



**CALIFORNIA
ENERGY**
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

2019 Title 24 Codes & Standards Enhancement (CASE) Proposal Demand Response Introduction

October 11, 2016

Scott E. Bailey
ASWB Engineering
sebailey@aswb-engineering.com

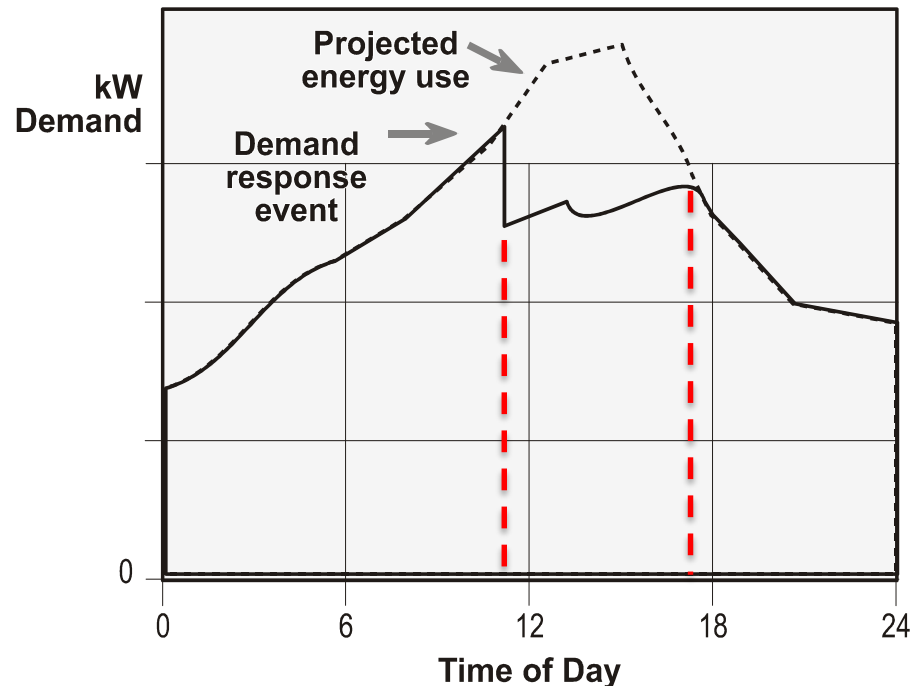


What is Demand Response?

Demand Response is short-term changes in the electricity usage by end users from their normal consumption patterns.

These end users typically reduce (or increase) their energy use in response to a request for Demand Response event or Price signals.

Example: Electricity end user reducing or shedding kW Demand for an 11 AM to 5 PM event.



How Demand Response Works (short version)

1. Demand Response events are usually triggered when:
 - Total electrical grid demand may exceed (nears) total electrical grid supply (generation plus renewables)
 - Cost of electrical generation is expensive
 - Cost of purchasing electricity is expensive
 - System or grid reliability is in jeopardy
 - Renewable energy sources produce overgeneration (future)
2. IOUs, CAISO, or other entities requests a Demand Response event
3. End users receive a Demand Response signal via a messaging protocol over the internet or from the cloud
4. End users respond by reducing (increasing) energy consumption

The Value of Demand Response – End Users

Value of Demand Response for the End User:

- Prevent blackouts and/or brownouts
- Reduce electricity costs due to Time Of Use (TOU) tariffs
- Respond to market prices (Real Time Pricing tariffs)
- Accommodate overgeneration of renewable energy
- Environmental benefits

The Value of Demand Response – IOUs and CAISO

Value of Demand Response for the California's power grid:

- Increase grid reliability
- Optimization of market pricing
- Plays a role in resource planning (new power plants)
- Provide “virtual generation”
- Reduce Greenhouse Gas emissions
- Manage overgeneration from renewable energy
- Future grid stabilization (e.g. frequency regulation)

By the way, IOU Demand Response programs are to be fully integrated with CAISO markets in 2018

Current Title 24 Demand Response

- Definitions for Demand Response
- HVAC systems
- Occupant Controlled Smart Thermostat (JA5)
- Indoor Lighting Controls
- Sign Lighting Controls
- Electrical Power Distribution systems
- Applies to both residential and nonresidential

Participation in a Demand Response program is not a requirement in Title 24.

