DOCKETED	
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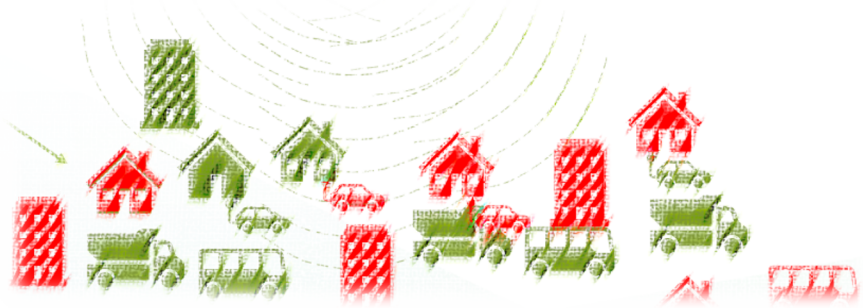
California Energy Commission
Load Management Standards Update



Mass-Market Demand Flexibility
through Responsive Automation

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CEC Commissioners

David Hochschild
Chair

Janea A. Scott
Vice Chair

Karen Douglas
Commissioner

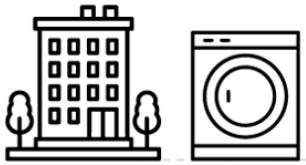
J. Andrew McAllister
Commissioner

Patty Monahan
Commissioner

Leading the state to a 100% clean energy future.

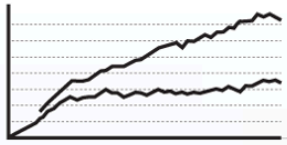
1974 Warren Alquist Act

Created the Energy Commission



load management

Set building and appliance efficiency standards



Forecast electricity demand

Support R&D into non-conventional energy sources

CEC Load Management Authority

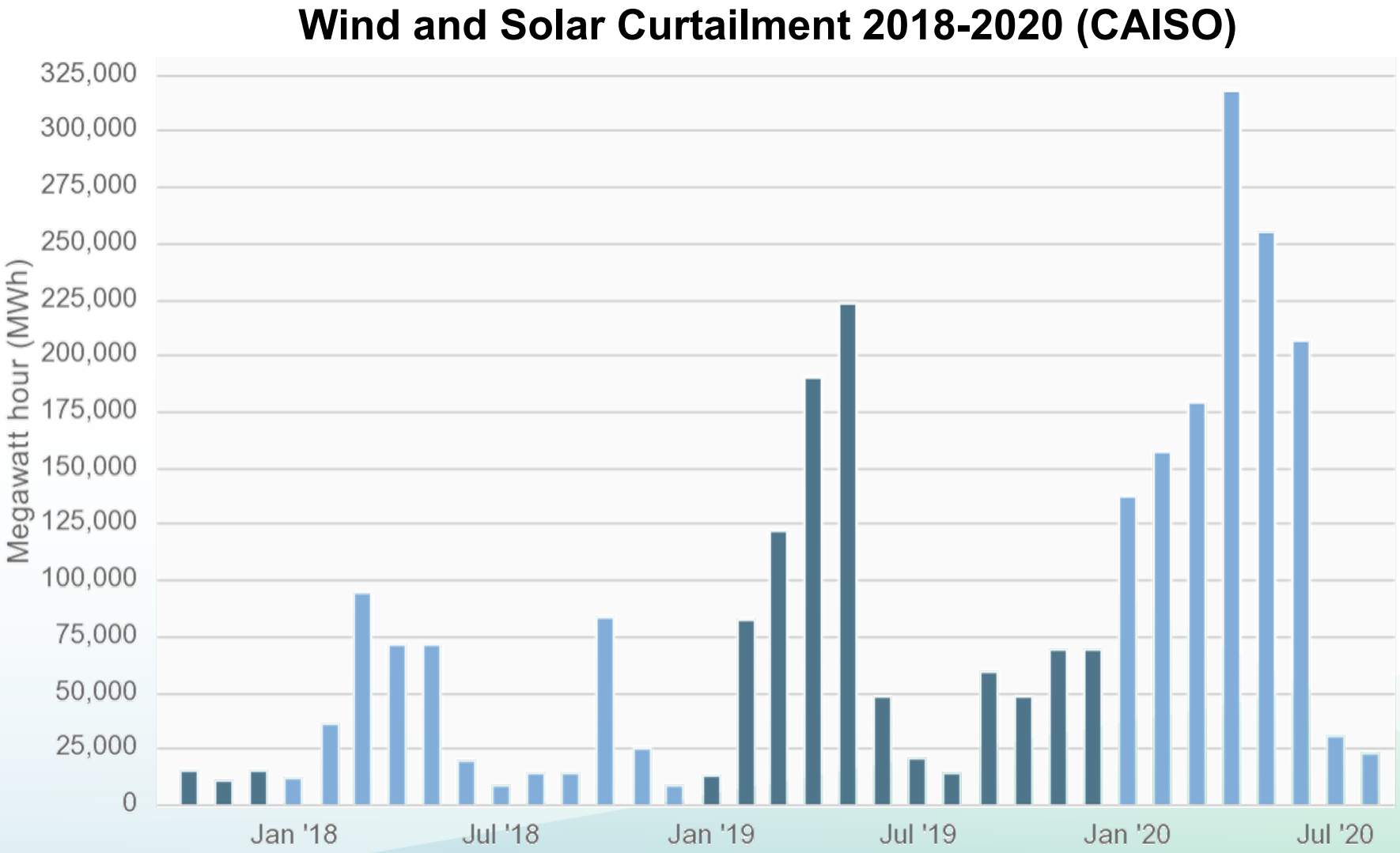
- The commission shall… adopt standards by regulation for a program of electrical load management for each utility service area.
- In adopting the standards, the commission shall consider, but need not be limited to, the following load management techniques:
    1. Adjustments in rate structure to encourage use of electrical energy at off-peak hours or to encourage control of daily electrical load.
    2. End use storage systems which store energy during off-peak periods for use during peak periods.
    3. Mechanical and automatic devices and systems for the control of daily and seasonal peak loads.

