



California ISO

# Conventional Generation in a Market of Intermittent Resources

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January 19, 2022

ISO PUBLIC

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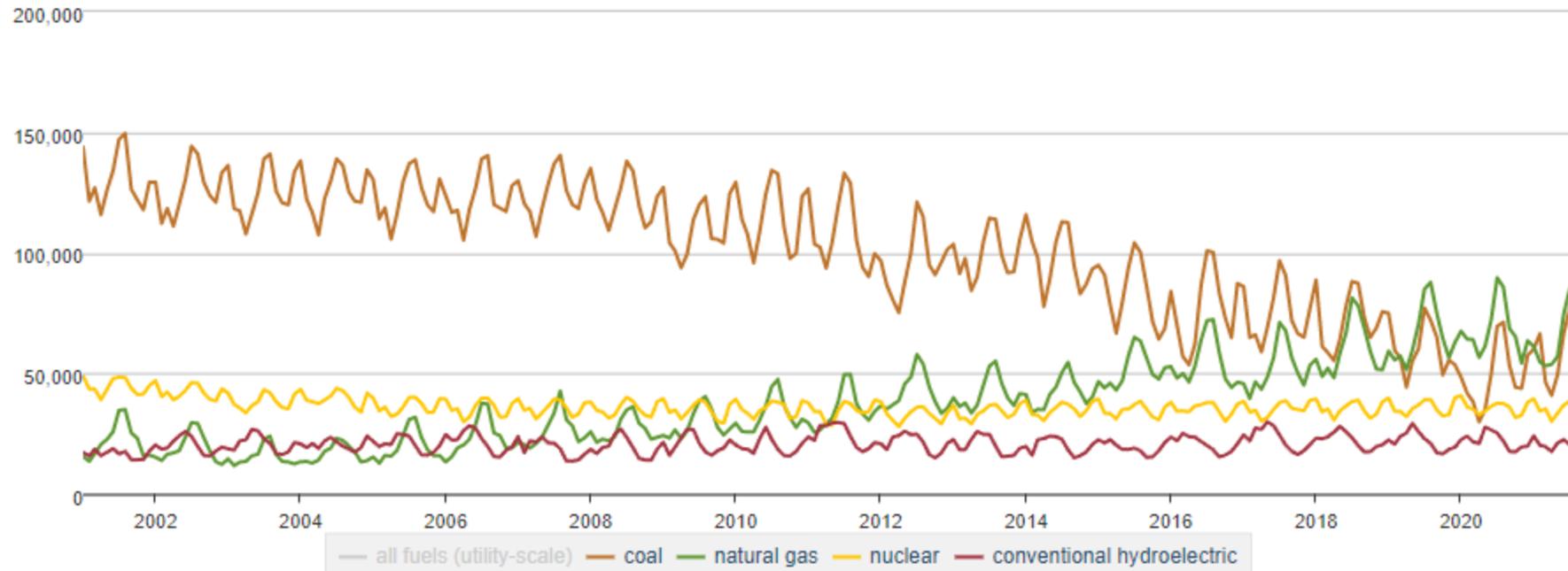
# Presentation Points

- Overview
  - Fuel Type Summary
  - Fleet Composition
  - Renewable Facts and Perspective
  - Renewables Direction
- Generation Details
  - Contribution Towards Reliability
  - Duck Curve
- Gas-Electric Coordination
  - General
  - Real-Time
  - Improvements
- Resource Adequacy (RA) Overview
- Reliability Must Run (RMR) Contract Overview

