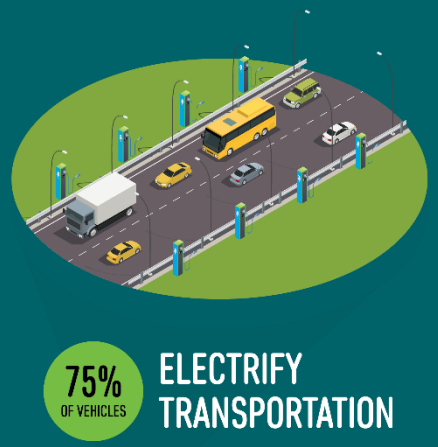
Reimagining the Grid

SCE's long-term vision of the future grid

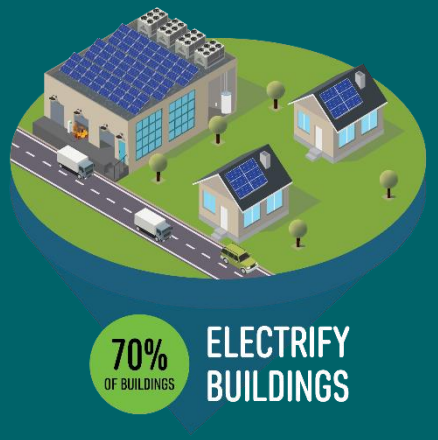
Pathway 2045, SCE's roadmap to a clean energy future in CA

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

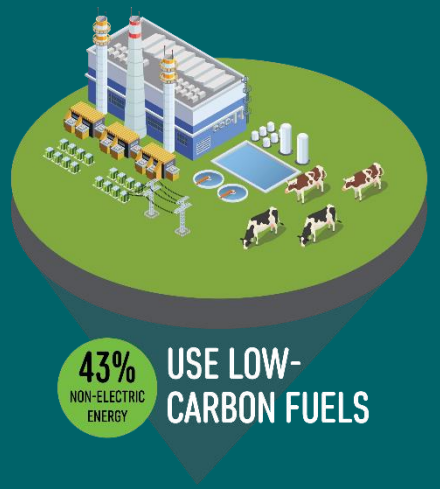
100% of all electricity purchased from California's grid is carbon free



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



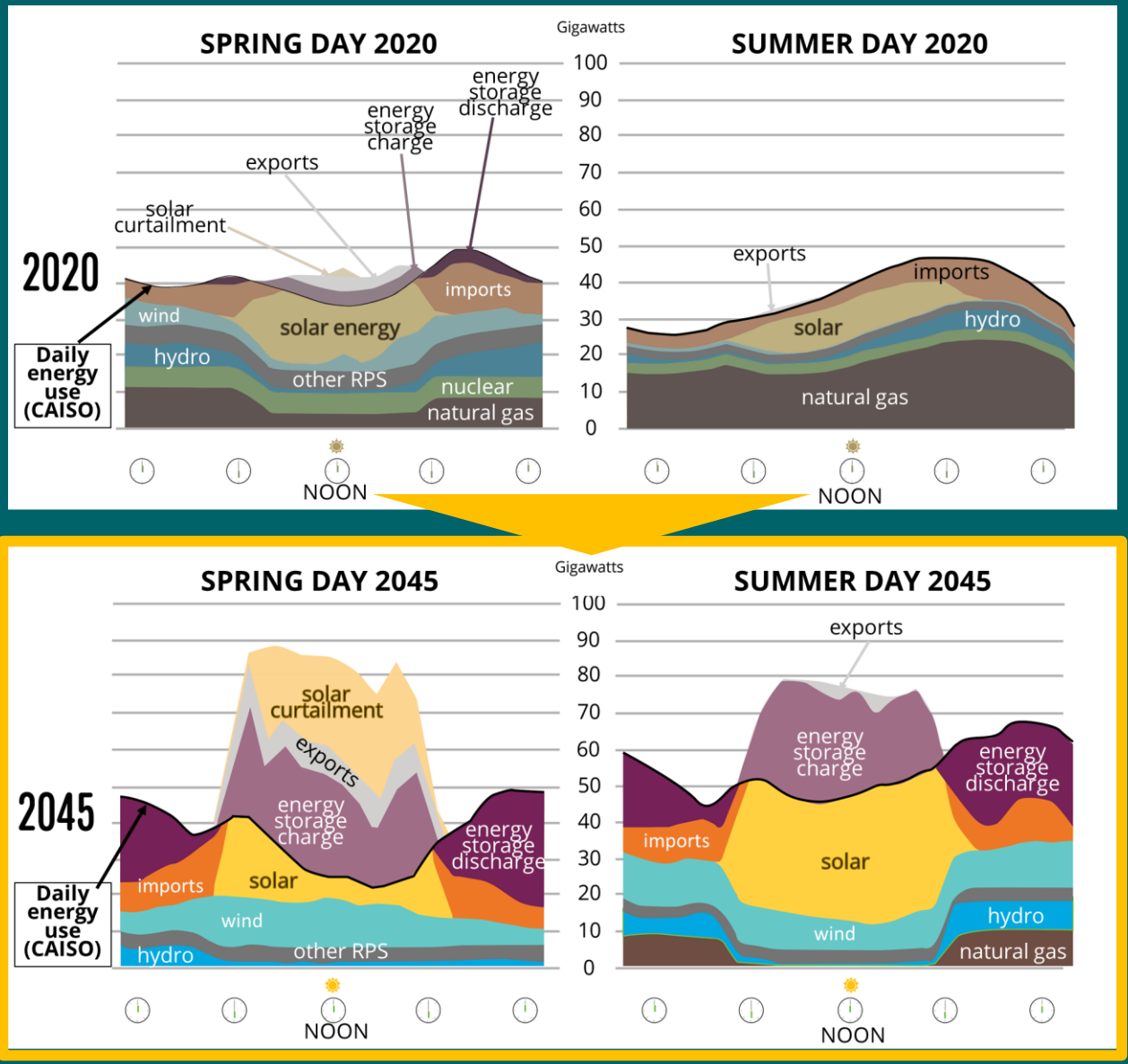
Widespread electrification of space & water heating in homes and businesses needed