Demand Response Trends– Past, Present and Future

	PAST	PRESENT	FUTURE
End Users	Large Facilities	All sizes, Residential	All sizes, Residential
Automation	Manual	Automatic	Automatic (Faster)
Communications	Phone call, Pager, Email	Internet, Cloud	Internet, Cloud, ?
Notification	24 hour prior notification	Day of event notification	Fast DR (quick as 4 secs)
Hardware	None	EMCS, DR Controls	EMCS, DR Controls
Applications	HVAC, Process Loads	HVAC, Lighting, Process Loads, Appliances	HVAC, Lighting, Process Loads, Appliances, IoT
Event Timing	Reduce Demand during hot summer days	Year around - Midday	Year around - Anytime
Purpose	Reduce Demand on power grid	Reduce Demand, React to Market Prices	Reduce Demand, Market Prices, Overgeneration, Frequency Regulation

Goals of Proposed 2019 Title 24 Demand Response Codes & Standards

Increase Enrollment in Demand Response Programs and Participation in Demand Response Events

- Enable end users to take advantage of Demand Response with minimal additional changes to building systems
- Update and harmonize all sections of Title 24 for Demand Response
- Better compliance and enforcement for Demand Response requirements
- Establish a pathway for future Demand Response and Demand Flexibility

Thank you.

Scott E. Bailey: sebailey@aswb-engineering.com

David Wylie: dwyllie@aswb-engineering.com

ASWB Engineering

www.aswb-engineering.com

714.731.8193



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Demand Response Clean-up

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Scott E. Bailey
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Proposed Code Change Overview

- **Buildings impacted:** Both residential and nonresidential
- **Building systems impacted**
 - Residential: HVAC systems
 - Nonresidential: HVAC, Indoor Lighting, Sign Lighting, and Electrical Power Distribution systems
- **Anticipated type of change**
 - Residential: Prescriptive
 - Nonresidential: Both mandatory and prescriptive
- **Description of change**

Clean up the existing Title 24 Demand Response code language utilizing current industry terminology. Harmonize all sections to make the Demand Response language consistent.

Proposed Code Change History

- **Why are we proposing this measure?**
 - Demand Response requirements that originated in the 2008 Title 24 need to be updated to current industry standards
 - Improve readability and clarify the code language thereby improving compliance and enforcement in buildings
 - Enhance and streamline compliance and enforcement process
 - Existing Demand Response code language is different for each section of Title 24 and these sections should be harmonized
 - Provide for a Demand Response standards-based messaging protocol for interoperability and eliminate barriers for participation in Demand Response programs
 - Feedback from implementers (designers, installers, commissioners, and manufacturers)
 - Ensure that buildings are equipped and ready for Demand Response

Current Code Requirements

- **Existing Title 24 Requirements for Demand Response**
 - Definitions for Demand Response
 - Mandatory Requirements for HVAC systems
 - Mandatory/Prescriptive Requirements for Indoor Lighting Controls
 - Mandatory Requirements for Sign Lighting Controls
 - Protocol Requirements for Electrical Power Distribution systems
 - Tradeoff exception for Solar Ready Buildings
 - Specifications for Occupant Controlled Smart Thermostat (JA5)
- **Other Existing Model Code Requirements**
 - ASHRAE 189.1-2014
 - International Green Construction Code (IgCC)

Current Code Requirements – Title 24 Map

Map of Demand Response Code Language in Title 24 (2016)

SECTION 100.1 - Definitions

SECTION 110.10 - Mandatory Requirements for Solar Ready Buildings

SECTION 120.2 - Required Controls for Space-Conditioning Systems

SECTION 130.1 - Mandatory Indoor Lighting Controls

SECTION 130.3 - Sign Lighting Controls

SECTION 130.5 - Electrical Power Distribution Systems

SECTION 140.6 - Prescriptive Requirements for Indoor Lighting

Reference Joint Appendix JA5 – Occupant Controlled Smart Thermostats (OCST)

NA7.5.10 Automatic Demand Shed Control Acceptance

NA7.6.3 Demand Responsive Controls Acceptance Testing

Typical Practices

- **Current practices**

- Implementers (building designers, contractors, and commissioners) have difficulty in understanding the requirements for Demand Response, making compliance difficult
- Acceptance Tests are limited in evaluating the functionality of Demand Responsive controls
- Title 24 does not require all Demand Responsive Controls to support standards-based messaging protocols which can interfere with participation in Demand Response programs

- **Trends**

- Buildings are not ready to participate in current Demand Response programs because of outdated and restrictive requirements

- **Any additional input?**

Cost-Effectiveness Analysis is not required

Since the purpose of this measure is to clean up and streamline Title 24 Demand Response requirements, not adding new requirements, a cost-effectiveness analysis is not required.