# Natural Gas Becomes Electric Generation's Primary Fuel as Coal Retires

Net generation, United States, electric utility, monthly

thousand megawatthours

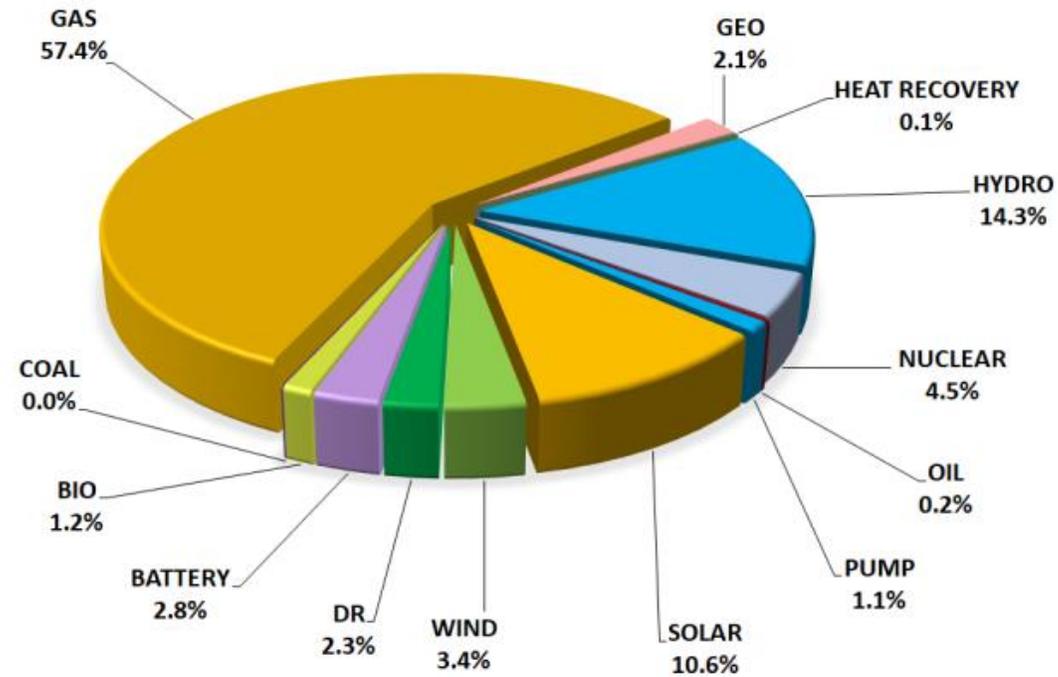


Data source: U.S. Energy Information Administration

