  
resilient grid, and  
balancing services



**Member**

**Load + Generation**

**Residential/  
Commercial**

- virtual demand response
- rooftop solar
- energy storage (e.g. Powerwall, V2G)

**Internet of Things (IoT)**  
energy + communications

**Intermittent**

# Capital Projects Plan



# OPALCO Grid: 740C Capital Projects - Now through 2040

				F.	G.	H.	I.	J.	K.	L.	M.	N.	O.
				Proposed Budget 2018	Forecast 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023	Forecast 2024	Forecast 2025	Forecast 2026	
	RUS CWP DESCRIPTION												
1	DISTRIBUTION												
2	100	New Services		\$ 361,000	\$ 372,000	\$ 384,000	\$ 396,000	\$ 408,000	\$ 421,000	\$ 434,000	\$ 448,000	\$ 462,000	
3	200	New Tie Lines											
4	300	Conversions and Line Changes		410,000	1,430,000	1,430,000	1,430,000	1,430,000	1,430,000	1,430,000	1,430,000	1,430,000	
5	400	New Substations, switching station, metering point, etc.											
6	500	Substation, Switching Station, Metering Point Changes											
7	600	Miscellaneous Distribution Equipment											
8	601	Transformers & Meters								654,000	674,000	695,000	
9	602	Sets of Service Wires to increase Capacity											
10	603	Sectionalizing Equipment		440,000	300,000	300,000	300,000	300,000	75,000	50,000	75,000		
11	604	Regulators		150,000		80,000							
12	605	Capacitors											
13	606	Ordinary Replacements		123,000	127,000	131,000	135,000	140,000	145,000	150,000	155,000	160,000	
14	608	Underground Dist. Cable Replacement		1,120,000	1,764,000	1,817,000	1,872,000	1,929,000	1,988,000	2,047,000	2,109,000	2,173,000	
15	700	Other Distribution Items											
16	701	Engineering Fees											
17	704	LMS & SCADA		162,000	84,000	87,000	45,000	24,000		7,000	4,000	3,000	
18	705	AMR Station Equipment (No Meters)		270,000									
19	706	Communications											
20		706.0	Island Network										
21		706.1	Fiber/Microwave Infrastructure	538,000	15,000	16,000	17,000	120,000	76,000	50,000	53,000	56,000	
22	TRANSMISSION												
23	800	New Tie Line											
24	900	New Substations, switching station, metering point, etc.											
25	1000	Line and Station Changes									109,000	113,000	
26	1100	Other Transmission		-	-	-	-	-	-	-	-	-	
27	GENERATION												
28	1200	Generation											
29	OTHER												
30	1300	Facilities		675,000	110,000	70,000	74,000	78,000	82,000	87,000	92,000	97,000	
31	1400	Acquisitions		-	-	-	-	-	-	-	-	-	
32	1500	All Other											
33	1501	Transportation/Equipment/Tools/Radios		613,000	631,000	568,000	597,000	627,000	659,000	692,000	727,000	764,000	
34	1502	Office Equipment/Furniture/Etc.		41,000	22,000	23,000	24,000	25,000	26,000	27,000	28,000	29,000	

loop feeds

storage

Meters

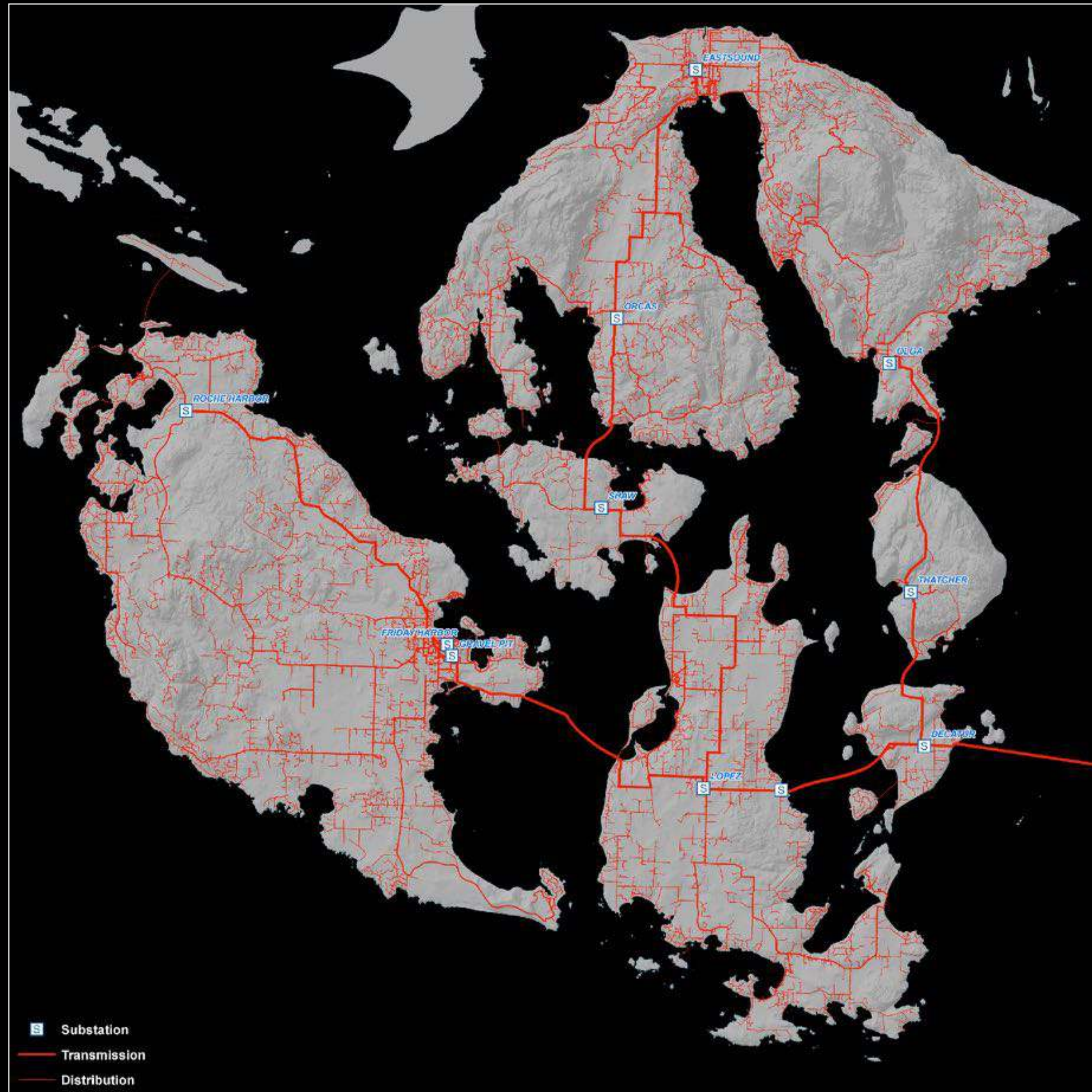
grid automation

cath protect

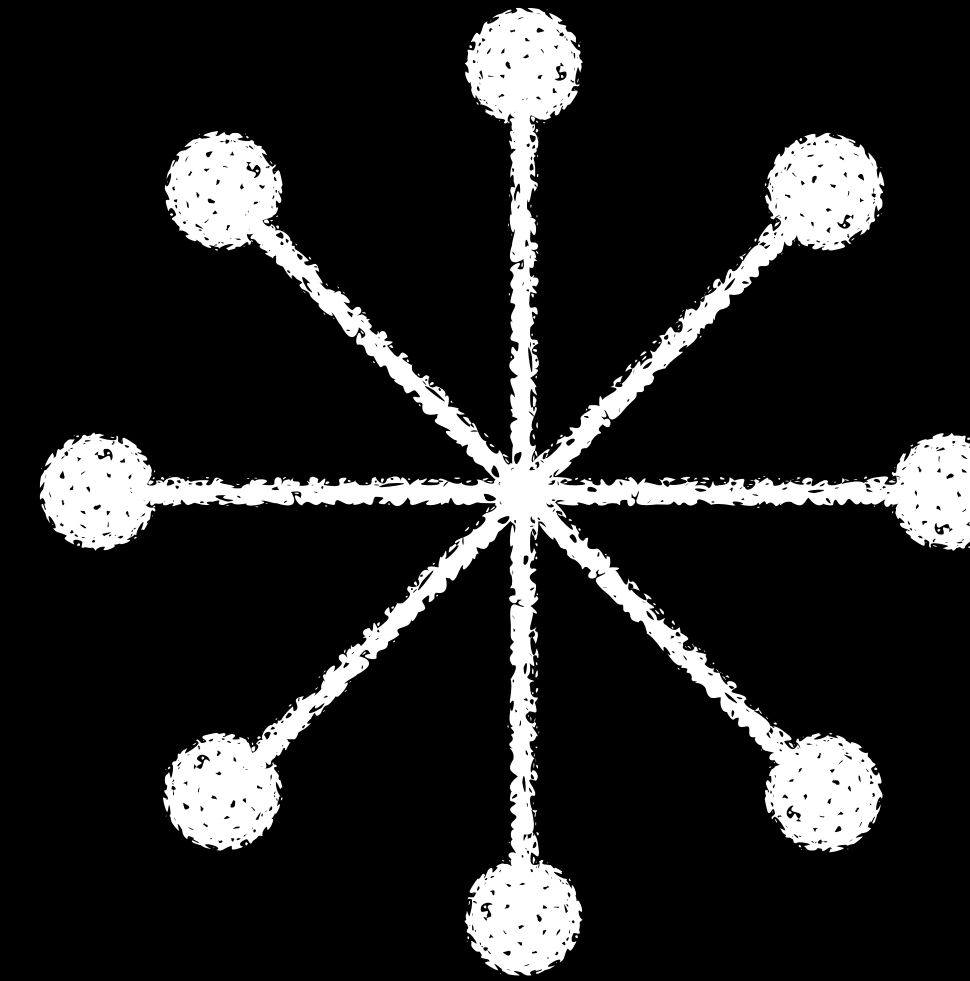
local generation



# OPALCO Grid: Now - Transmission and Distribution



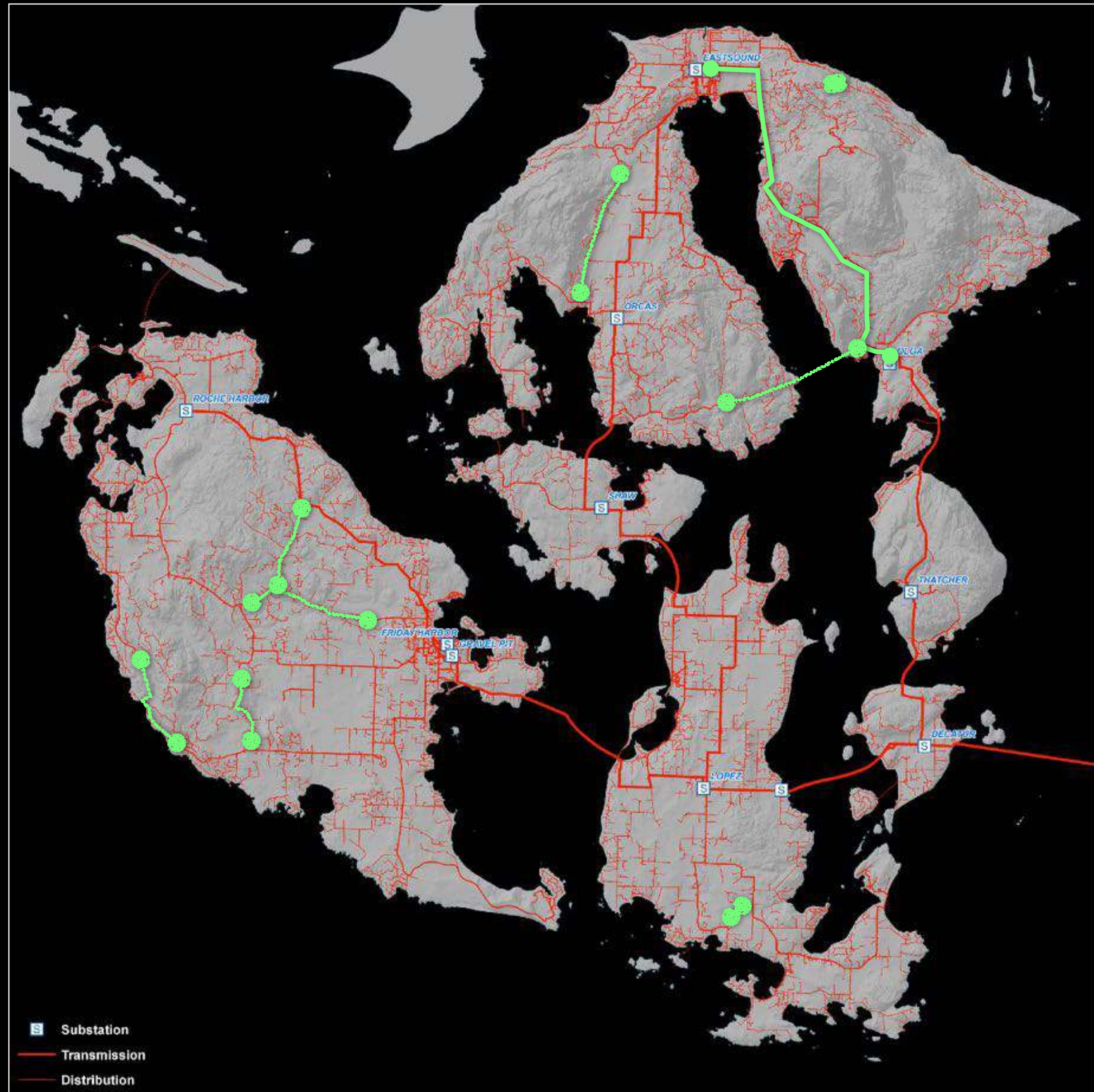
Now



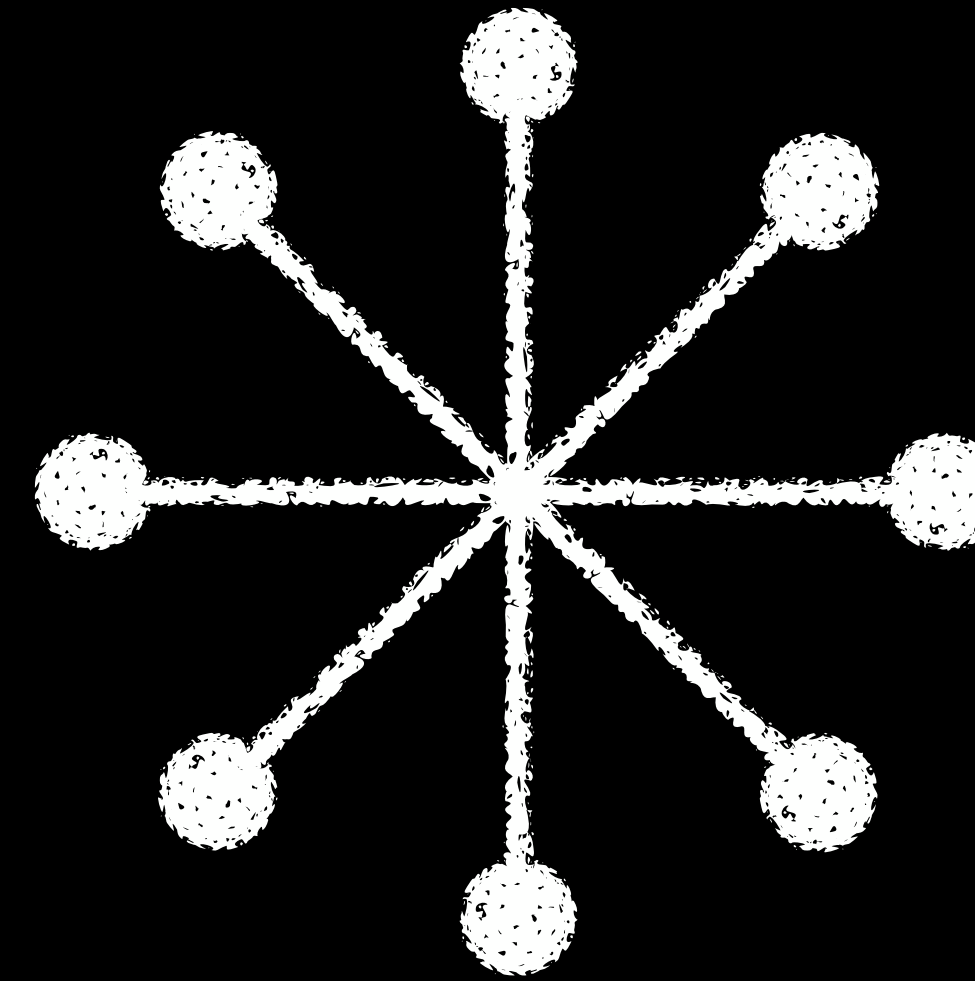
**Mostly Radial**  
vulnerable to  
single-point  
failure



