California Energy Commission Load Management Standards

CPUC Workshop on Advanced DER and Demand Flexibility Management

May 25, 2021

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Energy Commission Specialist III

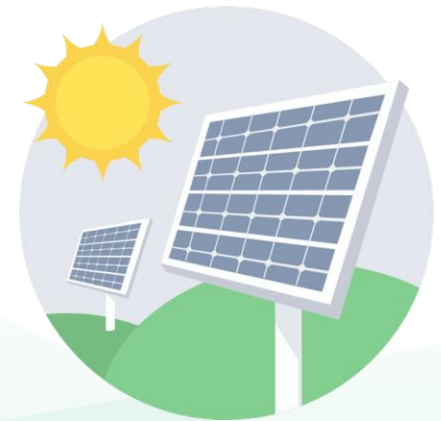Efficiency Division, California Energy Commission

California State Goals

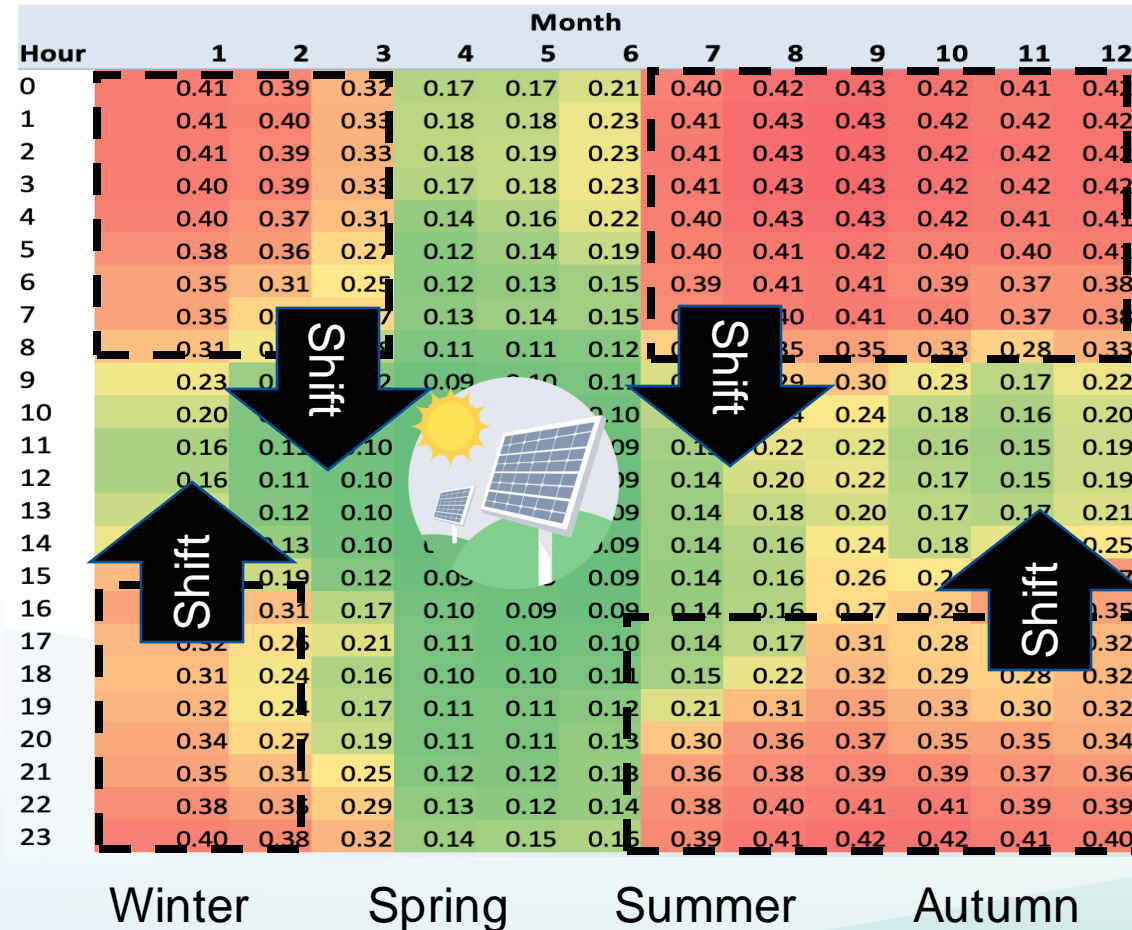100% emissions-free vehicles by 2035

100% carbon-free grid by 2045

Renewables alone aren't enough
Load management helps decarbonize the grid

2021 Hourly Marginal Emissions Intensity (MT CO_2/MWh)

Hour	Month
	1	2	3	4	5	6	7	8	9	10	11	12
0	0.41	0.39	0.32	0.17	0.17	0.21	0.40	0.42	0.43	0.42	0.41	0.41
1	0.41	0.40	0.33	0.18	0.18	0.23	0.41	0.43	0.43	0.42	0.42	0.42
2	0.41	0.39	0.33	0.18	0.19	0.23	0.41	0.43	0.43	0.42	0.42	0.41
3	0.40	0.39	0.33	0.17	0.18	0.23	0.41	0.43	0.43	0.42	0.42	0.42
4	0.40	0.37	0.31	0.14	0.16	0.22	0.40	0.43	0.43	0.42	0.41	0.41
5	0.38	0.36	0.27	0.12	0.14	0.19	0.40	0.41	0.42	0.40	0.40	0.41
6	0.35	0.31	0.25	0.12	0.13	0.15	0.39	0.41	0.41	0.39	0.37	0.38
7	0.35			0.13	0.14	0.15		0.40	0.41	0.40	0.37	0.38
8	0.31			0.11	0.11	0.12		0.35	0.35	0.33	0.28	0.33
9	0.23		2	0.09		0.11	29	0.30	0.23	0.17	0.22
10	0.20					10		0.24	0.18	0.16	0.20
11	0.16	0.1	10		09	0.1	0.22	0.22	0.16	0.15	0.19
12	0.16	0.11	0.10		09	0.14	0.20	0.22	0.17	0.15	0.19
13		0.12	0.10		09	0.14	0.18	0.20	0.17	0.17	0.21