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

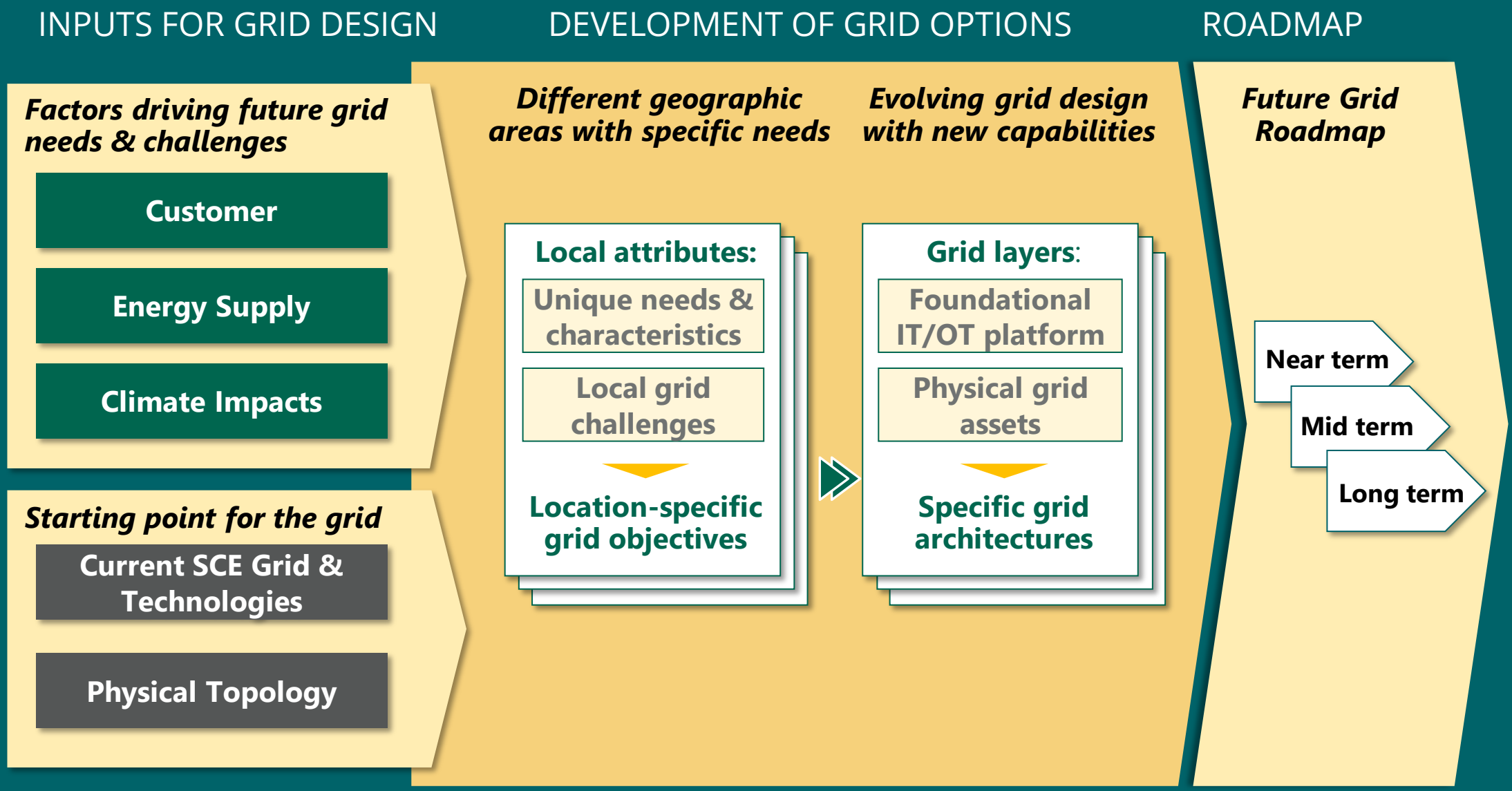


2045 will see a **60% increase in electricity demand** and **40% increase in peak load.**

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



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

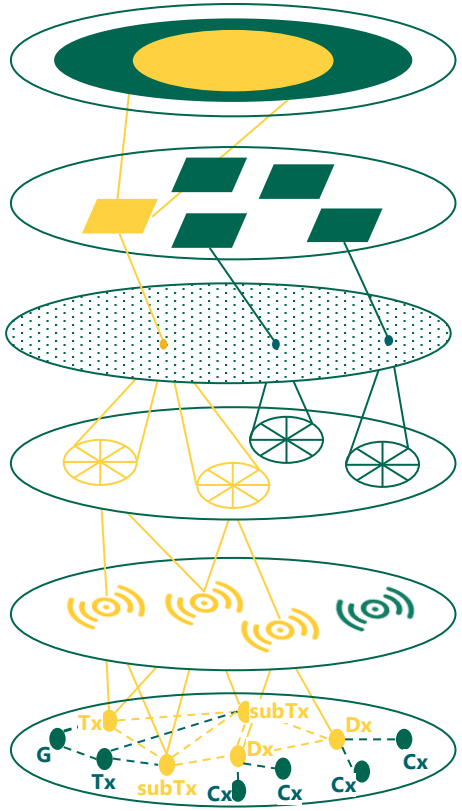
Grid technology layers for foundational operating platform and physical capabilities