# OPALCO Grid: 2040 - Becoming More Adaptive - Loop Feeds

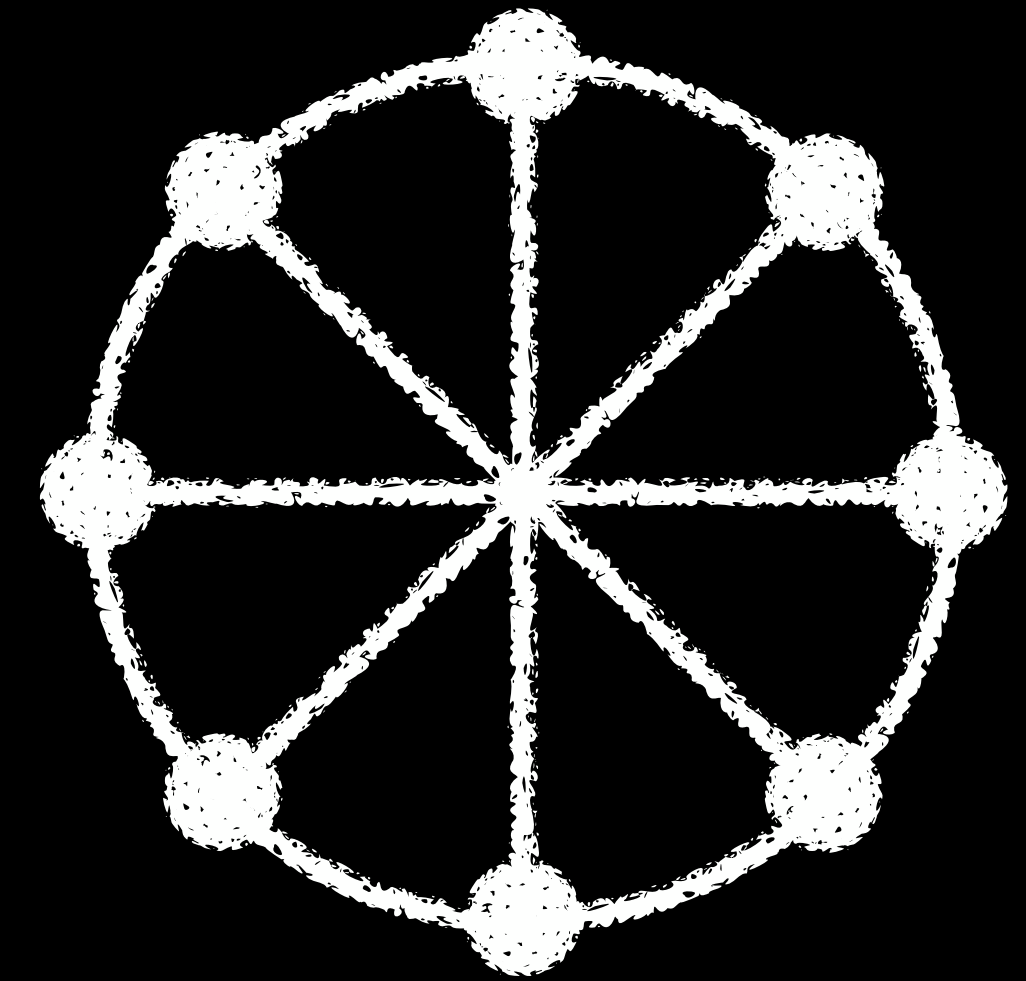


Now



**Mostly Radial**  
vulnerable to  
single-point  
failure

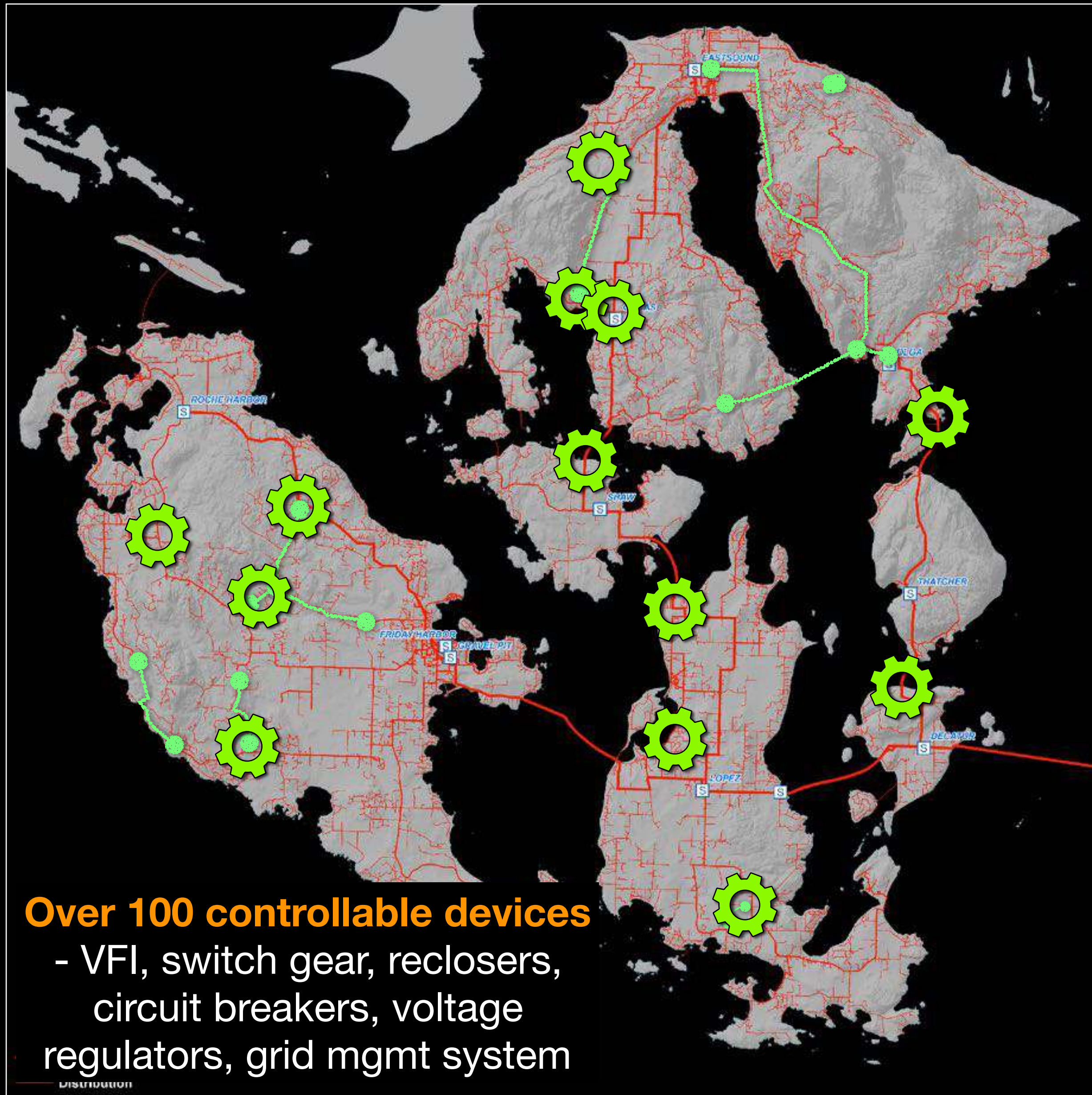
2040



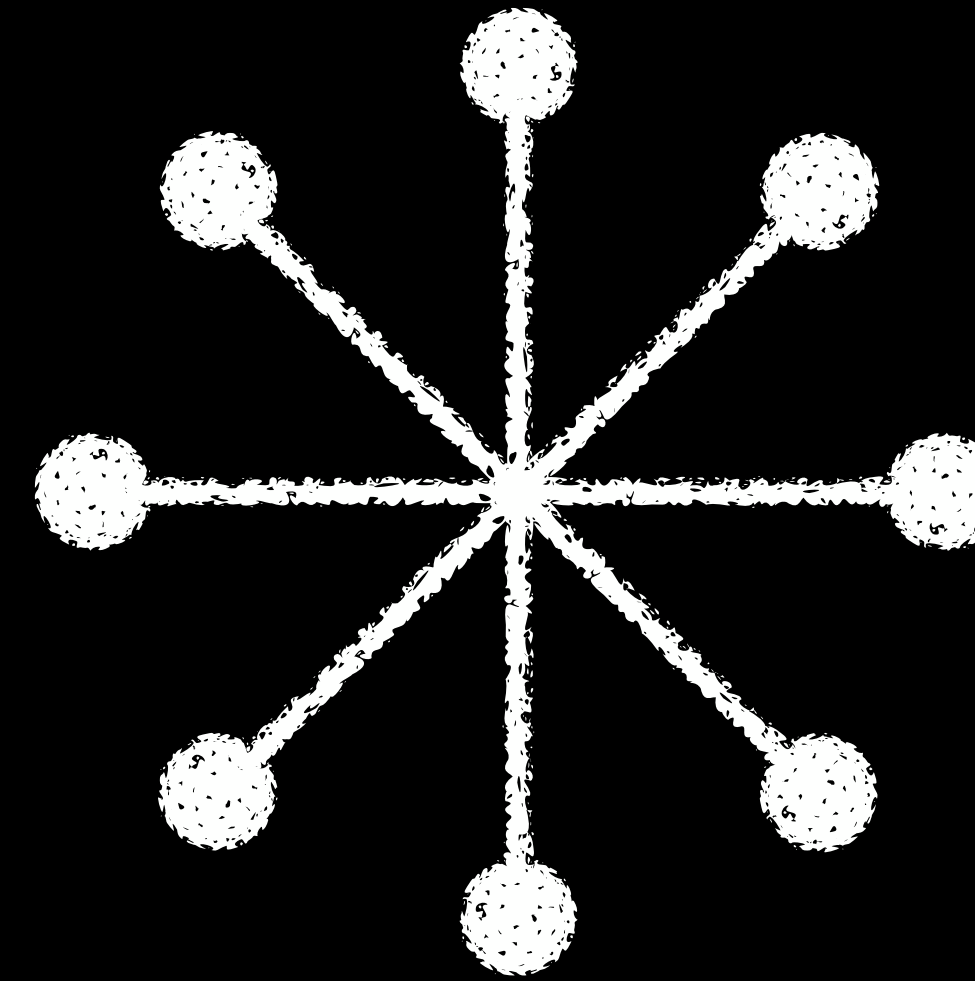
**Mostly Multi-path**  
fault-tolerant



# OPALCO Grid: 2040 - Becoming More Adaptive - Loop Feed Automation

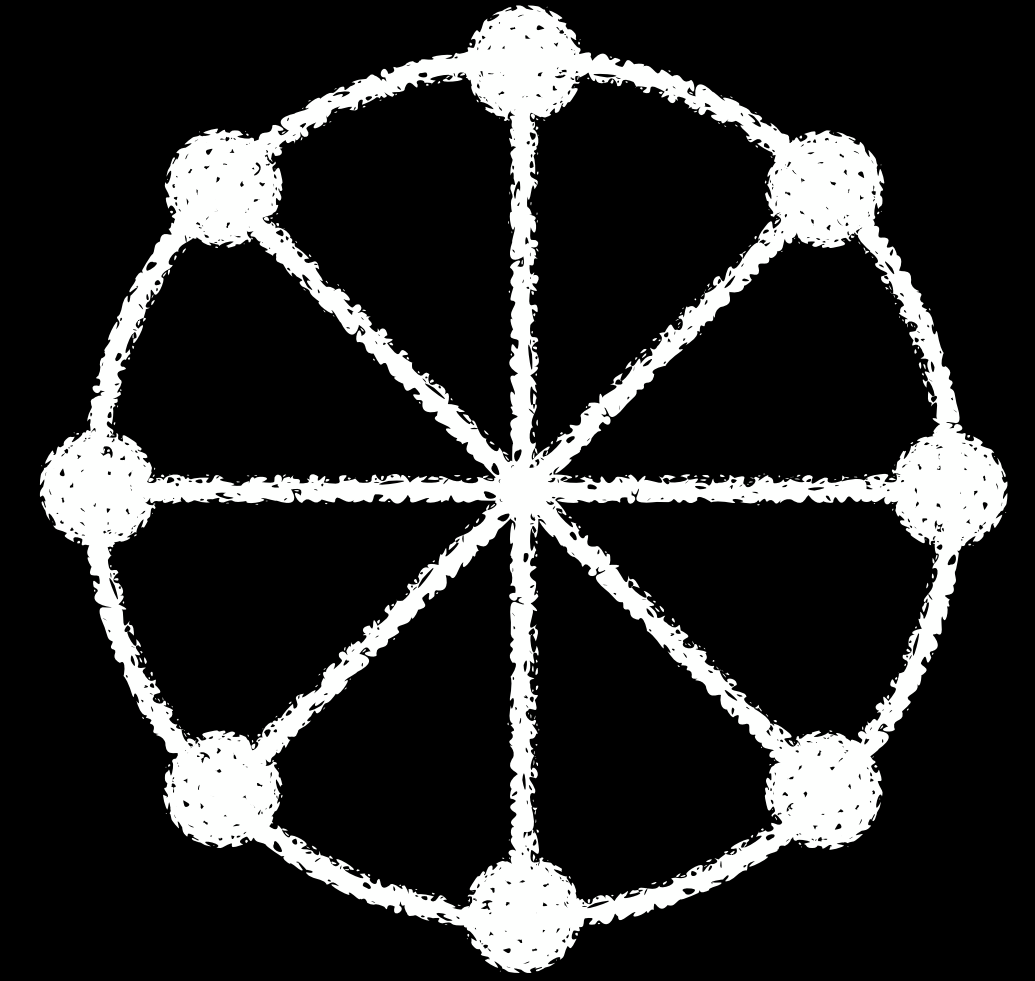


**Now**

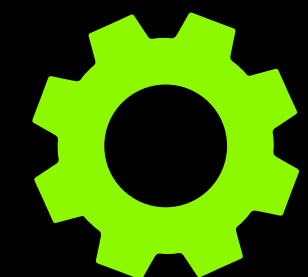


**Mostly Radial**  
vulnerable to  
single-point  
failure

**2040**

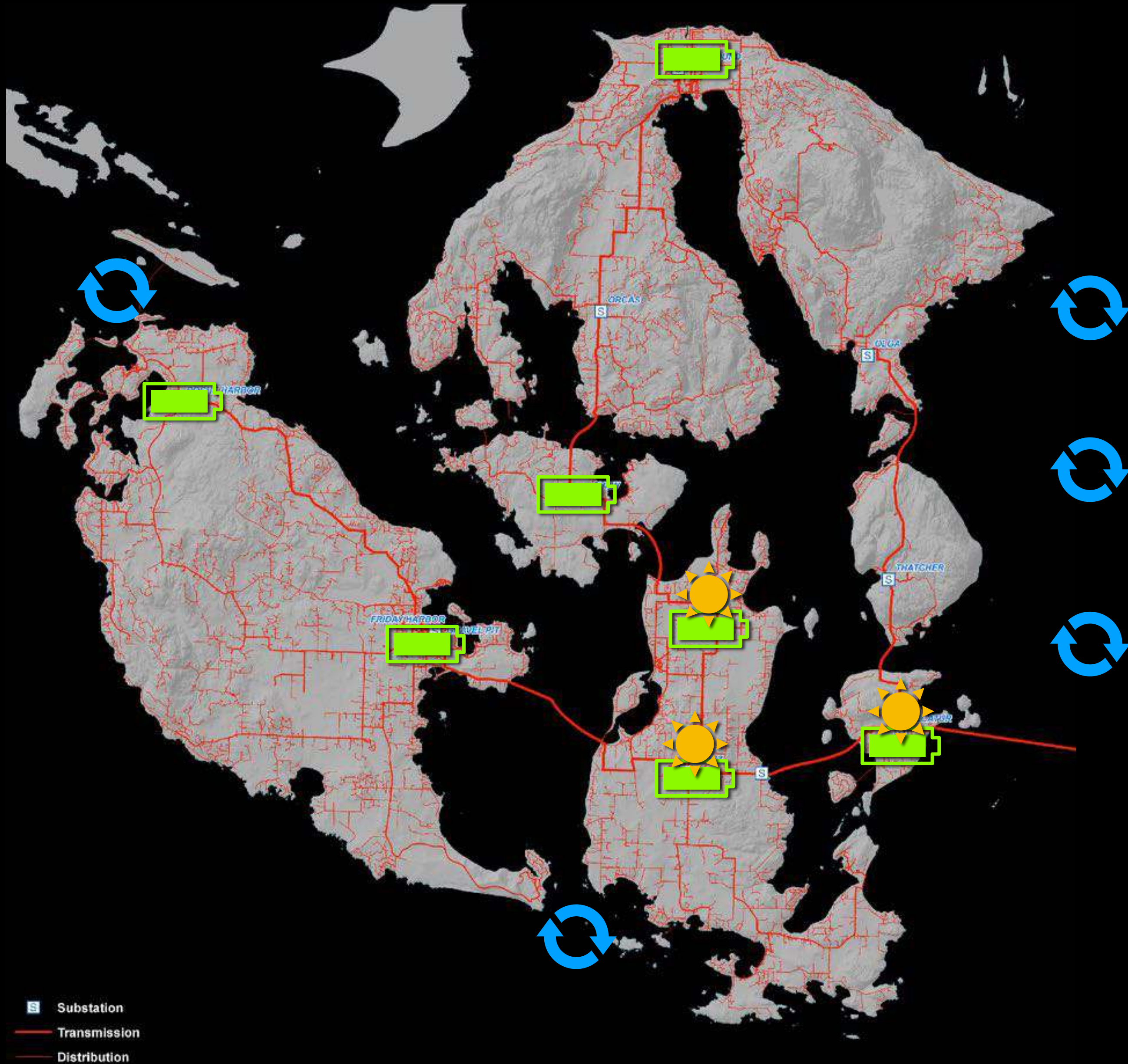


**Mostly Multi-path**  
fault-tolerant,  
self-healing





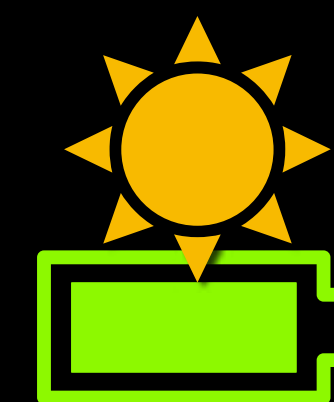
# OPALCO Grid: 2040 - Increasing Local Energy Resilience - Tidal, Micro-Grids



## Micro-Grids



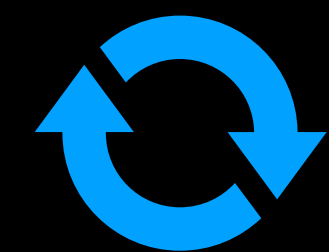
**Solar + Battery**  
at substations and  
town-centers



## Tidal Energy

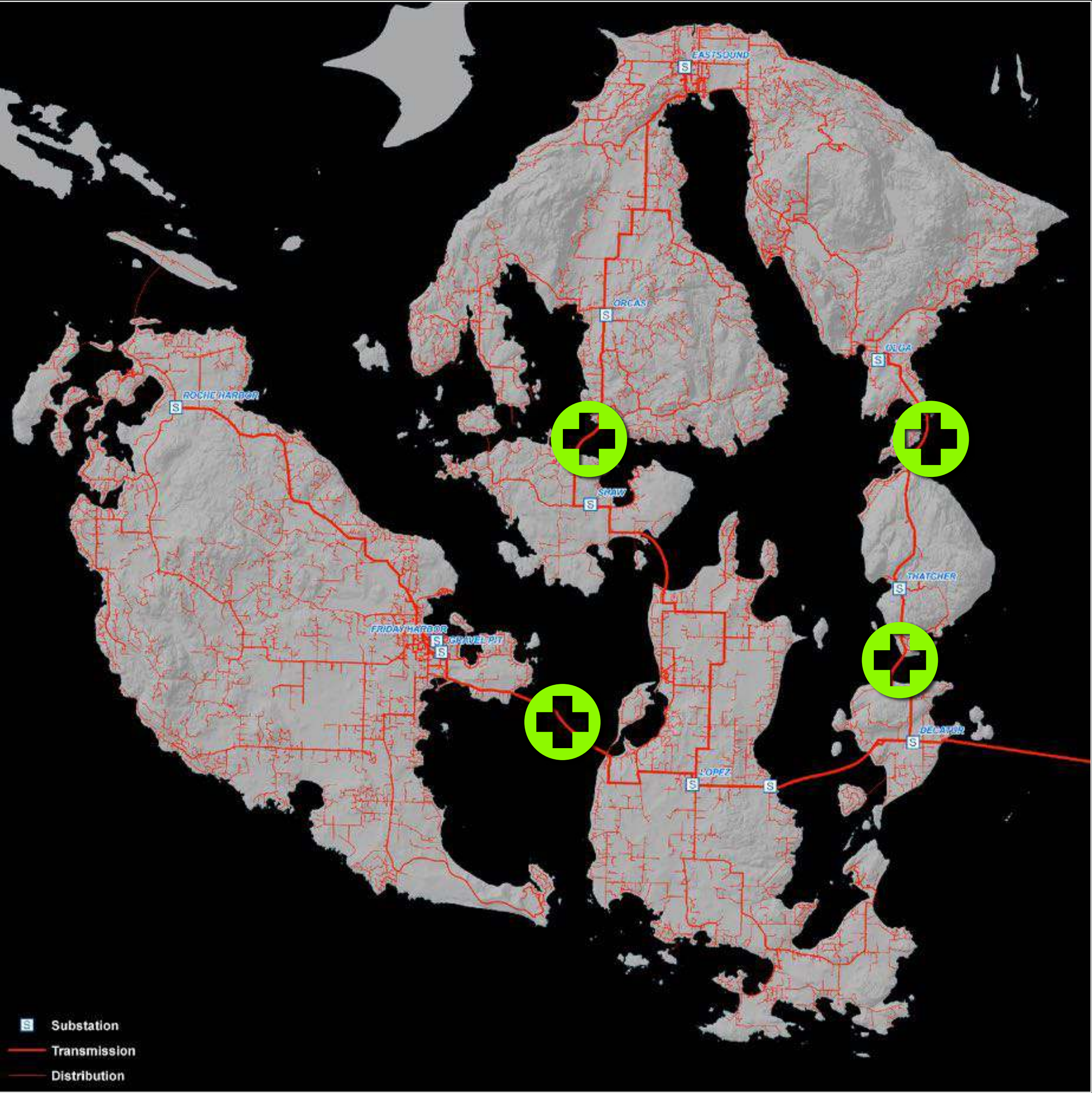


**Tidal Generators**  
in tidal streams,  
generating year-round

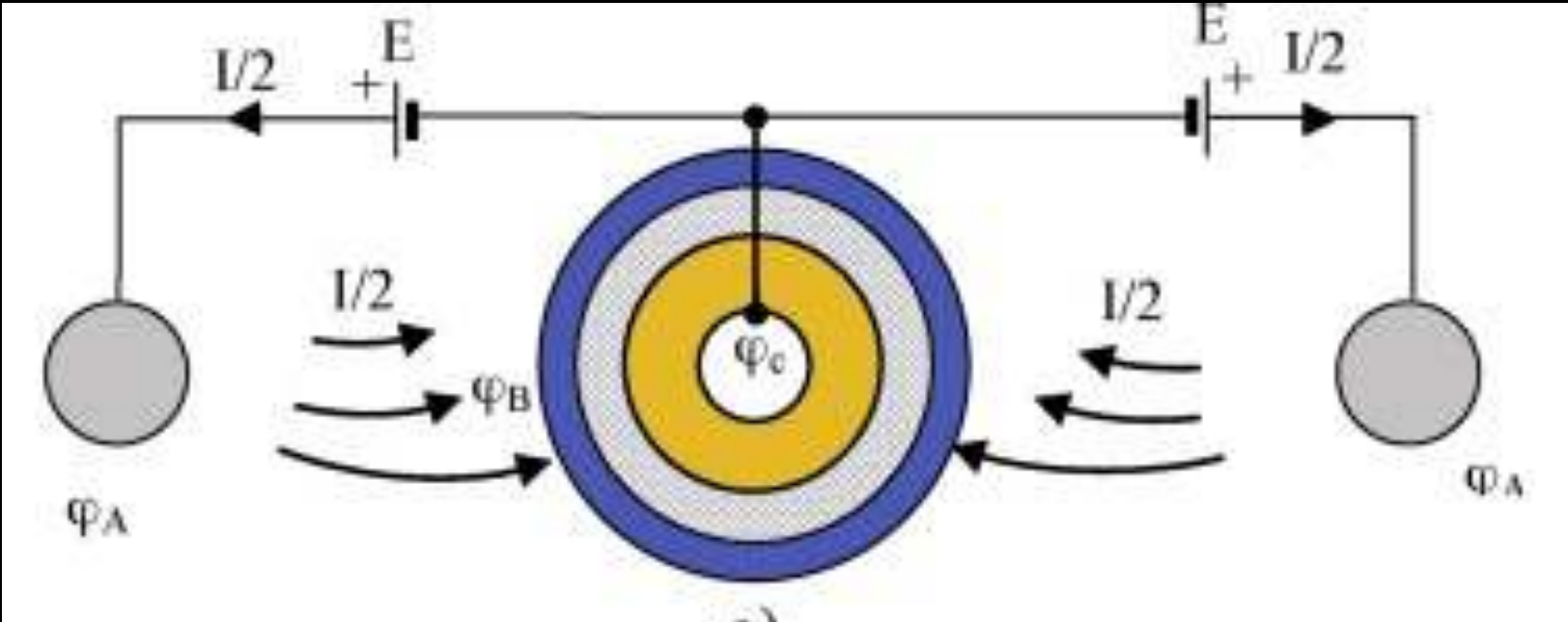




# OPALCO Grid: 2040 - Increasing Asset Life - Cathodic Protection



## Cathodic Protection



Reduce  
Corrosion  
extend submarine  
cable life

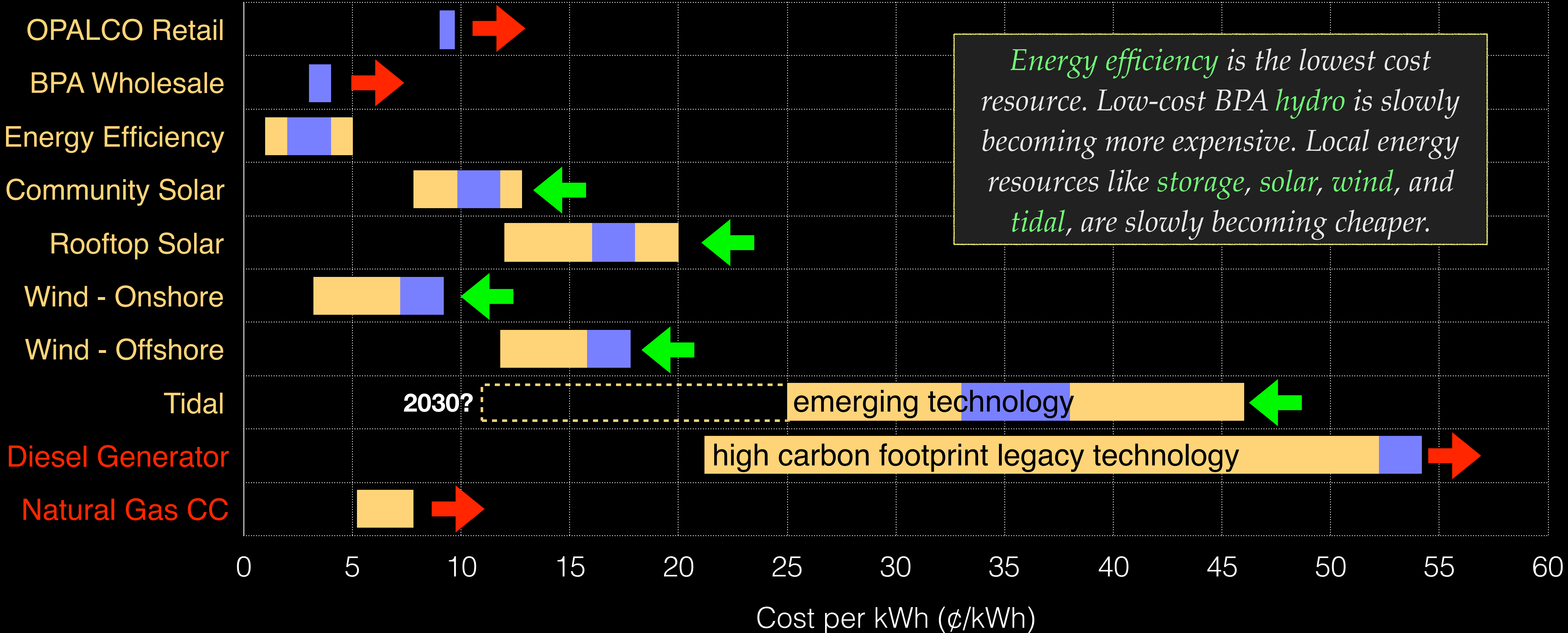




# Unsubsidized Levelized Cost of Energy Sources: Now

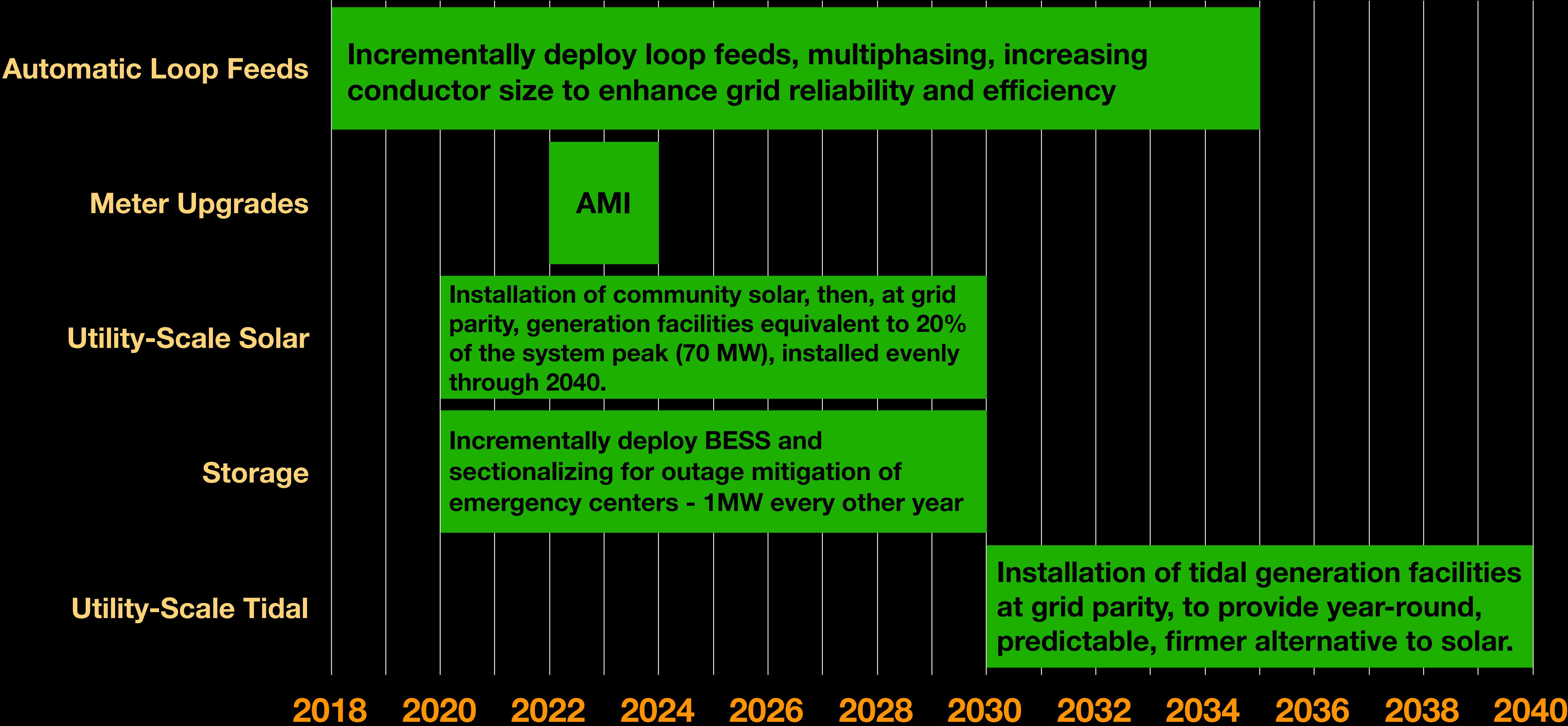
Cost Range:  = US  = SJC (actual, or estimated due to NW capacity factor or fuel costs)