14	13	0.10			0.09	0.14	0.16	0.24	0.18		0.25
15		0.19	0.12	0.0		0.09	0.14	0.16	0.26	0.2		
16		0.31	0.17	0.10	0.09	0.09	0.14	0.16	0.27	0.29		35
17	32	0.26	0.21	0.11	0.10	0.10	0.14	0.17	0.31	0.28		32
18	0.31	0.24	0.16	0.10	0.10	0.11	0.15	0.22	0.32	0.29	0.28	0.32
19	0.32	0.2	0.17	0.11	0.11	0.12	0.21	0.31	0.35	0.33	0.30	0.32
20	0.34	0.27	0.19	0.11	0.11	0.13	0.30	0.36	0.37	0.35	0.35	0.34
21	0.35	0.31	0.25	0.12	0.12	0.1	0.36	0.38	0.39	0.39	0.37	0.36
22	0.38	0.3	0.29	0.13	0.12	0.14	0.38	0.40	0.41	0.41	0.39	0.39
23	0.40	0.38	0.32	0.14	0.15	0.1	0.39	0.41	0.42	0.42	0.41	0.40

Winter   Spring   Summer   Autumn

Shift   Shift   Shift   Shift

Shift electricity use from dirty hours…

…to clean hours
(charge, heat, cool, pump: 9am to 3pm)

HOW?
Publish price & emissions signals for automation devices to reschedule default run-times

Source: Angela Tanghetti, CEC

Challenges to Load Management

1. No public access to machine-readable TOU prices
2. Markets for grid-responsive automation are limited
3. Existing TOU rates not sufficiently granular in time/space
4. Customers unaware of load shifting automation options

Proposed Amendments to the CEC's Load Management Standards

1 **Rate Database**
- Maintain the accuracy of existing and future time-varying rates in the publicly available and machine-readable MIDAS rate database.