Although this measure does not result in electricity or gas savings, the measure would promote:

- Better comprehension of Demand Response requirements by implementers
- Better compliance and enforcement for Demand Response in buildings
- Building readiness for enrollment in Demand Response programs and events

Resulting in higher participation in Demand Response programs and increased grid reliability

Market Overview and Analysis

- **Current Market**
 - The market is already well established for Demand Response
 - Multiple manufacturers produce Demand Responsive Controls
 - Both Technology Incentives and Demand Response programs are already in place
- **Market impacts**
 - Encourage, clarify, and increase participation in Demand Response
- **Market barriers**
 - Implementers may know how to install Demand Responsive Controls however some lack the knowledge to properly commission them
- Any other market related information that should be considered?

Compliance and Enforcement—Market Actors

- **Who would be involved in implementing this measure?**
 - Lighting Designers
 - Contractor/Builder
 - Electrician
 - Energy Consultant/Modeler
 - Plans Examiner
 - Building Inspector
 - Utility Demand Response Programs
 - Demand Response Aggregators
 - CAISO
 - HVAC and Lighting Controls Manufacturers
 - Home Automation Systems Manufacturers
 - Acceptance Testers & Commissioners
- Others?

Compliance and Enforcement—Tasks (1 of 4)

Market Actor	Task(s)	Success Criteria
HVAC, Electrical and Lighting Designers	<ul style="list-style-type: none"> - Design systems to meet Title 24 code - System performance to owner specifications & needs - Specify DR controls in construction docs - Complete compliance forms 	<ul style="list-style-type: none"> - System meets owner needs - Do this quickly and within budget and schedule - Do this cost-effectively - System is Title 24 compliant
Builder/Contractor	<ul style="list-style-type: none"> - Build system exactly as designed to meet code - Purchase system from retailers/distributors - Install DR controls to specifications - Coordinate with other market actors including CxA 	<ul style="list-style-type: none"> - Do this quickly and within budget and schedule - Do this with minimal paperwork - System is Title 24 compliant
Acceptance Testers & Commissioning Authority	<ul style="list-style-type: none"> - Third –party verifier of proper installation and functionality 	<ul style="list-style-type: none"> - Compliance demonstrated on first visit

Compliance and Enforcement—Tasks (2 of 4)

Market Actor	Task(s)	Success Criteria
Plans Examiner	<ul style="list-style-type: none"> - Confirm Title 24, Part 6 compliance in construction documents 	<ul style="list-style-type: none"> - Only one review required; no clarifications necessary
Building Inspector	<ul style="list-style-type: none"> - Confirm proper installation and Title 24, Part 6 documentation 	<ul style="list-style-type: none"> - Only one site visit required
Utility Demand Response Programs	<ul style="list-style-type: none"> - Coordinate controls software programming to receive requests - Send load reduction requests to participants - Evaluate reduction periods to determine actual savings - Administrate DR Incentive Programs 	<ul style="list-style-type: none"> - Demonstrated energy savings to meet savings goals
Demand Response Aggregators	<ul style="list-style-type: none"> - Identify small facility candidates for aggregated groups - Coordinate controls software programming to receive requests - Send load reduction requests to participants - Evaluate reduction periods to determine actual savings 	<ul style="list-style-type: none"> - Demonstrated energy savings to meet savings goals

Compliance and Enforcement—Tasks (3 of 4)

Market Actor	Task(s)	Success Criteria
CA Independent System Operator (CAISO)	<ul style="list-style-type: none"> - Owner of electrical grid - Determines when load reduction request is appropriate; coordinates with Utilities to send request - Runs DR program independent of utilities 	<ul style="list-style-type: none"> - Maintain optimal grid function
HVAC and Lighting Controls Manufacturers	<ul style="list-style-type: none"> - Provide compliant equipment to marketplace 	<ul style="list-style-type: none"> - Selling equipment with minimal product returns or exchanges
Home Automation Systems Manufacturers	<ul style="list-style-type: none"> - Provide compliant equipment to marketplace 	<ul style="list-style-type: none"> - Selling equipment with minimal product returns or exchanges

