

California Is Electrifying: Learn About the CA Grid and the Scope of the Effort Required

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South Coast Air Quality Management District

12th Annual International OSAR Conference

March 31st, 2023



South Coast Air Basin



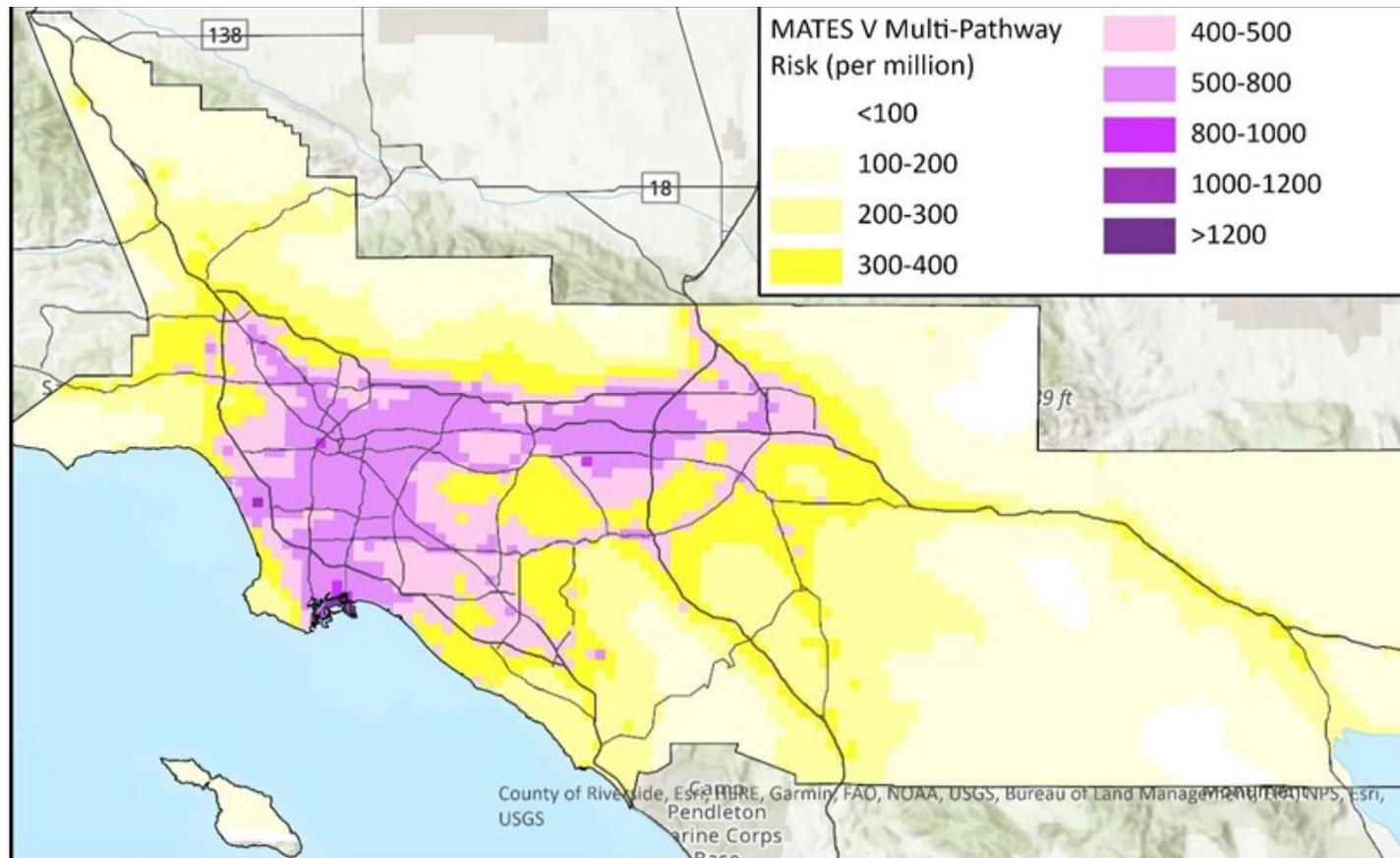
One-third of all U.S. containerized cargo ²

Mobile Sources Largest Contributor to Air Toxics Cancer Risk

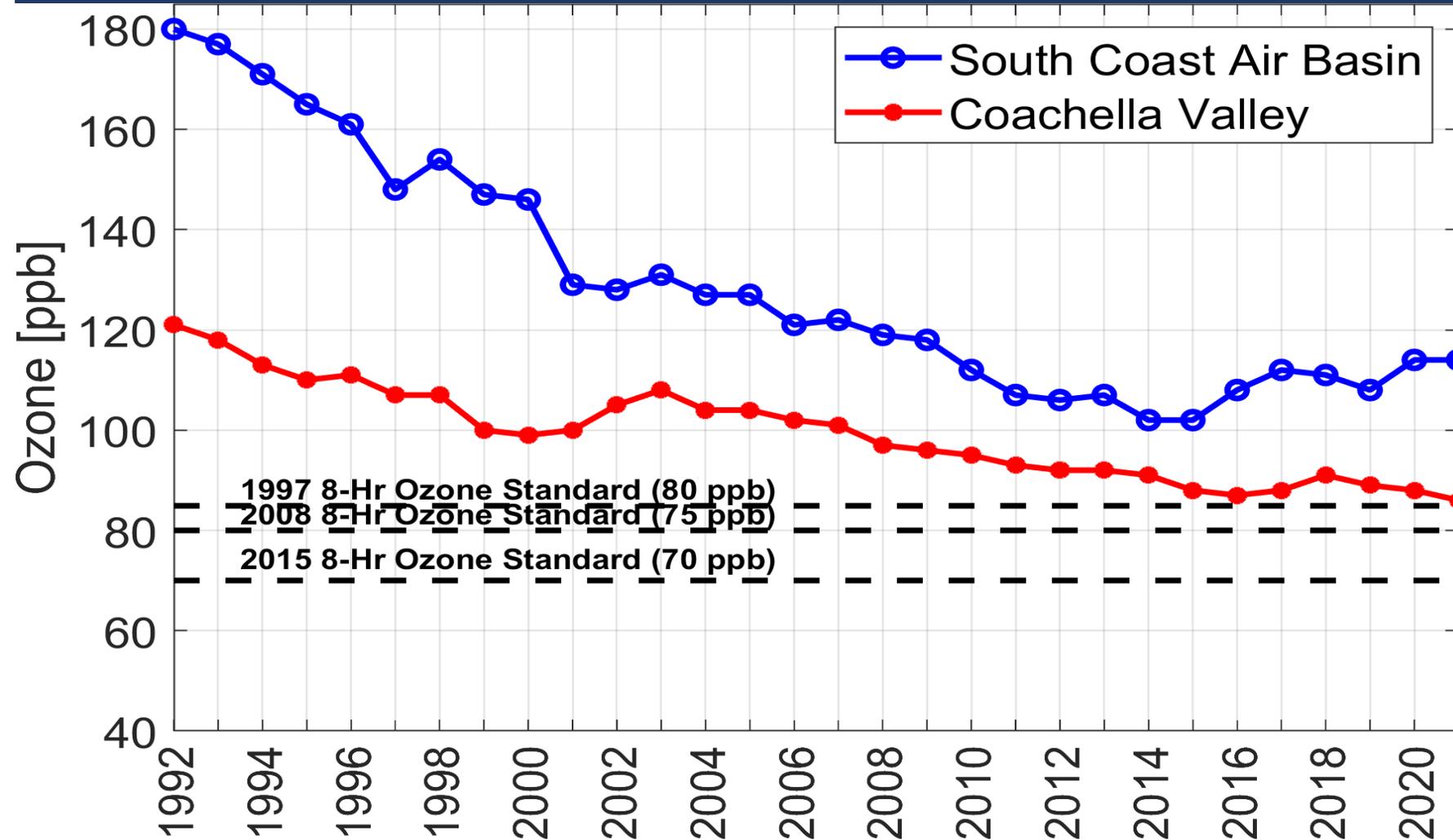
Multiple Air Toxics Exposure Study (MATES V) (population-weighted):

