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LPM DCP Workshop Presentation

Additional submitted attachment is included below.

Title 20 Low Power Modes Roadmap

Proposed Data Collection Procedure

August 25, 2021

On behalf of the California IOUs

Presentation Overview

1) IOU Team's Role

2) DCP Motivation & Background

3) DCP Walkthrough

4) IOU Team Next Steps

IOU Team’s Role

IOU C&S Team's Role

IOU C&S Team

PG&E

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL™ Company

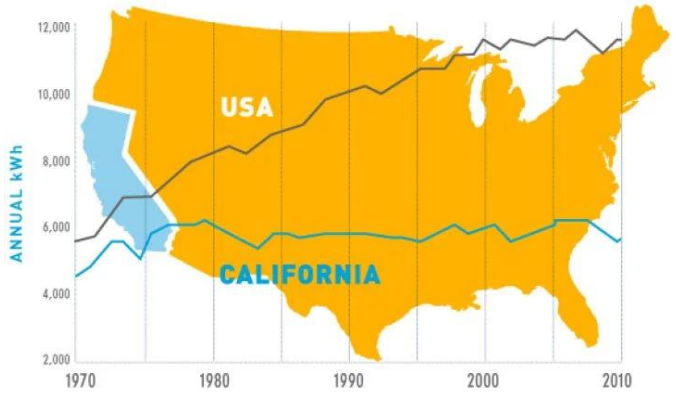
SDGE
A Sempra Energy utility®

Other stakeholders

Adopted regulations, voluntary targets, test methods, etc.

STATE OF CALIFORNIA
ENERGY COMMISSION

Energy Savings, Peak Demand Reduction, Consumer $ Savings, Reduced GHGs…

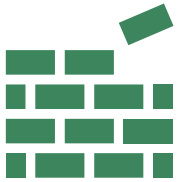


PUBLIC UTILITIES COMMISSION
EUREKA
STATE OF CALIFORNIA

CPUC evaluates C&S Program, sets energy savings goals

DCP Motivation & Background

IOU Team Objectives



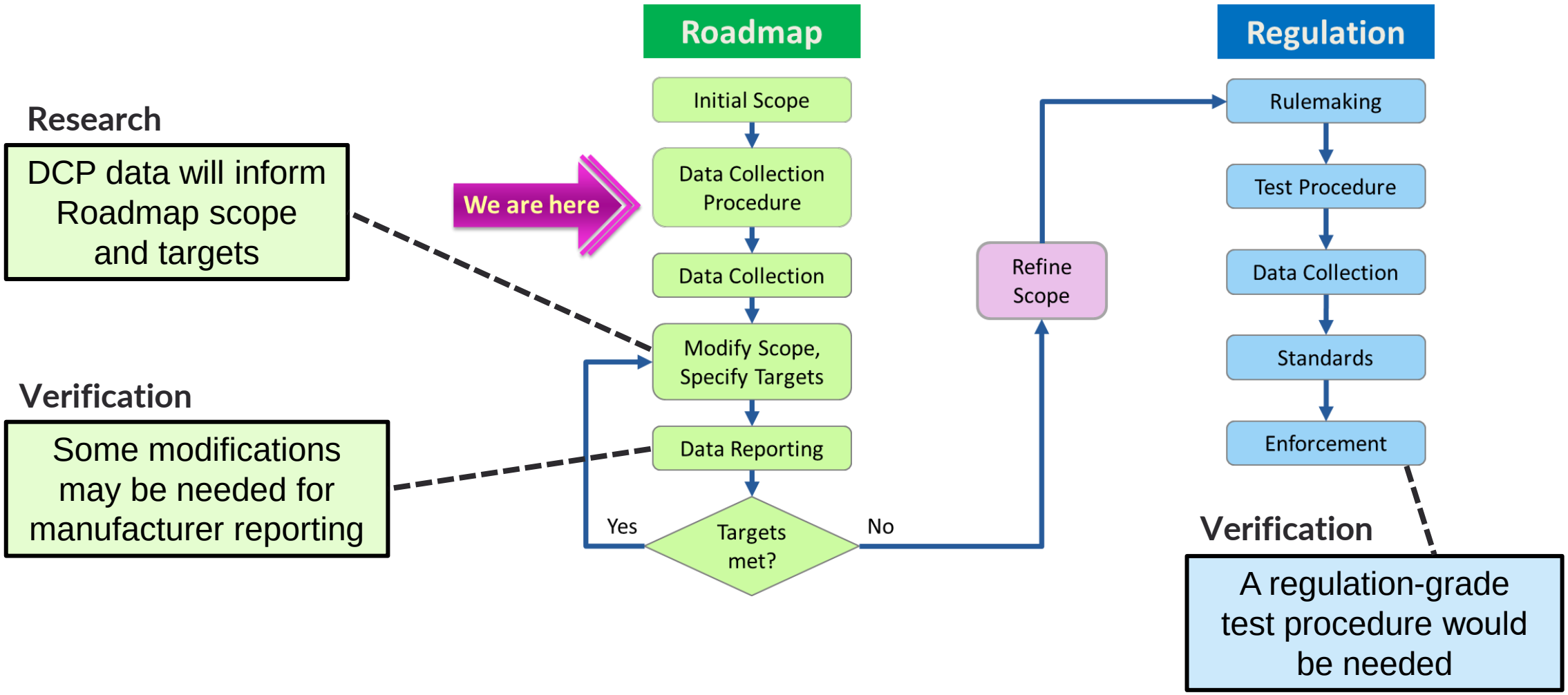
Build on CEC Test Procedure Discussion Draft published June 20, 2018.