Compliance and Enforcement—Resources

Market Actor	Resource(s)
HVAC, Electrical and Lighting Designers	<ul style="list-style-type: none"> - Title-24 standards & associated docs - Title-24 consultant - Energy Code Ace tools - CEC Hotline - Energy Design Resources DR Design Brief
Builder/Contractor	<ul style="list-style-type: none"> - Title-24 standards & associated docs - Energy Code Ace tools - CEC hotline
Acceptance Testers & Commissioning Authority	<ul style="list-style-type: none"> - Industry training classes - Energy Code Ace tools
Plans Examiner	<ul style="list-style-type: none"> - Title-24 standards & associated docs - Industry training classes - Energy Code Ace tools
Building Inspector	<ul style="list-style-type: none"> - Title-24 standards & associated docs - Industry training classes - Energy Code Ace tools

Are we missing any resources or tools?

Compliance and Enforcement—Resources

Market Actor	Resource(s)
Utility Demand Response Programs	- Title-24 standards & associated docs
Demand Response Aggregators	- Title-24 standards & associated docs
CA Independent System Operator (CAISO)	- Title-24 standards & associated docs
HVAC and Lighting Controls Manufacturers	- Title-24 standards & associated docs - Industry training classes - Energy Code Ace tools
Home Automation Systems Manufacturers	- Title-24 standards & associated docs - Industry training classes - Energy Code Ace tools

Strawman Code Change Language

Title 24 Code Language

- Existing Definitions:

 - DEMAND RESPONSE**

 - DEMAND RESPONSE PERIOD**

 - DEMAND RESPONSE SIGNAL**

 - DEMAND RESPONSIVE CONTROLS**

- Potential New Definitions (tentative):

 - DEMAND FLEXIBILITY**

 - DEMAND RESPONSE NOTIFICATION**

 - HOME AUTOMATION SYSTEM**

 - • •

Strawman Code Change Language

Title 24 Code Language

- Proposed Actions for Demand Response Definitions:
 - Establish a framework of definitions to support Demand Response language
 - Review existing definitions and modify if necessary
 - Ensure correct meanings
 - Ensure terminology is consistent
 - Review other sources of definitions: ASHARE, IgCC, CAISO, FERC, and DOE

Still a work in progress...

Strawman Code Change Language

Title 24 Code Language

- Current Code Language (2016):

Section 120.2 – Required Controls for Space-Conditioning Systems

(h) **Automatic Demand Shed Controls.** HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for non-critical zones as follows:

1. The controls shall have a capability to remotely setup the operating cooling temperature set points by 4 degrees or more in all non-critical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).

...

- Example of Proposed Code Language (2019):

Section 120.2 – Required Controls for Space-Conditioning Systems

(h) **Demand Response Controls.** HVAC systems with DDC to the Zone level shall be programmed with Demand Responsive Controls for non-critical zones as follows:

1. Upon receipt of a Demand Response signal, the EMCS shall increase operating cooling temperature set points by 4 degrees or more during the demand response period.

...

Strawman Code Change Language

Title 24 Code Language

- Existing Demand Response Messaging and Communications:

Title 24 System (Section)	Demand Response Messaging Protocol	Demand Response Communications
Space Conditioning / HVAC (Section 120.2)	No requirement	No requirement
Indoor Lighting Controls (Section 130.1(e)2)	At minimum, a standards-based messaging protocol	No requirement
Sign Lighting Controls (Section 130.3)	No requirement	No requirement
Electrical Power Distribution Systems (Section 130.5(e))	At minimum, a standards-based messaging protocol	No requirement
Occupant Controlled Smart Thermostats (OCST) (Reference Joint Appendix JA5)	At minimum, OpenADR and/or Smart Energy Profile (SEP) 1.1	WiFi or Zigbee (residential) Ethernet (nonresidential)

Strawman Code Change Language

Title 24 Code Language

- Proposed Actions for Demand Response Messaging Protocol:
 - Resolve messaging protocol language with stakeholders to identify the appropriate solution
 - Harmonize Title 24 and JA5 language for messaging protocol to facilitate building readiness for Demand Response
 - Identify how messaging protocols should work with cloud based communications