    - Warren Alquist Act, 1974

Load Management Definition

The process of maintaining the electric supply-demand balance by adjusting the load rather than the power station output.

Note: Wind and Solar are not Flexible

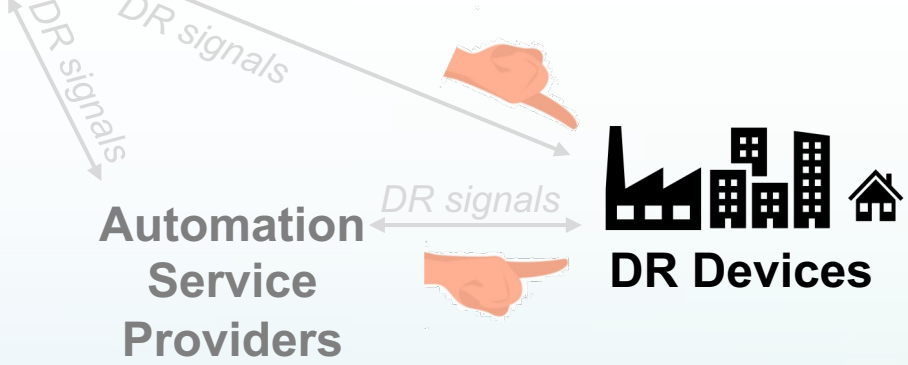


Load Management Benefits

- Reduce greenhouse gas emissions while maintaining services
  - Avoid use of high-polluting peaking plants
  - Shift loads towards times of carbon-free energy production
- Improve grid reliability
  - Prevent transmission & distribution congestion
- Reduce system costs
  - Minimize electricity use when generation costs are high
  - Avoid construction of battery and power capacity
  - Reduce renewable curtailments
- Increase customer choice
  - Option to reduce customer bills by shifting load out of high cost hours
  - Option for customers to contribute to GHG reductions

CA Load Management Today

50+ CA Load Serving Entities



Connected Devices *(Internet)*

- Smart plugs
- Thermostats
- Energy management systems
- Electric vehicle supply equipment
- Batteries

California Context

- Goals
  - **60% renewable generation** by 2030
  - **100% of new vehicles emissions free** by 2035
  - **100% carbon-free grid** by 2045
- Opportunities
  - TOU default for all customer classes at 4 of 5 top electric utilities in CA
  - 5-minute GHG signal from CPUC's Self Gen Incentive Program (SGIP)
  - Connected devices increasingly available
- Challenges
  - No statewide access to machine-readable rates
  - Lack of responsive automation (because of above)
  - Broadband Internet access in ~70% of CA homes[1]

[1] Source: broadbandnow.com

History

1982 Load Management Standards

- "Marginal cost rates" → TOU rates for large customers
- Residential programs: Air conditioners, Water heaters, Pool pumps
- Commercial building audits

(…two decades pass…)

2001 California Energy Crisis

- CEC – CPUC – CAISO joint strategy
  1. Install interval metering for all customers
  2. Support widespread TOU and CPP + mass-market automation
  3. Support RTP + mass-market automation