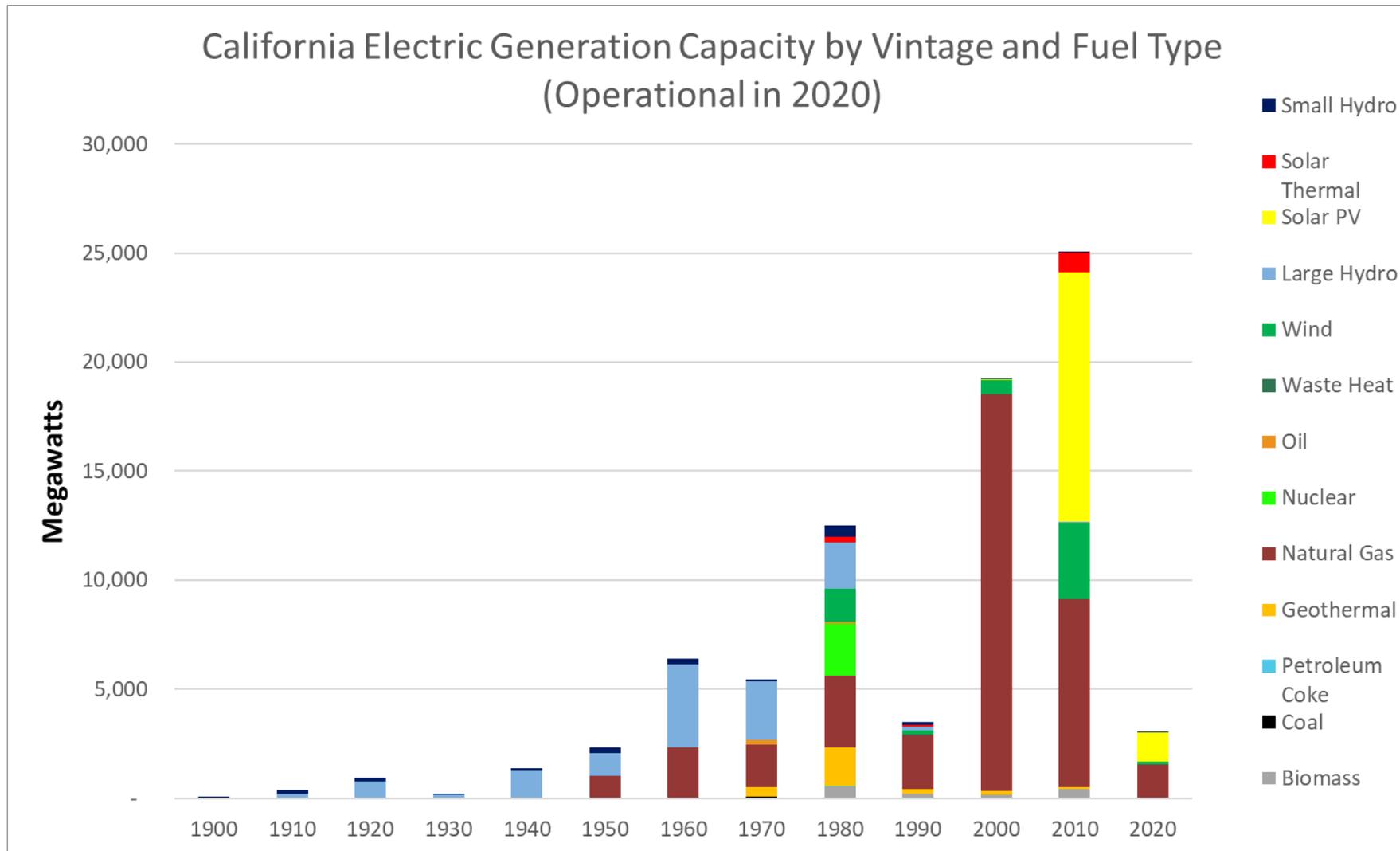
# ISO 2021 Summer On Peak Available Capacity by Fuel Type

California ISO

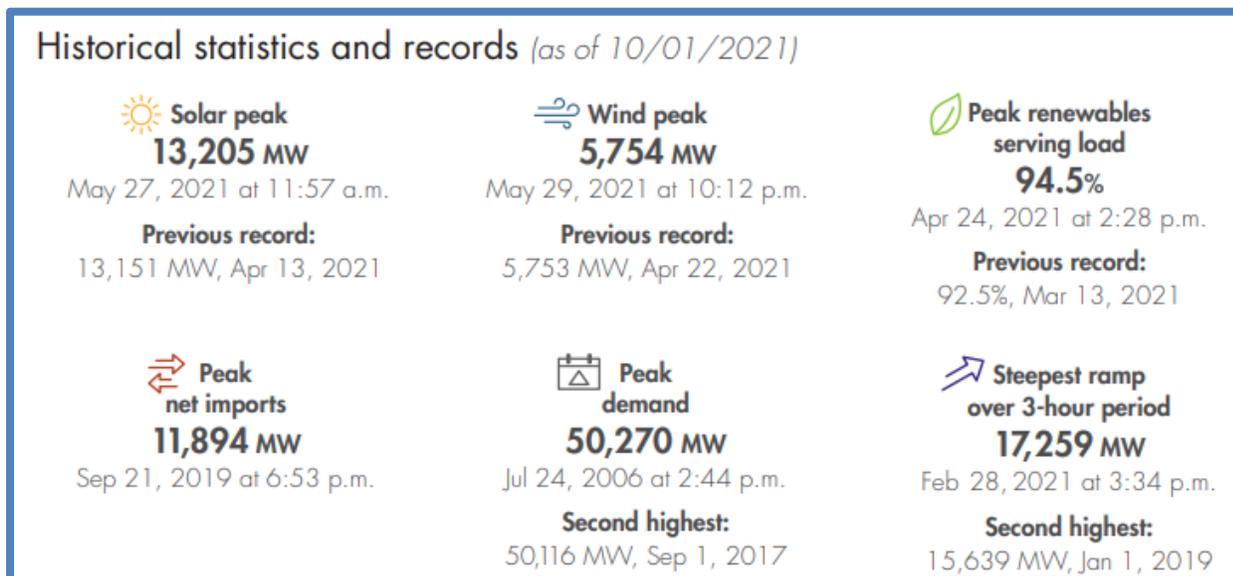
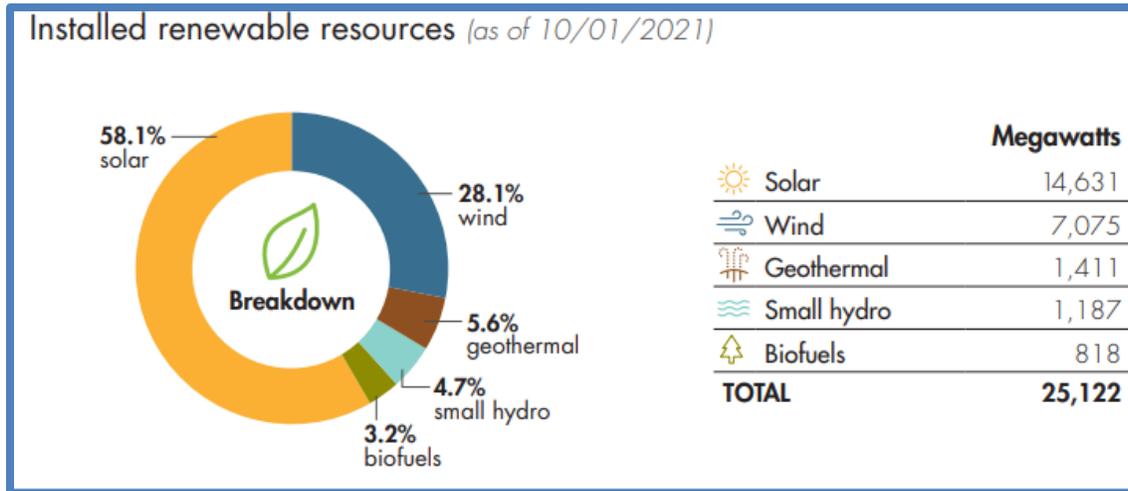
Appendix C: 2021 ISO Summer Maximum On-Peak Available Capacity by Fuel Type