Strawman Code Change Language

Reference Joint Appendix JA5 - OCST

- Appendix JA5 Clean-up
 - Use current industry terminology that is consistent across T24
 - Remove obsolete and overly restrictive requirements
 - Resolve communications protocol, either proprietary or open standard
 - Resolve confusion between Demand Response Signal and Price Signals
 - Use more intuitive language to support manufacturers compliance
 - Clarify OCST Manufacturers compliance with both JA5 and Title 24 requirements for nonresidential buildings
 - Include sources of approved OCST thermostats

Strawman Code Change Language

Compliance Manual and Acceptance Tests Documents Clean-up

- The goal of the compliance documentation clean-up is to clarify the requirements thereby improving compliance and enforcement
- Ensure Demand Responsive Controls are compliant with Title 24, and will be installed “plug and play” for participation in Demand Response programs
- Enhance and streamline compliance and enforcement process
- Consider if Demand Responsive Controls should be pre-certified, field verified, or fully tested during acceptance testing
- Existing Acceptance Test documents will be revised and improved to meet new standards to facilitate enforcement

Bill AB 793 - Energy Efficiency

The CASE Team's efforts to clean up Demand Response requirements will include coordination with AB 793 implementation plans.

AB 793 (Quirk, 2015) Background:

- Chaptered October 8, 2015
- Requires electric and gas utilities to:
 - Develop an incentive program for residential and small/medium business customers to acquire 'Energy Management Technologies' for use in homes or businesses
 - Develop a plan to educate residential and small/medium business customers about incentive program
- 'Energy Management Technology' may include a product, service, or software that allows a customer to better understand and manage electricity or gas use in the customer's home or place of business.

Feedback Request from Stakeholders

We would appreciate feedback and/or data on the proposed measure.

Stakeholders can provide comments and feedback to CASE authors by email or telephone:

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David Wylie: dwylic@aswb-engineering.com

ASWB Engineering

www.aswb-engineering.com

714.731.8193

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Demand Flexibility

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Scott E. Bailey
David Wylie, P.E.
ASWB Engineering
sebailey@aswb-engineering.com
dwylie@aswb-engineering.com