South Coast Air Basin: 455-in-a-million

Coachella Valley: 250-in-a-million



Progress in Cleaning the Air

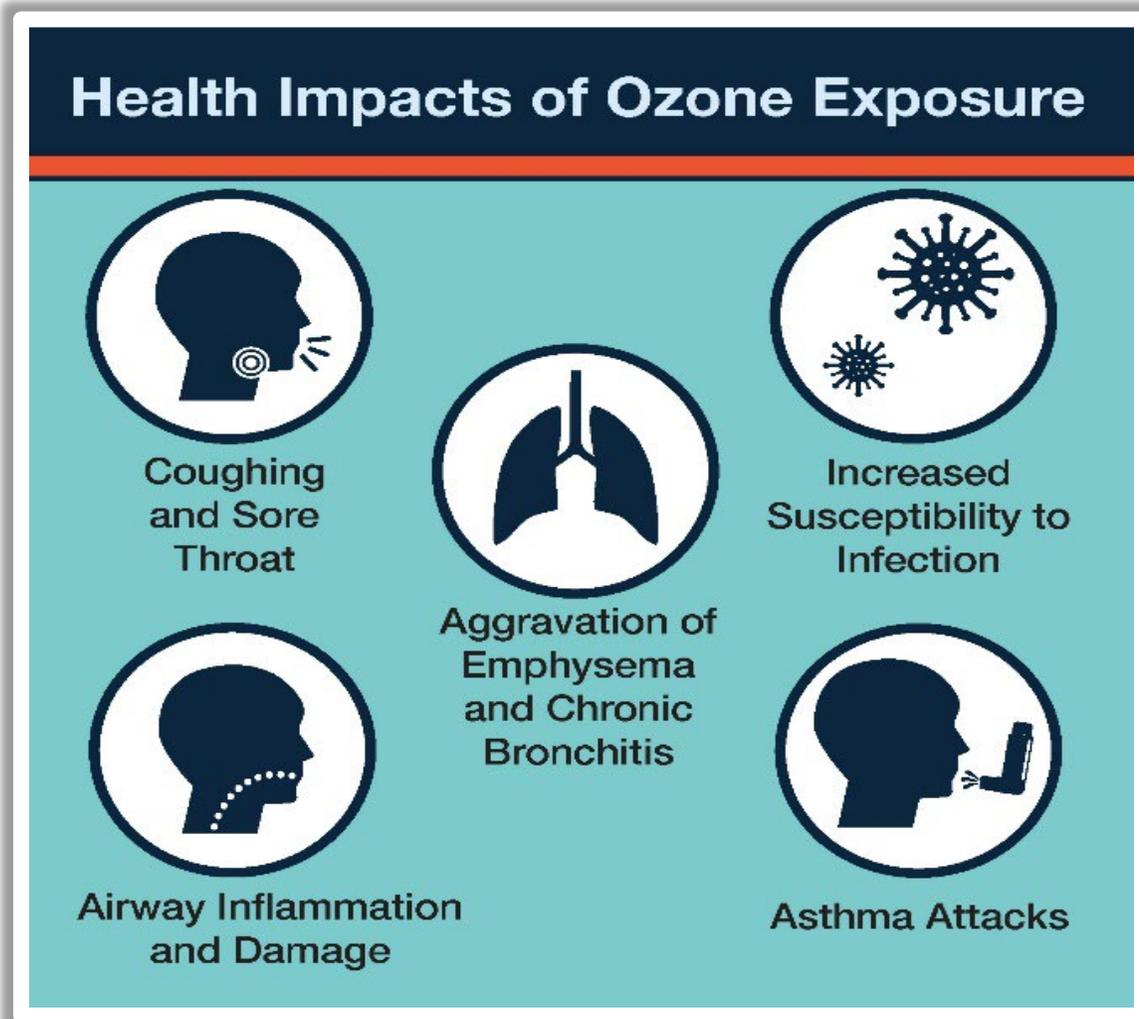


Despite substantial progress, we remain far above air quality standards

2023 Deadline
2031 Deadline
2037 Deadline



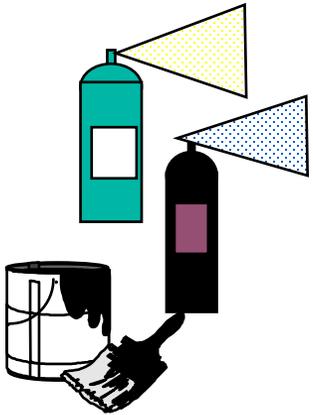
Health Impacts of Ozone



- Ozone precursor pollutants also increase fine particulate (PM2.5) pollution
- PM2.5 can cause premature death in addition to other serious health effects

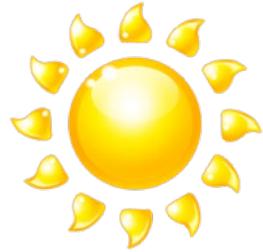
Ozone Formation

Hydrocarbons (VOCs)