Cost Trend:  = Inflation  = Deflation



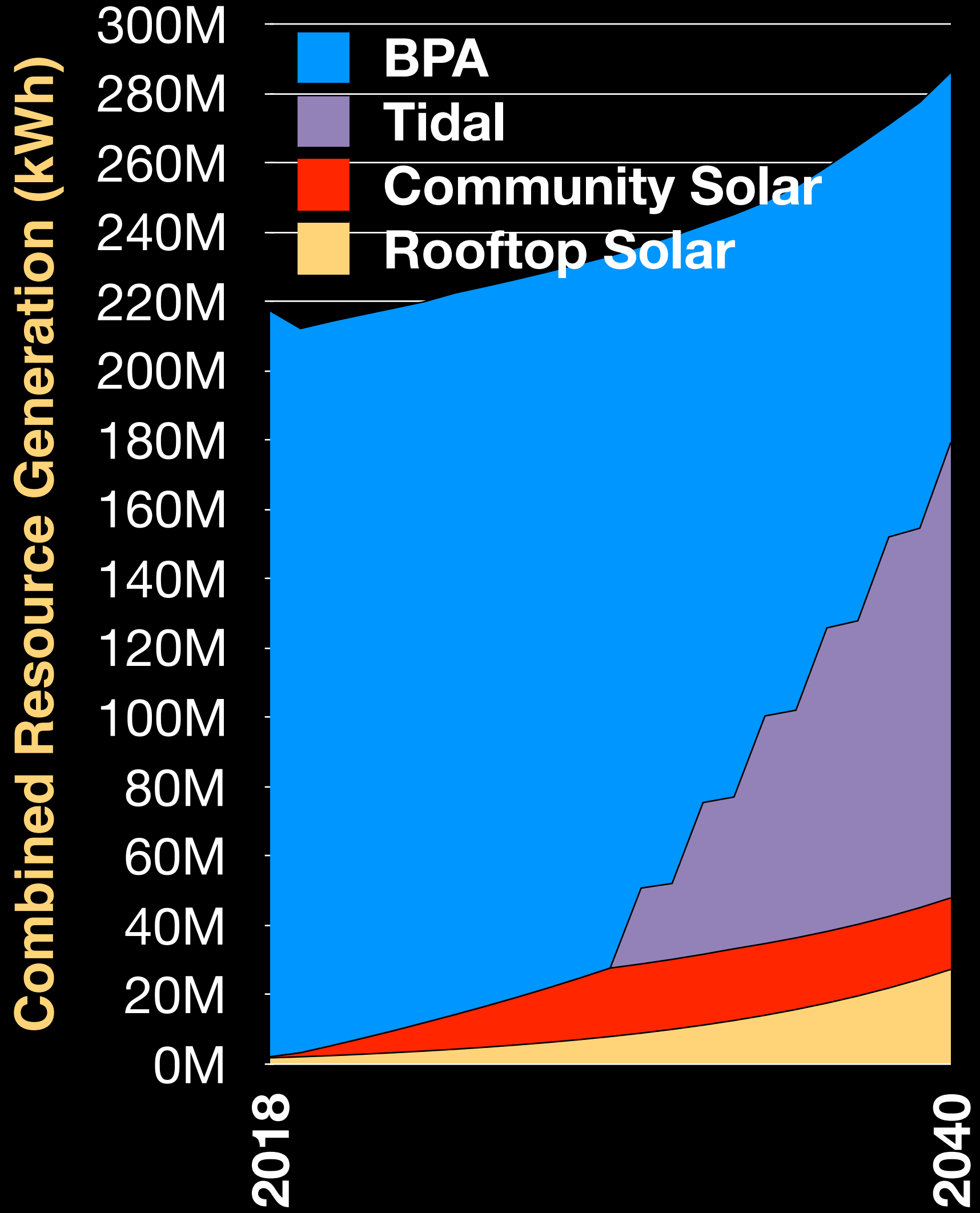
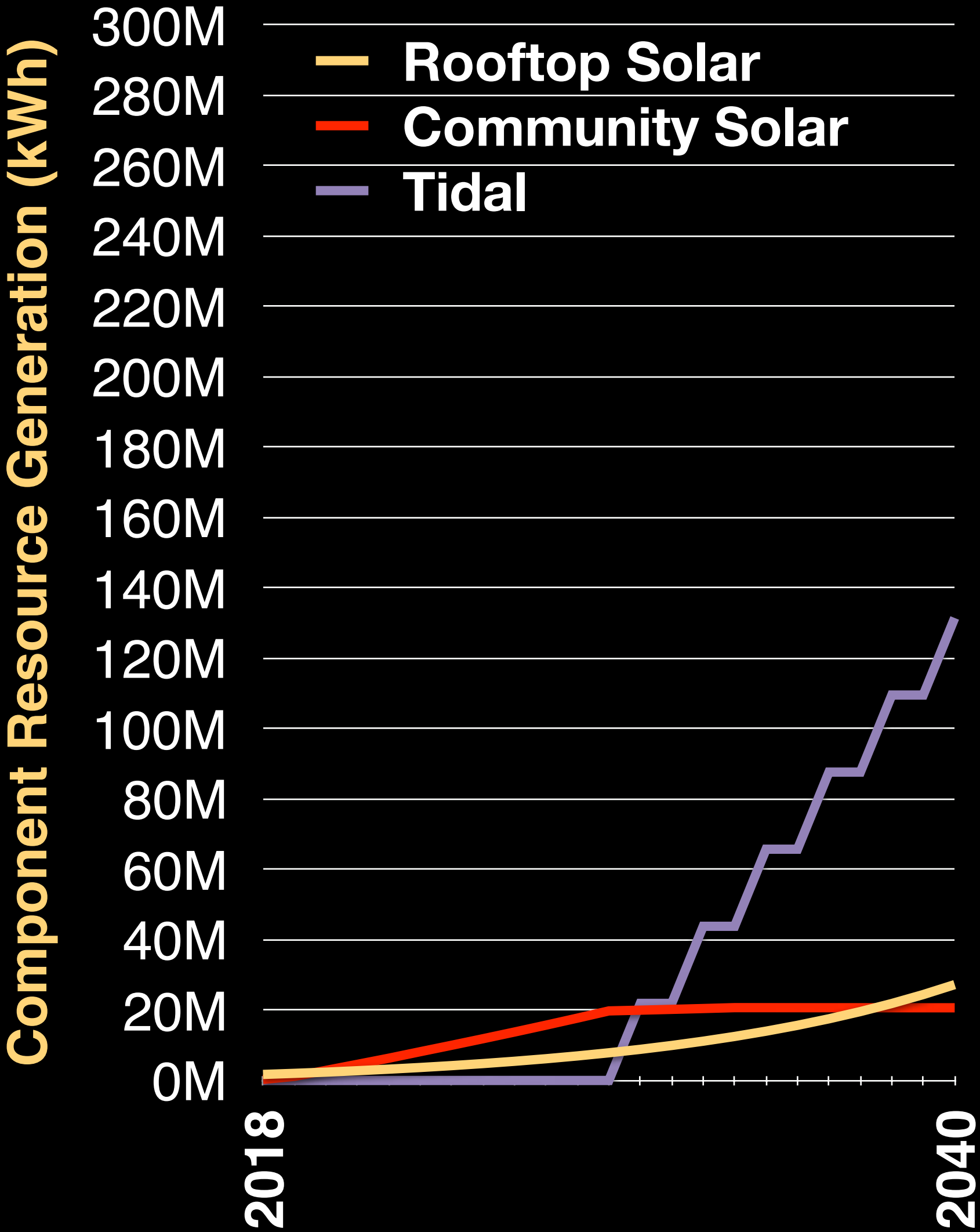
source: OPALCO, NREL, Bloomberg, IRENA, Lazard Levelized Cost of Energy Analysis —version 10.0

# Capital Investment Roadmap



# LRP Resources: Net Change

*combining BPA + rooftop solar + utility-scale solar + tidal + firmed with storage*

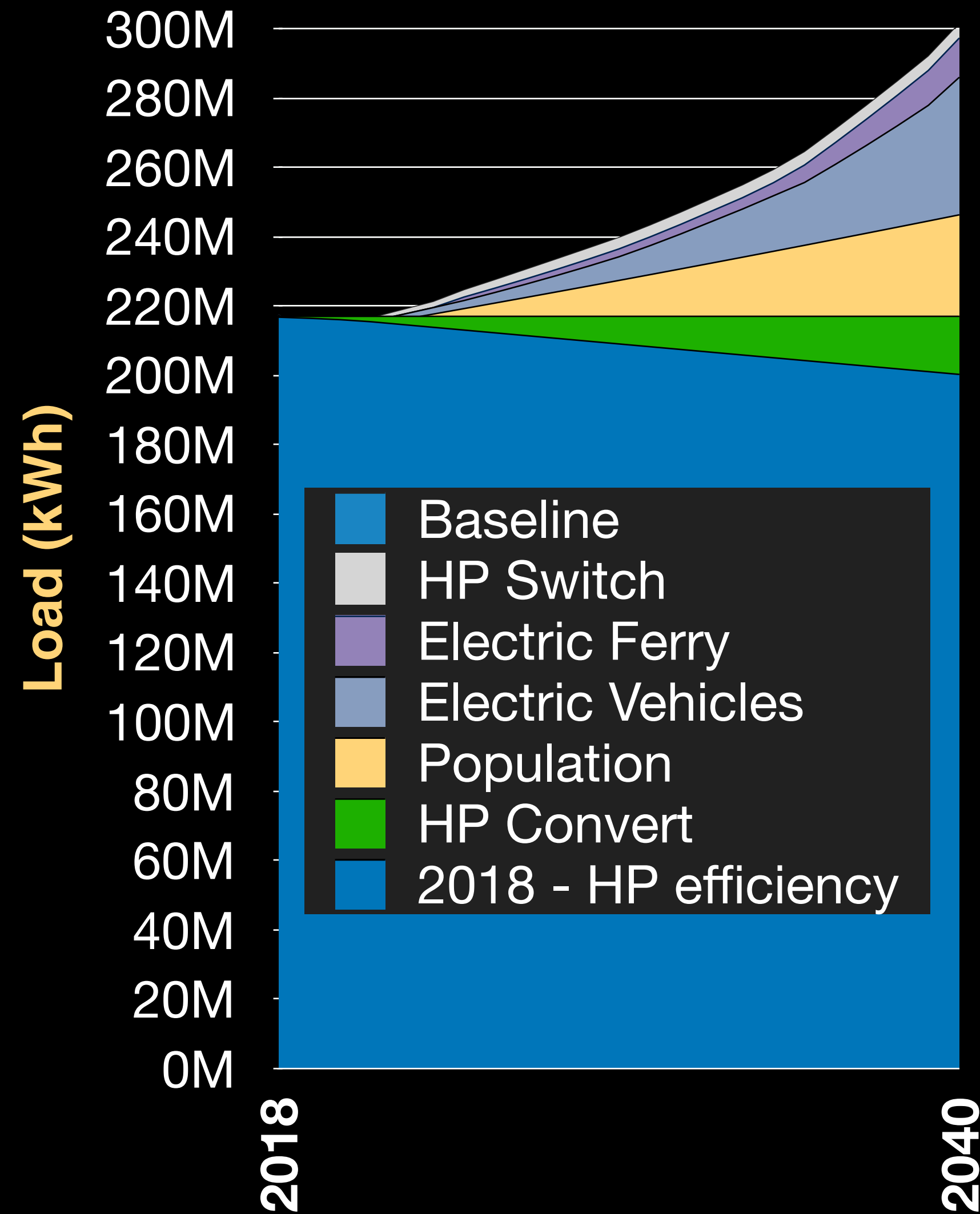
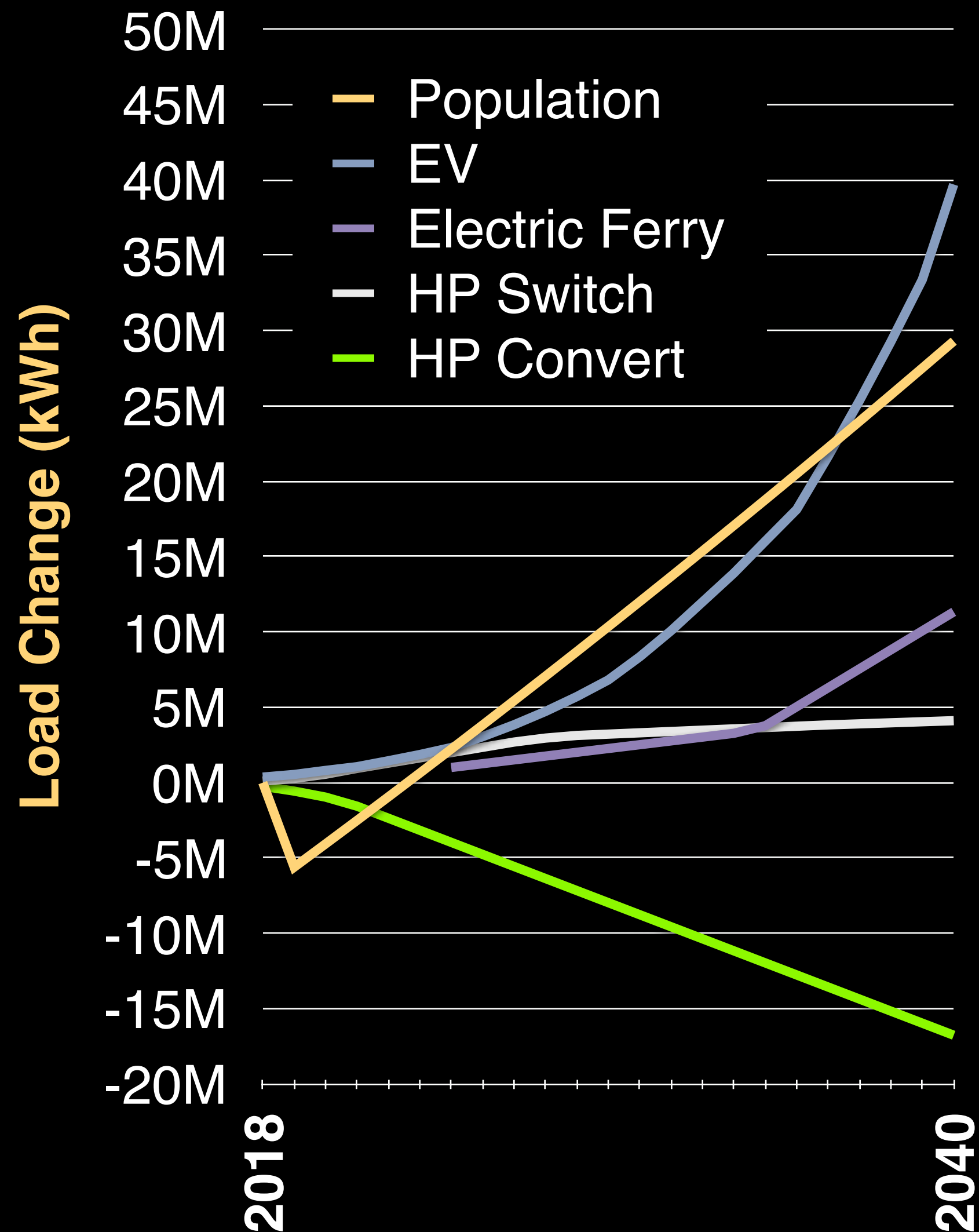


## Notes

- Ramp up community solar in 3 phases:
  - as proving ground for energy cost control, critical system backup, micro-grid and community solar firming
  - Micro-grid town centers to improve local energy resilience
  - when grid parity with BPA, ramp up general deployment until tidal hits grid parity
- Ramp up tidal in two phases:
  - as proving ground working with UW and grant programs
  - then accelerate at grid parity
- Backfill with BPA and storage for firming

# LRP Load Growth: Net Change

*combining population + fuel switching - efficiency*



## Notes

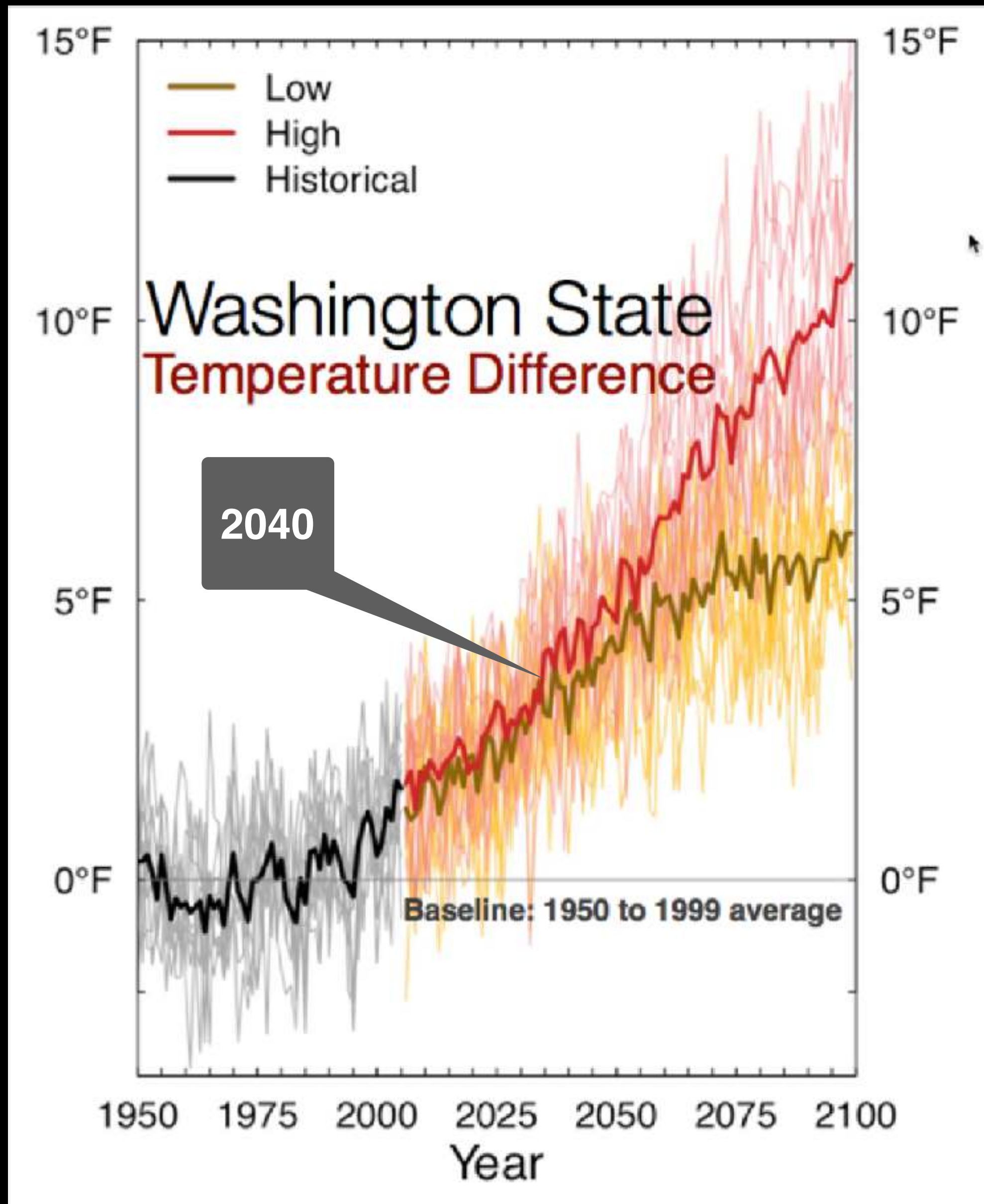
- Net load growth is about 2 million kWh per year over next decade, accelerating in 2030s as electric transportation becomes the norm.
- HP Convert is members that convert from resistance electric heat to ductless heat pump. This reduces load significantly going from 100% efficient resistance heat to 300% efficient ductless heat.
- HP Switch is members that heat with fossil fuels who switch to ductless heat pump. This increases load slightly, but not much due to the high efficiency of ductless heat pumps.