Develop DCP proposal that meets CEC stated goals in January 24, 2019 webinar:

- ❑ Create a common test procedure for a wide variety of products
- ❑ Break products into groups only when absolutely needed
- ❑ Define test setups that are repeatable and representative of the real world
- ❑ Measure power draw in an “idle” or “inactive” state—when products are not performing their primary function
- ❑ Measurement should capture power draw of whatever secondary functions are present
- ❑ Allow stakeholders to collect and submit comparable data

Receive broad stakeholder input on our proposal.

DCP: A Research Tool that Will Evolve into a Verification Tool



Power Data Needed to Inform Roadmap

1

Data Collection Procedure (DCP)

Whole-product power primarily for:

- Estimating baseline power draw
- Identifying efficiency gaps
- Target verification

2

Power for secondary functions

Component- or function-level power draw information primarily for:

- Target setting (functional adders)

Components of a DCP for Inactive State

General Test Requirements

- Ambient conditions
- Power source
- Power quality
- Measurement accuracy

UUT Setup Instructions

- Powering
- Network connections
- Peripherals
- Additional attached equipment
- Mode or condition to test

Power Measurement Guidance

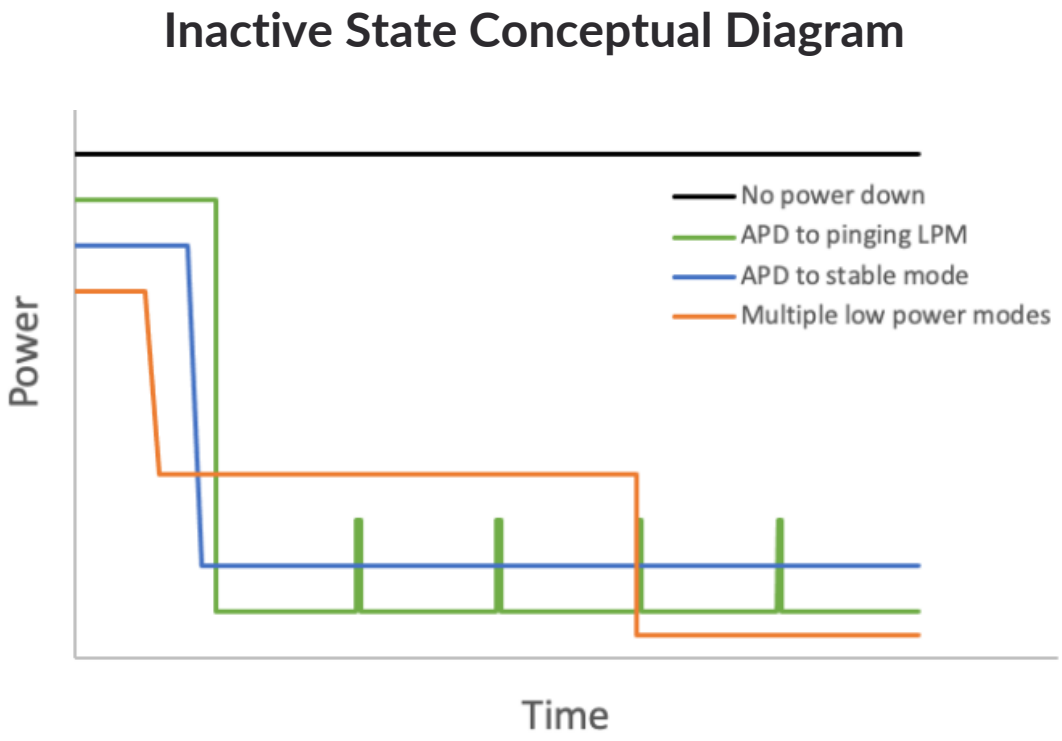
- Sampling interval
- Determining validity of test
- Method for calculating average power

Original Approach: Add Setup Instructions to IEC 62301

General Test Requirements	UUT Setup Instructions	Power Measurement Guidance
• Ambient conditions • Power source • Power quality • Measurement accuracy	• Powering • Network connections • Peripherals • Additional attached equipment • Mode or condition to test	• Sampling interval • Determining validity of test • Method for calculating average power
IEC 62301	**Compile from existing procedures, add as necessary**	**IEC 62301**

Modifying the Original Approach

- Complications with power measurement:
  - IEC 62301 tests a specific operating mode, tests for stability.
  - Challenging to define operating mode to test for every product in scope
  - LPM as a state of inactivity, stability tests do not apply
- Proposed solution: **Time-averaged power over interval that captures range of product power draw behavior in inactive state**
- Using product-specific test procedures:
  - Can be useful for setup instructions (ex. CTA-2049A for SNE setup instructions)
  - But generally specify operating mode for testing, so less applicable for test instructions



Source: IOU DCP proposal

Proposed Approach

General Test Requirements

- Ambient conditions
- Power source
- Power quality
- Measurement accuracy

IEC 62301 + more specificity from ENERGY STAR & DOE

UUT Setup Instructions

- Powering
- Network connections
- Peripherals
- Additional attached equipment
- Mode or condition to test

Compile from existing procedures, add as necessary

Power Measurement Guidance

- Sampling interval
- Determining validity of test
- Method for calculating average power

Time-averaged power of UUT inactive state rather than operating mode

IEC 62301 vs. IOU DCP Proposal

IEC 62301

- Purpose: **test standard** for regulatory compliance
- Measures **individual LPMs** (one at a time)
- Includes **stability criteria** to ensure LPM of interest is captured
- Relies on **external**, product-specific procedures or standards to fully define **setup** conditions

IOU DCP proposal

- Purpose: **collect data** to inform Roadmap
- Designed to measure **inactive state**
- Goal is **not stability** but to capture evolving inactive state (over a reasonable duration)
- **Includes setup** instructions for network connections, peripherals, sensors