Done and To Do

Done

☑ **Interval Meters:** statewide installation completed ~2013

☑ **TOU rates:** statewide default October 2020

☑ **CPP rates**: PG&E residential SmartRate and commercial options

To Do

☒ **TOU and CPP automation**

☒ **RTP rates + automation**

Basic Tenets

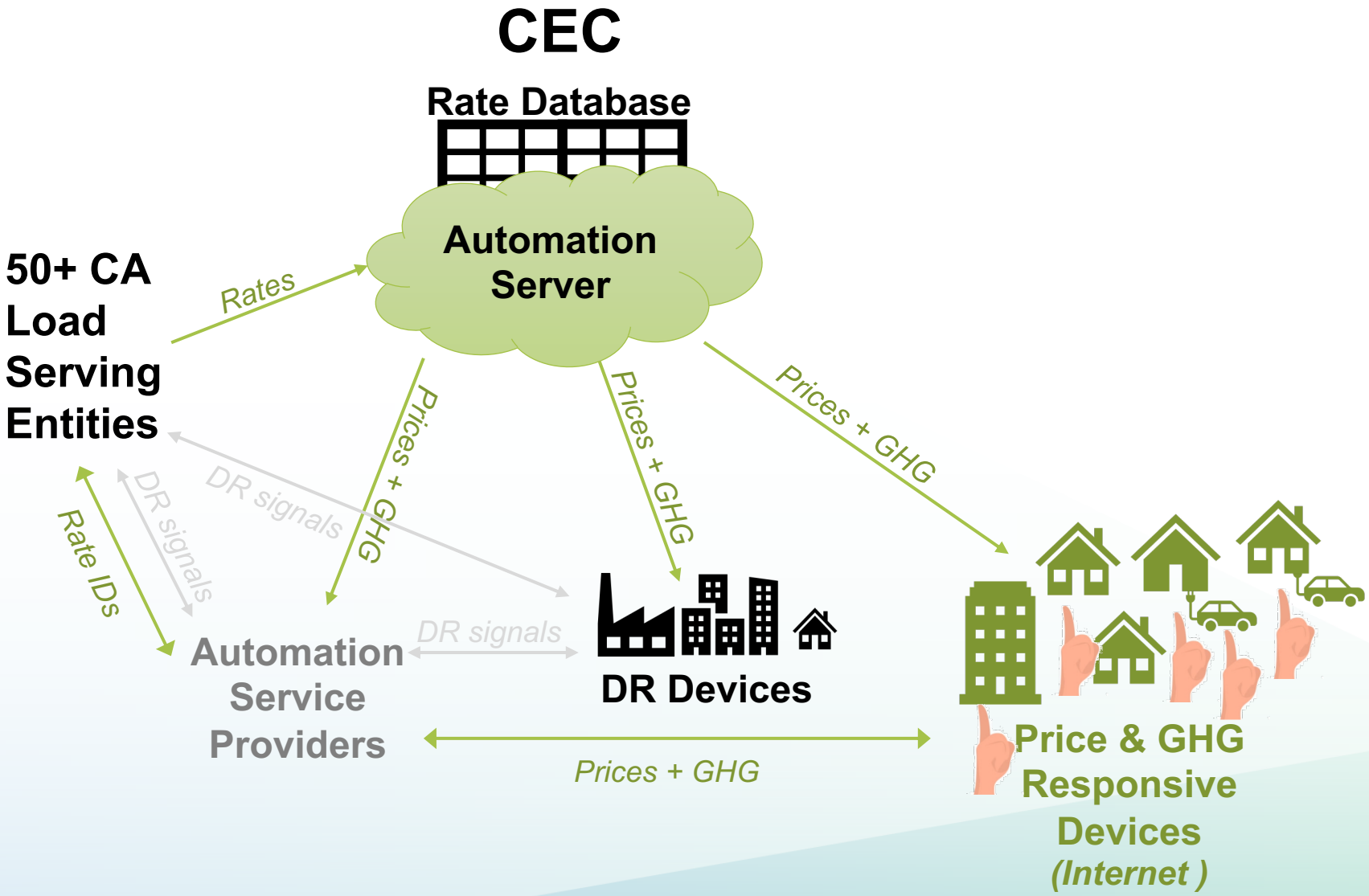
All customers should be able to

- Readily find the current price of electricity for their building
- Connect their devices to their time-varying electricity rate
- Quickly give their energy service provider access to their rate
- Choose to receive prices or GHG signals that change hourly or sub-hourly
- Purchase automation that can respond to price or GHG emission signals
- Feel confident that cybersecurity risks are low or nonexistent