Strawman Code Change Language

Demand Response Strategies – Overgen Strategies

Define Overgen

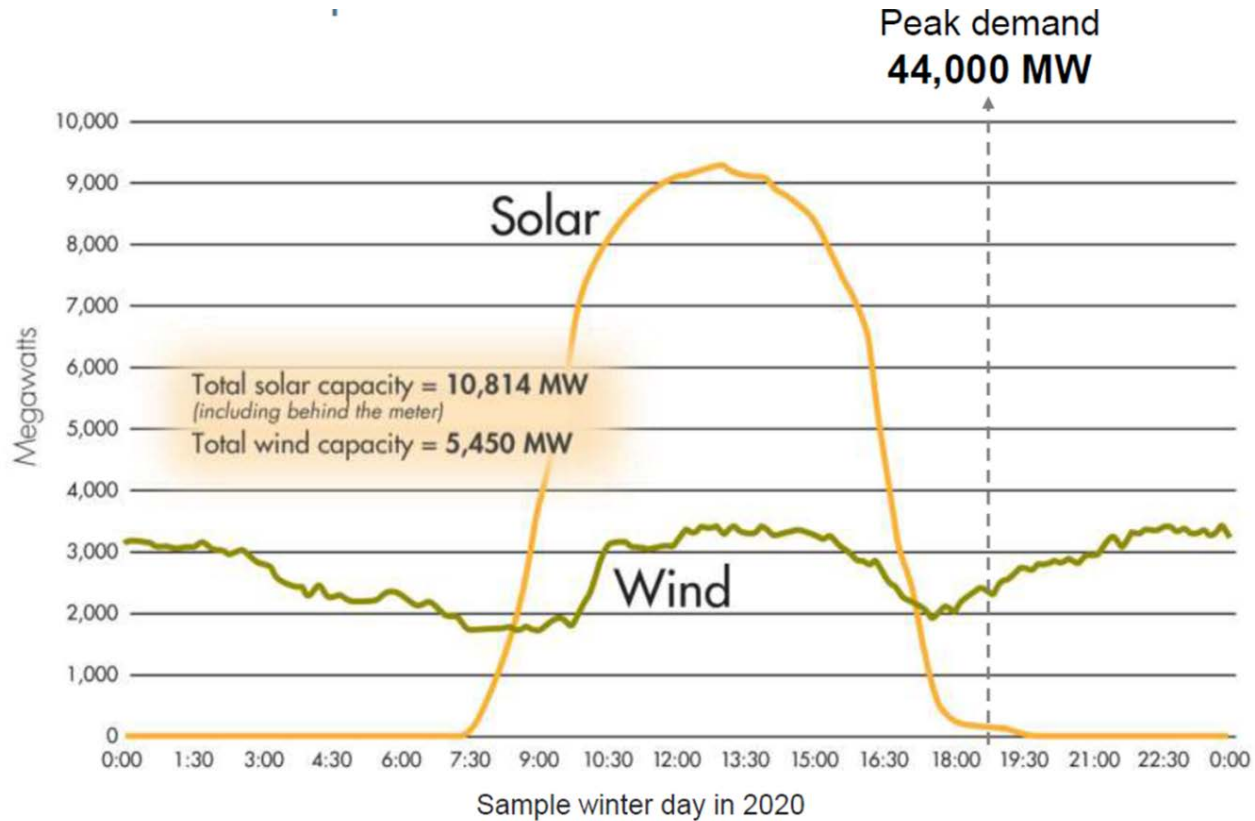
Define Renewable Resources

- Wind and solar are “intermittent” and stability is more challenging
- When renewable resources are down, DR can serve as backup



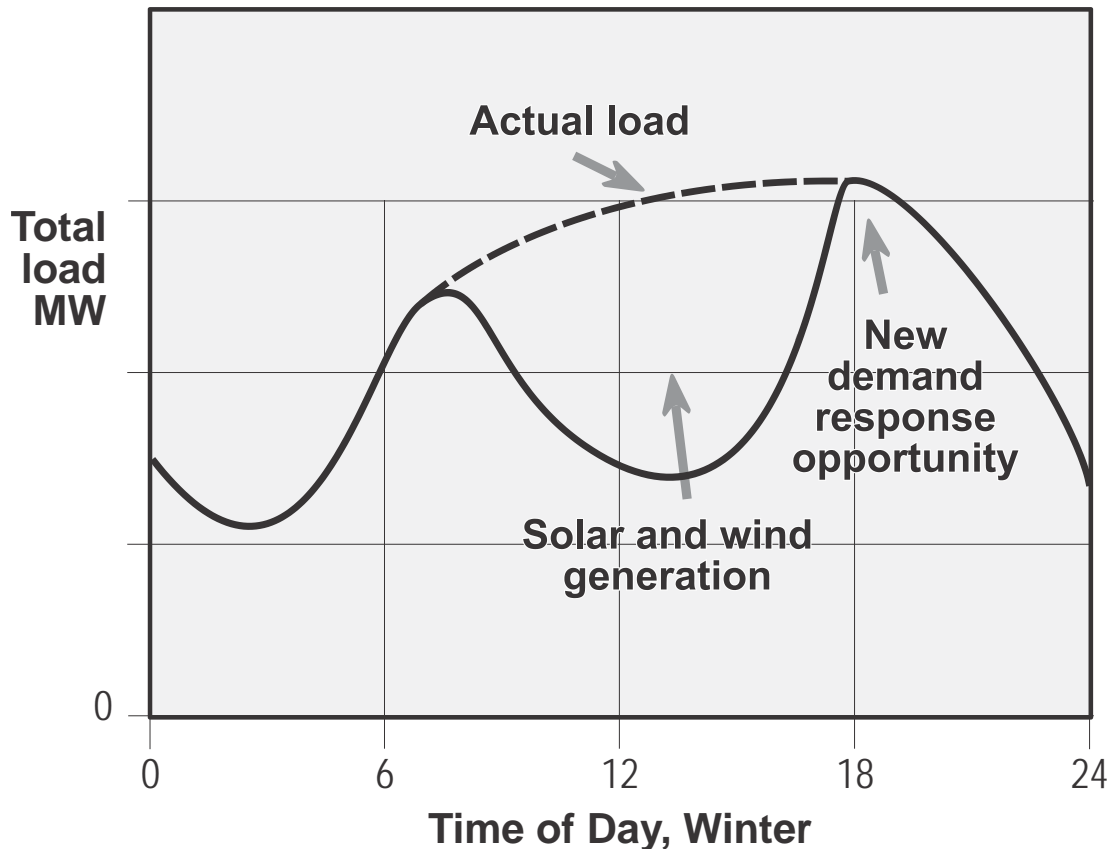
Strawman Code Change Language

Demand Response Strategies – Overgen Strategies



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Demand Response Strategies – Overgen Strategies