+

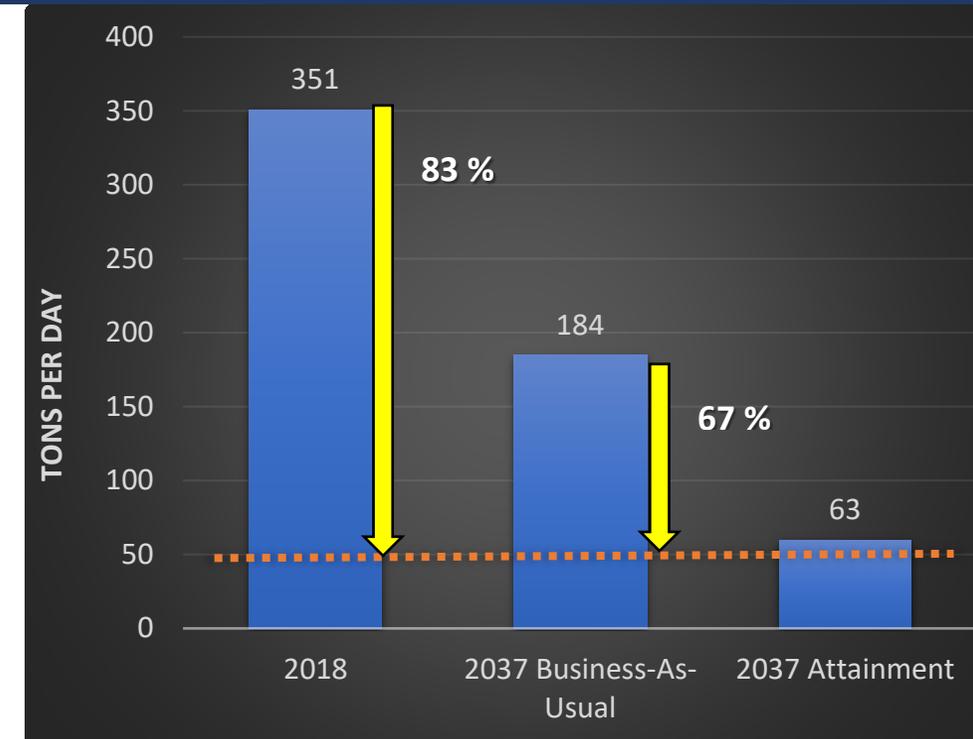
NO_x





Air Quality Management Plan - NOx Reductions Needed for Ozone Attainment

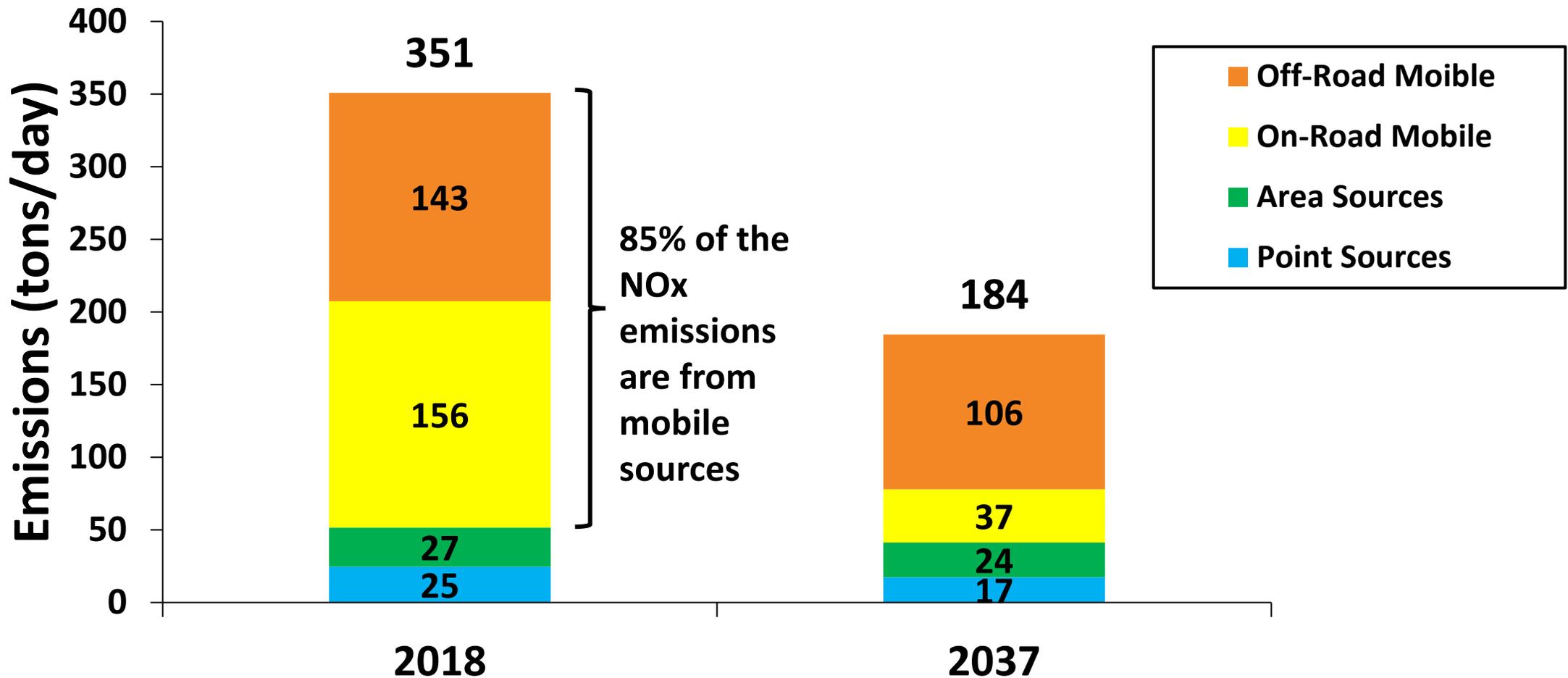
- Air Quality Management Plan (AQMP) is blueprint to improve air quality and achieve federal air quality standards in South Coast Air Basin and Coachella Valley
- NOx is primary pollutant that must be controlled to reduce ozone in our region
- NOx must be reduced to 60 tons per day to meet 70ppb ozone standard
 - 83% below current conditions
 - 67% below Business-As-Usual conditions in 2037
- **Push to zero emission technologies across all sectors wherever feasible.**



2022 AQMP and supporting documents: <http://www.aqmd.gov/2022aqmp>



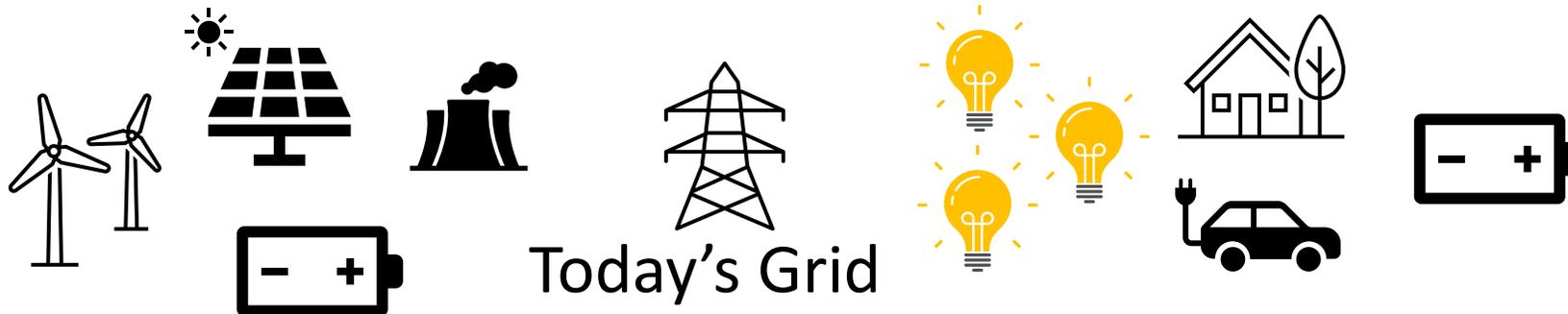
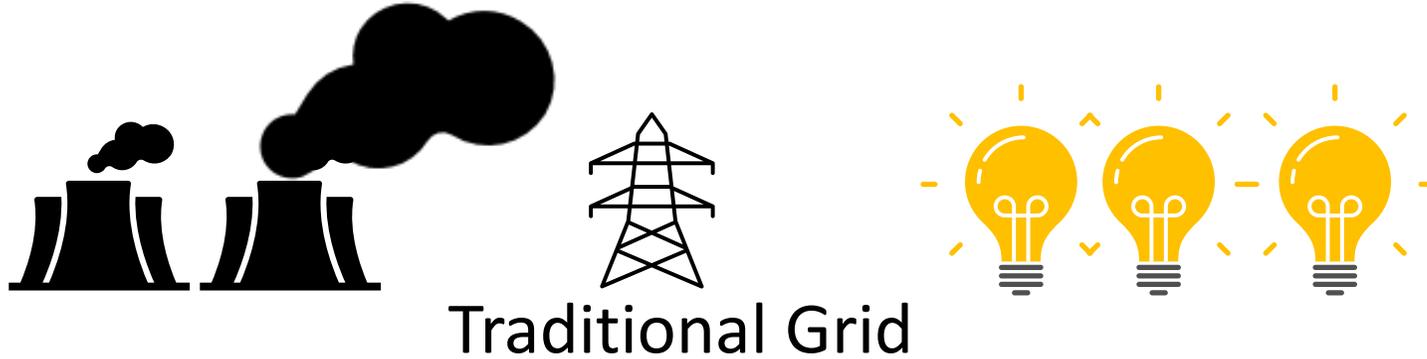
NOx Baseline* Emissions by Source Category