# Choice/Crossroads: Business as Usual or Local Energy Resilience

- Focus on Today (Business as Usual)
  - Continue Mainland Power Purchase (BPA/PNGC)
  - Automate the Grid
  - Adjust as members integrate new technology (EV, rooftop solar)
- Focus on Tomorrow (following IRP plan as a Fast Follower)  
*Strategic Grid Modernization, Balancing Operator*
  - Automation the grid (self healing concept), resilience
  - Balance, augment and connect local generation, storage and member devices (Loss of Power from Mainland)
  - Support member control of usage (transactive energy - contention and get)

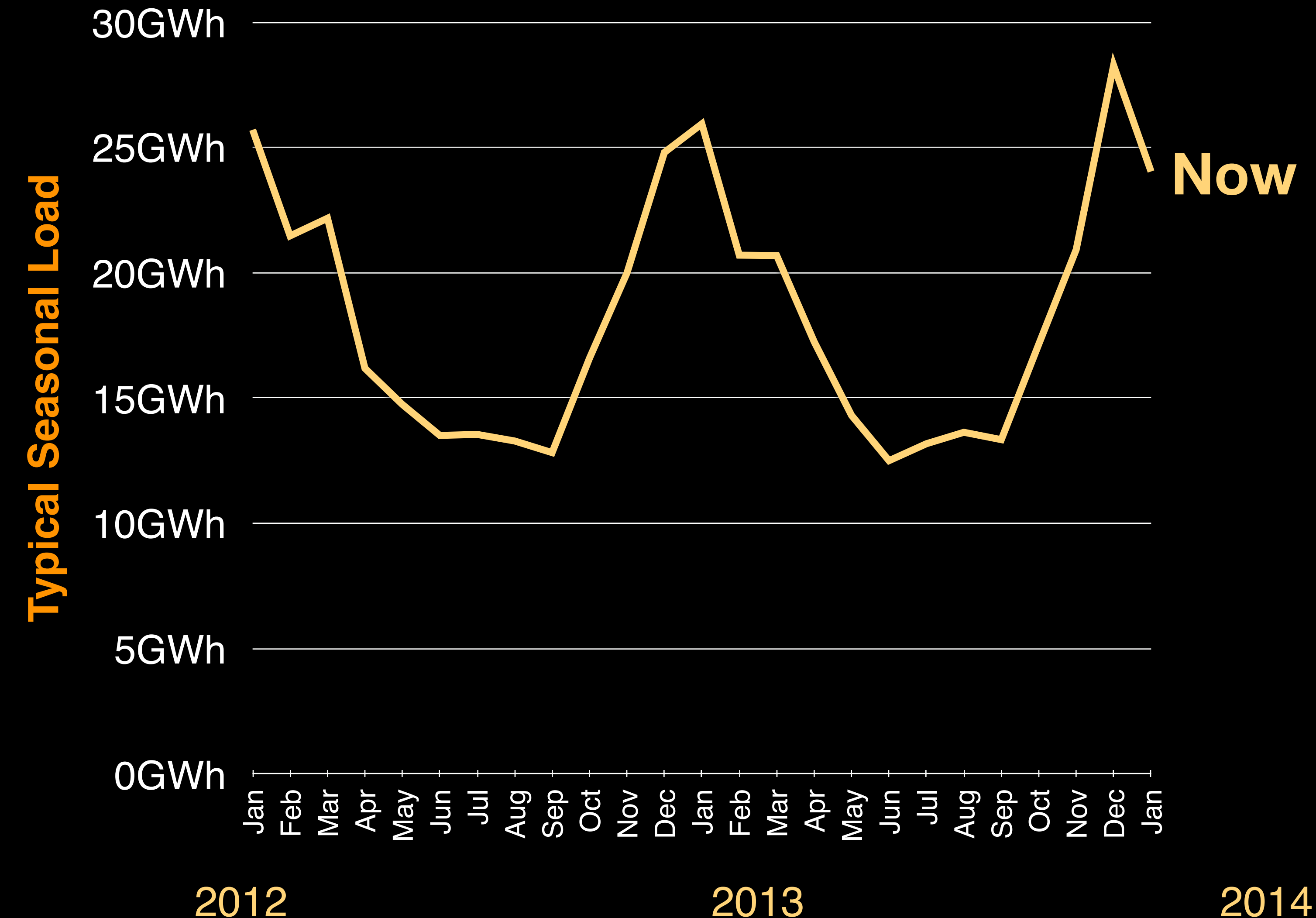
# Changing Load Shape: Now and in 2040



*winters are warming, summers too...*

# Changing Load Shape: Now

*load will become flatter as winters warm and members convert to heat pumps*



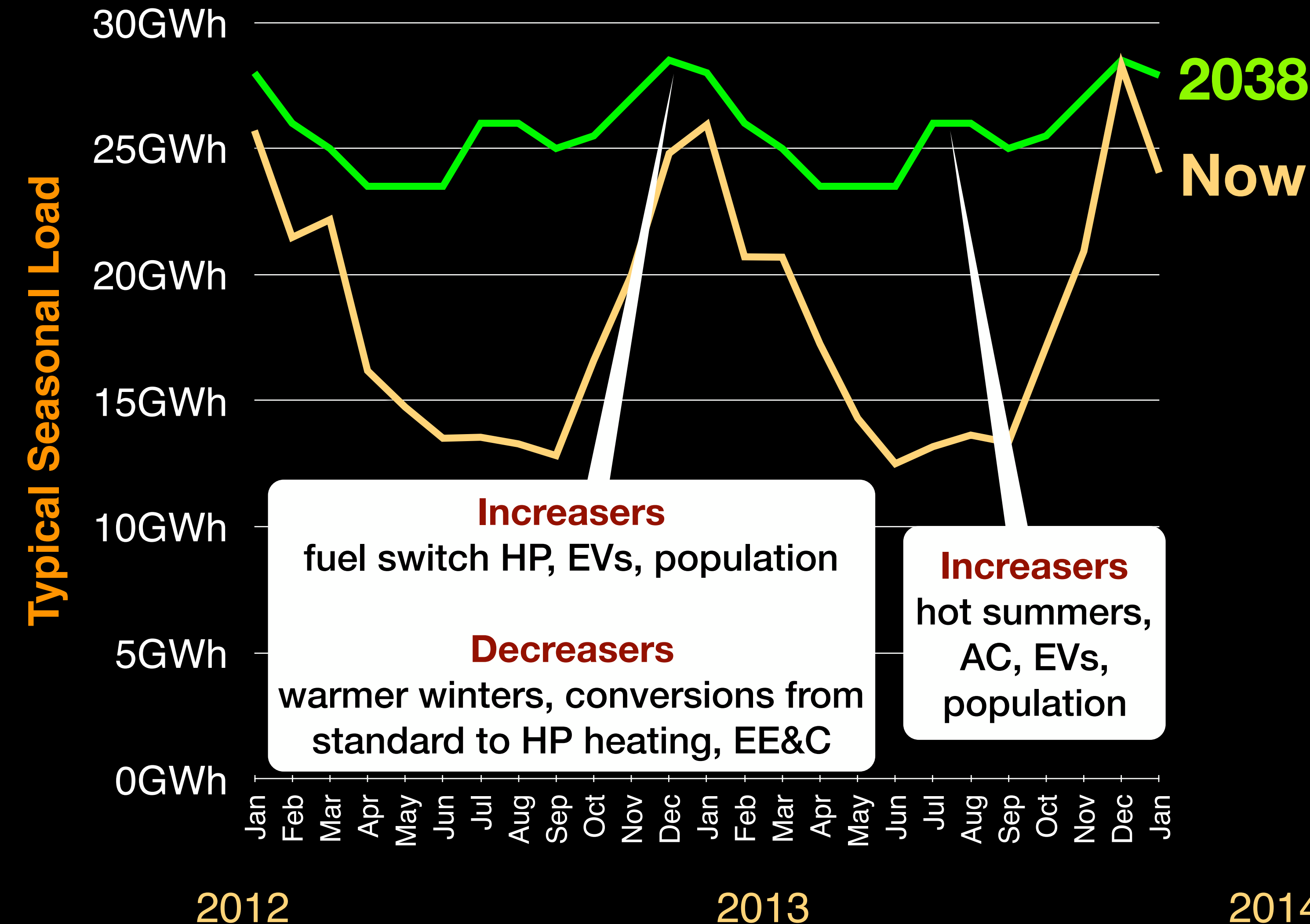
## Notes

- By 2040 summer cooling will start the formation of a secondary peak
- By 2100, load will peak in summer and winter peak will be diminished due to major climate impact on northwest temperatures
- EV load will be more in summer due to increased seasonal business activity and visitors EV traffic
- Transition to super efficient heat pumps (HP) will reduce winter heat load, but increased EVs will supplant it



# Changing Load Shape: Now and in 2040

*load will become flatter as winters warm and members convert to heat pumps*



## Notes

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# Discussion



# Next Meeting

LRP Finance

# Addenda

# OPALCO's Long Range Plan: Load Growth Change

## Load Growth Change

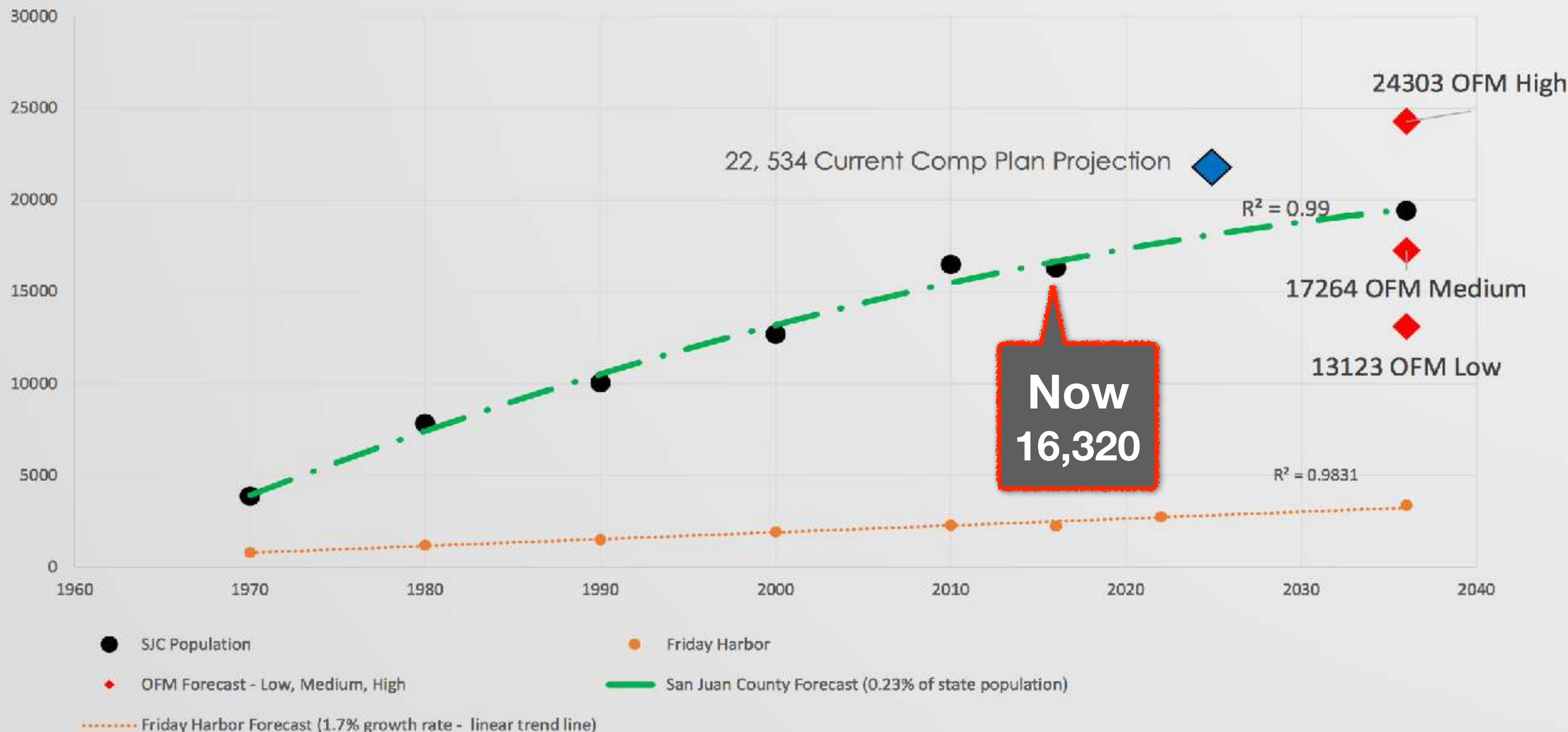
- Population
- Fuel Switching (electrification of fossil heating and transportation)
- Efficiency (conversion from standard electric heating to heat pumps)
- Climate change impact
- Demand (managed with DRUs, storage, and rates)

➡ *Shifting load shape provides challenges and opportunities*

# LRP Load Elements: Population

*the county expects the population to grow at about .9% per year*

## SAN JUAN COUNTY 2036 POPULATION FORECAST



## Notes

- Forecast from Washington State Office of Financial Management (OFM)
- OFM forecasts medium growth 2036 population of 17,264
- SJC planning staff recommends the adoption of 19,423 as the County population in 2036 (about 20,000 in 2040).
- WA state median age is 37. The county median age is 54, up from 47 in 2000.

# LRP Load Elements: Population

*the county expects the population to grow at about .9% per year*

## Notes

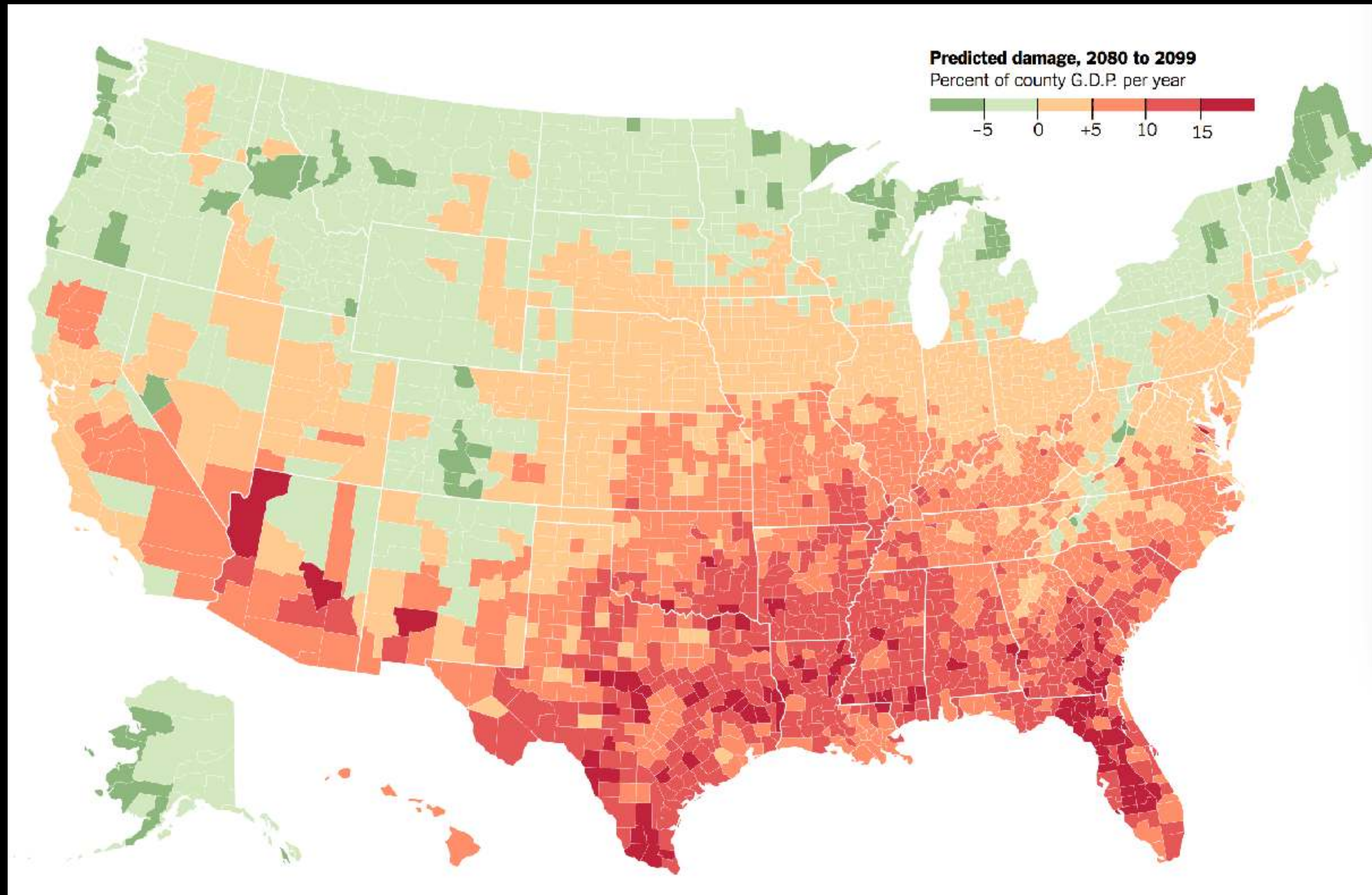
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- Natural growth is in decline
- Out-Migration Drivers:
  - Housing costs
  - Limited employment options
  - Social isolation/ family elsewhere
  - Medical needs
- In-Migration Drivers:
  - Personal capital/investment options
  - Retired or semi-retired/(self- employed)
  - Rural amenities (privacy)
  - Natural beauty
  - Improving medical facilities



# LRP Load Elements: Population

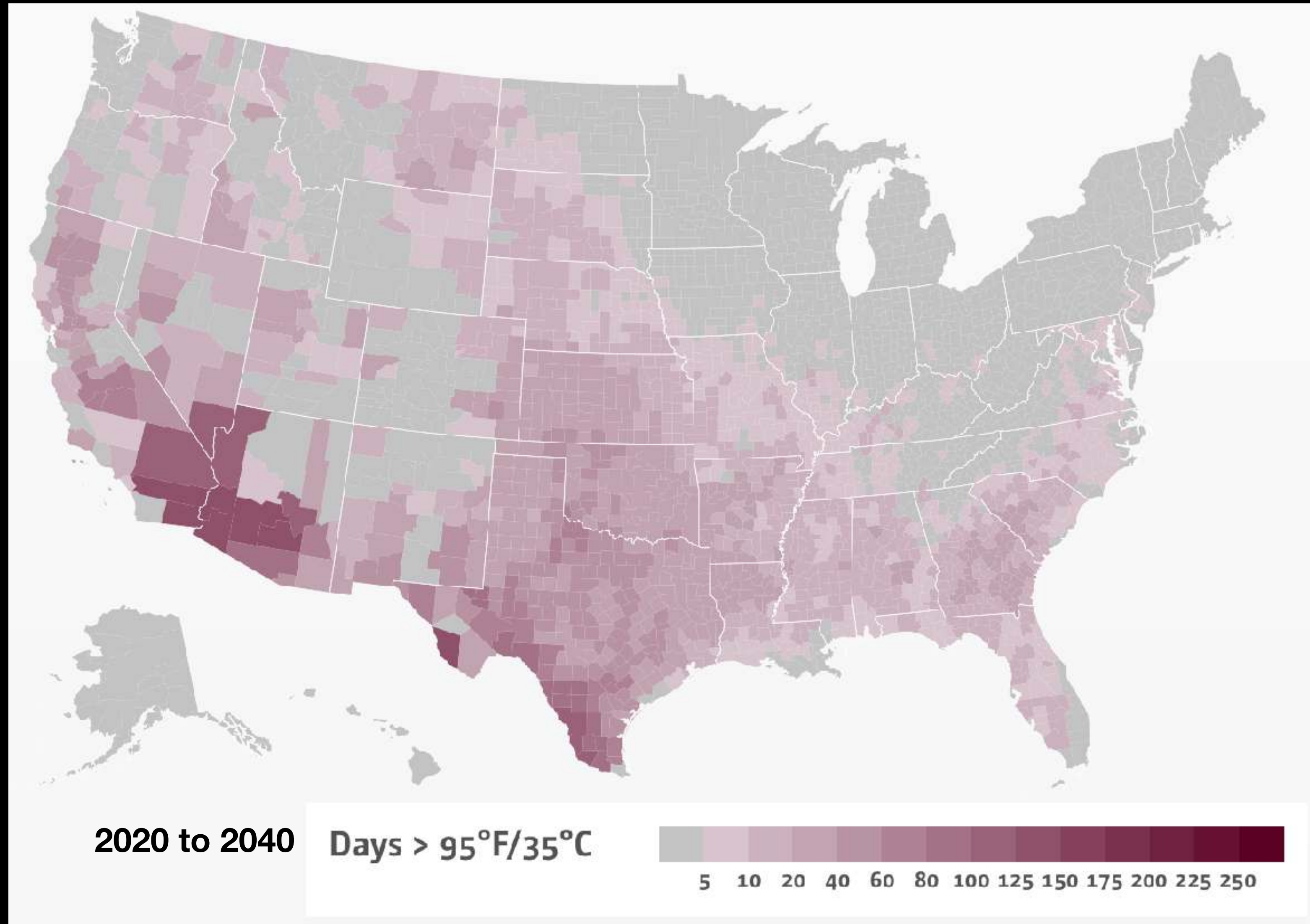
*Wild Card: climate change may drive a northward migration*





