

Reimagining the Grid

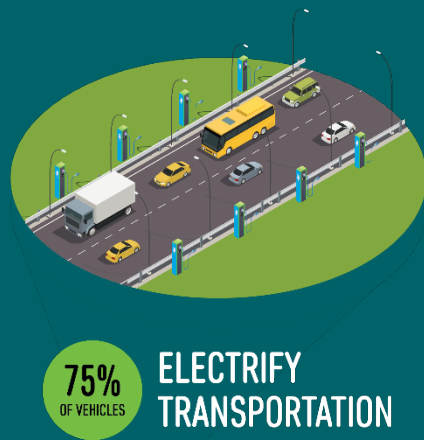
SCE's long-term vision of the future grid

Pathway 2045, SCE's roadmap to a clean energy future in CA

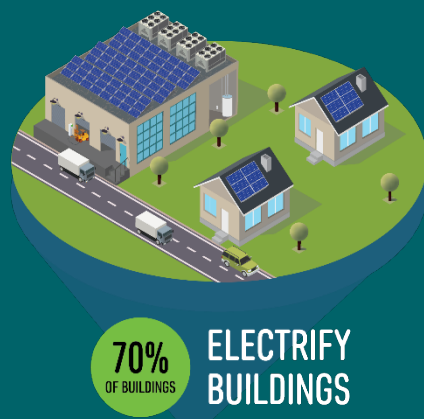
We'll need dramatic change to achieve economy-wide decarbonization by 2045



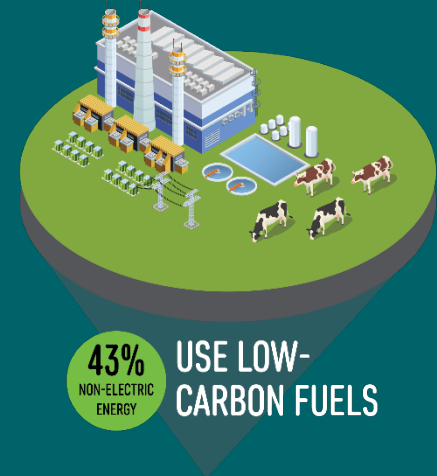
100% of all electricity purchased from California's grid is carbon free



3/4 of light-duty, 2/3 of medium-duty and 1/3 of heavy-duty vehicles will need to be electric



Widespread electrification of space & water heating in homes and businesses needed