2 **Third-Party Services**
- Develop a standard rate information access tool to support third-party services

3 **Hourly Rates**
- Develop and submit locational rates that change at least hourly to reflect marginal wholesale costs.

4 **Customer Education**
- Integrate information about new time-varying rates and automation technologies into existing customer education and outreach programs.

Load Management Today
Payment for Load Control / Demand Response (DR)
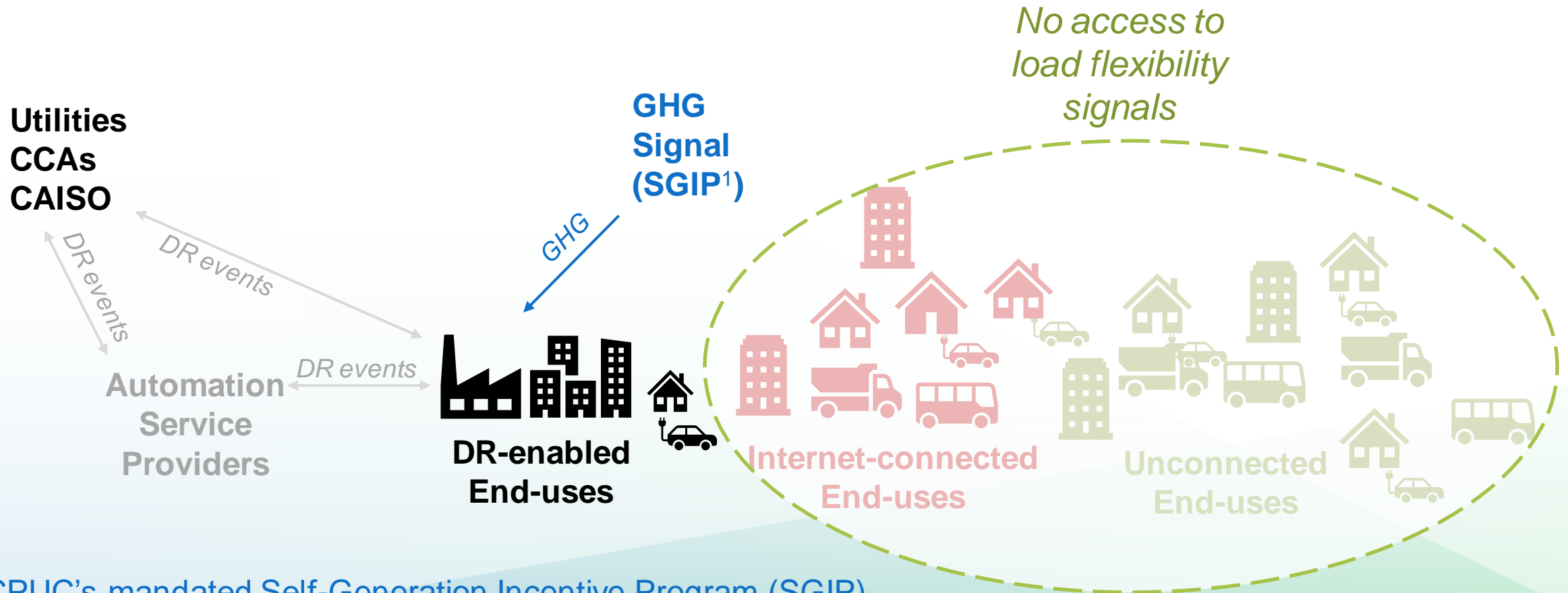
Utilities
CCAs
CAISO

DR events

DR events

DR events

Automation
Service
Providers

GHG
Signal
(SGIP[1])

GHG

DR-enabled
End-uses

No access to
load flexibility
signals

Internet-connected
End-uses

Unconnected
End-uses

[1] The CPUC's mandated Self-Generation Incentive Program (SGIP)