*Baseline emissions reflect growth and control from existing rules and regulations

Requirement for a Stable Grid

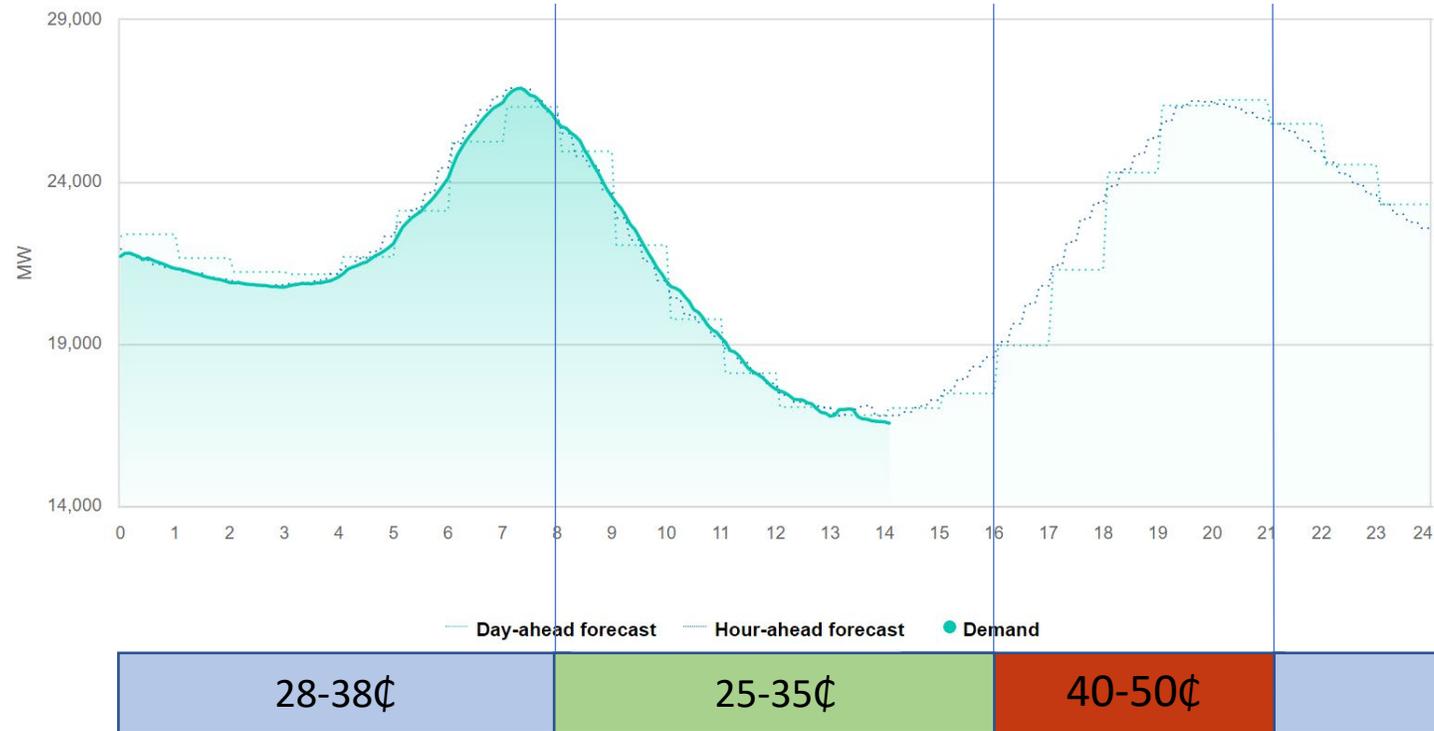
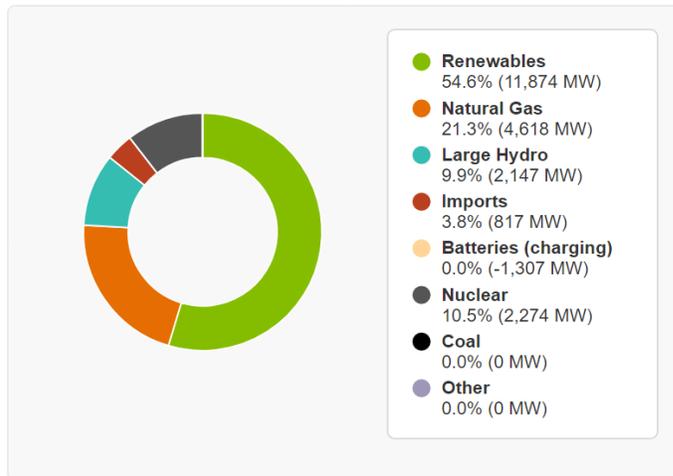
Generation = Demand