Product Types Covered by Proposed DCP

Network Equipment

Sole primary function is to pass IP traffic among various network interfaces

Integrated Network Device

Possesses multiple primary functions, one of which is to pass IP traffic among various network interfaces

Network-Connected Device

Can be connected to a network to send and receive IP traffic

Non-Network Device

Cannot be connected to an IP network

DCP Proposal Development (So Far)

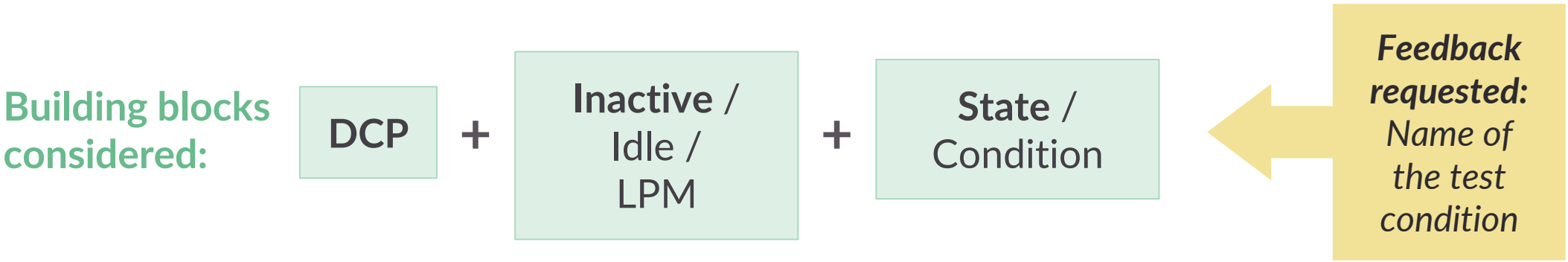
Developed preliminary draft → Vetted on 44 products at PG&E lab, iteratively revised → Internal round robin testing → Expert review → Docketed proposal → Requesting feedback

Initial testing has been conducted at PG&E's Applied Technology Services (ATS) lab in San Ramon, CA

Proposed Test Condition: Definition & Naming

- **Test condition:**
  - Defined as the state tested by the proposed DCP
  - Includes the time-averaged modes of a product when its *primary functions* are not used or not needed.
  - Generally represents state of a product in absence of user interaction.

- Proposed name: **DCP inactive state**



Primary and Secondary Functions

- **Primary function(s):** The main service(s) that the product provides to a user
  - Present in active mode
  - Not present in DCP inactive state (unless "always-on" product)

Feedback requested: *Primary function definition*

- **Secondary functions:** Other functions which can enhance the primary function or can assist with the use and operation of a product
  - May be present in any operating mode (except off)
  - Examples: sensors, displays, network connections
  - DCP instructs tester to avoid conditions that may cause secondary functions to activate primary functions (or decide whether to activate primary functions)

Feedback requested: *What secondary functions might be difficult for the tester to identify?*

- **Usage in the proposed DCP:** inactive state defined by absence of primary function. (Or for always-on products, the period when primary function is not needed.)

Example: Smart Speaker + Display

Primary Function: Playing User-Requested Audio or Video Content

DCP Inactive State

- Voice sensor listening but not triggered
- Display shows photo, clock, weather
- Network connection maintained, product receives programmed information (time, weather) but does not move user-generated or requested data

Neither DCP inactive state nor active mode

Ambient sound events: Sound detected and processed (locally or in cloud)

Active Mode

Product plays user-requested content

Power

Time

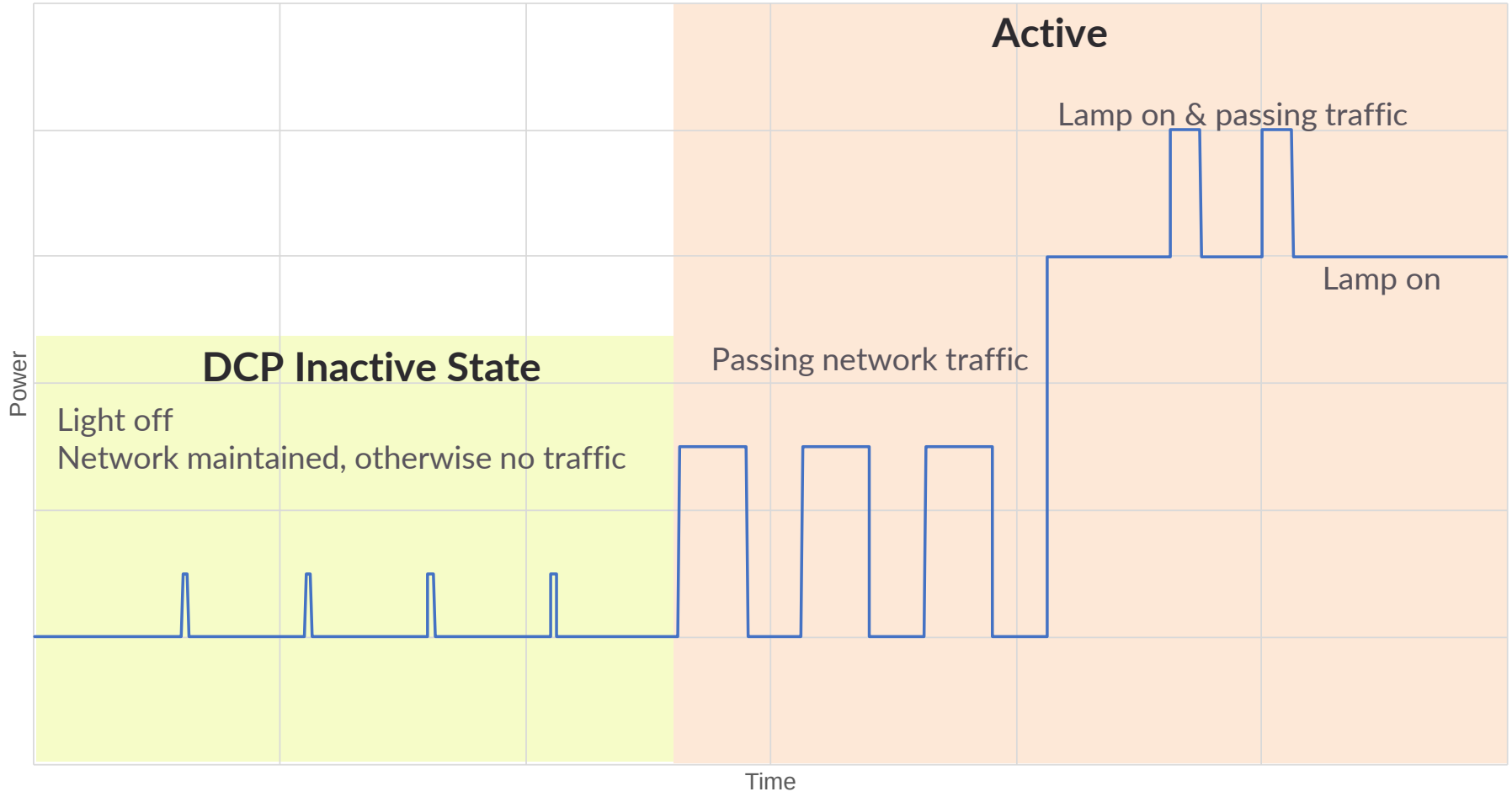
No trigger word identified; product returns to inactive state