Load Management Standards
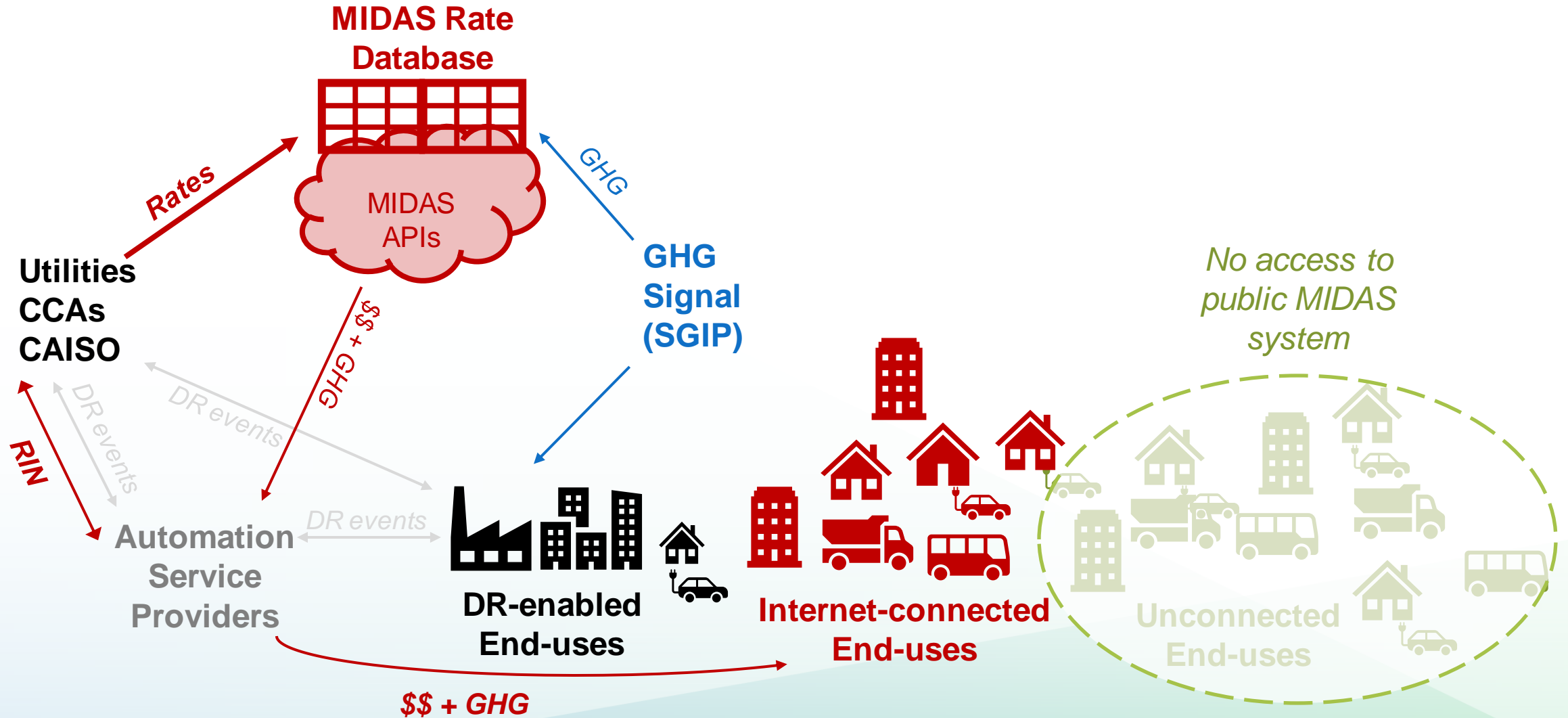## Time-varying rates and greenhouse gas (GHG) signals

MIDAS Rate Database

Rates

Utilities CCAs CAISO

GHG

GHG Signal (SGIP[1])

GHG

No access to load flexibility signals

DR events

DR events

DR events

Automation Service Providers

DR-enabled End-uses

Internet-connected End-uses

Unconnected End-uses

[1] The CPUC's mandated Self-Generation Incentive Program (SGIP)