California ISO – Balances Generation and Demand

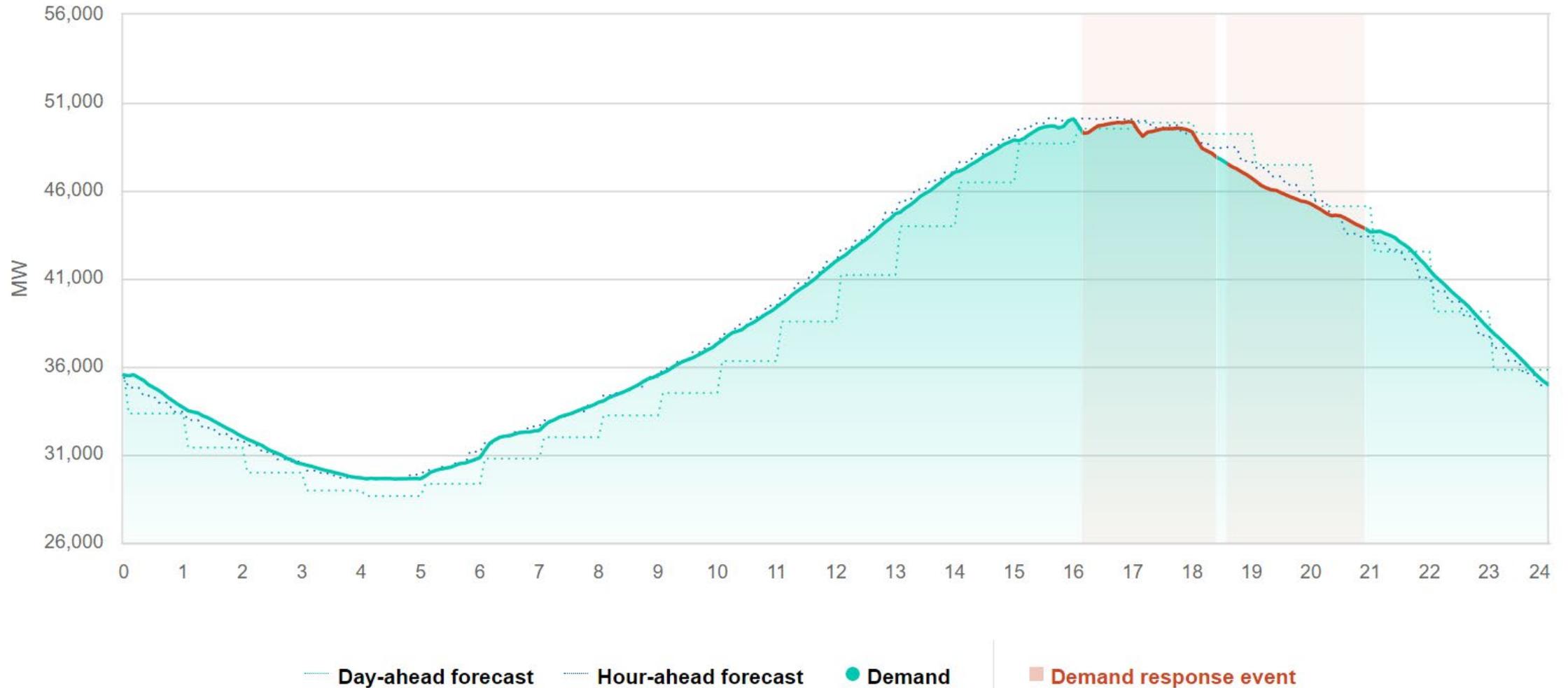
Monday March 27th

Current supply



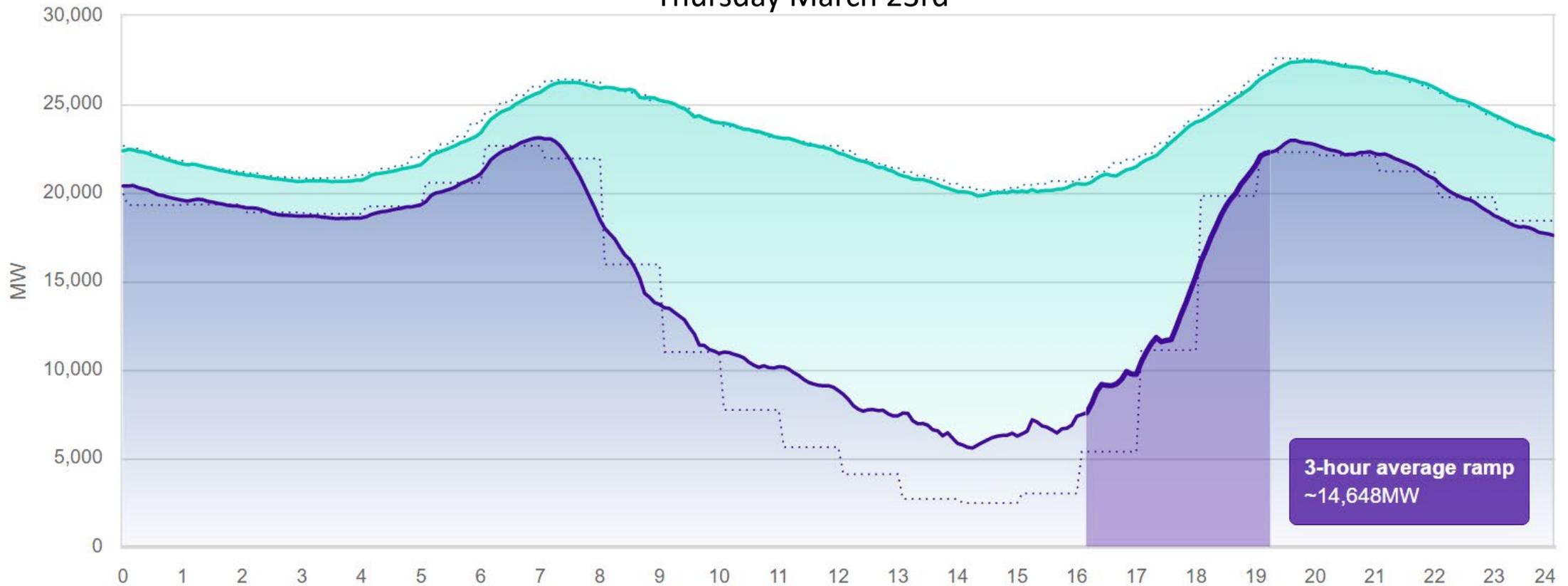
Southern California Edison Time of Use Rates
(October – May; TOU-D-4-9)

Summertime High Demand



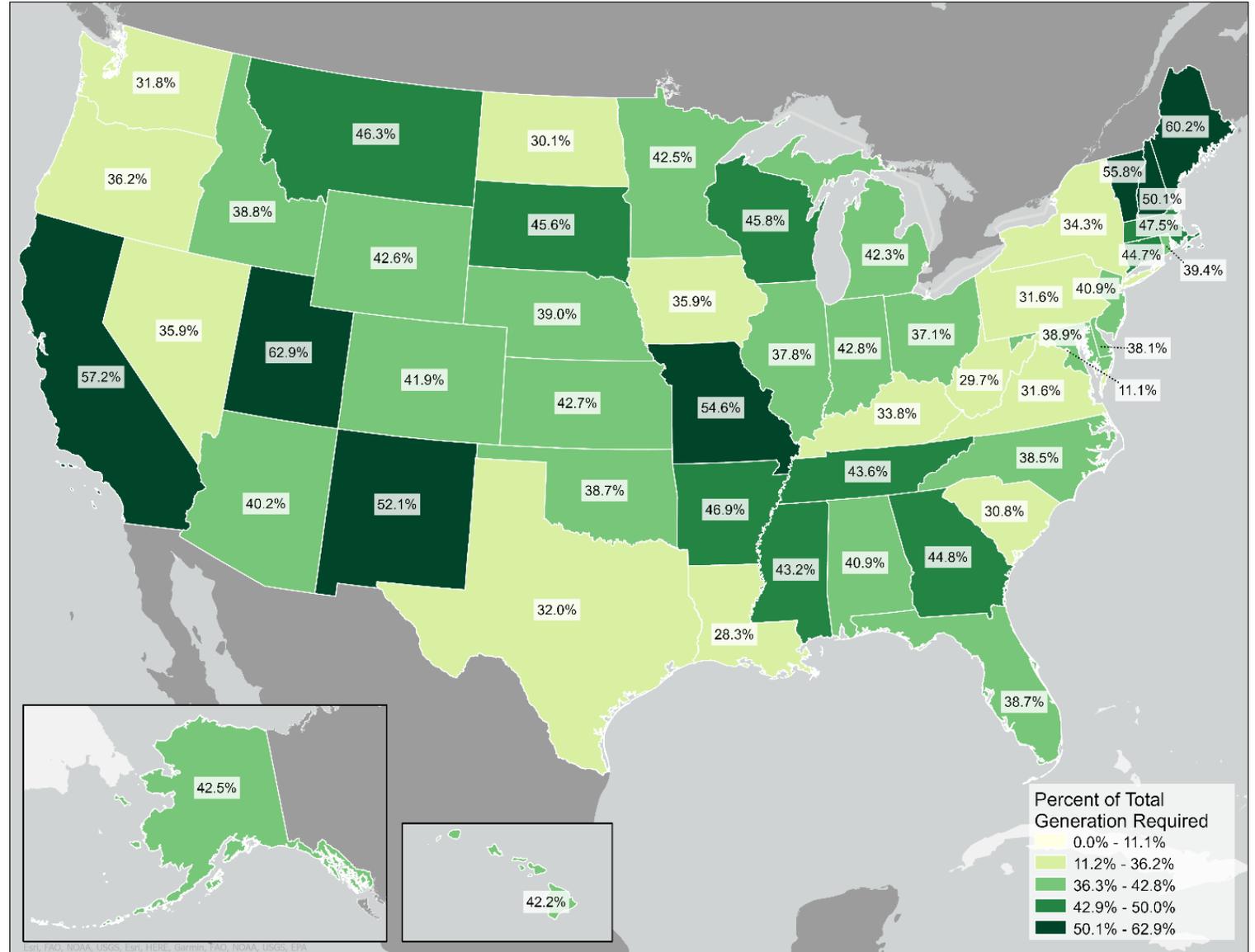
Net Demand (Demand minus Renewables)