5-year Load Flexibility Roadmap

1. CEC publishes a central statewide **Rate Database**
   - Time and location dependent electricity prices (TOU, CPP, etc.)
   - Automation Server application for prices to devices
2. Utilities establish
   - **Programs** to help customers respond to prices and GHG signals
   - Systems enabling third-party **energy services**
   - Locational marginal hourly and sub-hourly **rates**
3. EPIC Load Flexibility Research Hub researches and develops
   - New responsive automation to expand mass-market flexibility
   - Options for public broadcast of rates and GHG emission levels

CEC's Load Management Vision



Proposed

- Smart plugs
- Thermostats
- Energy management systems
- Electric vehicle supply equipment
- Batteries
- Water heater controls
- Electric vehicles
- Refrigeration
- Pool pump and hot tub controls

1. CEC Automation Server

- **WHAT:** Machine-readable database of time-dependent electricity rates
- **WHY:** Enable automated peak reduction, increased renewable use
- **WHO**: Developed by the CEC; maintained by the LSEs
- **WHERE**: Available to all Californians on the CEC website
- **HOW**: Vendors enable conversations between devices and price server; Customers and their service providers configure devices to respond
- **WHEN:** 2021

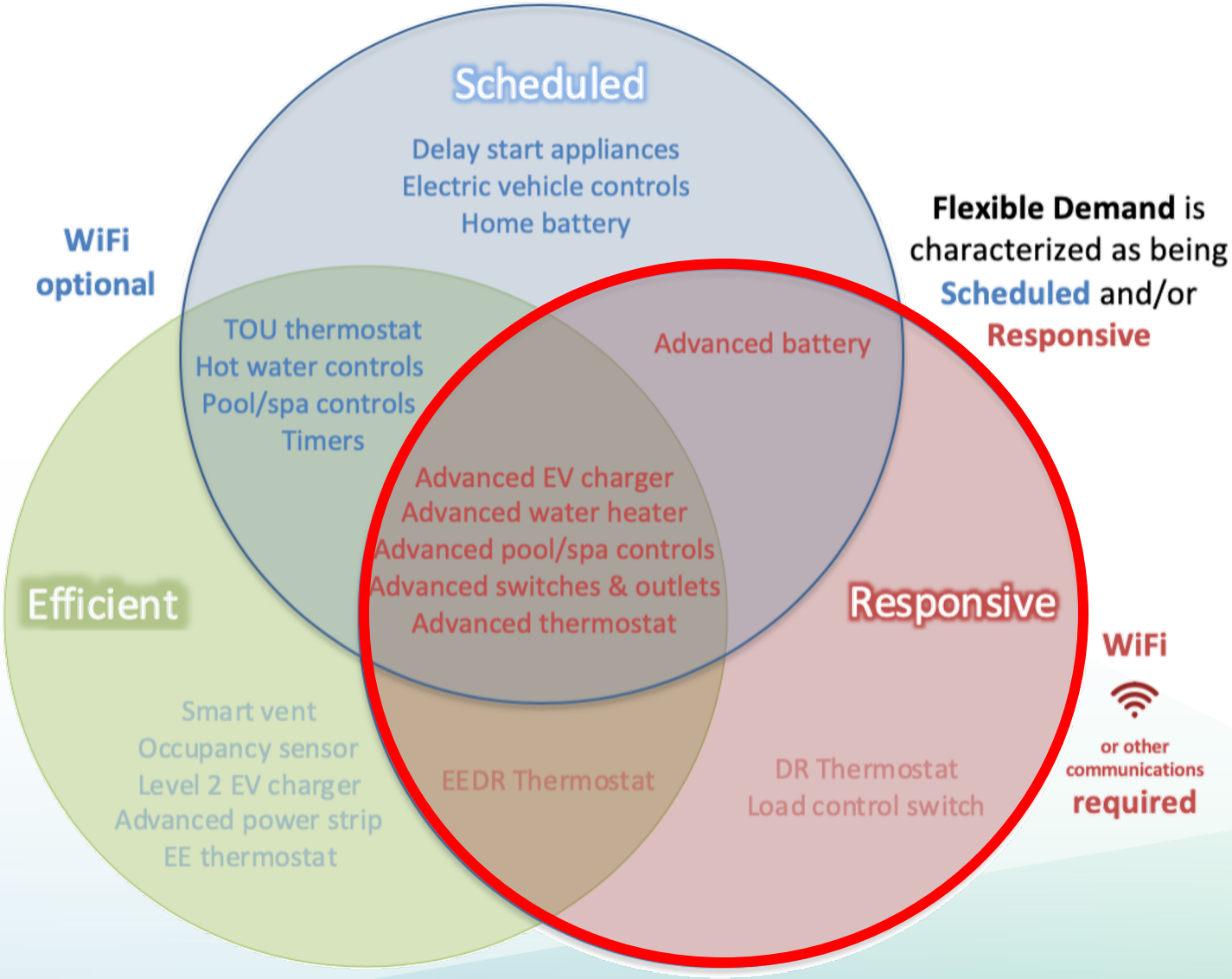
2. Utility Rates & Programs

- **WHAT**: Rates and programs that encourage load flexibility
- **WHY**: Enable granular demand flexibility in space and time
- **WHO**: PG&E, SCE, SDG&E, LADWP, SMUD, CCAs
- **WHERE**: Available to all customers through their LSE
- **HOW**: Education + Rebates and incentives for responsive devices
- **WHEN**: ~2024

Flexible Loads – C&I

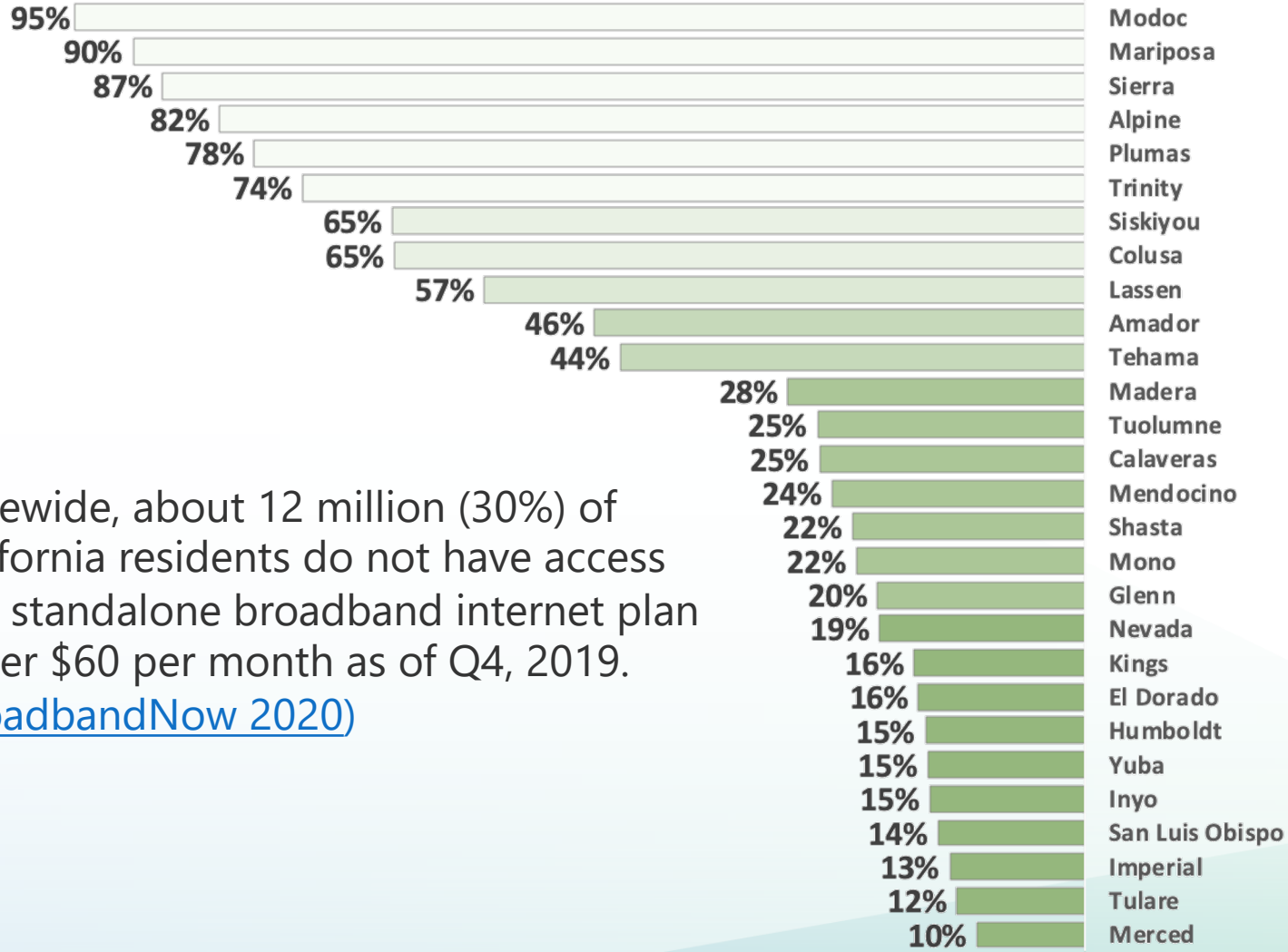
- State Water Project and Ag water pumps – pump controls
- Data centers – HVAC controls, non-urgent compute tasks
- Electric vehicles – Fleet EV supply equipment
- Water heating – heating controls
- Pools and hot tubs – pump and heating controls (e.g. hotel chains)
- Battery storage – charging controls
- Refrigerators & freezers – compressors and anti-sweat heaters
- Heating and Air conditioning