Load Management Standards
Time-varying rates and greenhouse gas (GHG) signals

MIDAS Rate Database

MIDAS APIs

Rates

Utilities CCAs CAISO

GHG

GHG Signal (SGIP[1])

GHG

$$ + GHG

DR events

DR events

DR events

Automation Service Providers

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No access to load flexibility signals

Internet-connected End-uses

Unconnected End-uses
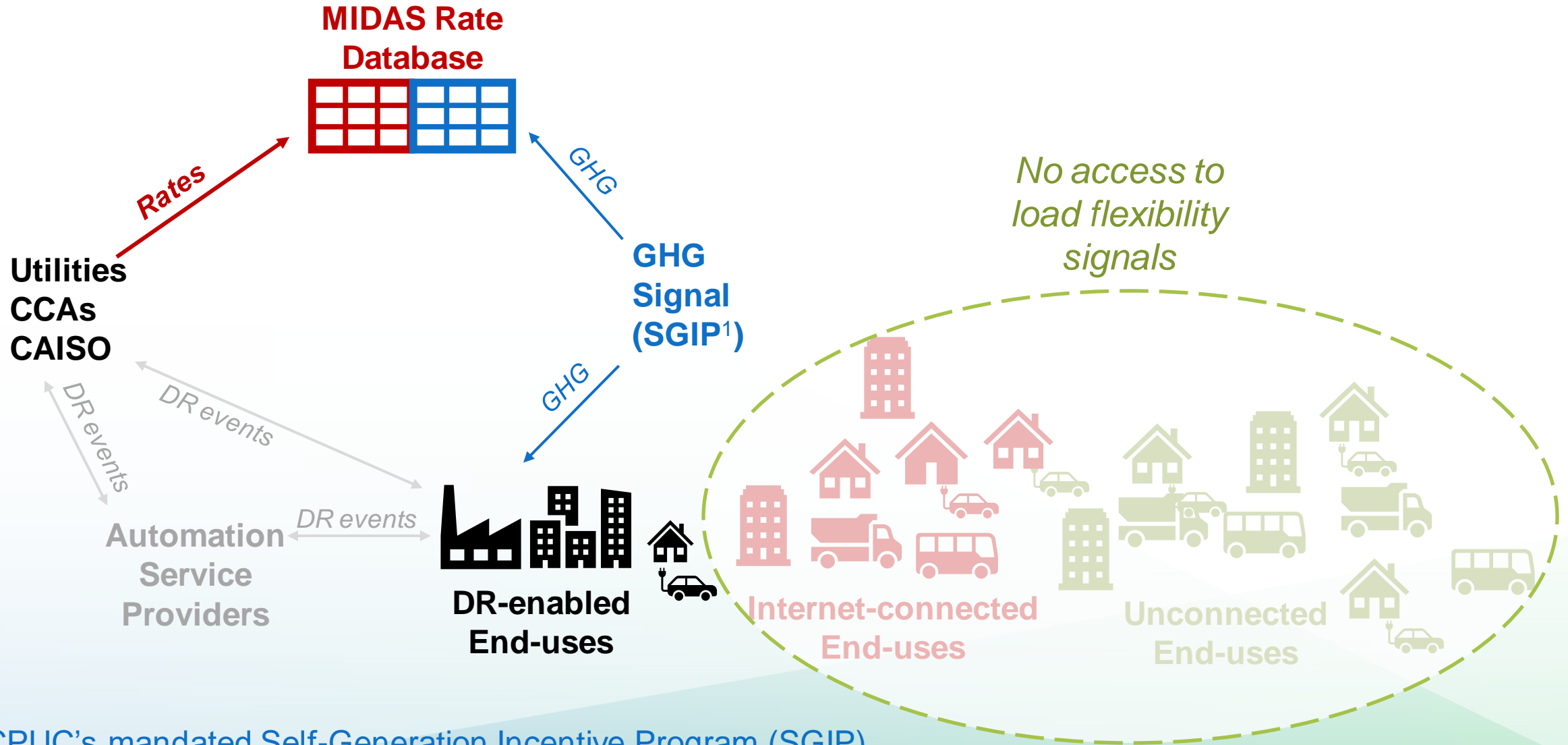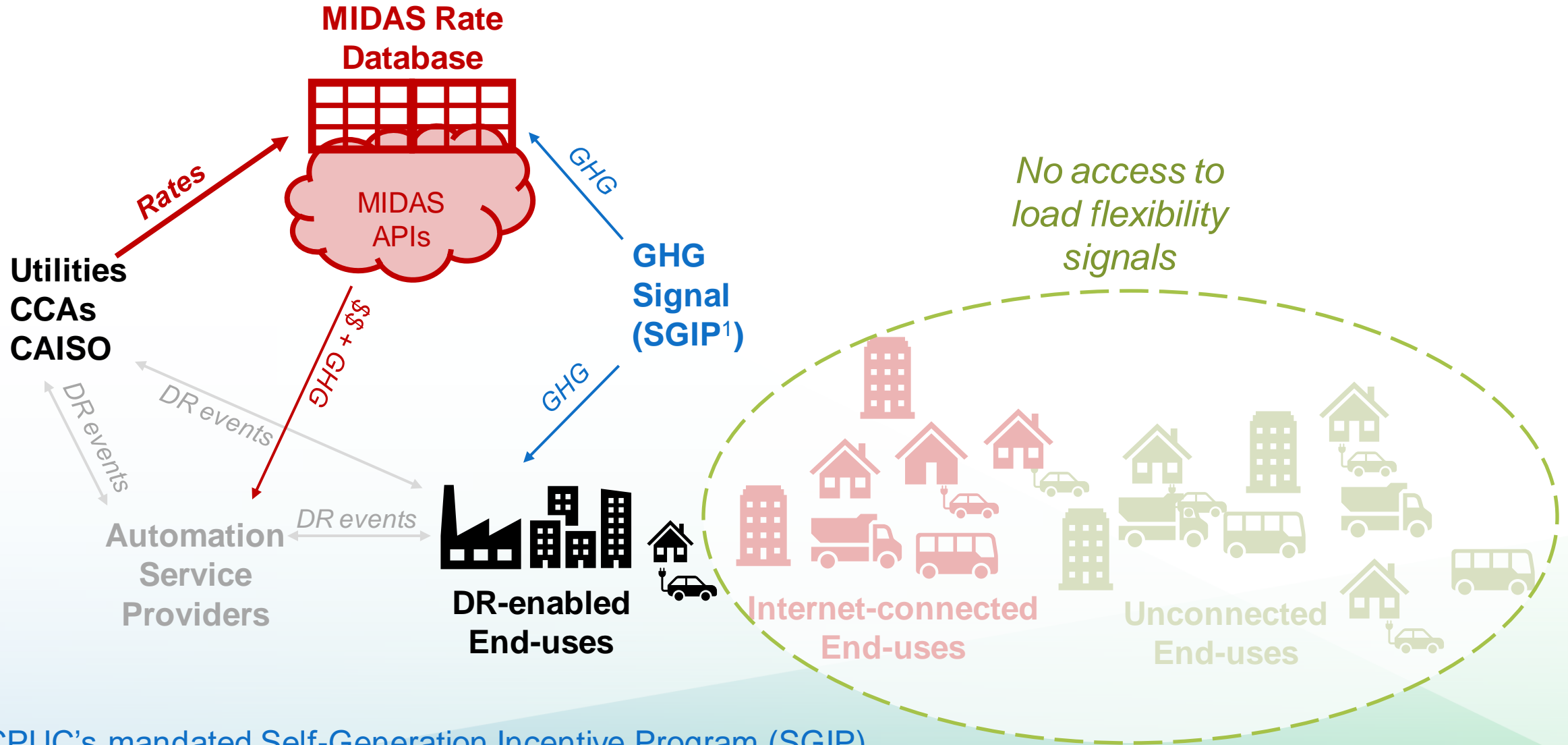
[1] The CPUC's mandated Self-Generation Incentive Program (SGIP)