Thursday March 23rd



Hour-ahead forecast Demand Day-ahead net forecast Net demand

Full Fleet Electrification as Percentage of Current Generation

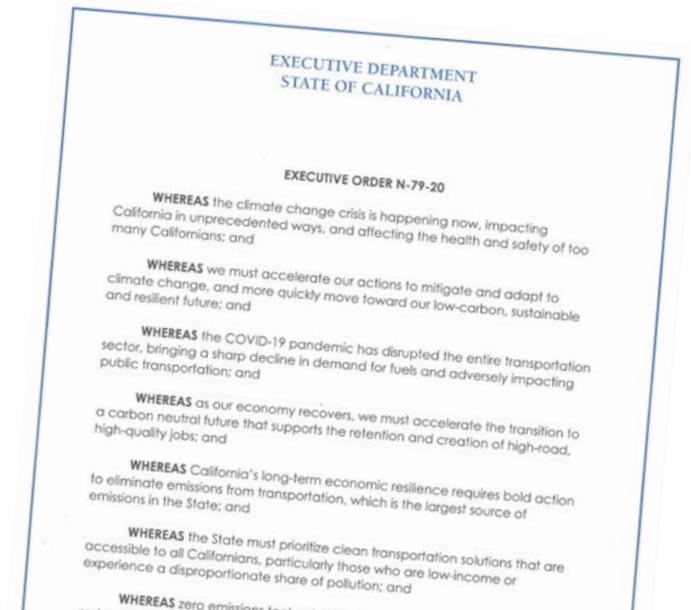


Push Towards Zero Emission in Transportation- Executive Order and Upcoming Regulations

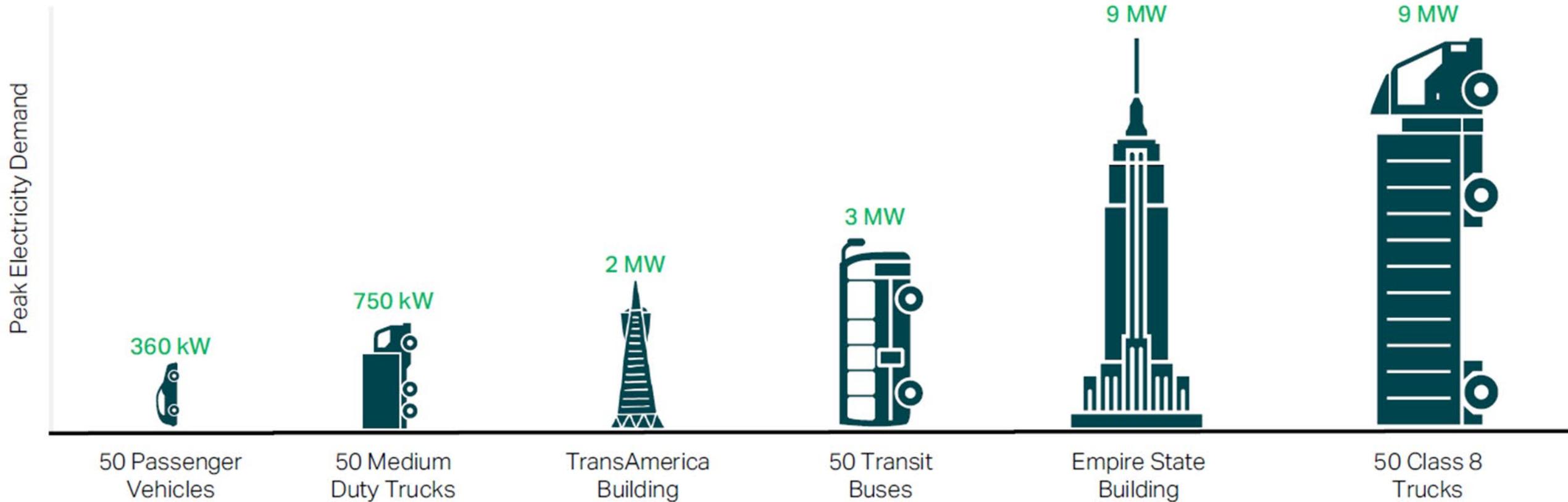
- California Governor Executive Order N-79-20
 - Goal for 100% sales of new cars and Trucks by 2035
 - 100% drayage trucks by 2035
 - 100% medium- and heavy-duty truck sales by 2045
- Advanced Clean Trucks (June 2020)
 - 100,000est. ZE by 2030
 - 300,000est. ZE by 2035
- CARB proposed regulation Advance Clean Fleets
 - New trucks in drayage truck registry ZE only starting 2024
 - 100% ZE drayage trucks by 2035
 - 100% refuse trucks by 2040
 - 100% ZE capable utility fleets by 2040



<https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets>



Bringing ZE Transportation onto the Grid



Driving EV Adoption - Program Recommendations for the Next Generation of EV Charging Deployment, Peter Olmsted & Renee Samson, FreeWire Technologies, White Paper, April 2022

Charging Infrastructure Needs

AB2127 CEC report

- 157,000 MD/HD chargers by 2030 (180k trucks)
 - 141,000 50kW and 16,000 350kW
- 700,000 LD chargers by 2030 (5-8million ZEVs)

[Electric Vehicle Charging Infrastructure Assessment - AB 2127 | California Energy Commission](#)

WSJ Feb 5, 2023

BUSINESSENERGYJOURNAL REPORTS: ENERGY

Can the Power Grid Handle a Wave of New Electric Vehicles?

The consensus is that utilities can generate enough electricity. The problem is to be getting it to people's homes and businesses.



As sales of EVs keep rising, they will test the power grid.
PHOTO: CAROLINE BREHMAN/SHUTTERSTOCK

By Bart Ziegler [Follow](#)

Quick Infrastructure Solutions Needed

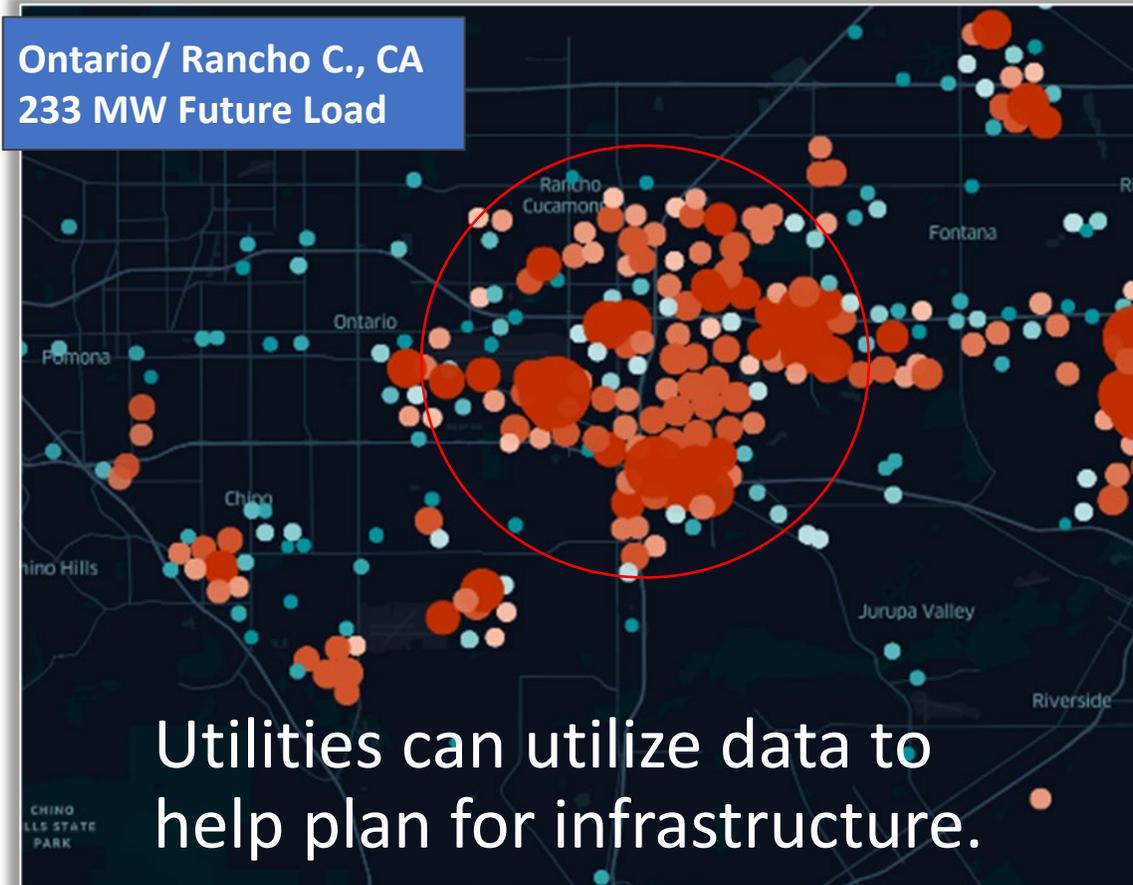
- Distribution grid was not built to support transportation
 - Many fleets are being told it will take years to get power for chargers
 - ZE Truck deliveries are occurring before infrastructure is ready
- Portable chargers and grid support using batteries and/or clean onsite generation