Trigger word identified; product activates circuitry to act on user request

Simplified conceptual diagram

Example: LED Bulb with Wi-Fi Extender

Primary Functions: Producing Light, Moving Network Traffic

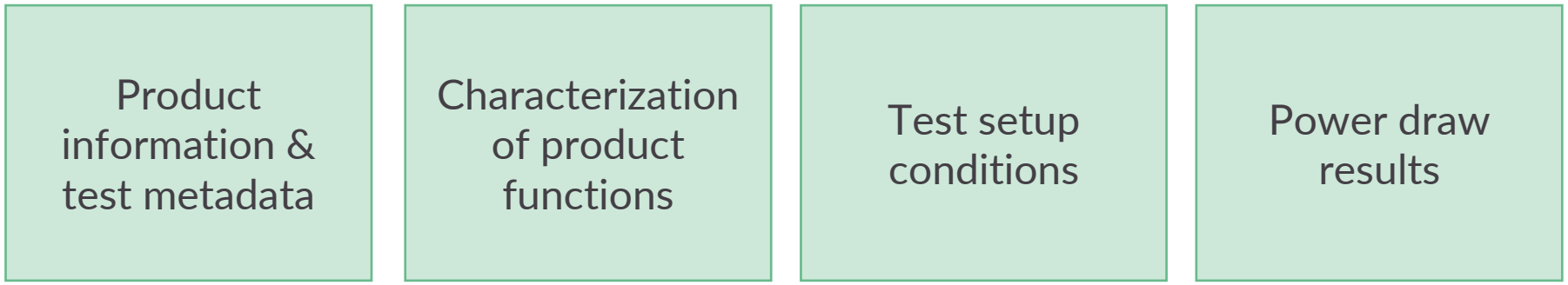


Simplified conceptual diagram

Data Reporting Tool

- Spreadsheet provides standardized data collection format for reporting:

Types of fields in the proposed DRT



- Posted to docket June 4, 2021 (link)
- Macro must be enabled for drop-down menus
- Recommend CEC allow stakeholders to submit or attach additional information as needed, such as plots of timeseries data, photos of set up or configuration settings, etc.

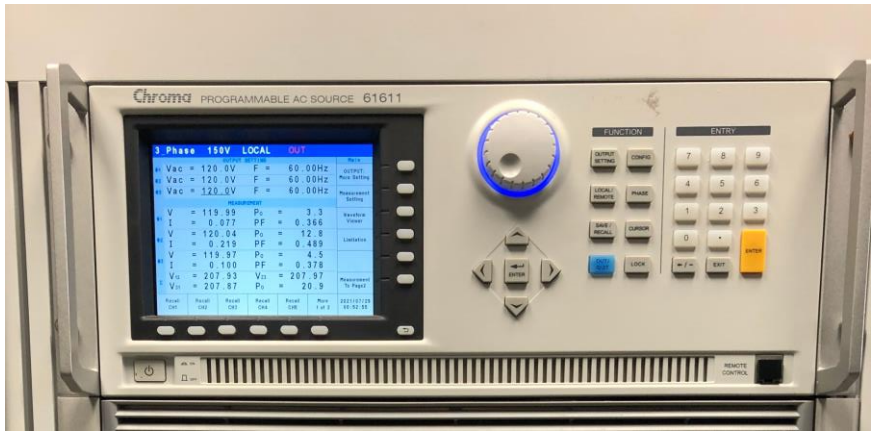
DCP Proposal Walkthrough

DCP Overview

1. Prepare instrumentation
2. Receive UUT
3. UUT setup using manufacturer instructions
4. Network connection setup
5. Prepare test environment
6. UUT warm up
7. Measure inactive state power
8. Conduct additional tests as necessary

1. Prepare Test Room and Instrumentation

- Instrumentation requirements: IEC 62301 with additional guidance based on ENERGY STAR and DOE test procedures
- Instructions for supplying power for ac and dc products



2. Receive UUT

- Remove from packaging and/or perform factory reset
- Record product information
- Determine primary and secondary functions (can be revised as tester gains experience with UUT)
- Determine whether product has off mode