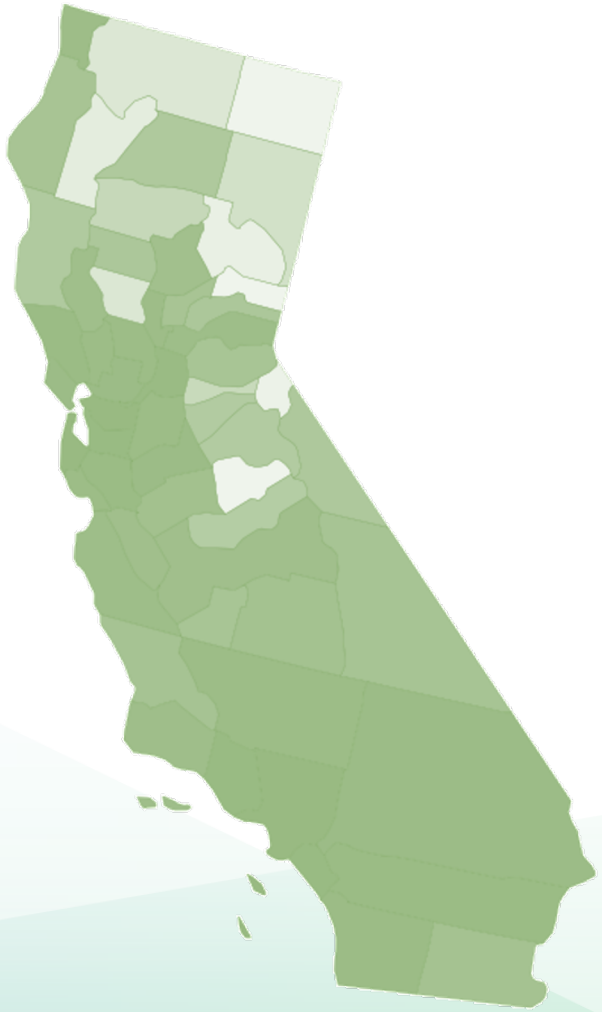
Flexible Loads – Residential



BUT – only about 75% of California homes have Internet

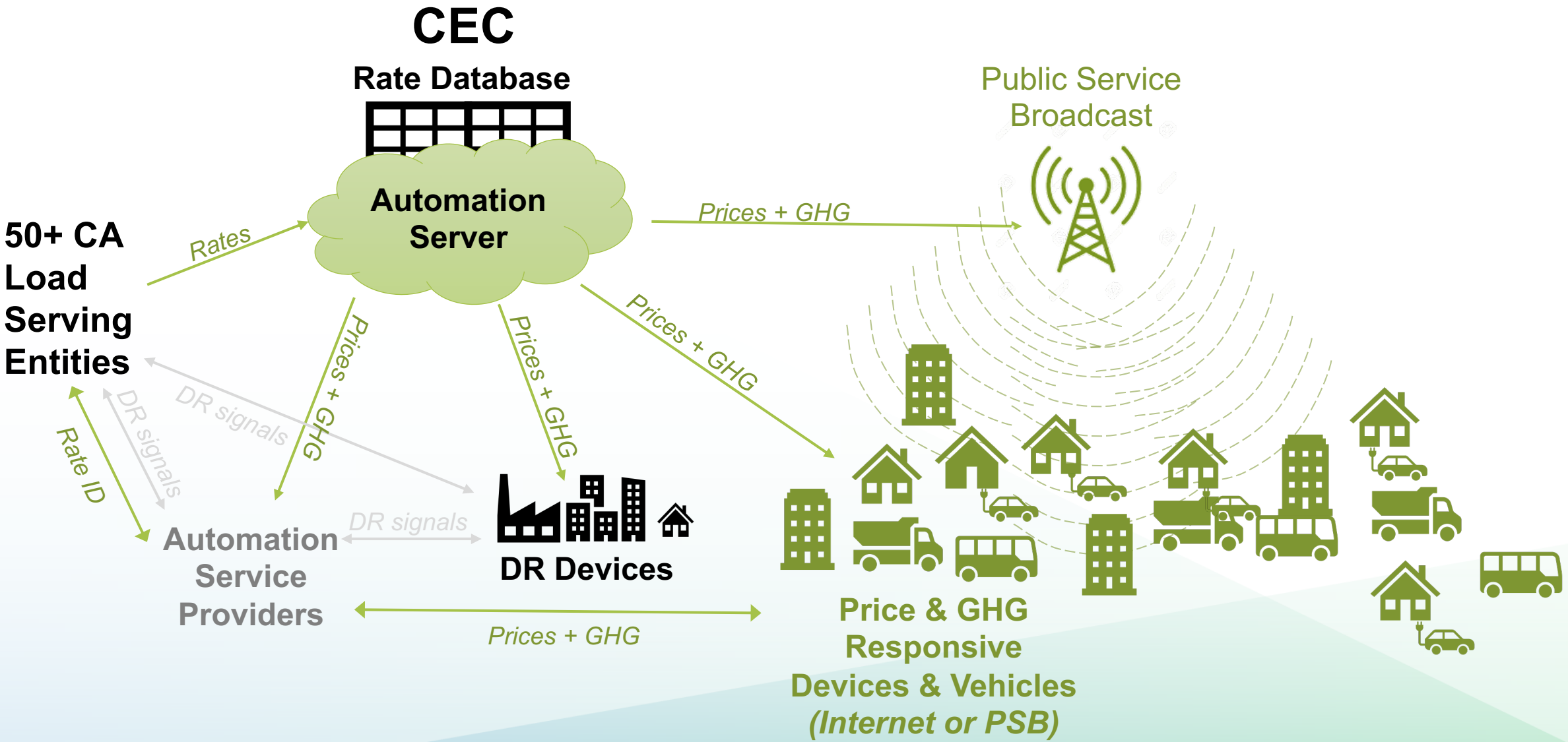
Broadband in California