Ontario, California



Planning for ZE Infrastructure – Vehicle Telematics Data



Renewable Generation - Zero Emission Transportation Requires a Clean Grid

California Renewable Portfolio Standard

- 2030 50% renewables (SB350, 2015)
- 2030 60% renewables (SB100, 2018)
- 2045 100% carbon free (SB100, 2018)

Grid flexible resources are needed to support renewables

2021 California Grid Power Mix

Conventional	66%
Coal	3%
Natural Gas	37.90%
Oil	0.20%
Nuclear	9.30%
Large Hydro	9.20%
Unspecified	6.80%
Renewable	34%
Biomass	2.30%
Geothermal	4.80%
Small Hydro	1.00%
Solar	14.20%
Wind	11.40%

[2021 Total System Electric Generation \(ca.gov\)](https://www.ca.gov)

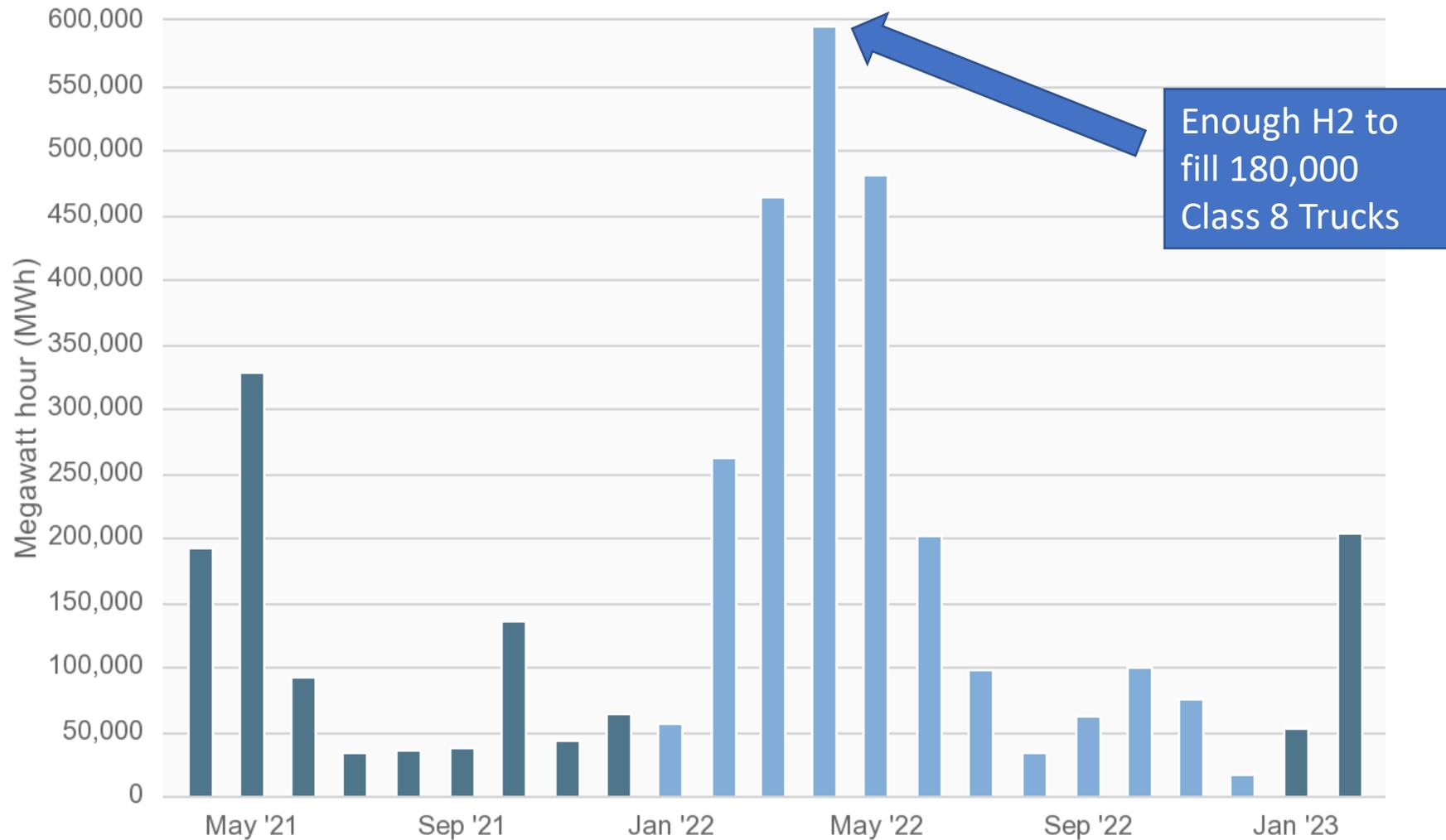


Hydrogen and the Grid

- California renewable resources often generate more electricity than is needed and results in curtailing electricity to maintain supply and demand.
- Opportunity to add load to grid
- Battery storage
- Charge EVs
- Produce hydrogen through electrolysis
 - Hydrogen can be used for long term seasonal storage
 - Transportation (fuel cell, efuels)



California Wind and Solar Curtailment Totals by Month



Fuel Cell and Battery Electric Trucks

	Battery Electrics	Fuel Cells
Challenges	<ul style="list-style-type: none">• Slower charging time; 1MW-500kW charging is needed• Lower range – 150-200 miles• Installing charging Infrastructure can be expensive – grid load issues• Weight issues• Battery recycling	<ul style="list-style-type: none">• Least commercialized option• High fuel cost• Fueling infrastructure not commonly available



U.S. DOE Energy Earth shots – Hydrogen Shot

Goal of 1\$/kg of hydrogen by 2030 “1.1.1”

- Multiple pathways to produce hydrogen from domestic energy uses
- Addresses carbon emissions for hydrogen production from non-renewable sources
- Engagement from multiple stakeholders with diverse perspectives, expertise, and experience