Smart speaker & display

- **Primary**: playing audio and video content
- **Secondary**: network communication (802.11ac); voice activation; ambient light sensor

Home security system

- **Primary**: relaying status information to user (ex. security breach)
- **Secondary**: network communication (Wi-Fi), sensing

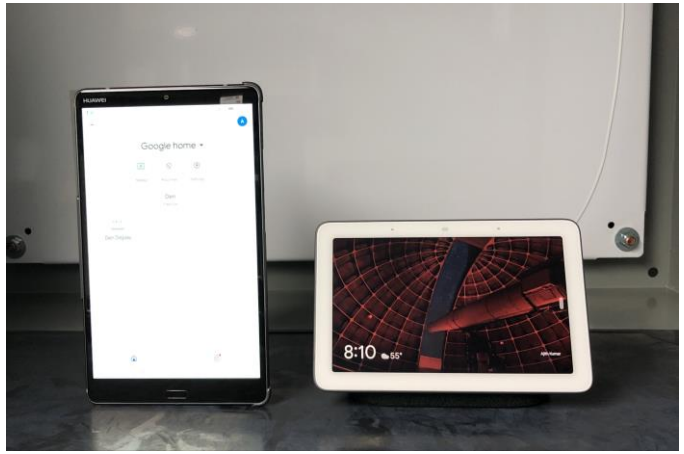
Integrated access device (IAD)

- **Primary**: Passing IP traffic
- **Secondary**: Maintain network connections to be prepared to pass IP traffic

3. Set Up UUT According to Manufacturer Instructions

- Guidance for supplying power, connecting peripherals and additional required products, enrolling in services, software/firmware updates, voice assistant setup

Smart speaker & display



Connect to 120Vac power source
Download and set up app
Update software
Set up voice assistant

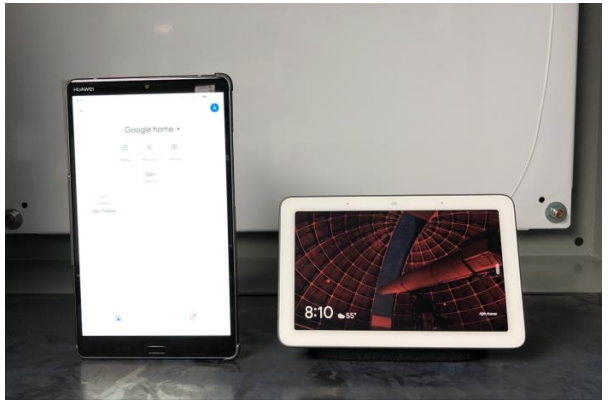
Home security system

Connect base station and camera to 120Vac power
Download and set up app
Pair sensors and camera to base station
Update software

4. Set Up Network Connection

- CTA-2049A sections for network equipment and integrated network devices

Smart speaker & display



Wi-Fi connection set up through app to live network
No user-generated traffic, but UUT can pass traffic as needed

IAD

Set up as network equipment using guidance from CTA-2049A
Live connection to service provider network (DOCSIS)
Test clients: 1 Wi-Fi client and 1/2 Ethernet ports connected
No client-generated traffic, but UUT can pass traffic as needed

5. Prepare Test Environment

- Controls to prevent active mode

Smart speaker & display

Voice activation: Prevent speech
Ambient light sensor: Control ambient light (test at 10 lux and 300 lux)

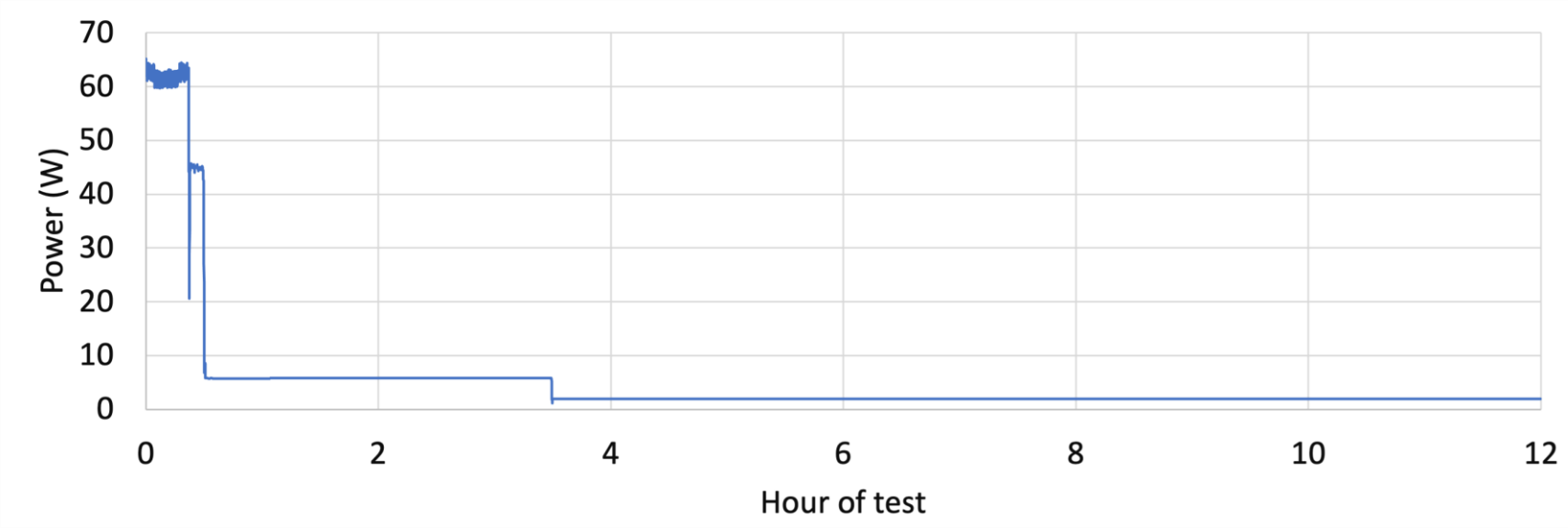
Home security system

Prevent noise, motion that trigger alarm
Camera has binary response to ambient light (day and night modes): test in each condition