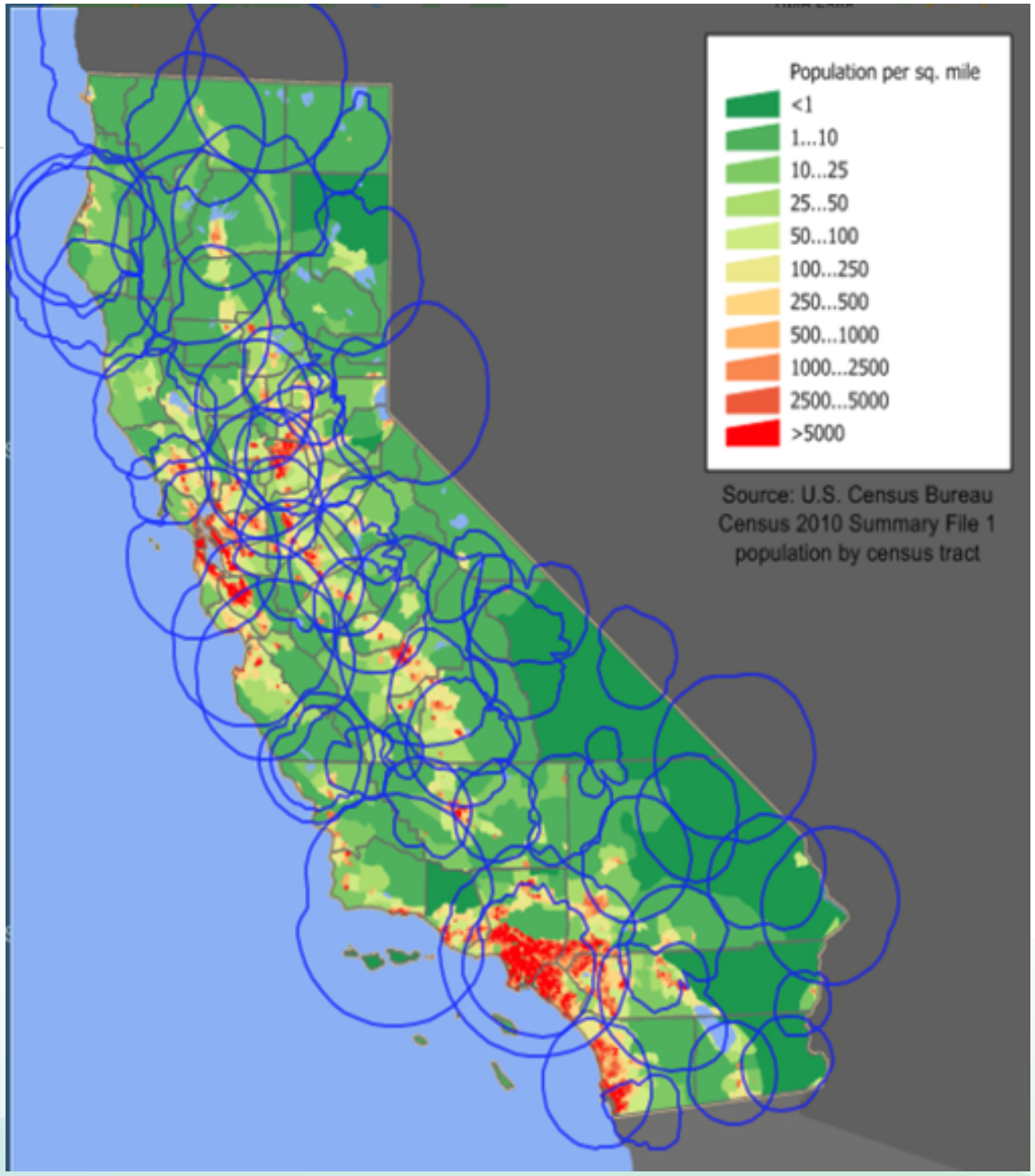
Statewide, about 12 million (30%) of California residents do not have access to a standalone broadband internet plan under $60 per month as of Q4, 2019. (BroadbandNow 2020)