Batteries for Energy Storage

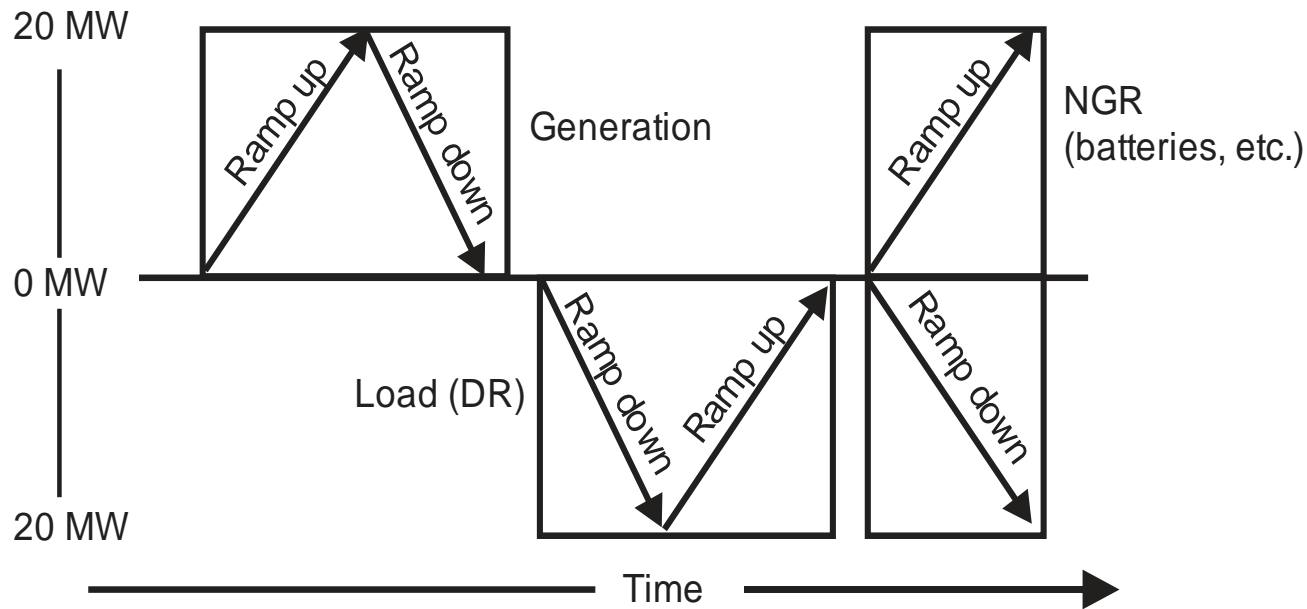
- Batteries to store the electricity when there is a supply surplus
- Relative to IDSM, battery storage is a type of distributed generation
- Future use: instantaneous use for residences and industrial facilities to keep demand charges down or participate in DR and/or regulation



Strawman Code Change Language

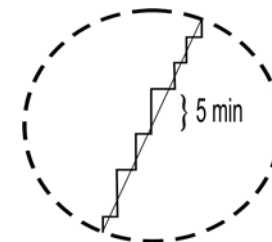
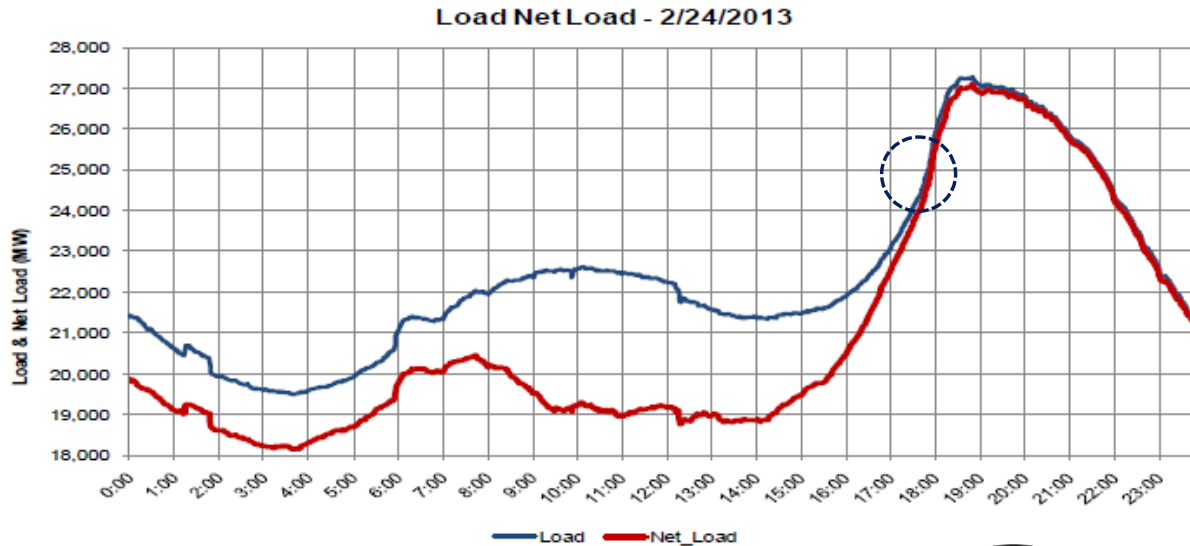
Demand Response Strategies – Overgen Strategies