Load Management Standards
Time-varying rates and greenhouse gas (GHG) signals

Long-term Vision: Public Broadcast
Time-varying rates and greenhouse gas (GHG) signals
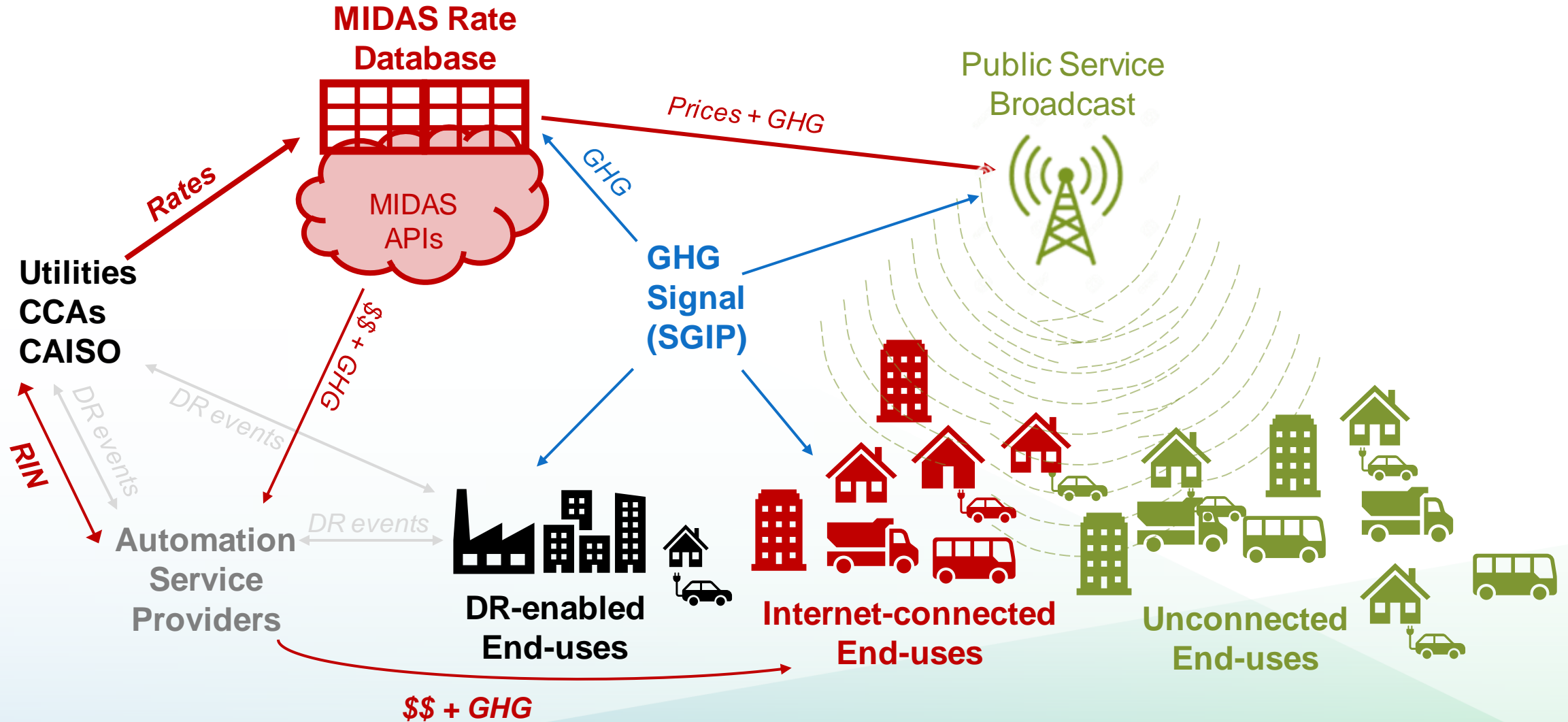
Proposed Amendments to the CEC's Load Management Standards

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Why locational hourly pricing?