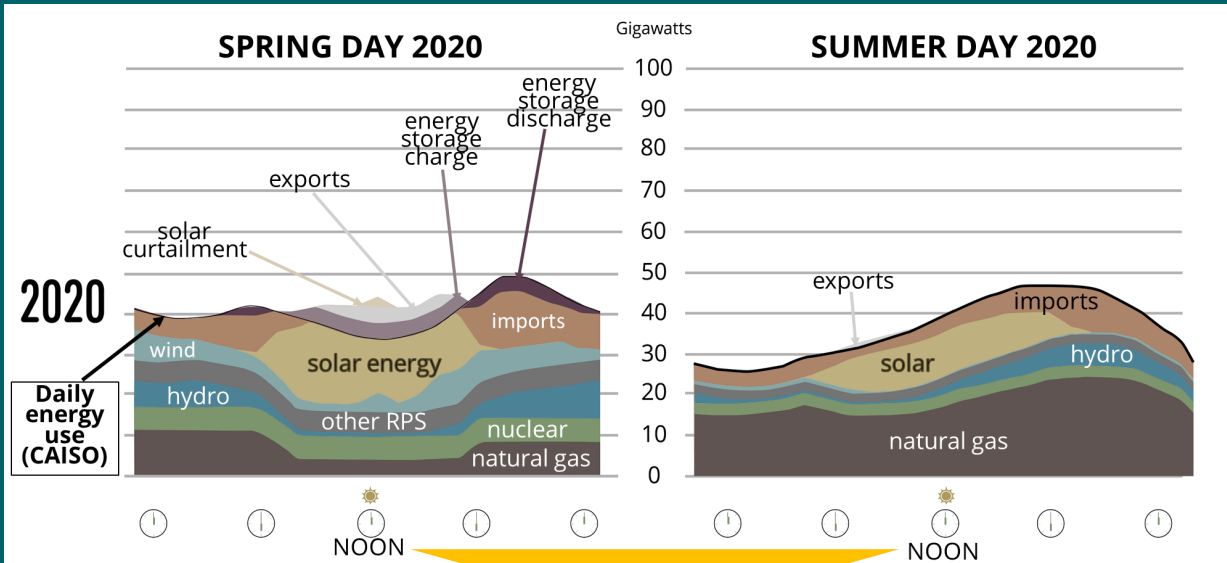


Low-carbon fuels such as hydrogen can help with hard-to-electrify energy uses



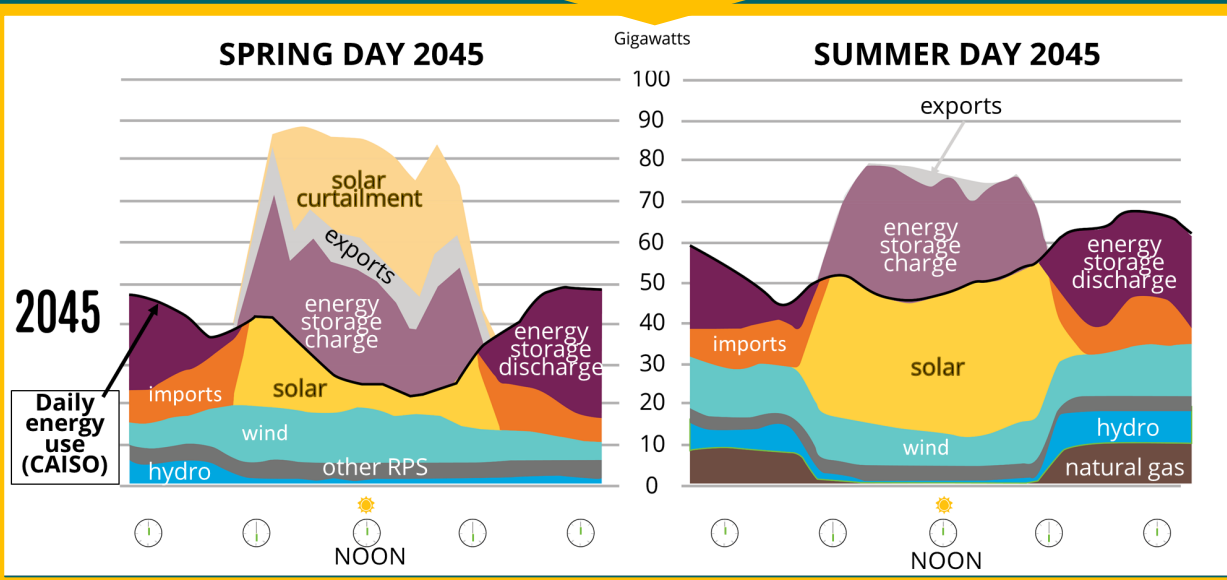
Natural processes and engineered solutions (e.g., CCUS) needed to sequester remaining carbon

To enable this vision, the grid will face significant challenges



2045 will see a **60% increase in electricity demand** and **40% increase in peak load**.

The grid will need to integrate large amounts of utility-scale variable resources at the transmission level, including **80 GW of wind and solar**, and **30 GW of storage CA-wide**.



At the distribution level, the grid will need to interconnect large amounts of customer-sited resources – **an additional 30 GW of solar and 10 GW of storage CA-wide**.

Our “Reimagining the Grid” approach

INPUTS FOR GRID DESIGN

Factors driving future grid needs & challenges

Customer

Energy Supply

Climate Impacts

Starting point for the grid

Current SCE Grid & Technologies

Physical Topology

DEVELOPMENT OF GRID OPTIONS

Different geographic areas with specific needs

Local attributes:

Unique needs & characteristics

Local grid challenges

Location-specific grid objectives

Evolving grid design with new capabilities

Grid layers:

Foundational IT/OT platform

Physical grid assets

Specific grid architectures

ROADMAP

Future Grid Roadmap

Near term

Mid term

Long term

Key drivers of grid needs in the future

(from Pathway 2045 and future climate change impacts)

SUPPLY



- **Very high level of renewables** (intermittent and away from load centers)
- Power system reaching **critically low level of inertia** due to gas retirements

CUSTOMER



- **Large adoption of DERs** dominating distribution level circuits
- **Significant changes in load density** due to urbanization, EV charging, etc.
- **More end uses that are sensitive to power quality** (e.g., power electronics)
- Overall, **increased reliance on electricity**