6. UUT Warmup

- Allow UUT to settle into normal operation
- Collect data that will help tester determine how to run tests
  - APD
  - Modes
  - Cycles

Feedback requested: *How long should the warmup time be?*

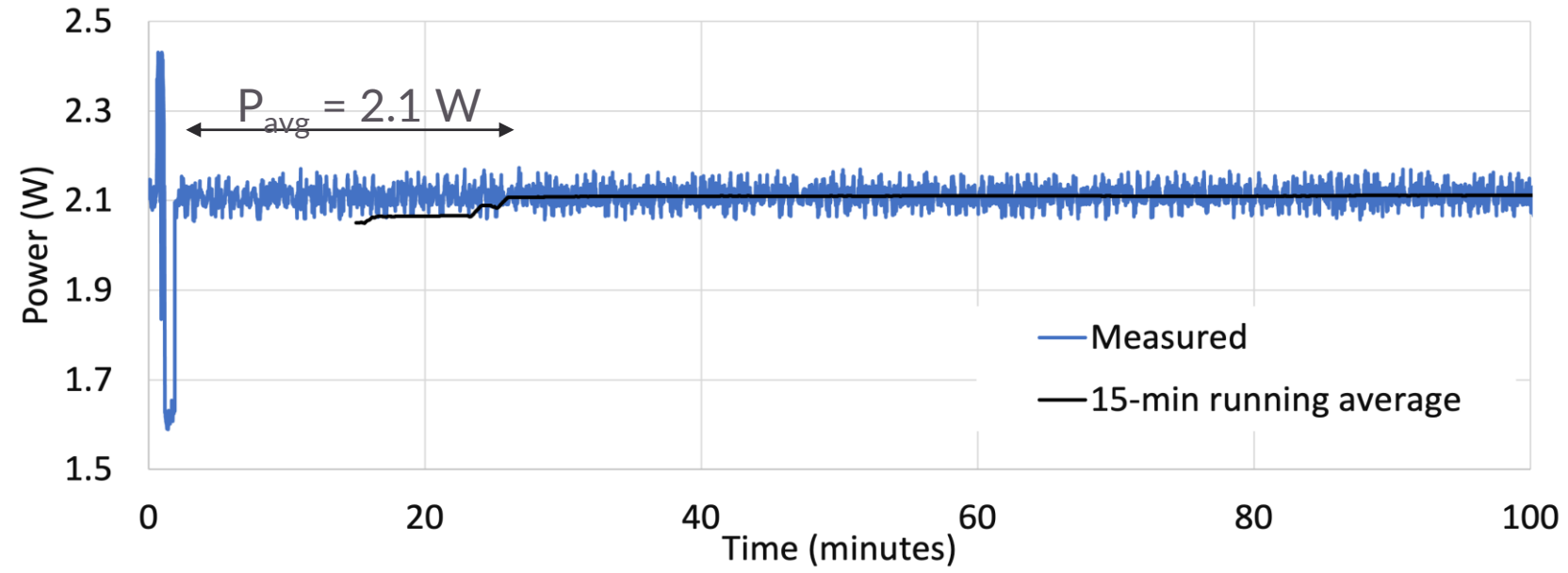


Example of 12-hour warmup period for a game console. Preliminary data for illustration purposes only. Source: CA IOU Team.

7. Inactive State Power Measurement

Feedback requested: *Does the state of any attached products need to be prescribed?*

- Place UUT in DCP inactive state.
- Test long enough to characterize power of UUT, 15 minutes to 3 hours