The alternative:

Payment for load shed = today's DR programs

These programs have a few shortfalls

Shortfalls of DR programs: High costs

- Develop and market programs

- Recruit and contract with participants

- Maintain complex administrative and control systems

- Pay for participation programs are prone to being particularly cost-ineffective in non-curtailment, zero-benefit years

Shortfalls of DR programs:
Limited demand resources

- Only the largest customers are targeted, so only a fraction of cost-effective demand resources are obtained.

- Residential programs are limited to certain end-uses, control technologies, and control strategies chosen by the utility.

- Load shed is practically or explicitly limited to certain seasons and certain hours of the day.

- Customer convenience and comfort commitments are high relative to customer value, so participation is low.

- Off-peak load building to prevent renewable curtailment is not supported.

Shortfalls of DR programs:
Limited customer involvement, user experience, sustainability

- Residential programs are controlled by the utility. Customer control, if available, is usually limited to a complete override of the event control strategy.

- Limited involvement/understanding impedes customer interest in peak reduction opportunities, so there is no transfer of strategies to non-event day TOU peak periods

- Direct incentives for participation help overcome barriers to initial participation, but do little or nothing to encourage ongoing contributions to load flexibility.

- Pay for participation is fraught with baseline calculation issues

Shortfalls of DR programs: Limited market benefits

- In the absence of statewide standards, technology vendors cater to utilities rather than to customers, limiting technology innovation and minimizing enhancements to user experience.

- Automation manufacturers are incentivized to withhold energy efficiency and load flexibility performance to sell peak resources into wholesale energy markets or highest bidding aggregators.

Shortfalls of DR programs: Equity issues

- "Pay-for-performance" payments, based on load drop from an estimated baseline, benefit the inefficient customers more than the efficient customers.

- Utilities target the largest customers, so smaller and more efficient customers have less opportunity to benefit from participation.

- Utilities target the largest loads, such as AC and electric water heating, so customers without those loads have no opportunity to benefit from participation yet contribute through rates to the costs of running those programs.

Why locational hourly pricing?

Locational Marginal Price Response
Customer benefits

- Choose a time-dependent rate or program (or not)

- Choose their own automation technology (or not)

- Maintain control of their own appliances

- Regulate their own comfort-convenience-cost tradeoffs

- Reduce customer bills by avoiding peak rates every day

- Contribute to GHG emission reductions

Locational Marginal Price Response
Societal benefits

Equity and fairness are maintained
- Any customer can participate - not just the well-off
- Efficient customers are rewarded - not the largest curtailable loads
- Customers with grid-friendly load shapes are compensated appropriately*

Standardization encourages innovation in technology markets

Mass-market plug-and-play flexibility becomes a real possibility

Lower system costs → Lower rates

In the context of accurate marginal pricing, the term "free rider" is a dysphemism

Locational Marginal Price Response
System and utility benefits

Reduce peak demand

- Avoid fires and blackouts
- Reduce consumption of fossil fuels
- Avoid construction of storage and generation capacity
- Reduce need for conventional DR programs
- Reduce use of high-polluting peaker plants
- Avoid transmission & distribution congestion
- Reduce electricity use when generation costs are high

Increase off-peak demand

- Improve grid reliability
- Maximize utilization of carbon-free renewable energy
- Enable electrification through resource optimization
- Maintain electrical services while decarbonizing consumption

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Planned Schedule (may be revised)

1. MIDAS TOU rates available: **June/July 2021**

2. MIDAS day-ahead GHG signals, FlexAlerts: **Aug/Sep 2021**

3. Flexible Demand Appliance Standards: **2022**

4. MIDAS locational hourly pricing: **TBD**

5. Public broadcast: **TBD**

For more information 🔗

- CEC Staff Contacts
  - Technical analysis: Karen Herter
  - Economic analysis: Gavin Situ
  - Project management: Gabe Taylor
- Relevant Documents and Websites
  - [CEC Draft Staff Analysis of Proposed Amendments](#)
  - [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](#)
  - [CEC 2003, Feasibility of Implementing Dynamic Pricing in California](#)