# LRP Load Elements: Population

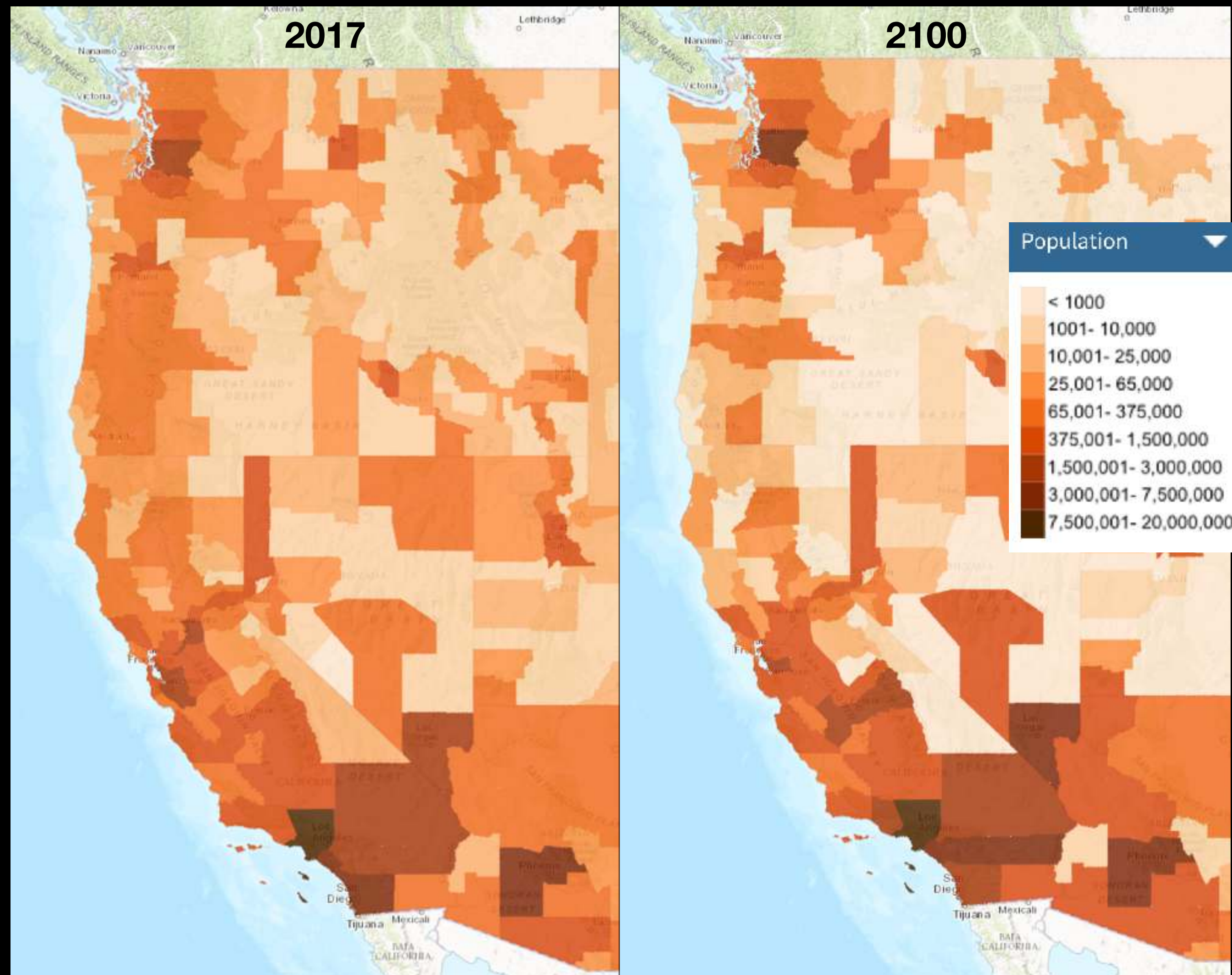
*Wild Card: climate change may drive a northward migration*





# LRP Load Elements: Population

*Wild Card: climate change may drive a northward migration*

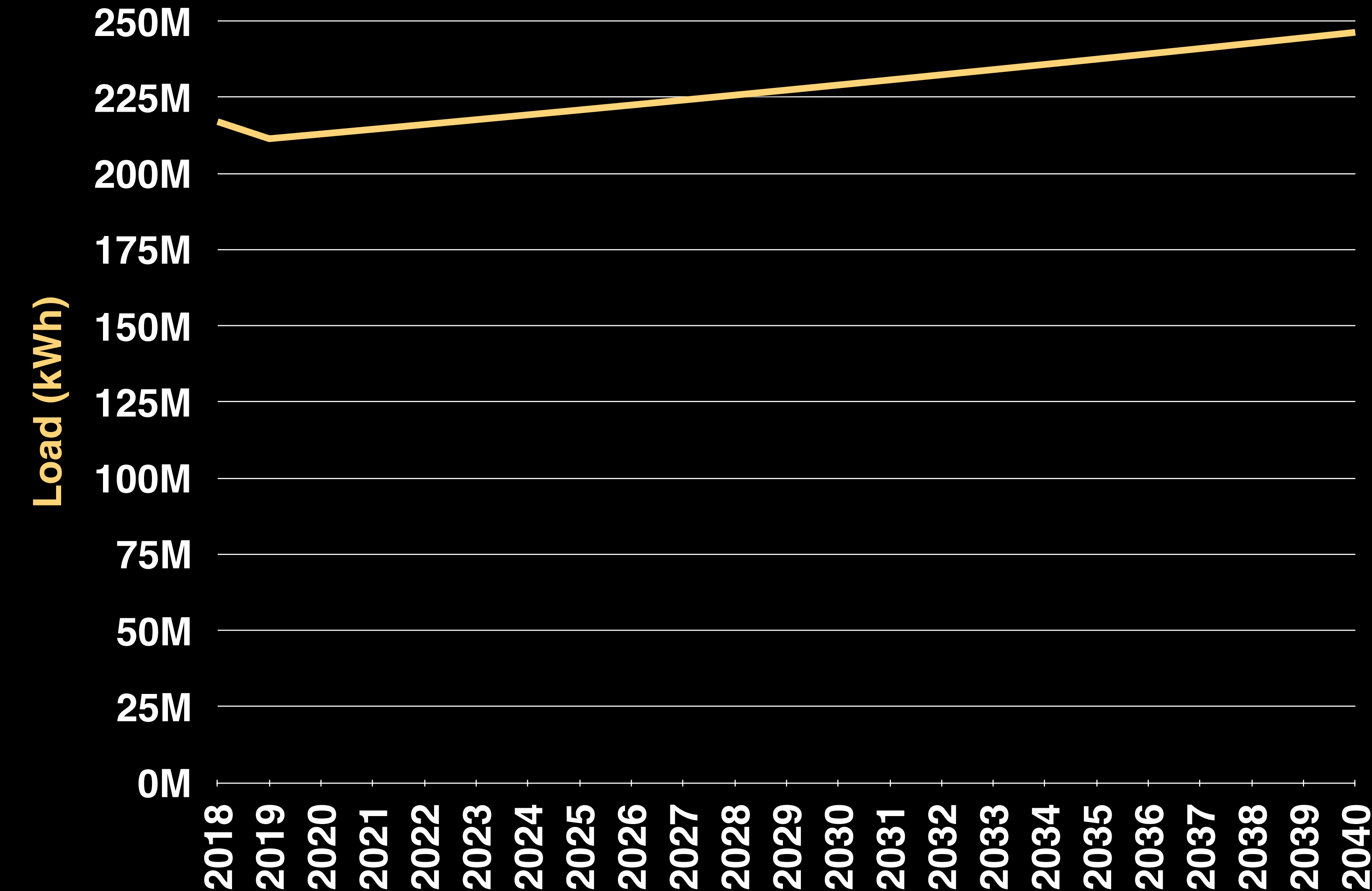


## Notes

- In general, counties to the south and east of our region will decrease in population, while counties in the Northwest will increase.
- But San Juan County is projected to decrease.
- Closely monitor for shifting national climate dynamics.

# LRP Load Elements: Population

*population load growth is estimated to be about 1% per year*



## Notes

- Assuming 1% population growth - slightly higher than county
- It is well balanced by steady improvement in county energy efficiency



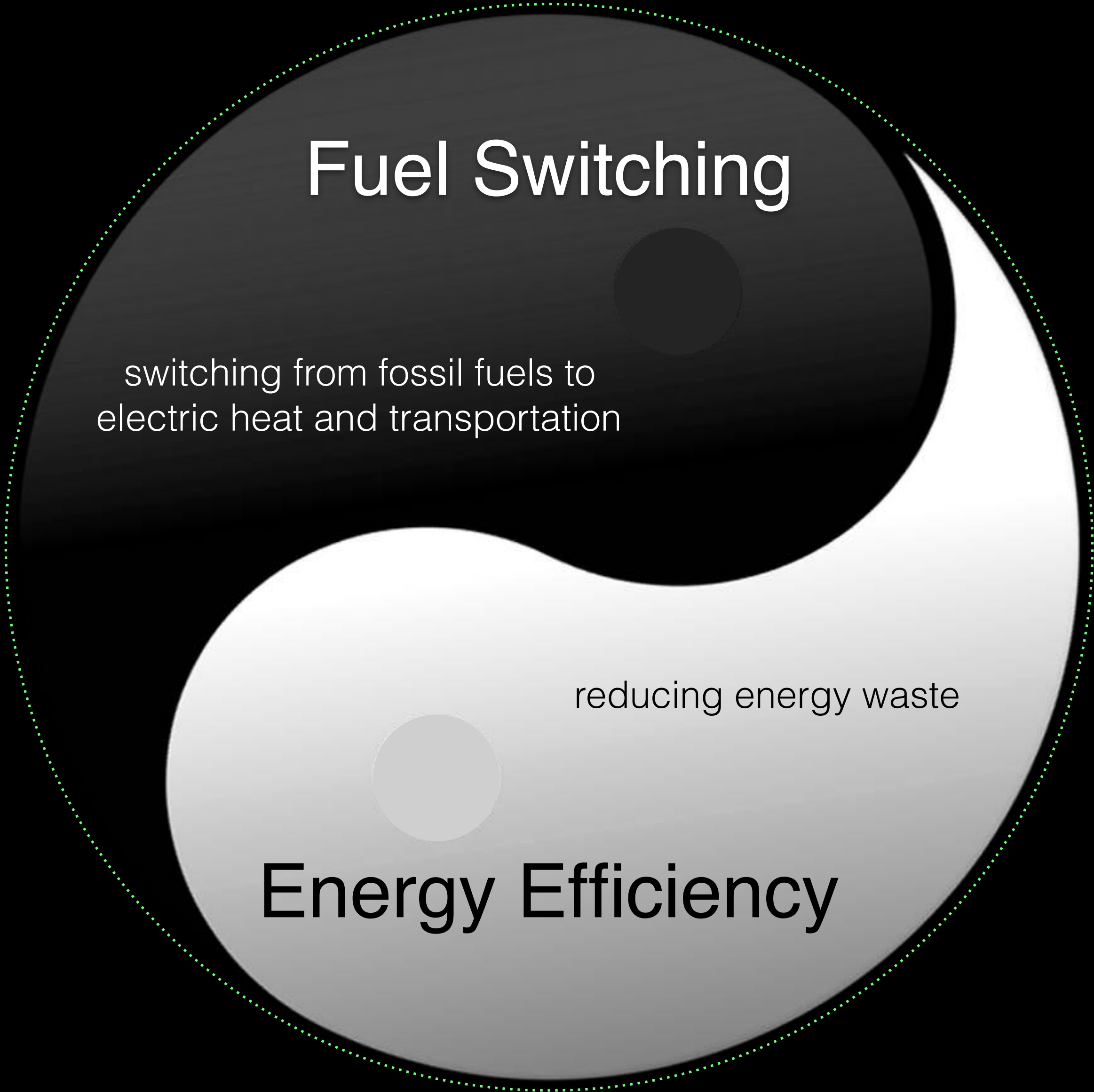
# LRP Load Elements: Efficiency

Though we help members with a number of efficiency improvements, including improving weatherization, insulation, appliance and window upgrades, we will look at one major efficiency action that has an important impact on load.

Conversion of standard electric heating to heat pumps



# Two Sides of the Same Coin



*In cold years, excess revenue finances future local energy resilience programs, reducing energy need (and revenue).*

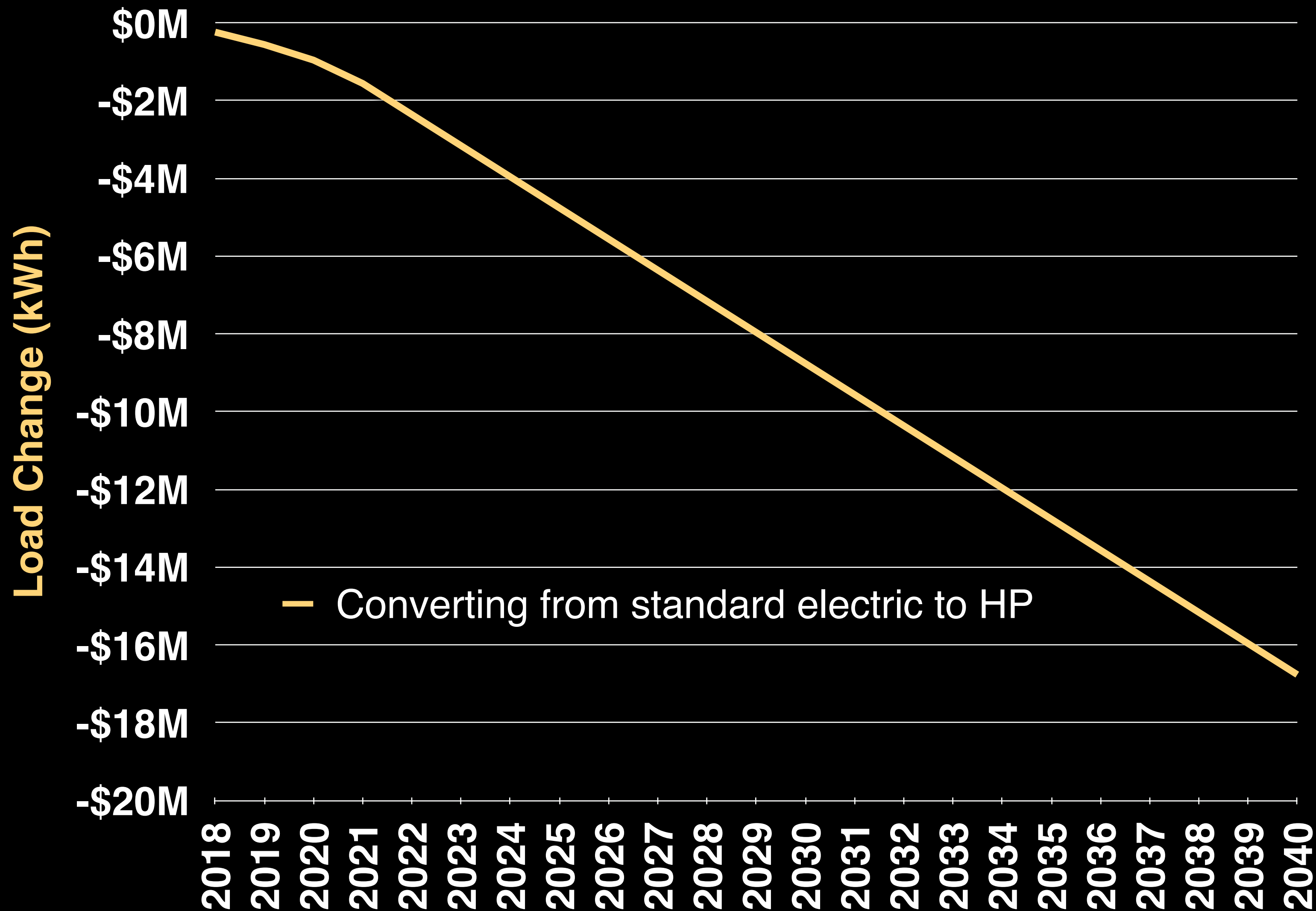
*In warm years, invest in fuel switching to keep revenues healthy and reduce carbon footprint.*

Each feeds and necessitates the other...

	Co-op Revenue	Co-op Benefit	Co-op Member <u>Total</u> Energy Bill	Co-op Member Carbon Footprint
Fuel Switching	Increases	finances efficiency programs	much smaller	much smaller
Local Energy Resilience	Decreases	reduces need for additional power resources	smaller	smaller

# LRP Load Elements: Efficiency

*heat pumps save standard electric members over \$1,000 per year in heating costs*



## Notes

- Most heating in SJC is already standard electric, so the number of homes to convert to heat pumps is substantial.
- That combined with the high efficiency of heat pumps leads to major load reduction potential.
- Doesn't include other efficiency measures such as weatherization, insulation, LED lighting, appliance upgrades.

# LRP Load Elements: Fuel Switching

## Fuel Switching

The electrification of heating and transportation

BPA electricity is some of the cleanest lowest cost energy in the world

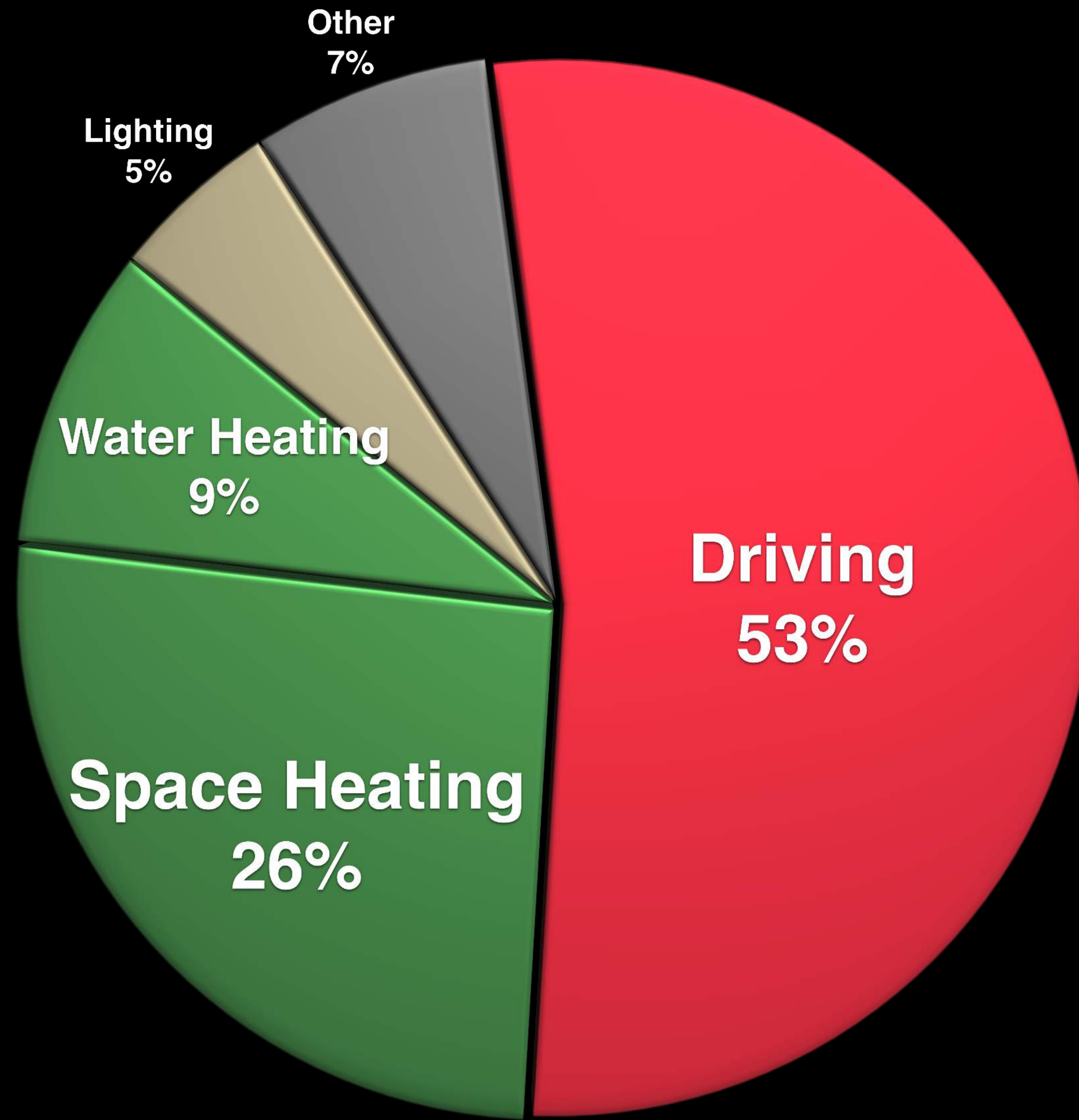
## Co-op Member Benefits of Fuel Switching

Save over \$1,000 per year on heating and driving cost

Lower carbon footprint

Speeds the transition to local renewable energy

# Avg. San Juan County Residential Primary Energy Use



*Over 80% of energy used in a typical San Juan County home is for transportation and heating.*

*In the US, the electrification of transportation and heating is accelerating and in the coming decades, most people will be driving and heating with electricity.*



# LRP Load Elements: Fuel Switching

**We will look at three emerging fuel switching loads**

## Electrification of Transportation

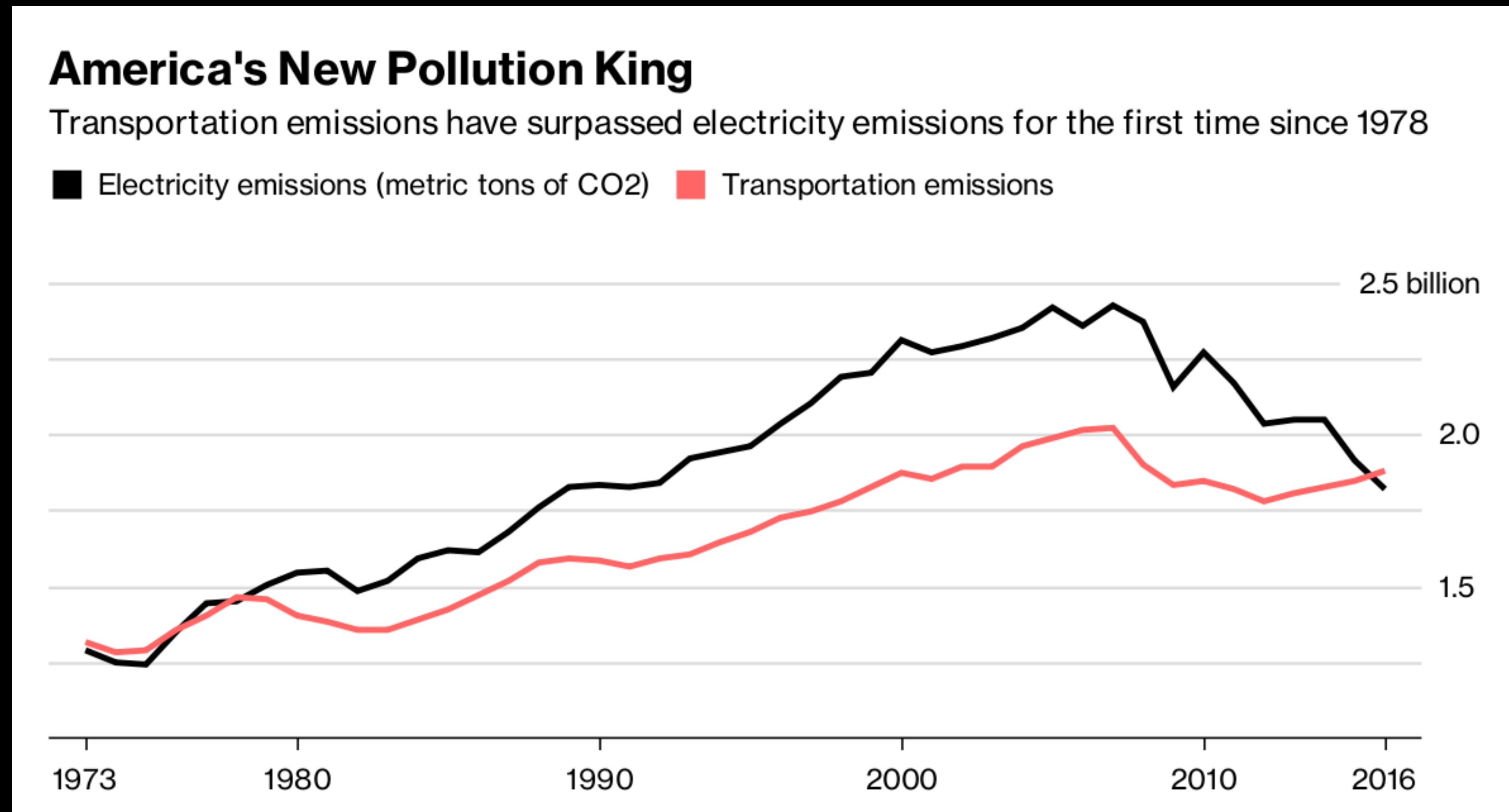
- Electric Vehicles (EVs)
- Electric Ferries