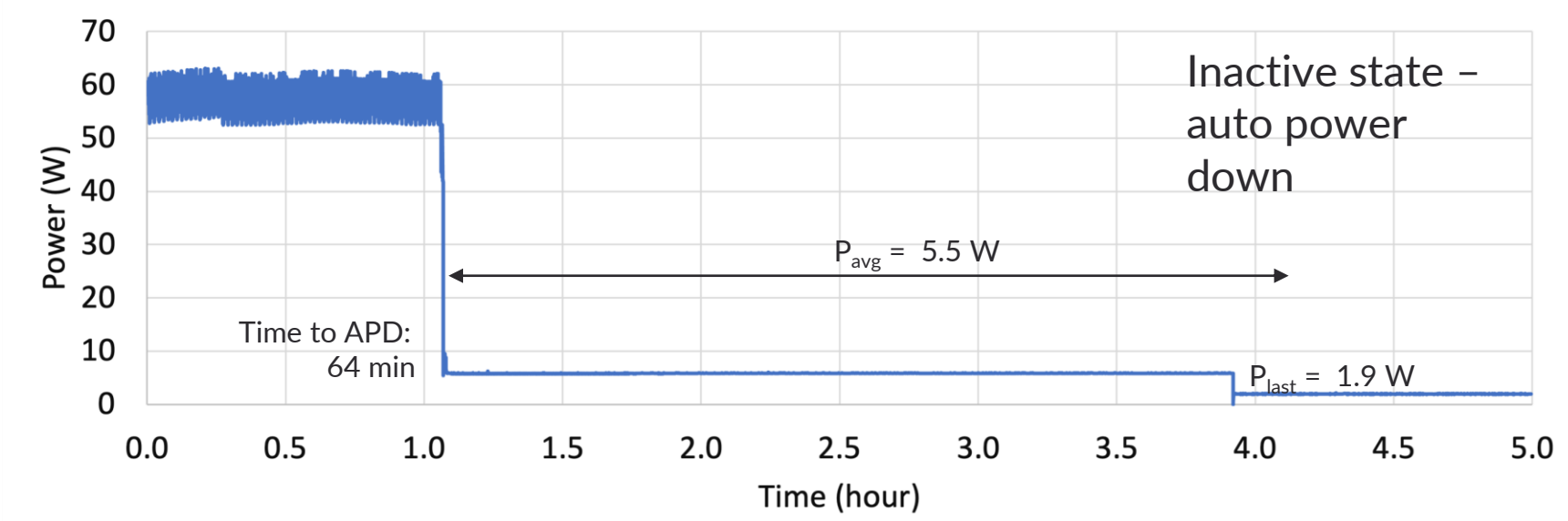


Example of test period for a connected smart home product that powers down to a pinging mode. Preliminary data for illustration purposes only. Source: CA IOU Team.

7. Inactive State Power Measurement (Cont.)

Feedback requested: *Is more guidance on length of test needed?*

- If product has multiple low power modes, report average power of entire test and lowest power mode.
- If product has reached lowest power mode after 2.75 hours but before 3 hours, extend test by up to 15 minutes to test 15 minutes of the lowest power mode.



Example of test period for a game console with APD and multiple low power modes. Preliminary data for illustration purposes only. Source: CA IOU Team.

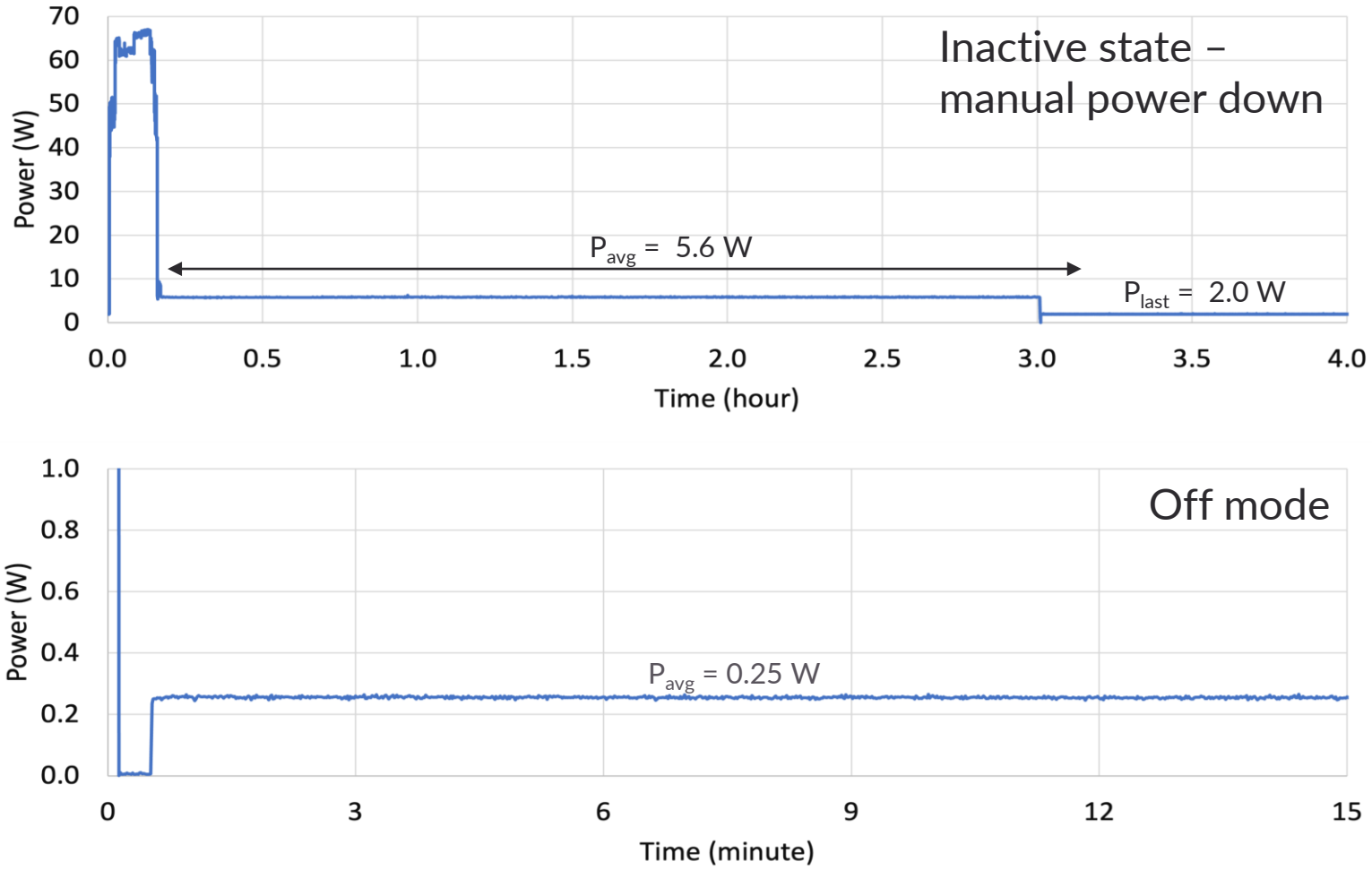
8. Additional Tests

- Suite of tests to run per product to characterize power draw behavior

Power Delivery	Network Technology	DCP Inactive State Initiation Method	Power Management Settings	UUT State
1. Mains (120 Vac) 2. Other ac voltage 3. USB 4. PoE 5. Other dc voltage	1. Highest bandwidth wireless technology 2. Highest bandwidth wired technology	1. APD 2. Manual power down 3. No power down method	1. Default settings 2. Highest power settings	1. DCP inactive state 2. Off mode

8. Additional Tests (Cont.)

- Suite of tests to run per product
  - DCP inactive state initiation method
  - Off mode



Example of additional tests for a game console: manual power down (top) and off mode (bottom). Preliminary data for illustration purposes only. Source: CA IOU Team.