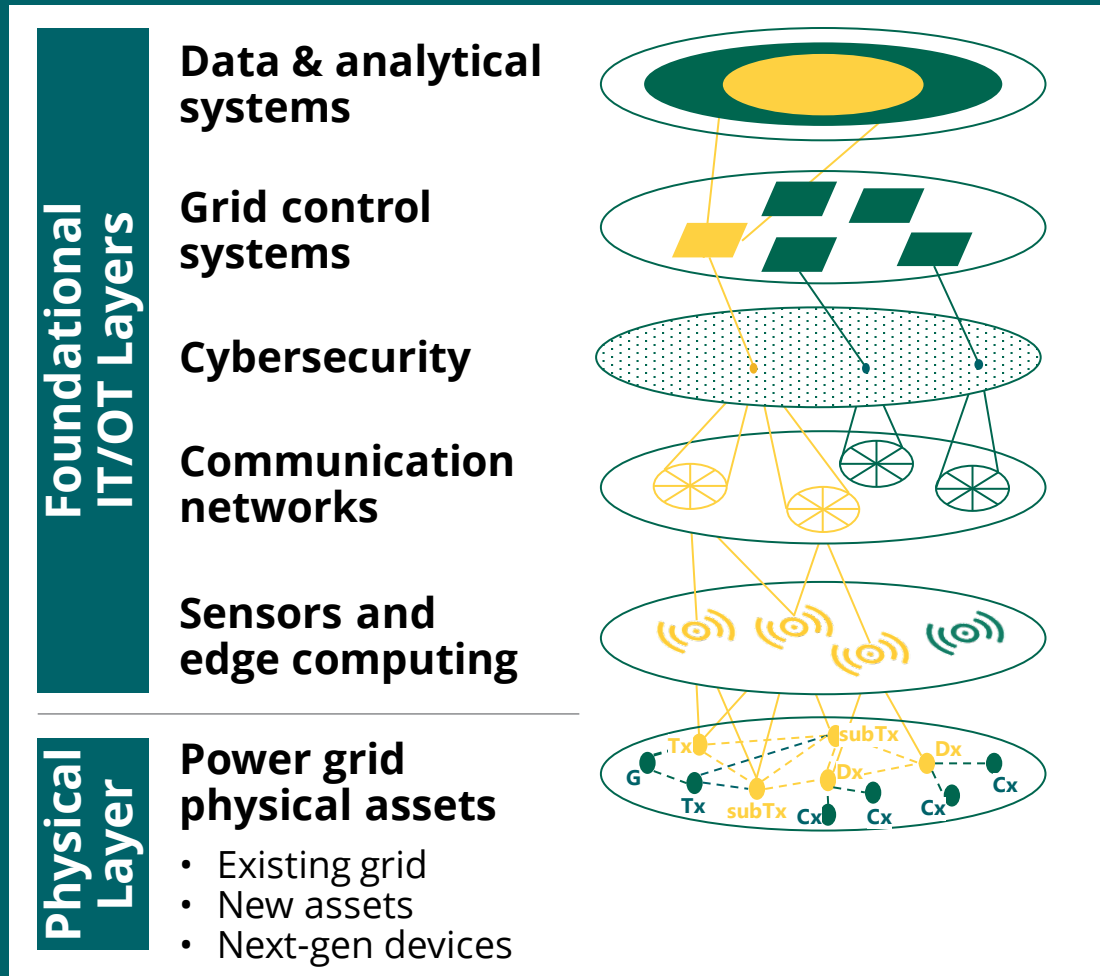
CLIMATE



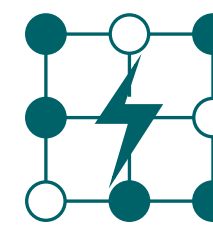
- Growing impacts to **performance of grid assets** under climate stress
- Climate-driven changes in **customer needs and electric service continuity**

What the Reimagined Grid may look like

Grid technology layers for foundational operating platform and physical capabilities



GRID ARCHITECTURES



What the Reimagined Grid may look like

Grid solutions for specific needs across different regions

Grid architectures for different types of communities *(illustrative examples)*



Urban/suburban/coastal areas:
Distributed control grid



Mountain/rural/remote areas:
Self-isolating grid
(mini/microgrids)



Transportation/industrial corridors:
High density/demand urban grid



Other regions w/ mixed attributes:
Hybrid grid (combined architecture)

Envisioned evolution of the grid (from uniform to modular design)

Traditional Grid

to deliver safe, reliable, affordable power

- Separate T (network) vs D (radial) architectures
- Human operated electro-mechanical

Today's Grid

to support more reliability, resilience & DER integration

- Modernized distribution technologies but still separate architecture from transmission
- Rules-based, automated and hardware-centric
- Centralized control of grid services

Reimagined Grid

to enable Pathway 2045 vision and meet location-specific needs

- Heterogenous architectures, integrated across transmission and distribution
- Partially autonomous, flexible and software/network-centric
- Decentralized control of grid services
- Advanced cybersecurity
- Common IT/OT platform deployed across the grid
- Tailored grid designs with next-generation technologies deployed as needed for different regions