3. EPIC Flexible Load Research Hub



FM Option

- 60 (shown right) of the 750 FM stations in CA cover 99% of the population
- FM access is free
- Low-cost radio receivers (<$1) can be embedded in appliances or CTA-2045 modules
- One-way price broadcast limits cybersecurity risks



Customer Benefits

- Universally accessible and free
- 100% voluntary for all customers, who can…
  - Choose a time-dependent rate or program (or not)
  - Choose their own automation technology (or not)
  - Choose their own valuation of electricity services
- Reduce inequities
  - Any customer can participate and save money
  - Reward the most efficient customers, not those with the largest curtailable loads
  - Reduce overpayment by customers with flatter load shapes
- Reduce bills by avoiding peak rates
- Increased satisfaction of contributing to GHG reductions
- Lower system costs → Lower rates

Utility Benefits

- Encourage off-peak consumption to reduce…
  - Renewable curtailment
  - Peak demand
- Reduce peak demand to reduce…
  - Fires
  - Blackouts
  - Consumption of fossil fuels
  - Need to install new storage and generation capacity
  - Need for (and associated costs of) DR programs

Societal Benefits

- Reduce greenhouse gas emissions
- Reduce renewable curtailment
- Encourage innovation in technology markets
- Support public radio stations
- Standardization of automation around 5-minute price response

Load Flexibility Timeline

Year	Milestone
2021	Time-dependent rates available to Internet devices
2022	Load Management Standards go into effect
2023	Flexible demand appliance standards
2024	EPIC Flexible Load Research Hub results
2025	Load flexibility programs at top 5 utilities + CCAs

For more information

- CEC staff contact
  - Karen.Herter@energy.ca.gov
- CEC Standards
  - 2020 Load Management Rulemaking Docket 19-OIR-01
  - 2020 Load Management Rulemaking website
  - Load Management Standards: CCR Title 20 §1621-1625
  - Flexible Demand Appliance Standards: PRC 25402
  - Warren-Alquist Act: PRC 25403.5
- Technology Demonstrations and Pilots
  - SMUD 2010 Small Business OpenADR to FM broadcast pricing pilot
  - PGE 2016, FM broadcast to CTA-2045 water heater case study
  - BPA 2018 FM broadcast to CTA-2045 water heater study
- Other
  - CEC 2003, Feasibility of Implementing Dynamic Pricing in California
  - GFO-19-309 - California Flexible Load Research and Deployment Hub Solicitation

Initializations

- CA – California (state)
- CAISO – California Independent System Operator
- C&I – Commercial and Industrial
- CCA – Consumer choice aggregator
- CEC – California Energy Commission
- CPP – Critical-peak pricing (rate)
- CPUC – California Public Utilities Commission
- DR – Demand response
- EPIC – Electric Program Investment Charge
- GHG – Greenhouse gas
- LSE – Load serving entity
- R&D – Research and Development
- RTP – Real-time pricing (rate)
- TOU – Time-of-use (rate)