IOU Team Next Steps

Feedback and Collaboration Is Welcome

1. **Name of the test state:** Is there a better name than “DCP inactive state”?
2. **Definition of primary function(s):** For which products would identifying primary function(s) be ambiguous? Can the definition of primary function be improved to reduce ambiguity?
3. **Hidden secondary functions:** Some secondary functions may not be evident to tester in visual or specification inspections. What secondary functions potentially impact power draw but would be difficult for a tester to identify?
4. **State of additional products during inactive state test:** In what situations might the DCP need to prescribe the state of products that must be attached for the UUT to operate but do not ship with the UUT?
5. **Warmup period and test period length:** Can either be reduced to decrease test burden? Is more guidance needed on determining test period length?
6. **Other feedback:** Other suggestions for how to improve the DCP, within CEC’s stated goals.

Additional stakeholder engagement: Additional OEMs to collaborate on testing, at PG&E’s lab or another location, to ensure the DCP is reproducible, representative, and streamlined

IOU Team Next Steps: DCP Proposal

Modify

Modify DCP proposal after receiving broad stakeholder feedback

Validate

Coordinate round robin testing on revised DCP proposal

Docket

Docket revised DCP proposal

Collaborate: Work with interested OEMs to improve and validate our current DCP proposal

IOU Team Next Steps: LPM Research Plan

Collaborate

- With interested stakeholders

Collect data using finalized DCP

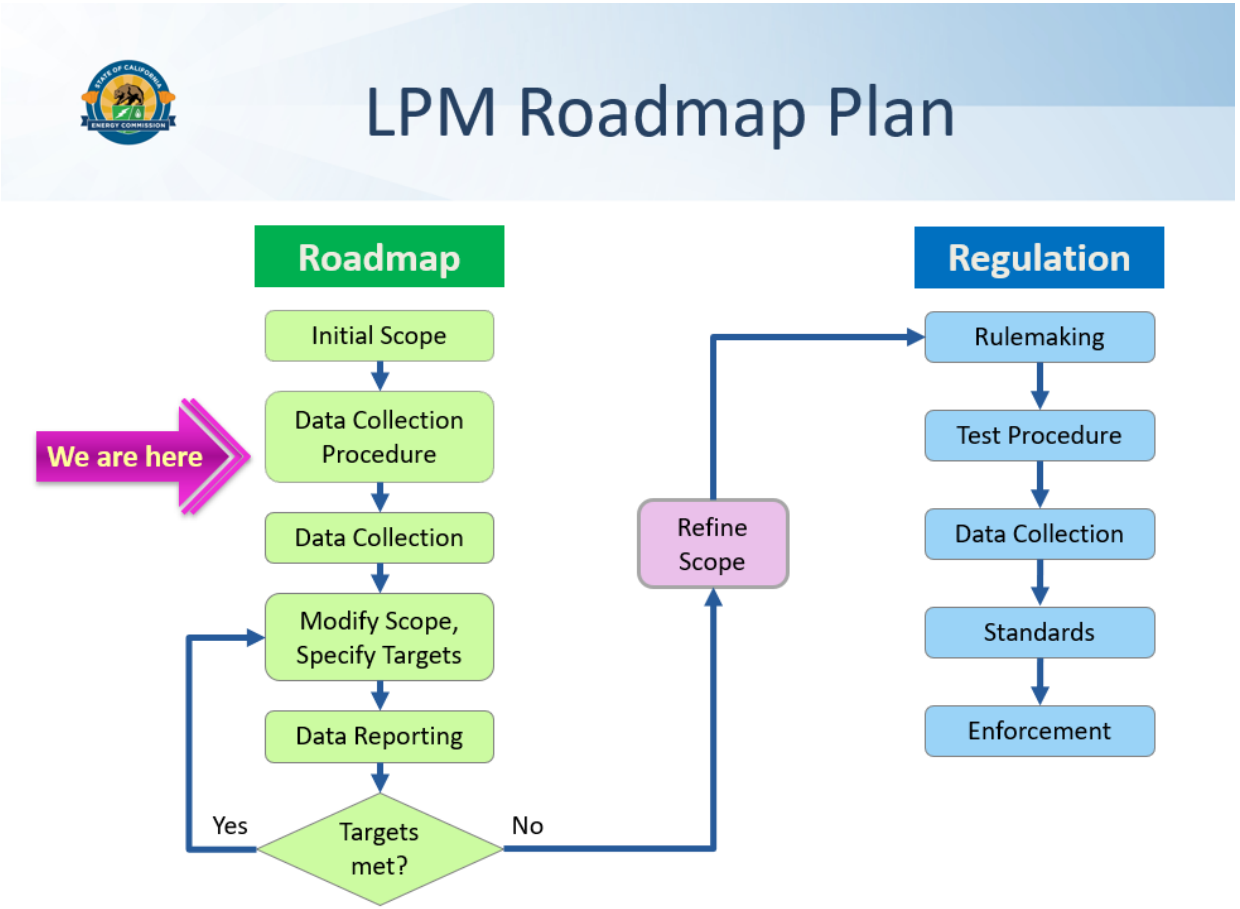
- Cross-cutting across scope

Power for functions research

- To inform proposed targets

Submit data & proposals

- In response to CEC requests



Thank you

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Feedback and collaboration is welcome