# State (age) of CAISO Total Generation

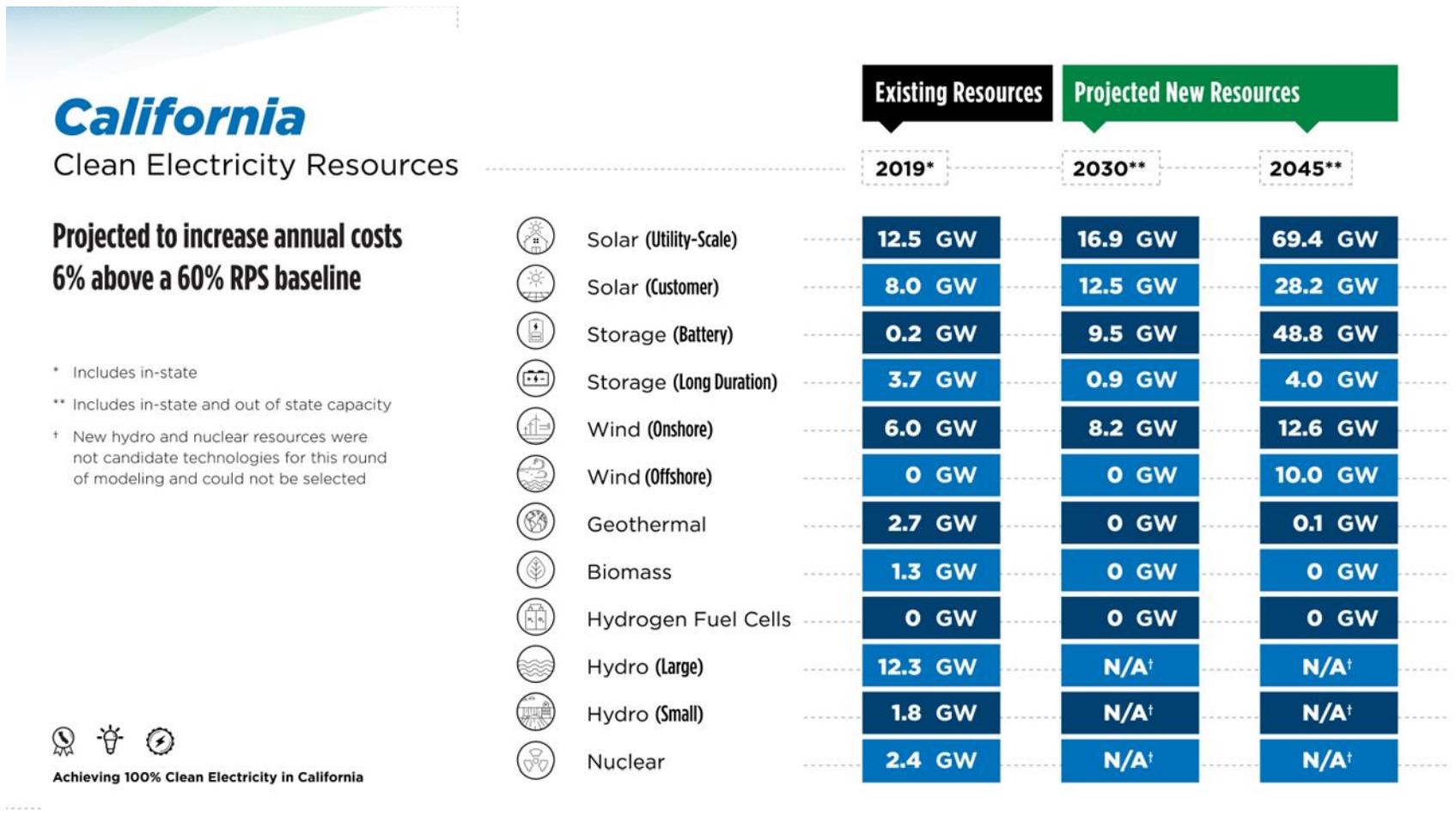


# Current CAISO Renewable Generation



# Achieving 100% Clean Electricity in California

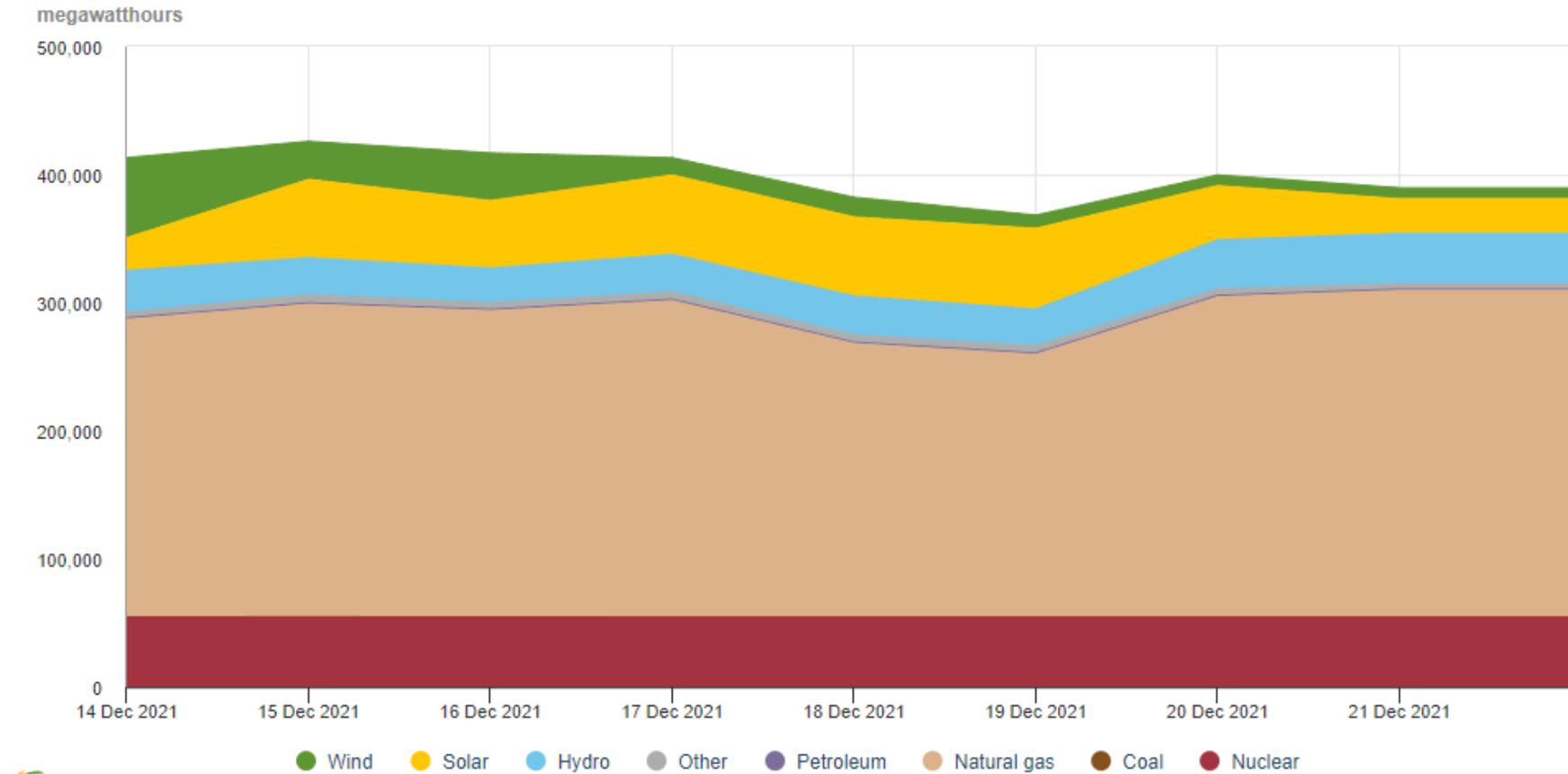
(2021 SB100 Joint Agency Report Summary)



Note: <https://ww2.arb.ca.gov/sites/default/files/2021-11/CEC-sp22-electricity-ws-11-02-21.pdf>