## Electrification of Heating

- Electric Heat Pumps

# Transportation: The New King of Pollution

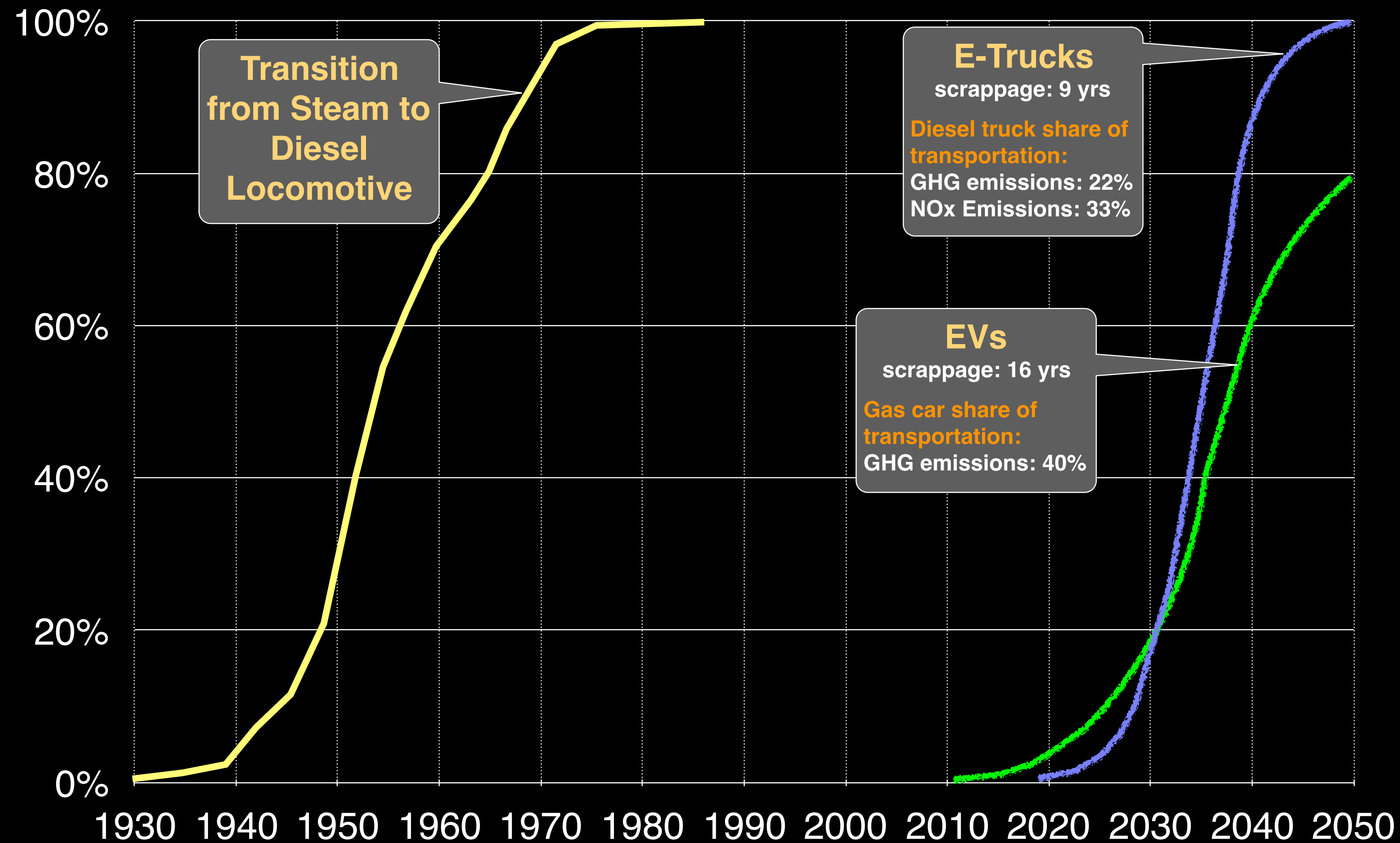
*decarbonization of energy and transportation go hand in hand*





# Transportation Transitions

## Market Share



*Nissan Leaf EV*



*Tesla E-Truck*





# Electric Transportation Evolution: Cars, Trucks, Ferries, Buses, Vans, Bicycles...

Nissan Leaf on Orcas Island



SJC County EV



EV Bug on Lopez



Norway Electric Ferry



Guemes Ferry going electric



King County Electric Buses



Electric Truck





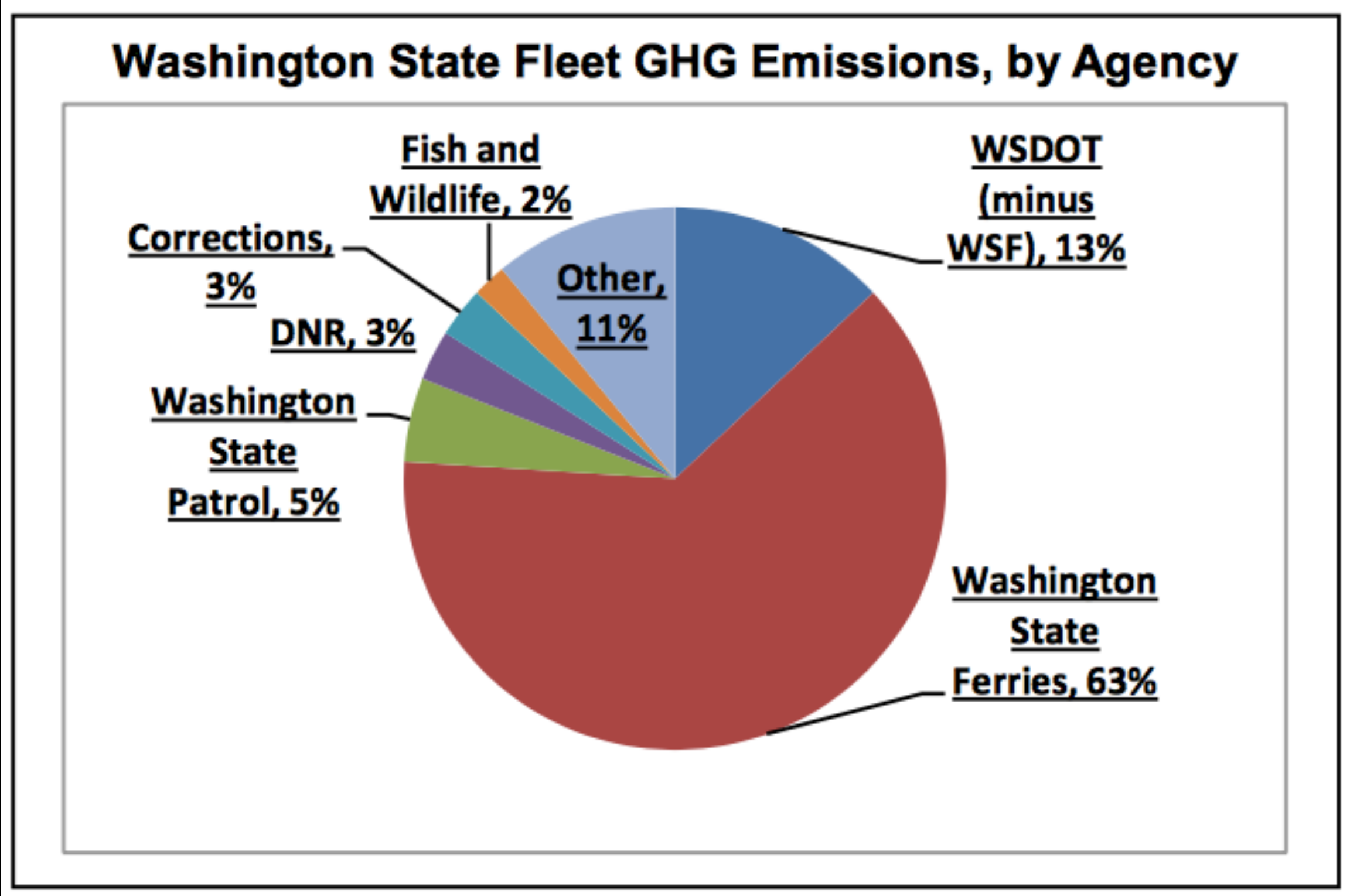
# Electric Transportation Evolution: Cars, Trucks, Ferries, Buses, Vans, Bicycles...



Norway Electric Ferry



Guemes Ferry going electric

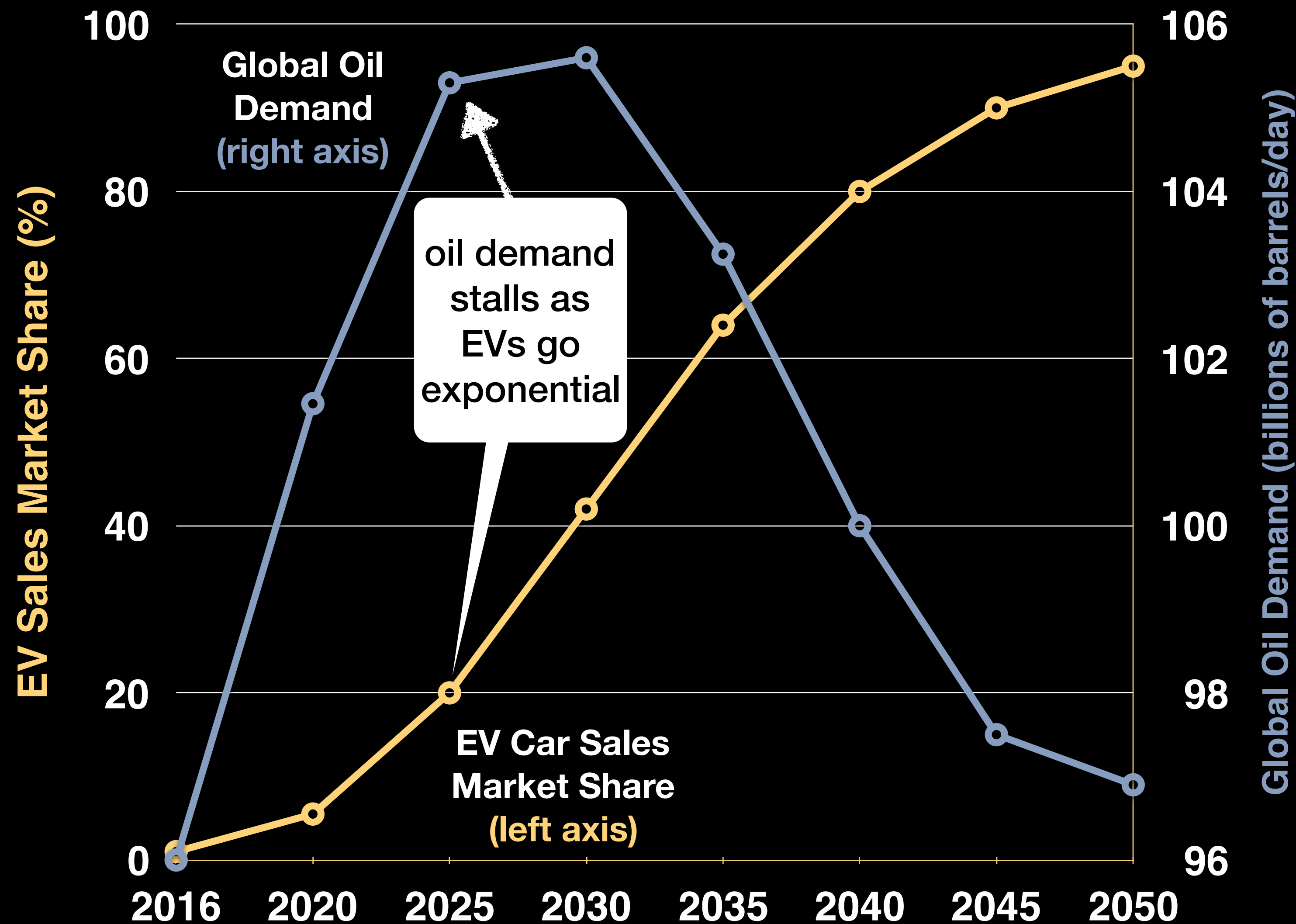


Source: WA DOT



# The Electrification of Transportation: Electric Vehicles (EVs)

*oil growth stalls in 2025 as EVs go exponential*

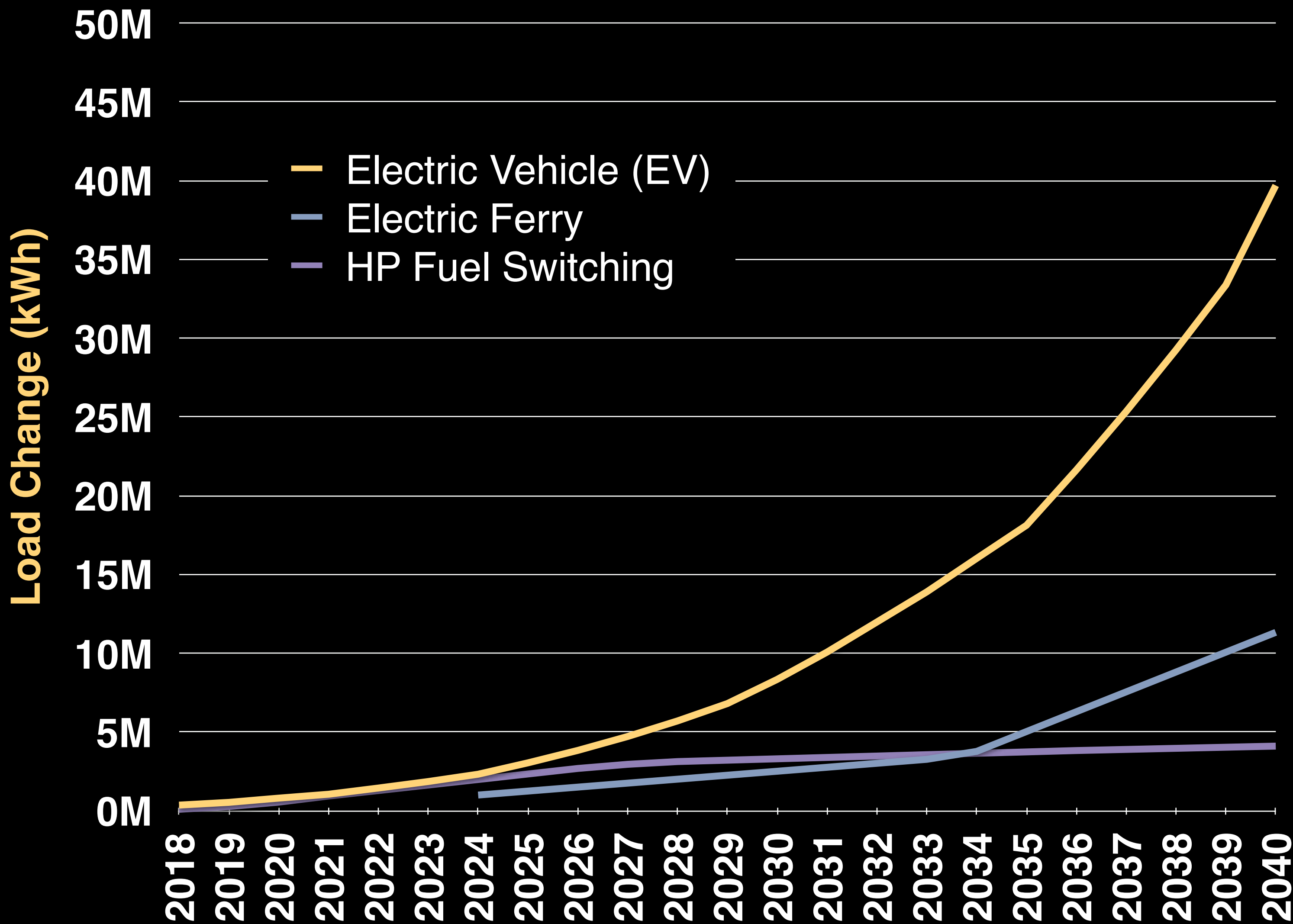


## Notes

- As oil demand stalls, fossil fuel prices may become cheap, increasing competition with electricity
- But, carbon taxes may help maintain electricity competitive edge
- And the cost of extracting fossil fuels has been going down recently as technology makes extraction more efficient. But that wave seems to be moderating and may resume a return to the inflationary trendline.
- In San Juan County, EVs will include cars, public transportation, boats, ferries, ride-share, autonomous vehicles, etc. - many with emerging vehicle-to-grid storage options.

# The Electrification of Transportation and Heating: Fuel Switching

*fuel switching strengthens the local economy and reduces carbon emissions*



## Notes

- Over 70% of county carbon emissions come from transportation and heating.
- Switching to EVs and heat pumps help members reduce their TOTAL energy bill by over \$1,000 per year, keeping millions of dollars in the local economy,
- EV and ferry load growth is modest due to much greater efficiency of electric systems
- Most heating in SJC is already electric, so the number of homes to convert from fossil fuel heating is modest. That combined with the high efficiency of heat pumps leads to minimal new load. But, it has substantial impact on reducing carbon emissions.



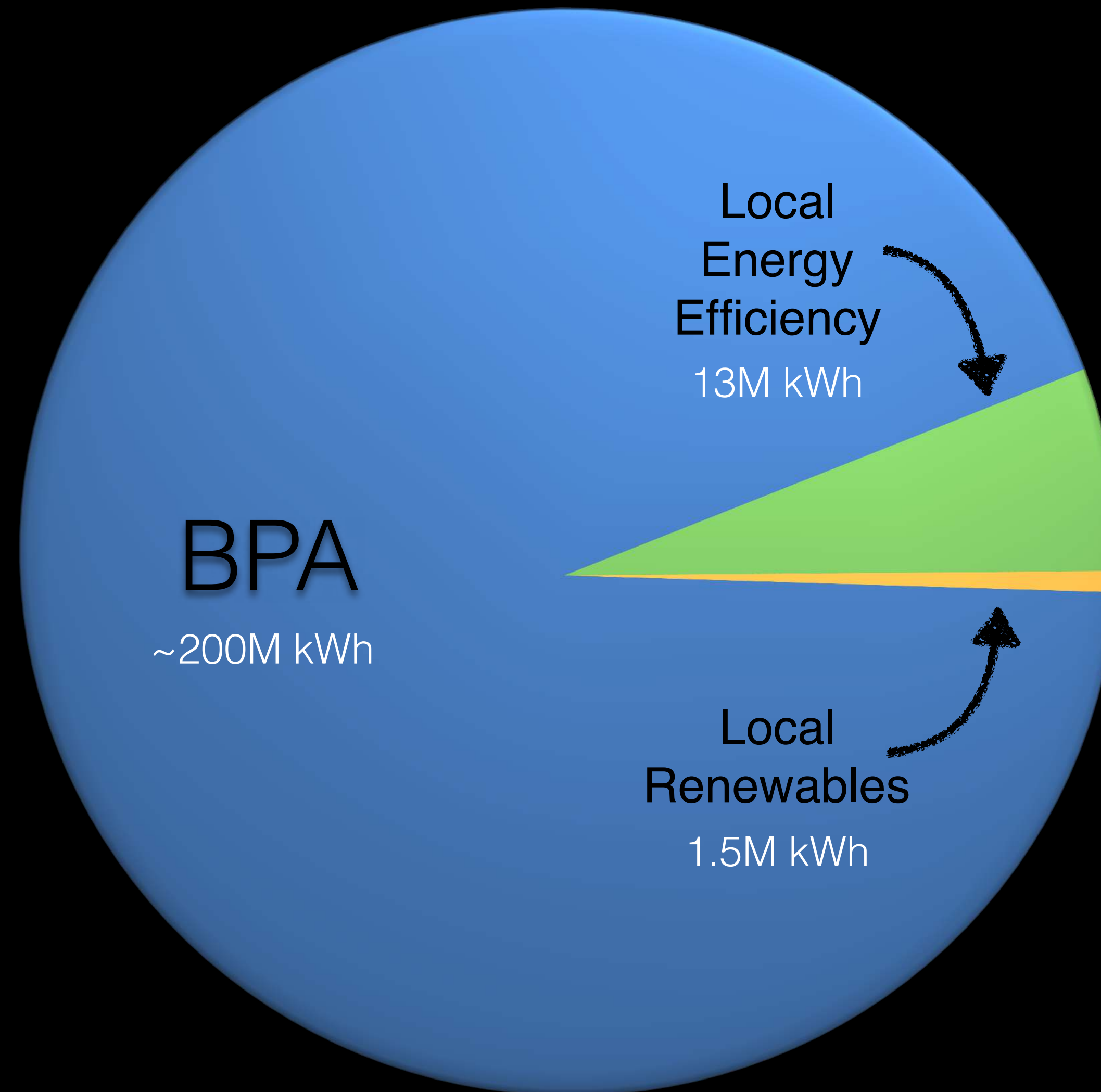
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- Implications as we transition to local resources that are "free" fuel, but capital expensive
- Grid Modernization Roadmap

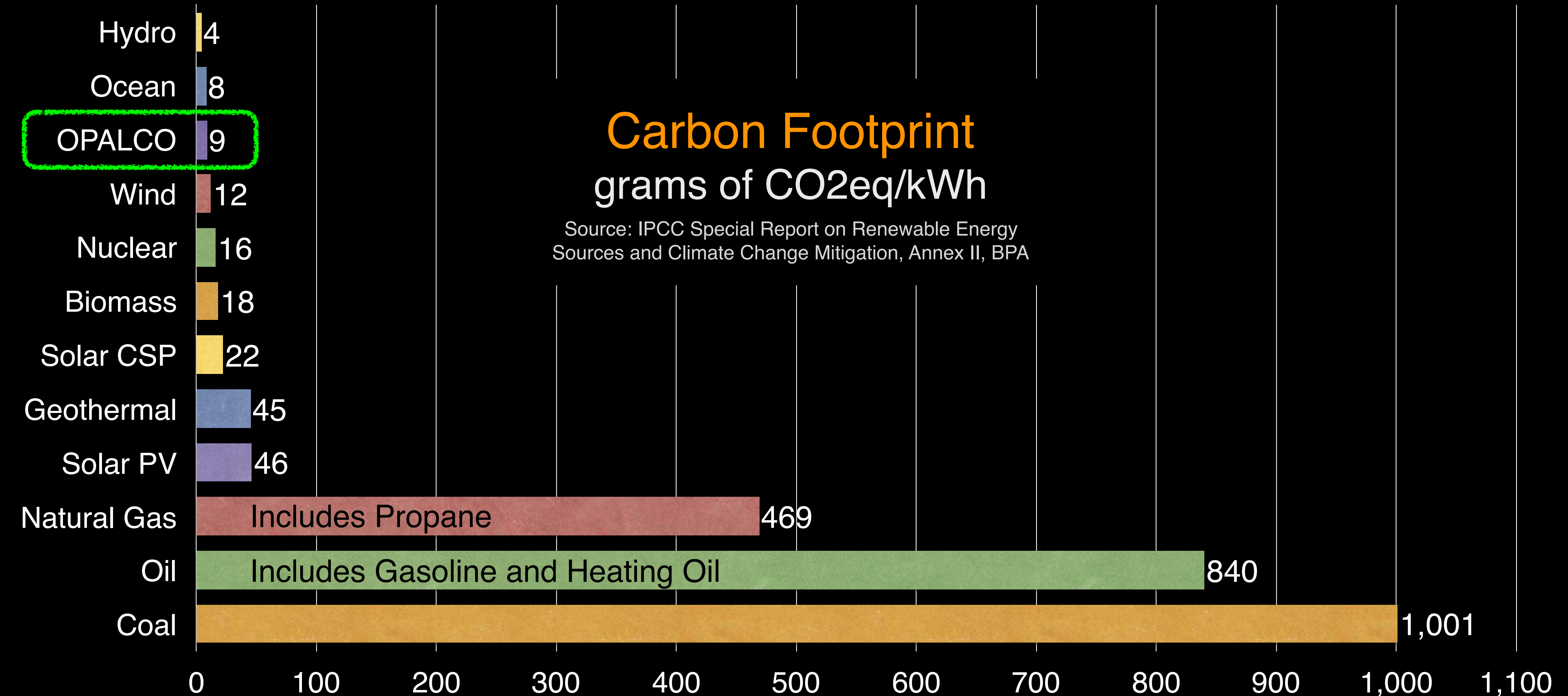
➡ *The resource mix is becoming more local and diverse and - properly engineered and managed - resilient, and affordable*