1 Dollar



1 Kilogram



1 Decade

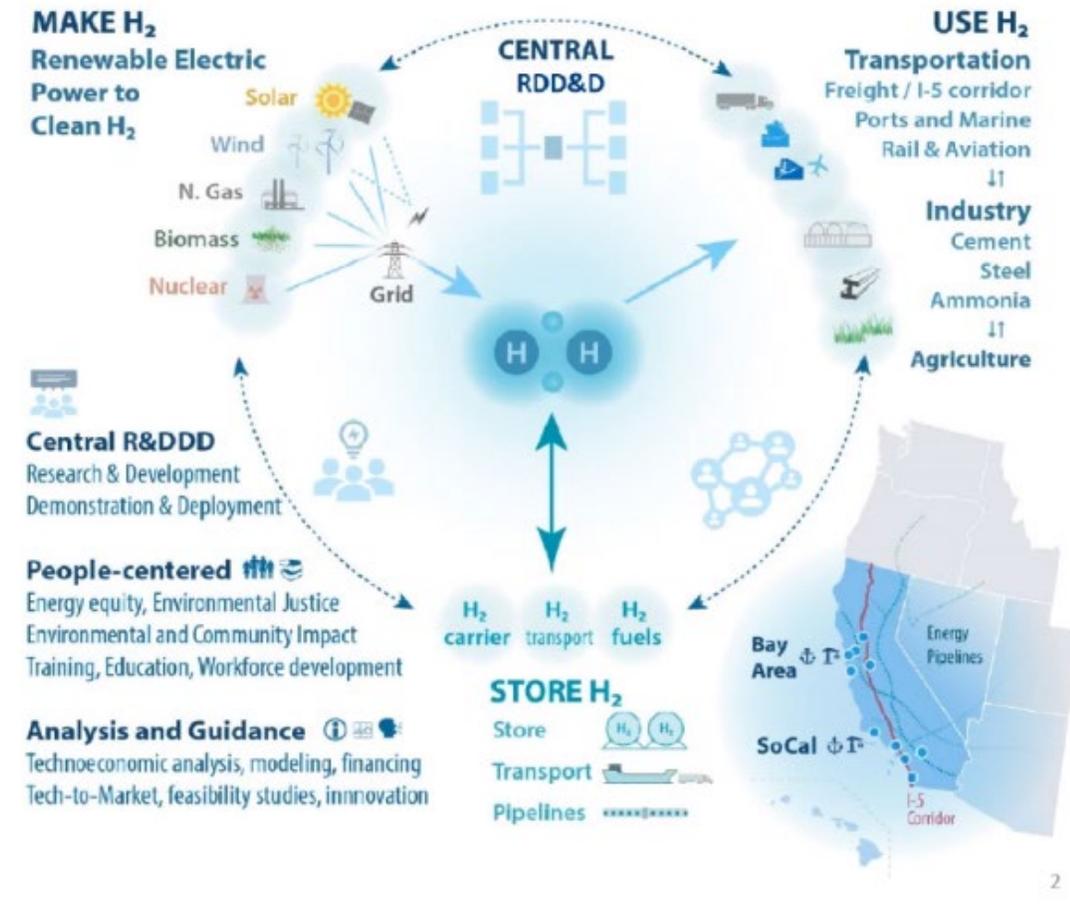


U.S. DOE Regional Hydrogen Hubs – California

California Formally Announces Intention to Create a Renewable Hydrogen Hub – May 2022

- Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES LLC) established (Go-Biz, UCOP)
 - Public-private hydrogen hub consortium to accelerate the development and deployment clean and renewable hydrogen projects and infrastructure
- DOE released Funding Opportunity Announcement (FOA) 22 Sept. 22, 2022
 - Concept papers are due - Nov. 7, 2022
 - Full applications are due - April 7, 2023

<https://archesh2.org/>



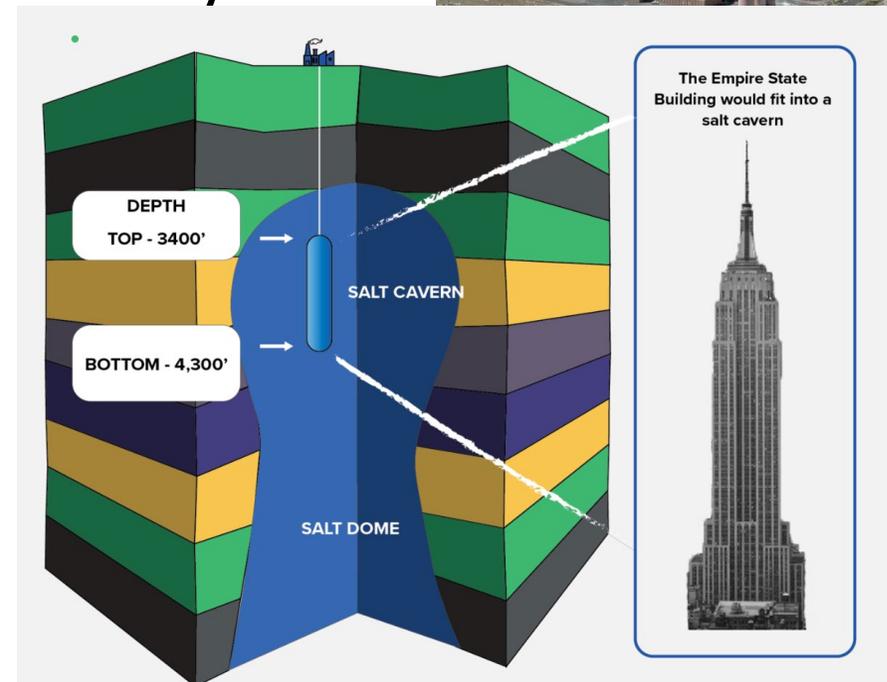
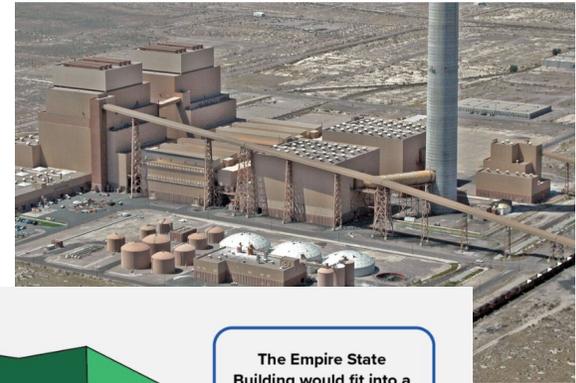
Containerized Fuel Cells – Charging Support

- Rapidly provide zero emission electricity supplies of several megawatts
- Stack with battery energy storage
- Connect in parallel, scalable and moveable
- Used in Europe for marine applications



Intermountain Power Project (Delta, Utah)

- Conversion of 1,800MW coal power plant to 840MW combined cycle gas turbine operating on hydrogen.
- ~4,000 MW of connected renewable generation
- Renewable resources to generate H2 via electrolysis
- Hydrogen stored in salt caverns
 - Seasonal storage of renewable energy
 - 1 cavern = 5,512 tons H2
 - 100 caverns possible at the site
- Planned operation in 2025 (30% blend)



Takeaways

- Rapid transition to ZE in all sectors where feasible needed for air quality and climate
- Renewable generation creates challenges and opportunities
- Shift to ZE in transportation and other sectors requires large infrastructure development
 - ZE truck deliveries often do not match infrastructure development at fleet sites
 - Need to be proactive in infrastructure development
 - Funding
- Workforce development planning needed
- Solutions need to be scalable



Thank You!

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