# Generation by Energy Type

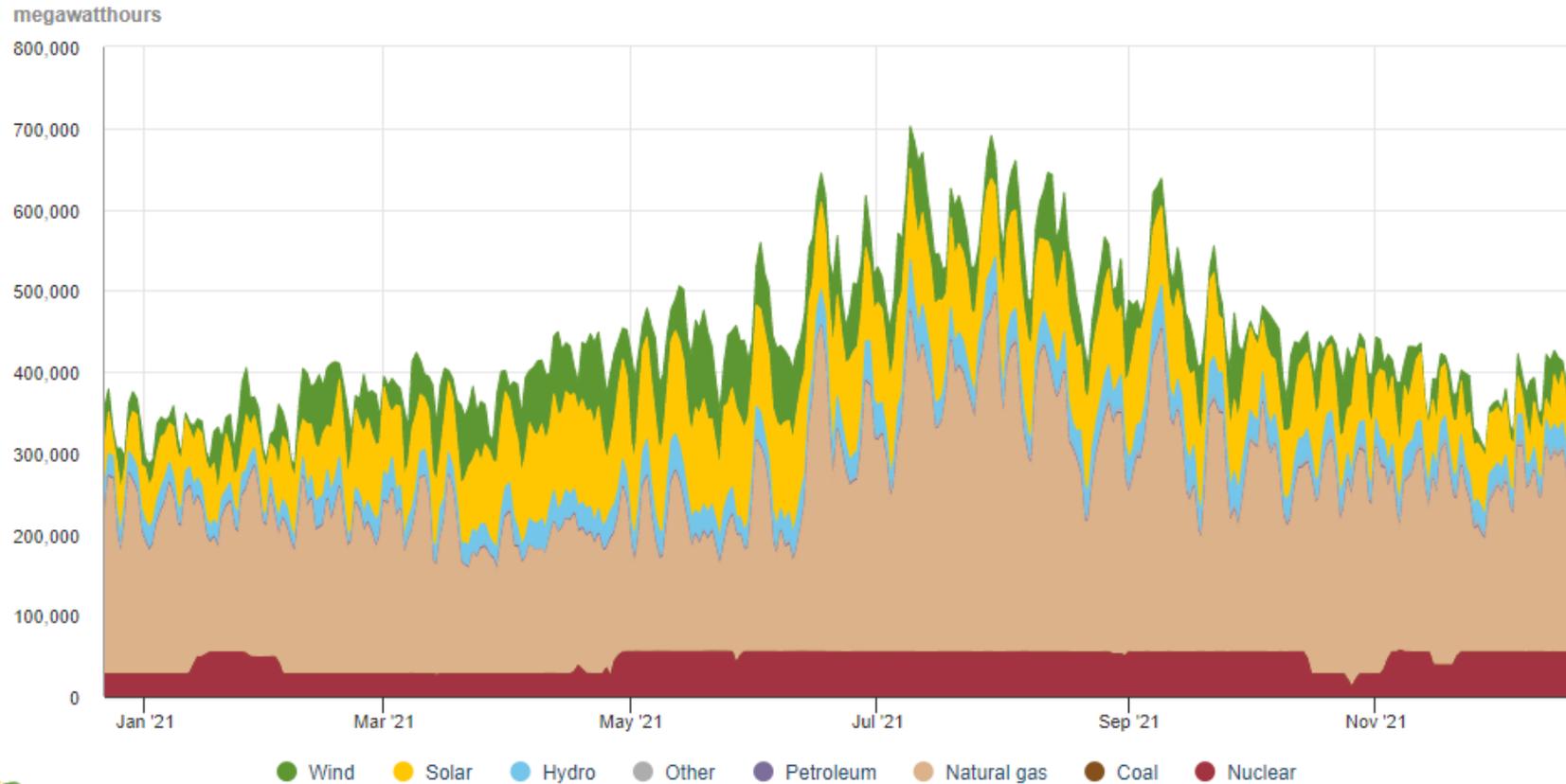
California Independent System Operator (CISO) electricity generation by energy source 12/14/2021 – 12/21/2021, Pacific Time



eia Source: U.S. Energy Information Administration

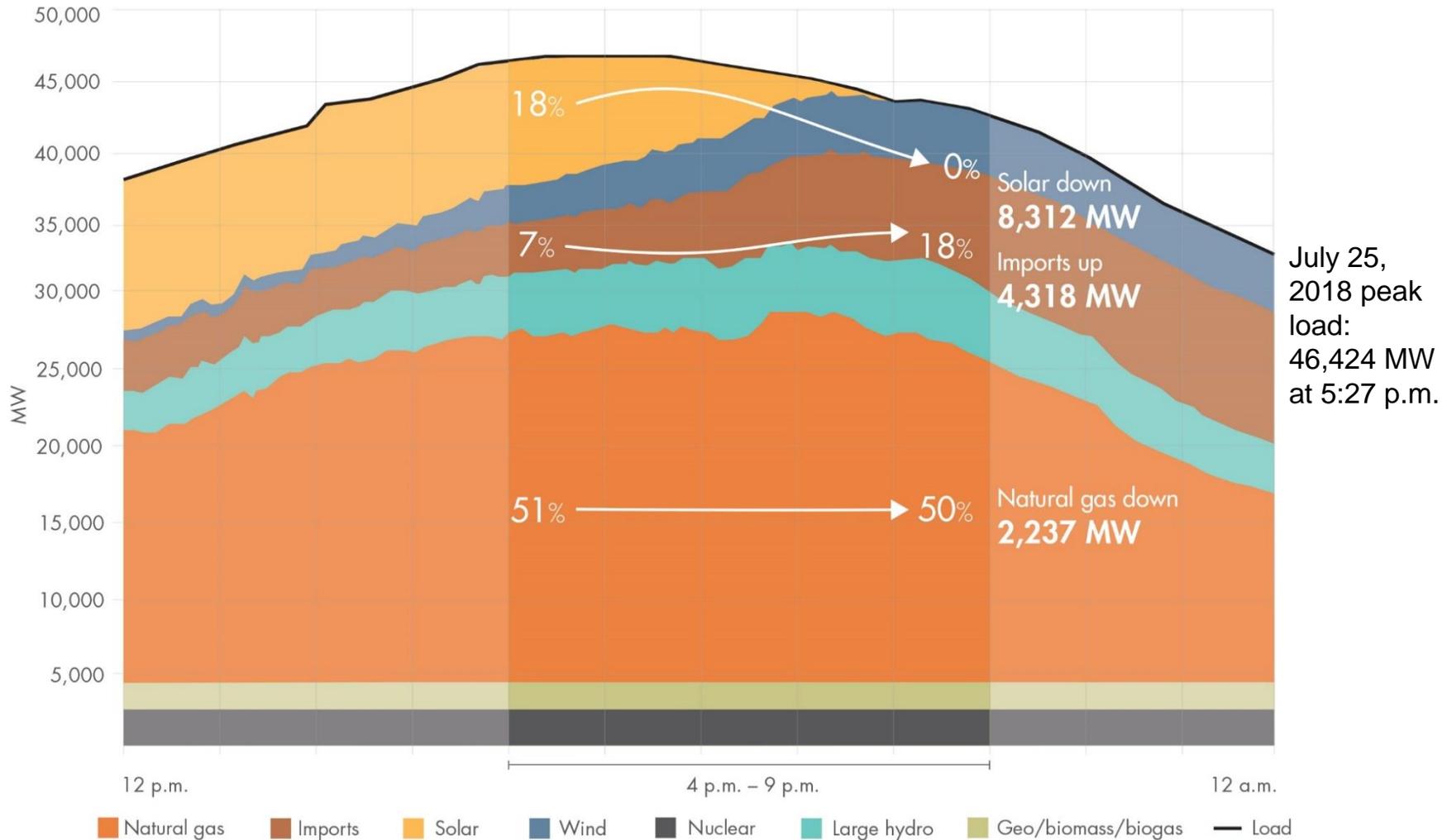
# Generation by Energy Type (cont.)