# OPALCO Resource Mix: 2017



# Carbon Footprint of Various Forms of Energy

OPALCO Electricity is much cleaner than fossil fuels

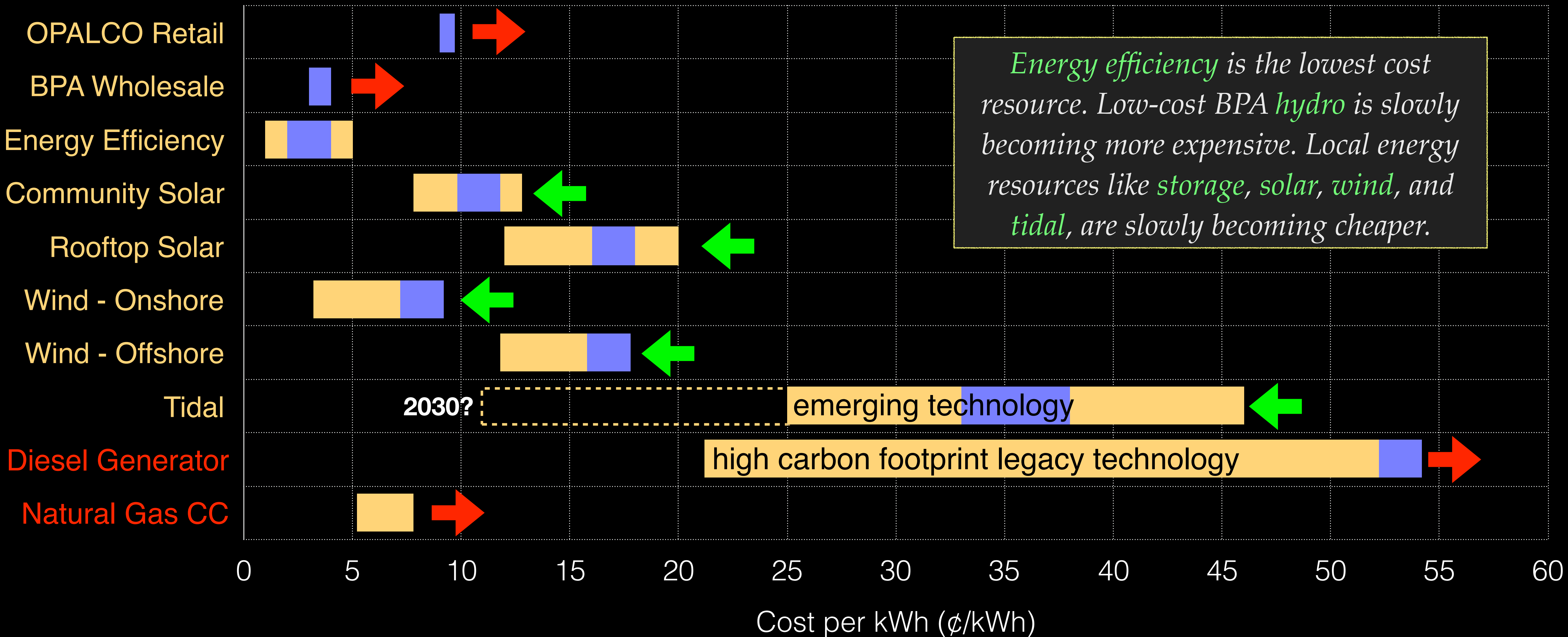




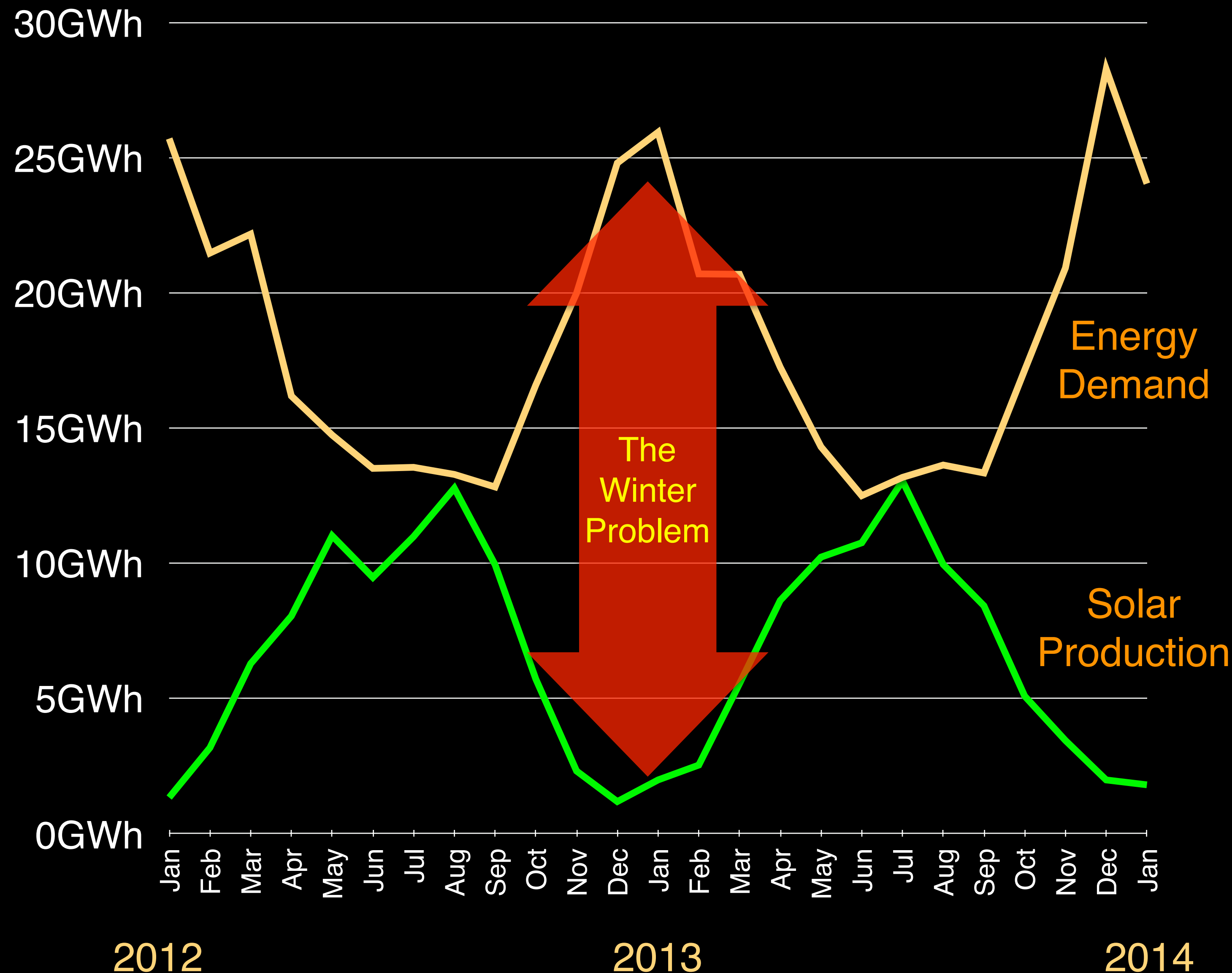
# Unsubsidized Levelized Cost of Energy Sources

Cost Range:  = US  = SJC (actual, or estimated due to NW capacity factor or fuel costs)

Cost Trend:  = Inflation  = Deflation



# What if every home in the county had solar? The Winter Problem

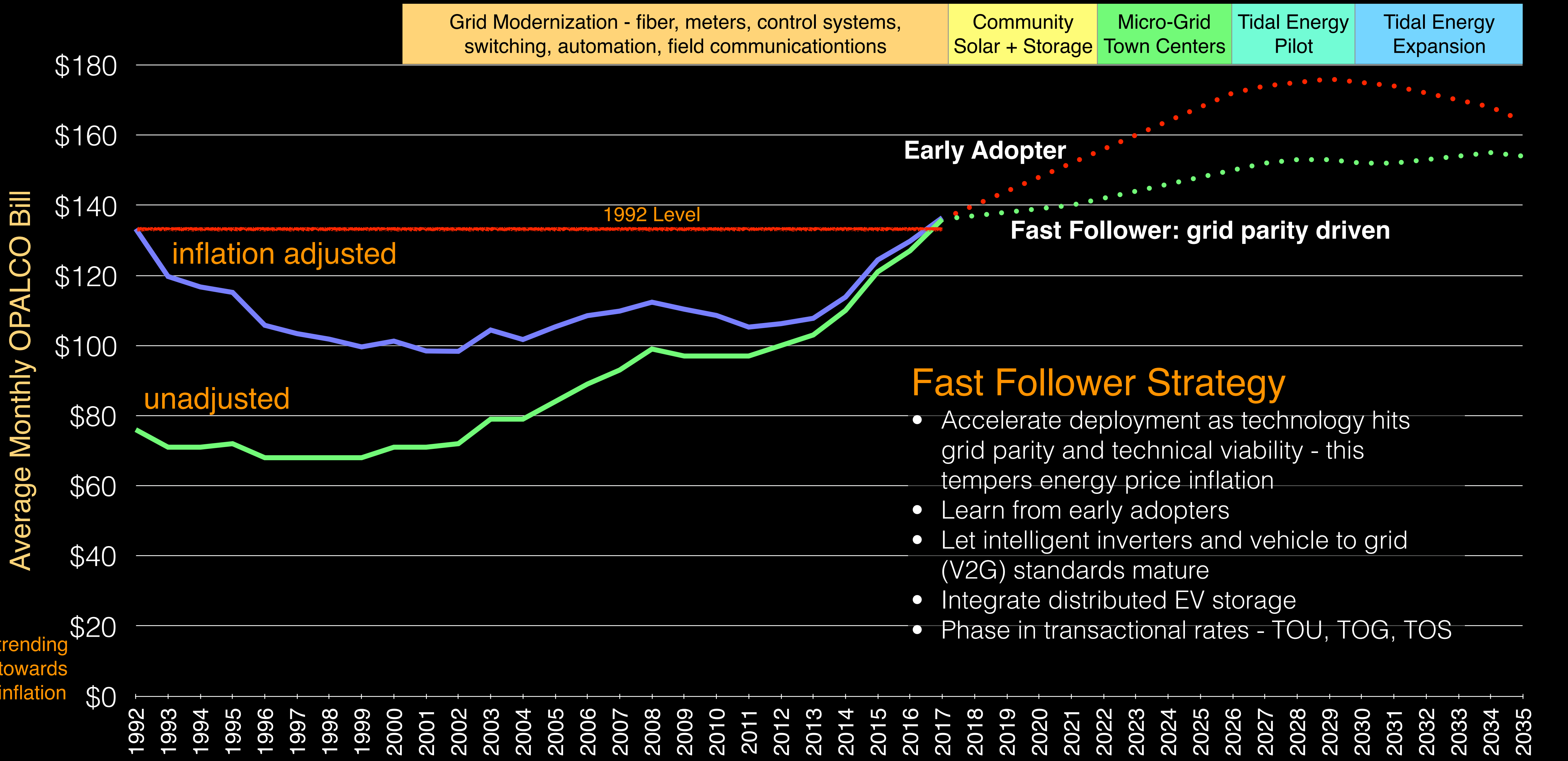


*Assuming each home had good sun, and had a 7.5 kW array, solar would only meet about 38% of the county electric load, due to limitations of sun in the Northwest.*

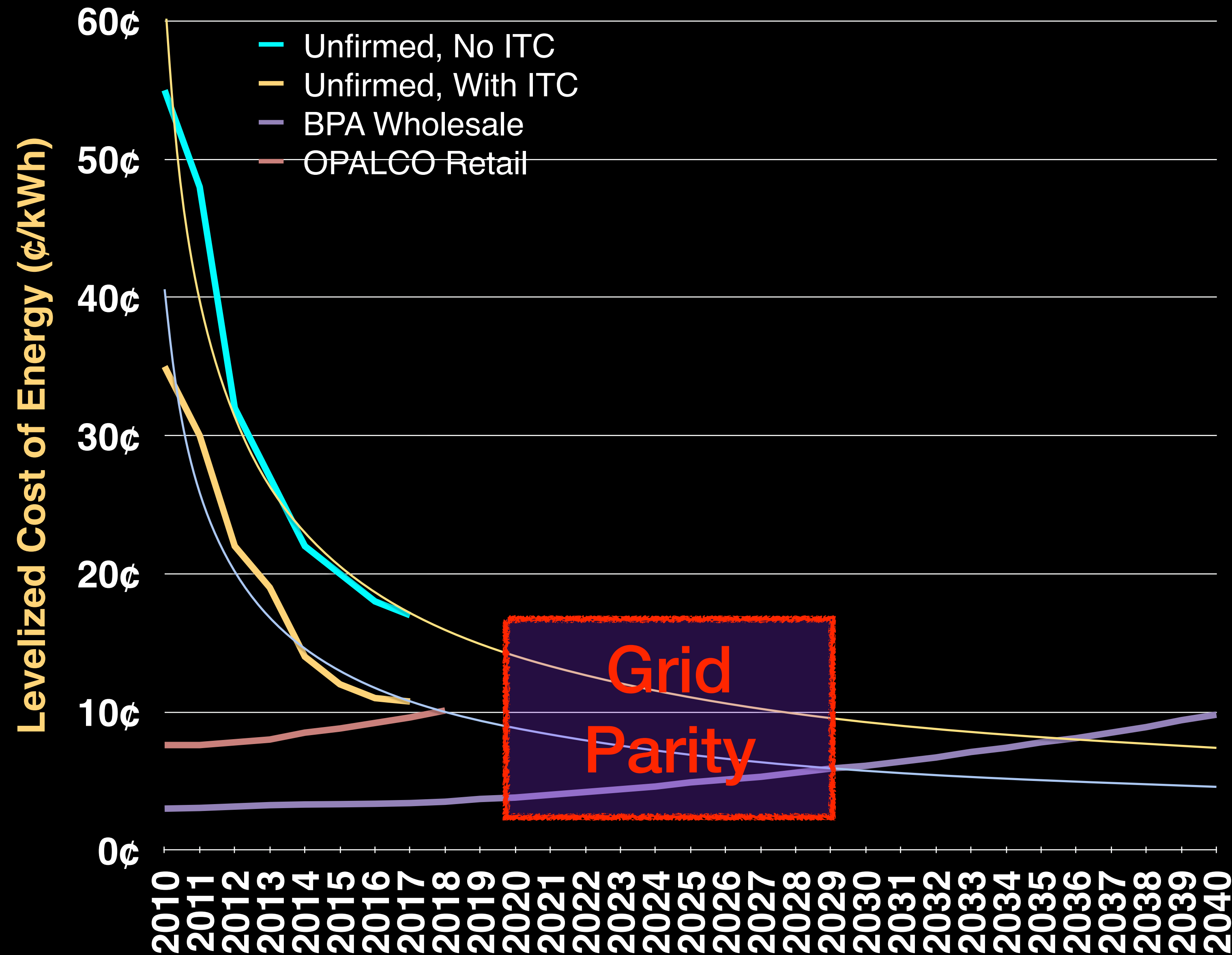
- In winter, load doubles, but solar decreases by 80%
- But, with climate change...
  - ♦ Winters are warming and summers are too
  - ♦ There will be reduced need for winter heat and increased need for summer air conditioning
  - ♦ Snowpack is decreasing, which means less hydro flow in summer, which could mean lower hydro production and higher hydro costs in summer when big cities have increased air conditioning load.
  - ♦ Solar can help fill the gap from reduced summer hydro
- ♦ And, increasing local renewable energy such as solar, wind and tidal helps increase local energy and economic resilience.



# Increasing Local Energy Resilience: Fast Follower Strategy



# Grid Parity: Rooftop Solar (retail), unfirmed

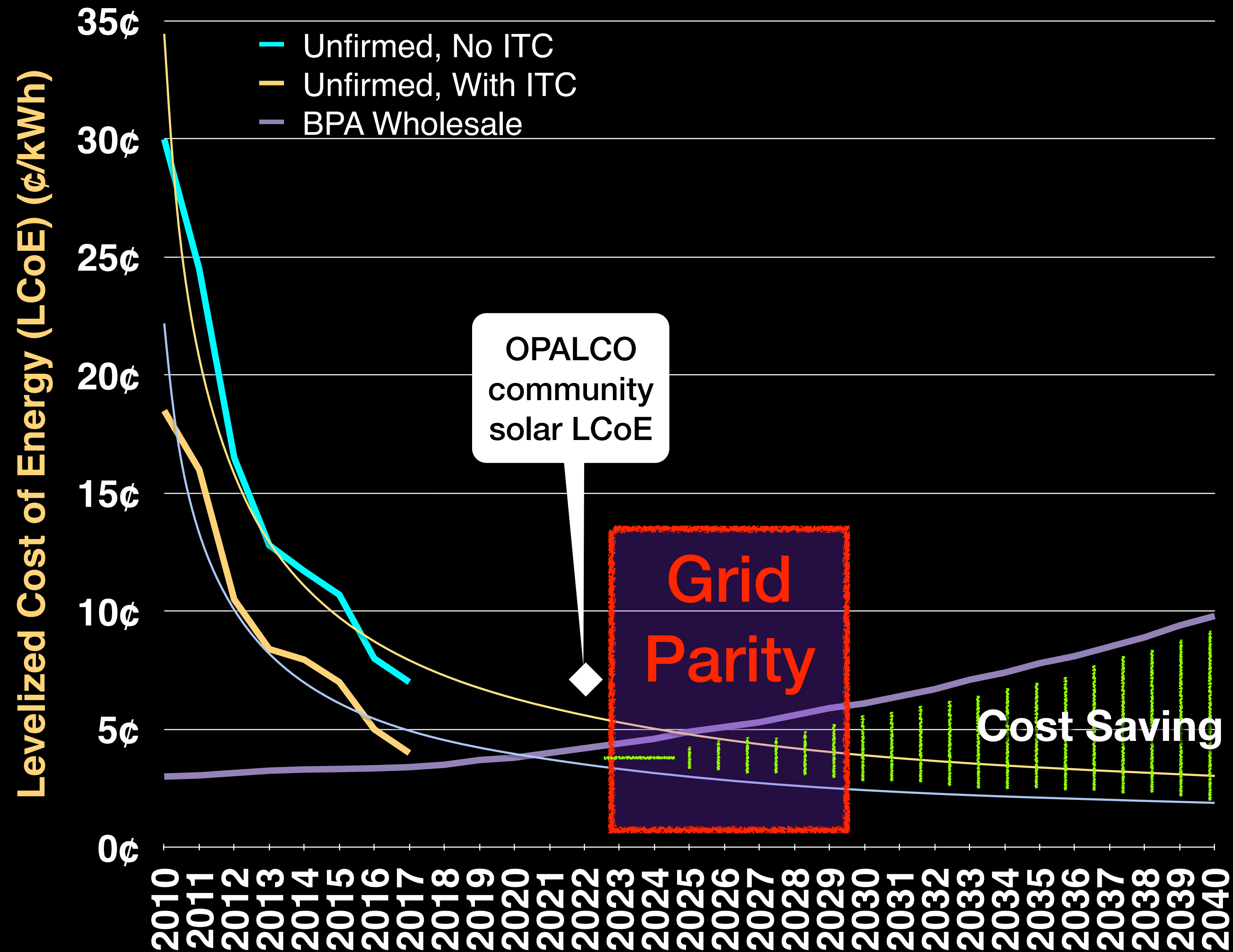


## Notes

- Residential rooftop solar Levelized Cost of Energy (LCoE) for New York - similar latitude to SJC
- No Investment Tax Credit (ITC) and with 30% ITC
- BPA Wholesale rate forecast at 4.8% annual inflation
- OPALCO residential retail rate



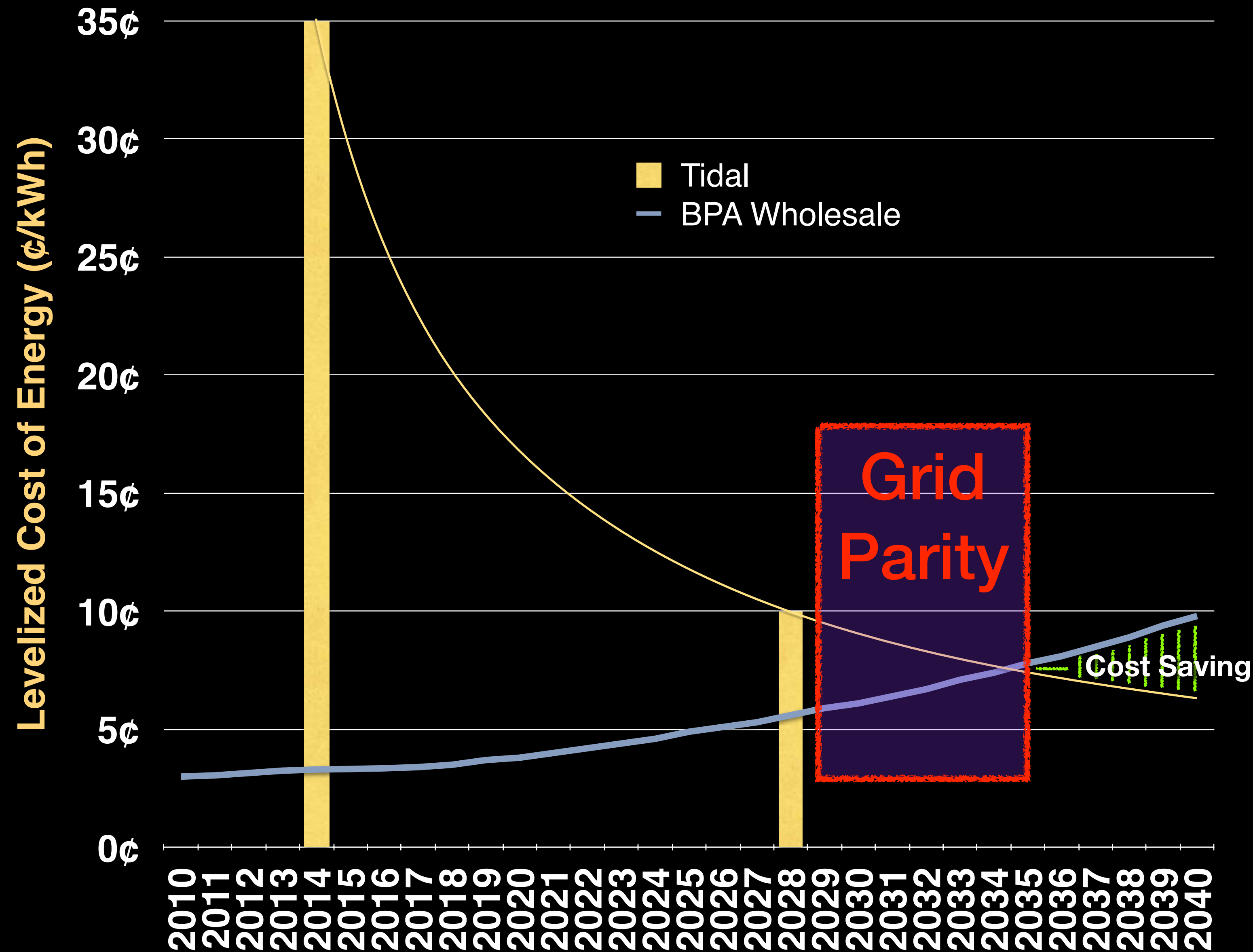
# Grid Parity: Utility-Scale Solar (wholesale), unfirmed