Foundational IT/OT Layers

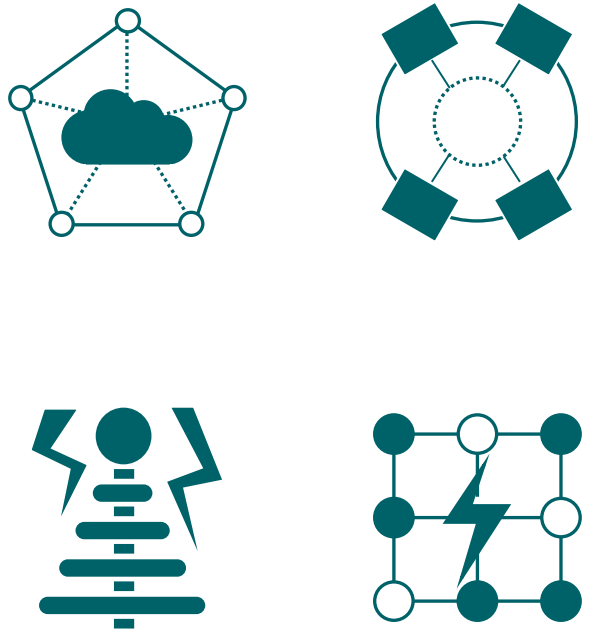
- **Data & analytical systems**
- **Grid control systems**
- **Cybersecurity**
- **Communication networks**
- **Sensors and edge computing**

Physical Layer

- **Power grid physical assets**
  - Existing grid
  - New assets
  - Next-gen devices



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