California Independent System Operator (CISO) electricity generation by energy source 12/22/2020 – 12/21/2021, Pacific Time

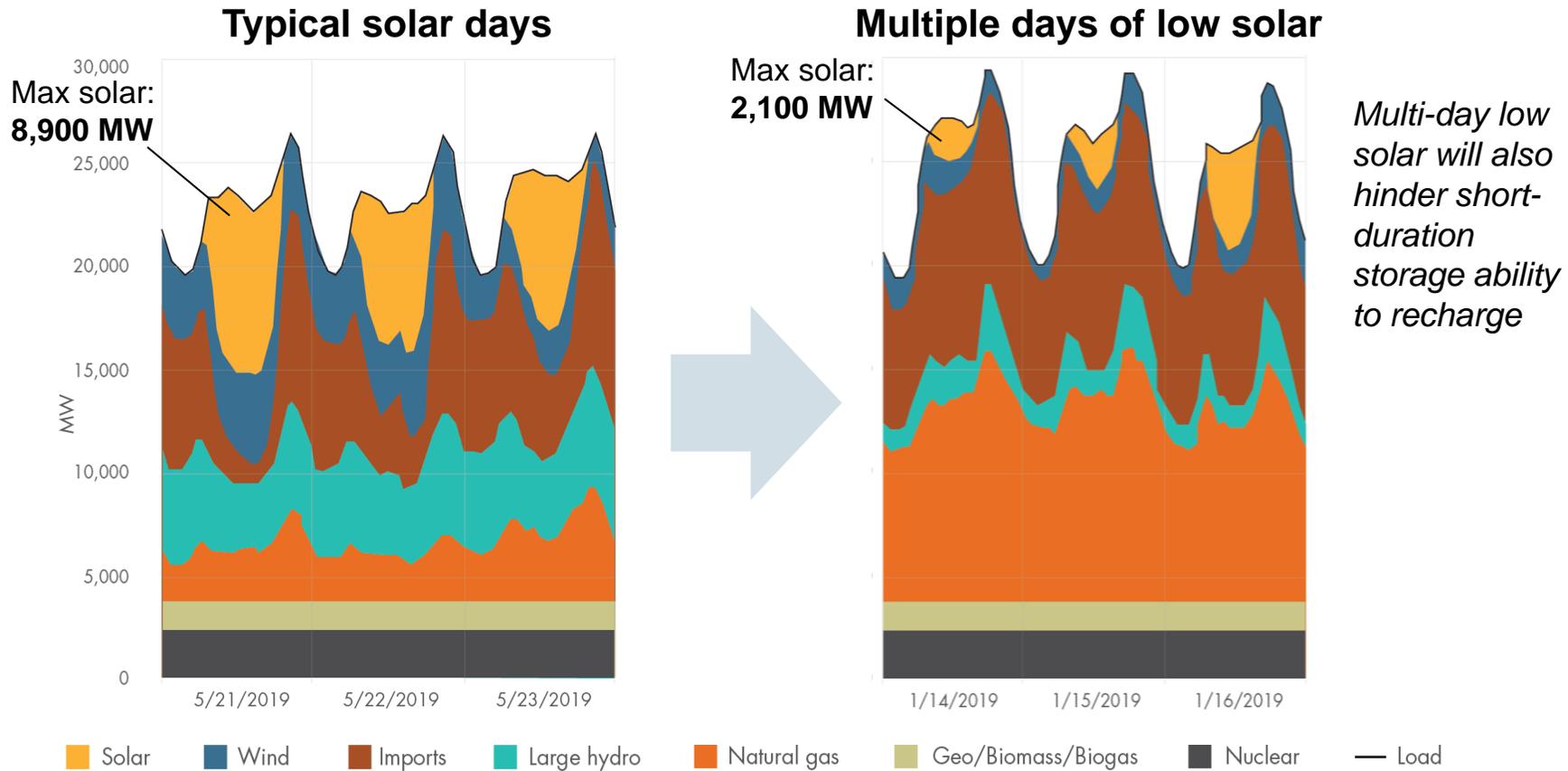


eia Source: U.S. Energy Information Administration

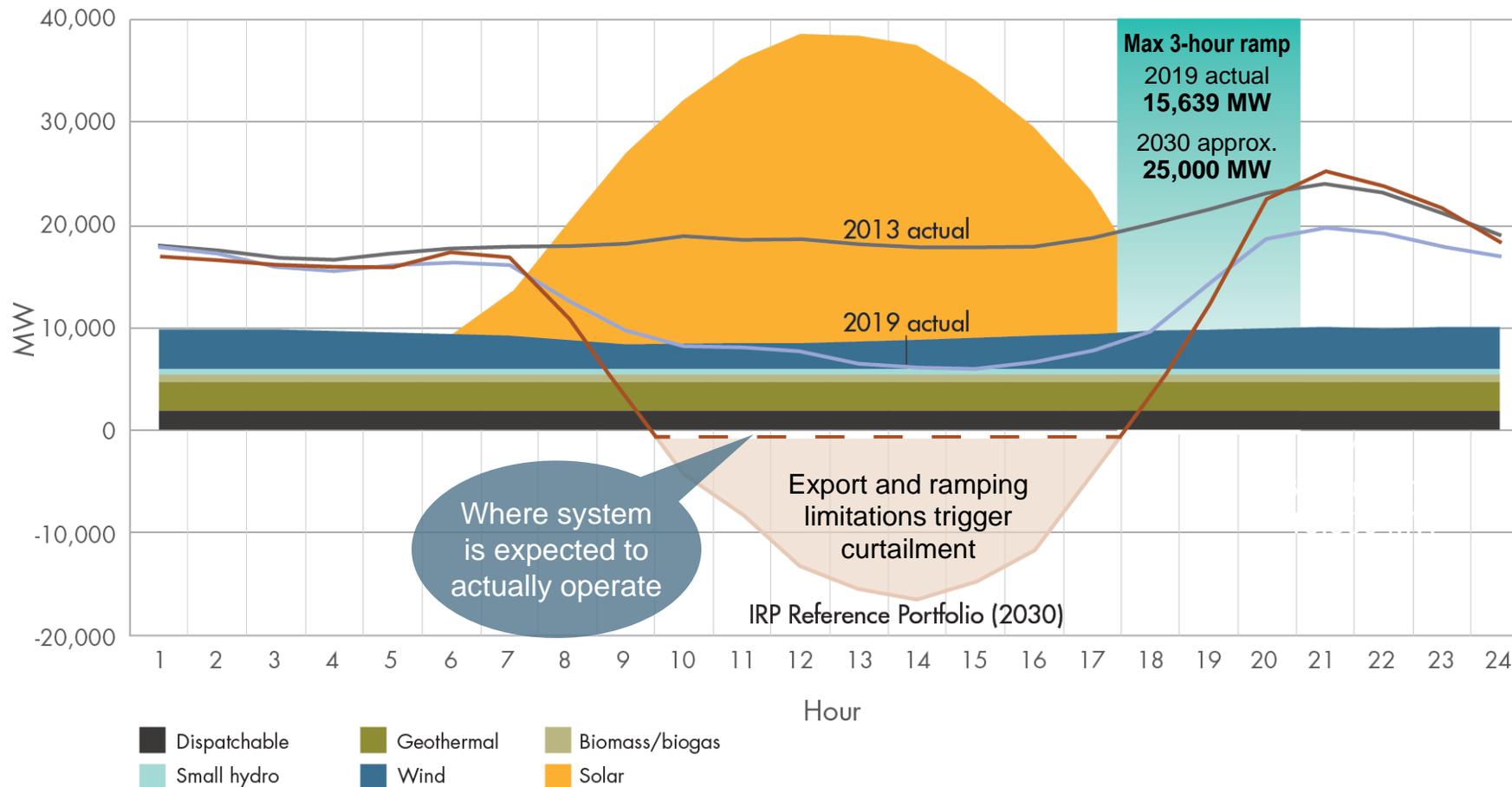
# Conventional Resources are Relied Upon as Solar Declines