Demand Response can either reduce or increase energy consumption.



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Demand Response Strategies – Fast Demand Response



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Demand Response Strategies - Nonresidential Strategies (cont.)

- Strategies for energy storage systems, including on-site storage batteries and Thermal Energy Storage systems (TES)
- Require buildings to be ready for energy storage systems

An example of a trade off option for Energy Storage systems:

On-site storage battery may exist as a trade-off to mandatory or prescriptive requirements. This would include defining eligibility criteria like minimum battery efficiency, etc.

Proposed Code Change History

- **Why are we proposing this measure?**
 - To ensure that buildings and facilities are ready for the Demand Response strategies of today and tomorrow, including Fast Demand Response and Overgen strategies

Typical Practices

- **Current practices**

- Most buildings implement a minimum of 15 percent reduction in lighting power to achieve their Demand Response goals
- Some buildings implement a GTA strategy of 4 degrees to achieve their Demand Response goals for HVAC. Other buildings, however, are reluctant to setback their temperature setpoints as drastically
- Today, buildings have many opportunities to achieve their Demand Response energy goals outside the above.

- **Trends**

- Demand Response implementers want more flexibility on how they can achieve Demand Response goals

- **Your thoughts?**

Market Overview and Analysis

- **Current Market**
 - Multiple manufacturers produce Demand Responsive Controls
 - Energy Management Control Systems (EMCS) are capable of implementing a variety of Demand Response strategies
 - Both Technology Incentive and Demand Response programs are already in place
- **Market impacts**
 - No additional energy consumption will occur since Demand Responsive Controls are already required in new buildings by code
 - Question: Do we need to consider round-trip efficiency here?
- **Market barriers**
 - No market barriers exist
- Other market information sources we should know about?

Demand Flexibility Ground Rules

Ground rules for Demand Flexibility:

- No trade-offs with Energy Efficiency for Demand Response to maintain loading order:
 1. Energy Efficiency (EE)
 2. Demand Response (DR) and Demand Flexibility (DF)
- No back-up generators for DR(per CPUC, no “BUG”s)

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Demand Response Strategies – Nonresidential Strategies

2016 Title 24 has a requirement for HVAC and Indoor Lighting each to have a base strategy for Demand Response. These are 4° GTA for HVAC and 15 percent dimming for Indoor Lighting.

2016 Title 24 has no requirement that addresses demand flexibility.

Do we need to introduce such a requirement? (e.g., battery-ready infrastructure, etc.)

Thoughts?

Strawman Code Change Language

Demand Response – Residential Strategy Code?

- Mandatory requirement for Demand Responsive Thermostats to be installed in new residential construction
- Residential Precooling
- On-site storage batteries (Rest state: charged or uncharged?)
- Grid connected electric water heaters as part of an alternative prescriptive pathway, both electric resistance and heat pump units.

Feedback Request from Stakeholders

We would appreciate feedback and/or data on the proposed measure.

Stakeholders can provide comments and feedback to CASE authors by email or telephone:

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Next Steps

- Please visit Title24Stakeholders.com for more information on the 2019 Title 24 code change process
- Send us an email at info@title24stakeholders.com if you have any questions or comments

Thank you for attending the Demand Response and Demand Flexibility Utility-Sponsored Stakeholder meeting