## Notes

- Utility scale: greater than 2 MW array.
- Utility scale solar Leveled Cost of Energy (LCoE) for New York - similar latitude to SJC
- No Investment Tax Credit (ITC) and with 30% ITC
- BPA Wholesale rate forecast at 4.8% annual inflation
- OPALCO community solar array is smaller than typical utility scale solar projects, hence the slightly higher LCoE

# Grid Parity: Utility-Scale Tidal (wholesale)

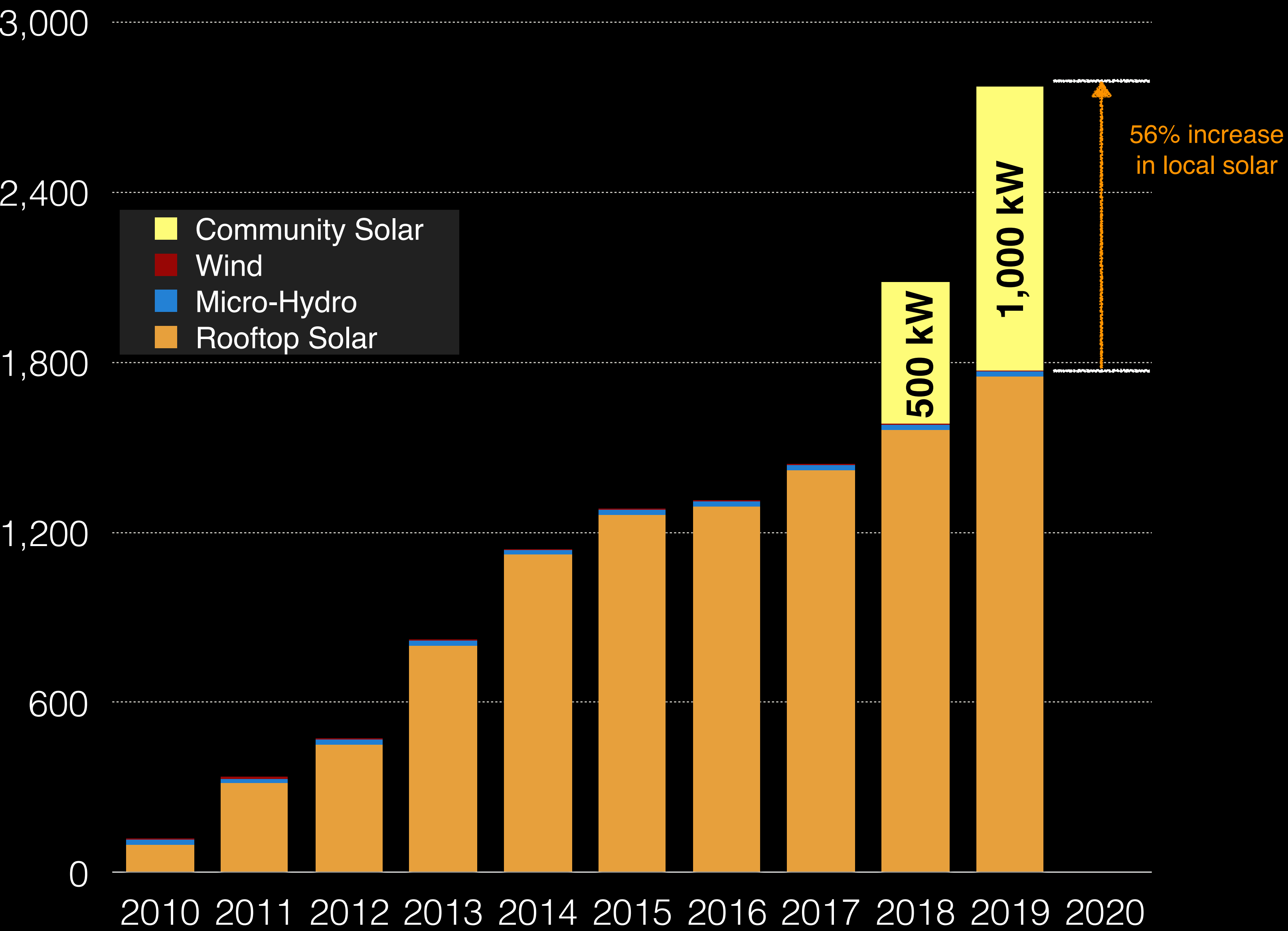


## Notes

- Grants and UW partnership may help accelerate tidal grid parity
- BPA Wholesale rate forecast at 4.8% annual inflation
- Rapid decline in LCoE forecast due to innovation from offshore and land-based wind turbine innovation.
- Utility-scale solar LCOE dropped 86 percent in the last eight years. For wind, the figure was 67 percent.



# Local Solar, Wind, and Micro-Hydro Power Capacity (kW)



*By 2019, OPALCO community solar arrays will increase local solar energy by about 58%.*

*This will likely be the largest community solar array in Washington state.*

PROJECTED

# Utility-Scale Solar: The Challenges

- ▶ Land siting
- ▶ Financial support
- ▶ Grid connectivity
- ▶ Ownership

## Strategy

Develop the minimum to support critical system backup in key substations and town-centers.

Preserve capital for tidal, which works year round and is predictable firmer power.



# Grid Parity: The Cost of Firming Solar Energy

*Although alternative energy is increasingly cost-competitive and storage technology holds great promise, alternative energy systems alone will not be capable of meeting the base load generation needs of a developed economy for the foreseeable future. Therefore, the optimal solution for many regions of the world is to use complementary conventional and alternative energy resources in a diversified generation fleet.*

**Lazard** *The Levelized Cost of Energy 11.0*

## **Strategy**

Firming with BPA until Levelized Cost of Storage reaches grid parity

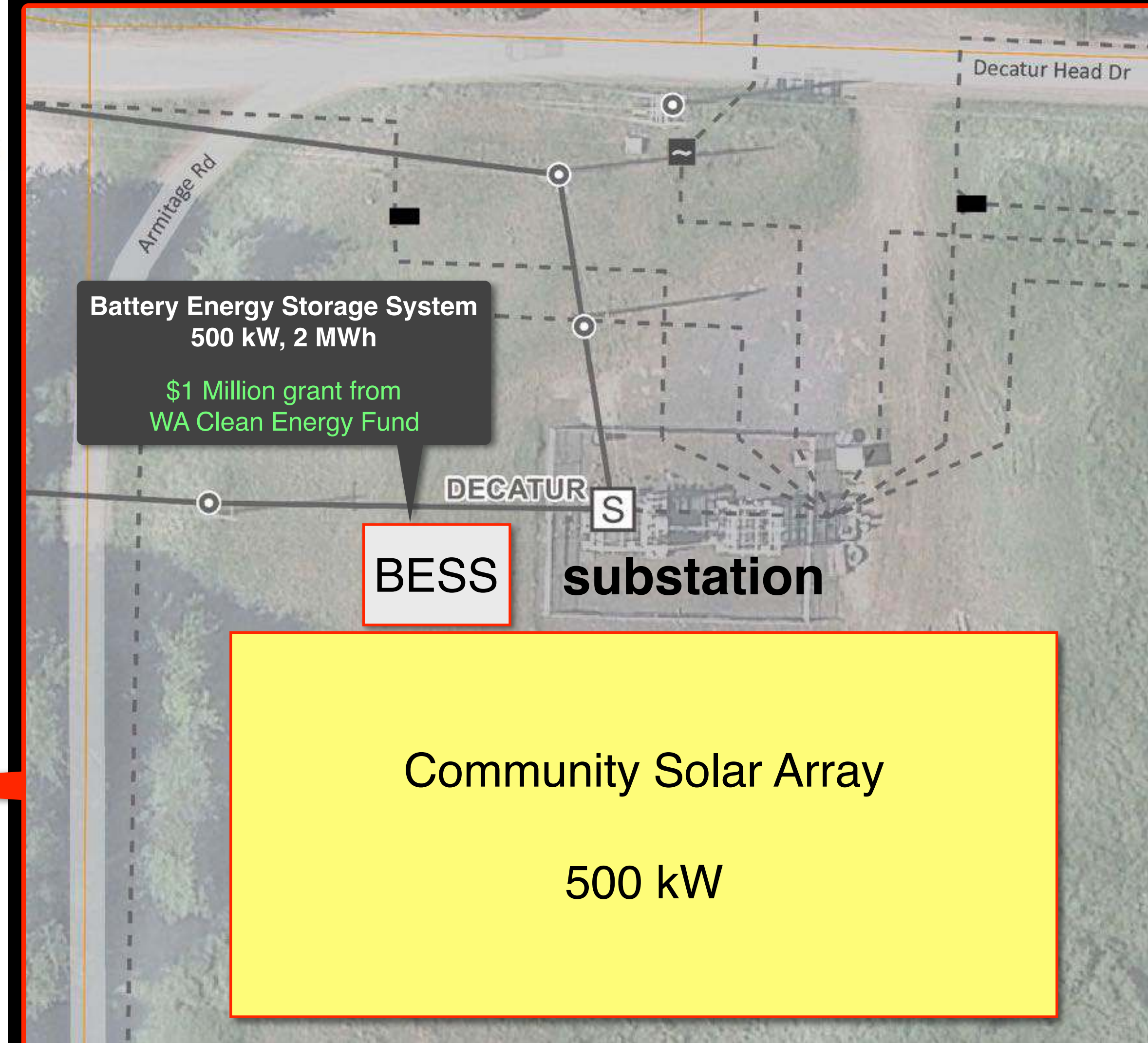
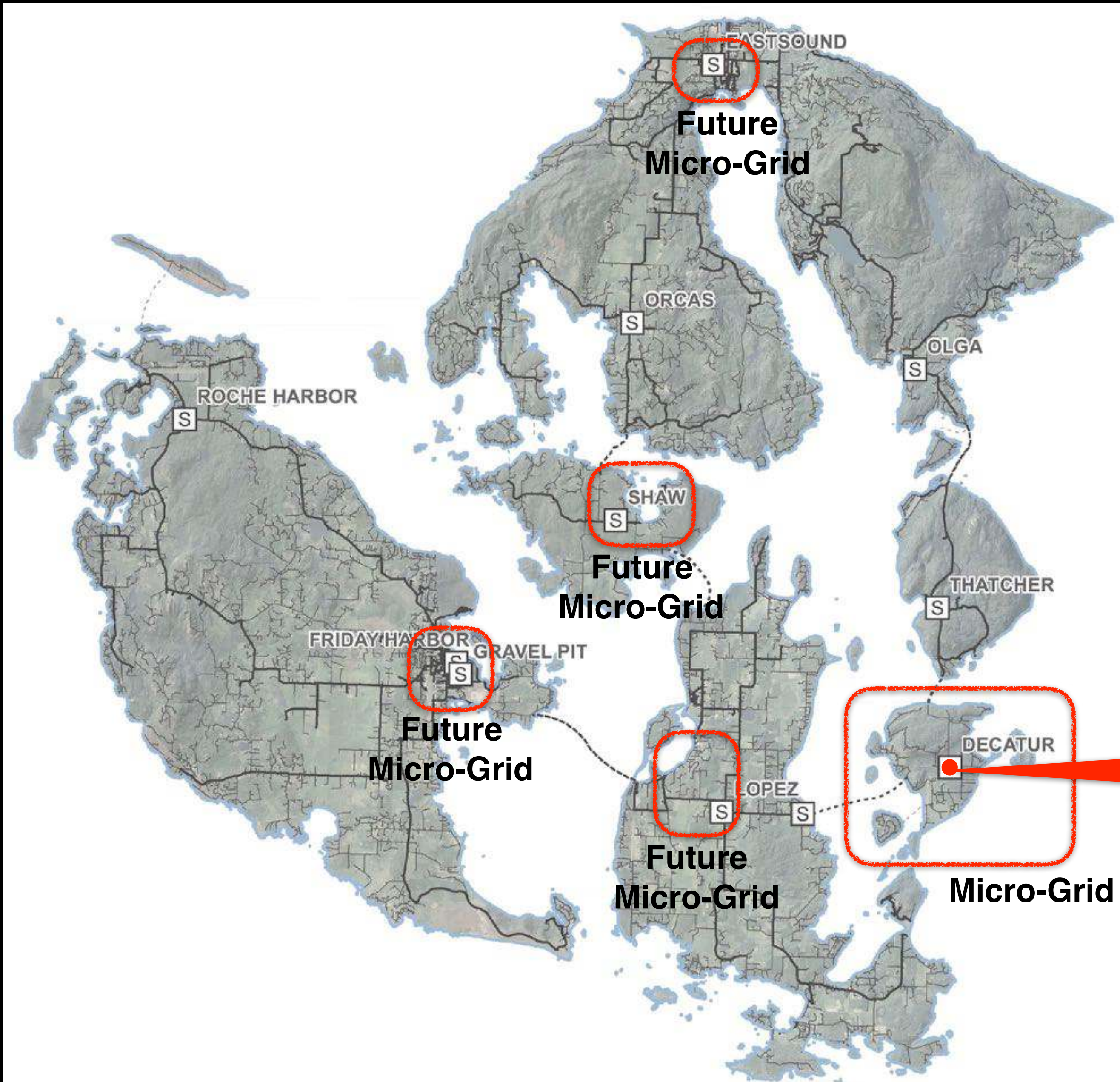
# Grid Parity: Approaches to Firming Intermittent Solar

*intermittence is like demand spikes - unpredictable and potentially expensive*

Method	Cost Examples
BPA	BPA wholesale + Demand Charge
Utility-Scale Storage	10¢ - 40¢ / kWh
Vehicle-to-grid (V2G) EV storage	BPA wholesale + 1¢ per kWh
Smart Home Storage	BPA wholesale + 1¢ per kWh
Demand Response Unit	BPA wholesale + 1¢ per kWh

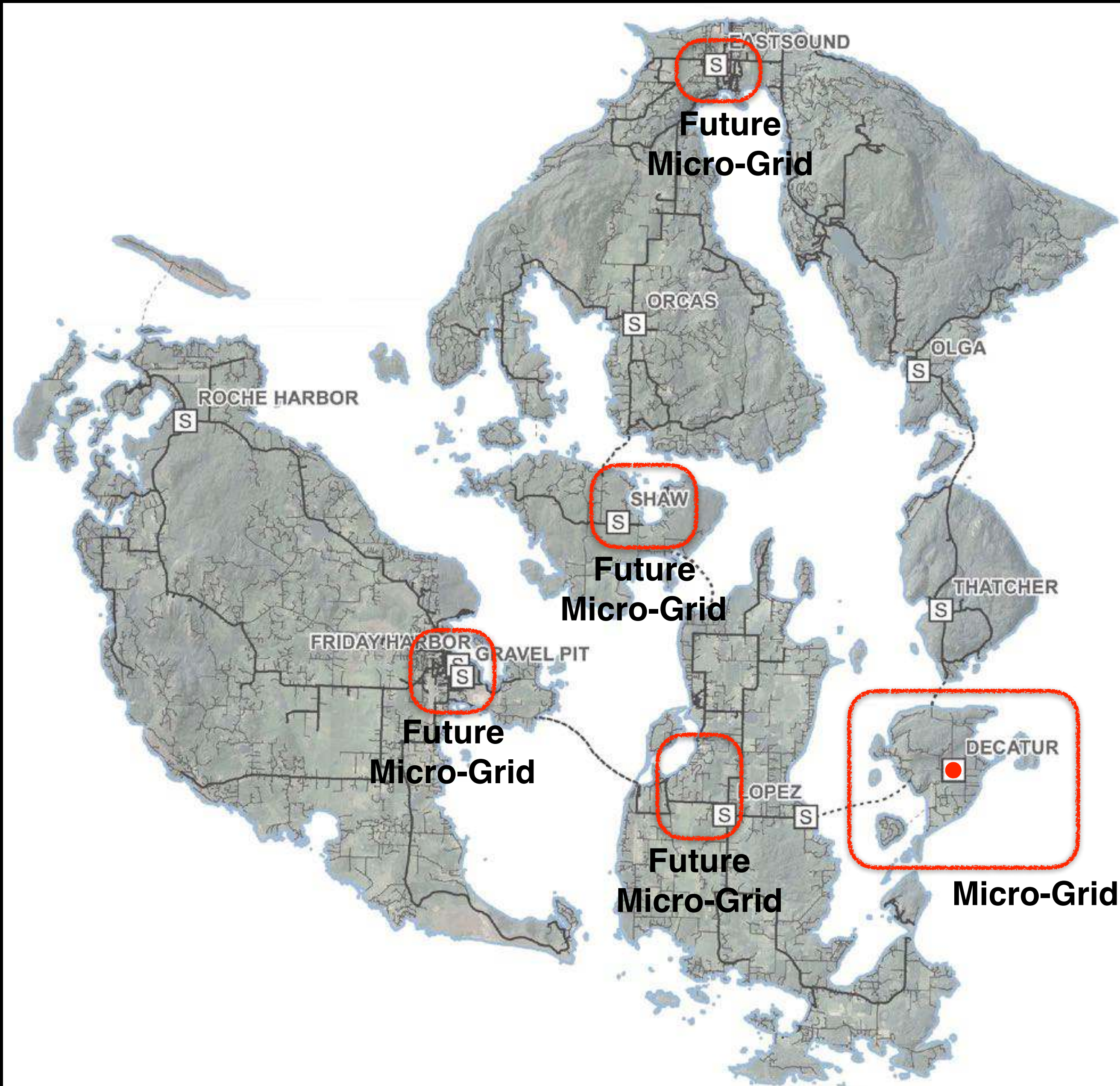


# Decatur Island Project: Solar + Storage = Local Energy Resilience





# Decatur Island Project: Solar + Storage = Local Energy Resilience

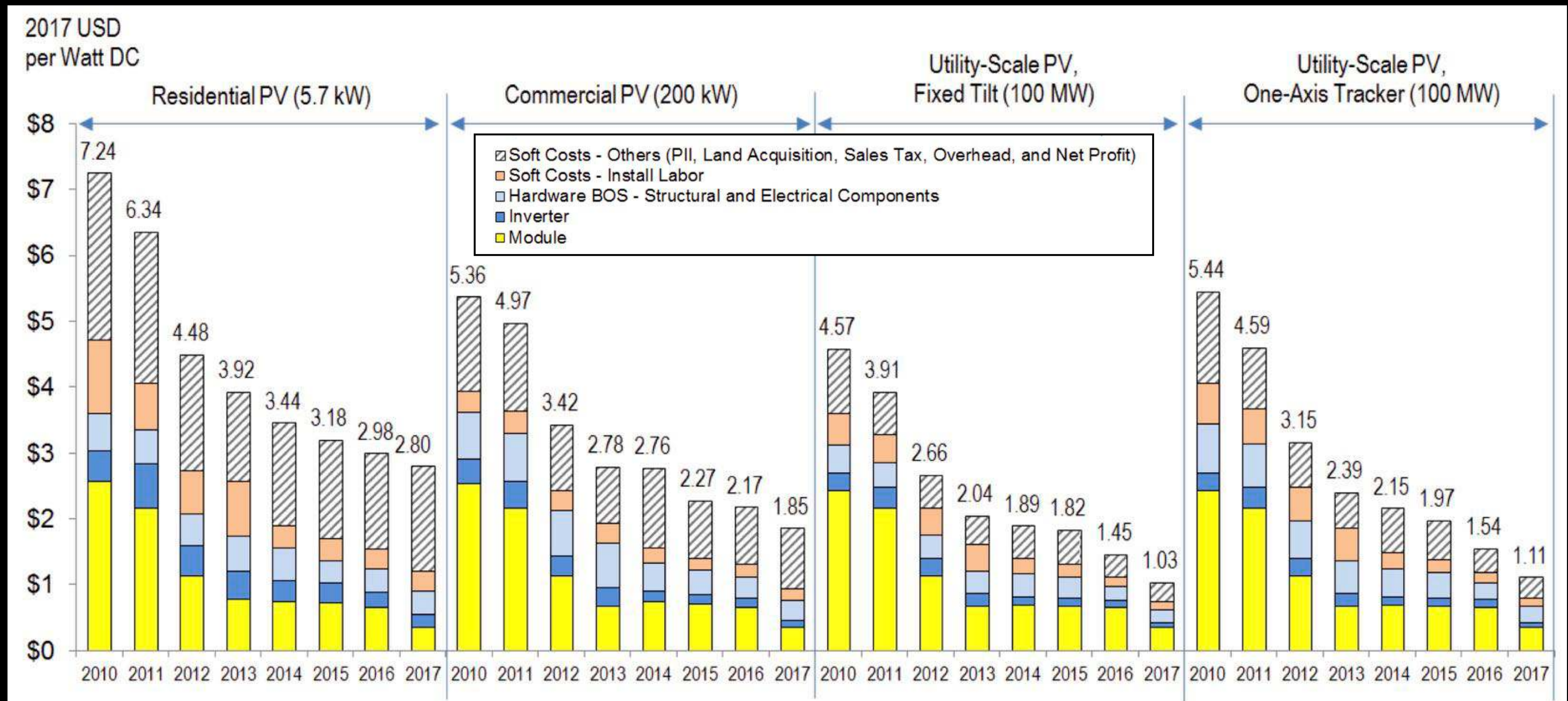


*The Decatur Island project is a grant-funded proving ground for how to combine solar + storage to increase local energy resilience and moderate the cost of energy.*



# Grid Parity: Cost of solar - the details

*module costs are low and may rise with tariffs, soft costs can be significant*



Thank You!