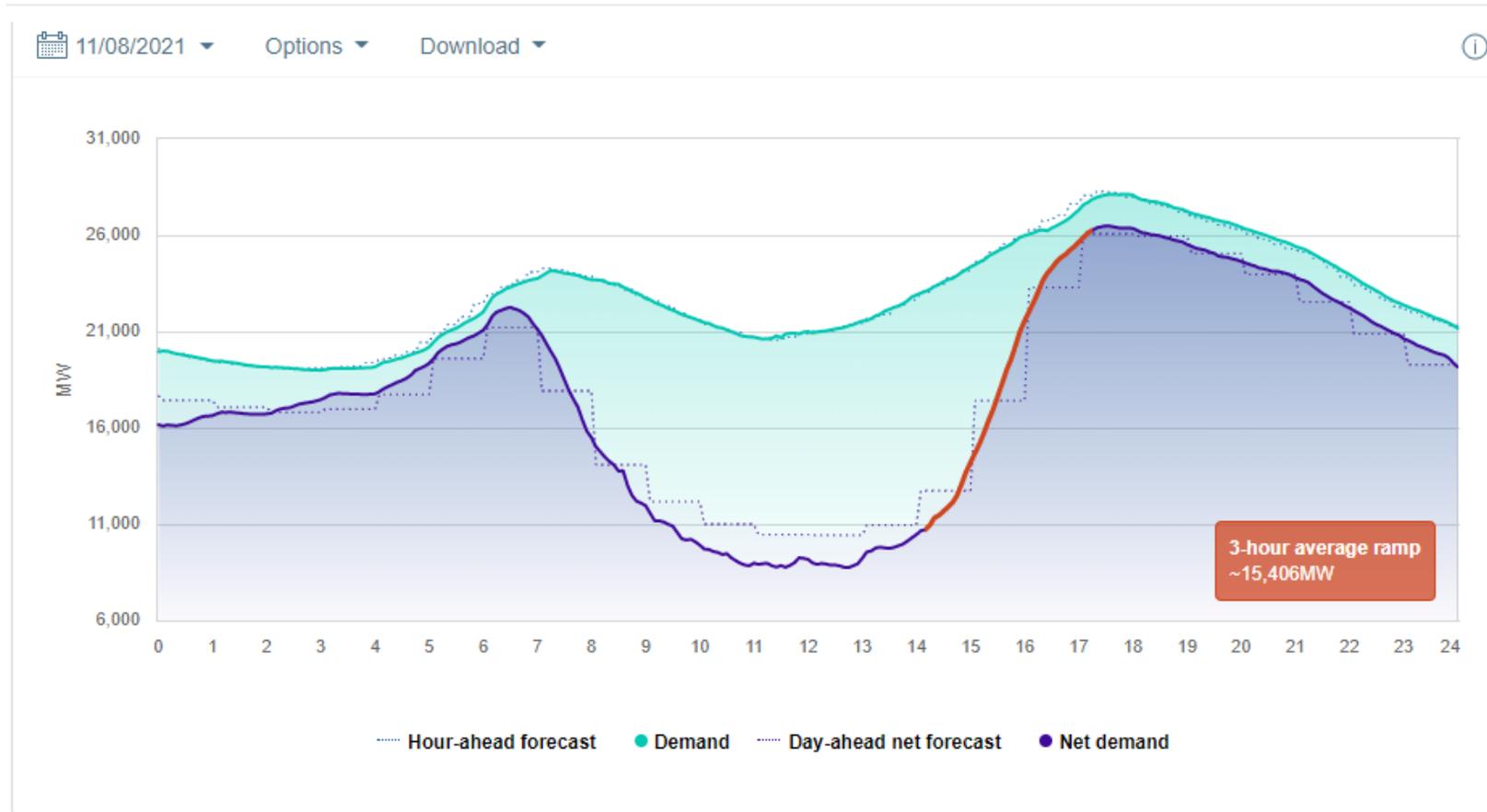
# Low Solar Production Across Multiple Days = Higher Reliance on Natural Gas and Imports



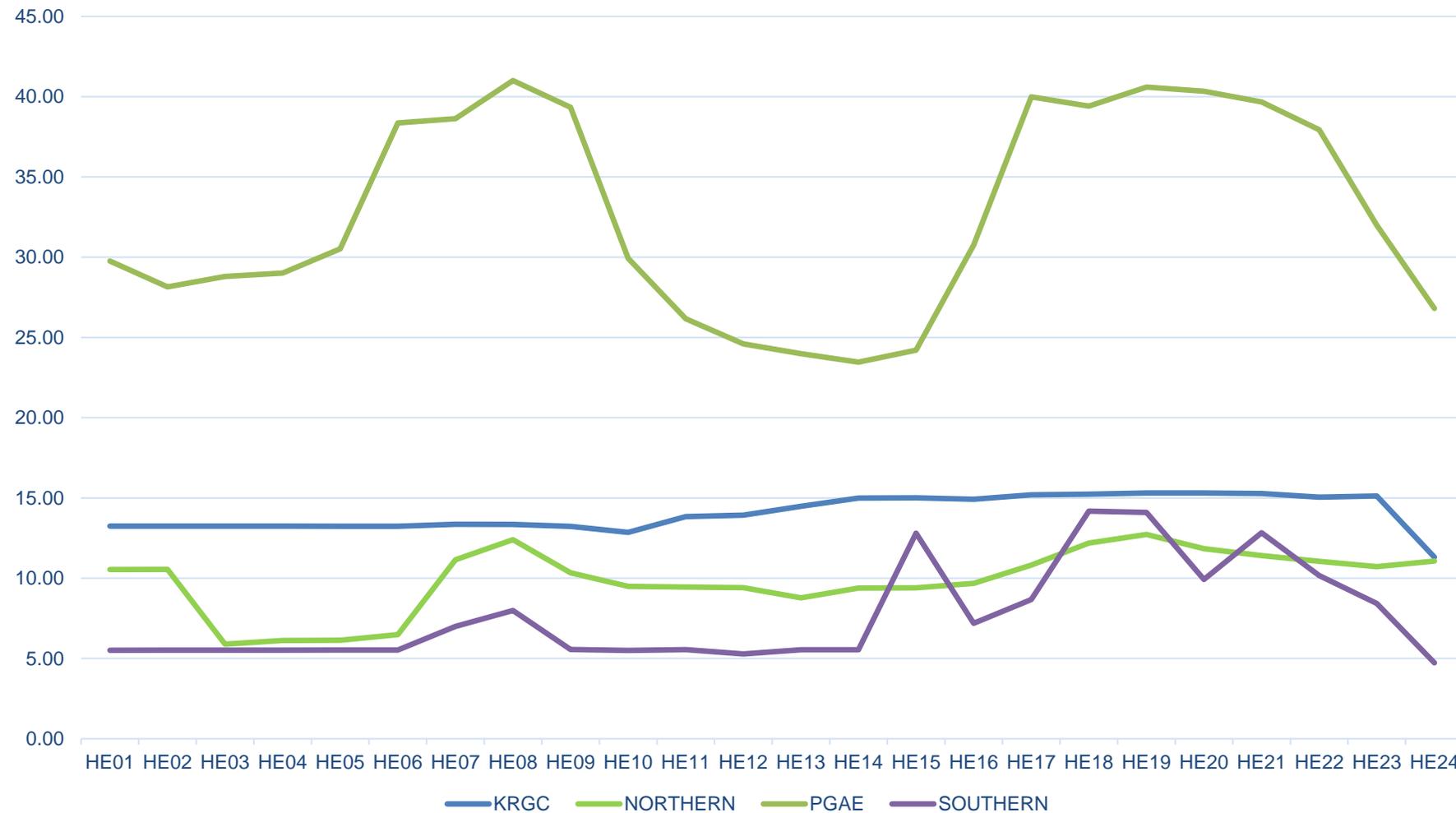
# By 2030, Solar is Expected to Contribute Even Further Towards Ramping Needs



# ISO November Evening Peak Ramp of 15,000MW / 3 Hour Ramp



# Typical Fuel Shape for Gas Generation in a Renewables Environment



# Gas/Electric Coordination

- Outage Planning
  - *Share outage planning with NDA-signed gas providers*
- Communications
  - *Bi-weekly phone calls with gas maintenance planners*
  - *Daily calls between Ops floors during peak demand periods*
- Challenges
  - *Conflicting Peak Operating/Maintenance Seasons*
  - *Traditional rules in a new Renewable World*

# Gas/Electric Coordination in Real-Time

- Current Practice
  - *Providing gas burn reports for Day Ahead and Day+1 and D+2 EG*
  - *Real-time notification if ISO dispatches high demand resources*
- Real-Time Incidents
  - *Coordinate with gas pipeline providers to re-dispatch as needed to mitigate real-time gas supply issues.*
  - *Gas Nomogram and exceptional dispatch capabilities*
- Challenges
  - *Short notice gas system maintenance that curtails a resource*
  - *February 2014*
  - *Current West-wide natural gas availability limitations*

# Gas/Electric Coordination Improvements

- Adapting Current Technology
  - Visibility
  - Gas Electric Operational Zones
  - Further Improving Communications
  - Using Non-Disclosure Agreements for confidential communications
- One LDC Tariff Allows Higher Prioritization of Critical Gas Generation during Emergencies

# CAISO Resource Adequacy (RA) Overview

- Load Serving Entities submit Annual/Monthly Resource Adequacy (RA) Plans to meet monthly peak load plus their planning reserve margin
- Resources submit Annual/Monthly Supply Plans and CAISO validates the capacity matches RA Plans
- Monthly plan capacity has a must offer requirement in CAISO Day Ahead and Real Time markets
- Resource Adequacy Availability Incentive Mechanism (RAAIM) penalizes availability below 94.5% and incentivizes availability above 98.5%

# Reliability Must Run (RMR) Agreement

- CAISO designates a resource for RMR service whenever a technical study indicates a reliability need and/or a resource has provided a notice of an intention to close the facility
- RMR Agreement provides for cost of service compensation based on historical costs as specified in a defined formula
- RMR Resource has obligation to offer capacity into the CAISO markets using cost of service bids and is subject Resource Adequacy rules including RAAIM.

# Q&A

