ENERGY STAR®
Electric Vehicle Supply Equipment
Draft 2 Follow-up Memo Webinar

November 7, 2016

ENERGY STAR Products Labeling Program

Webinar Details

- Webinar slides and related materials will be available on the EVSE Product Development Web page:
  - www.energystar.gov/NewSpecs
  - *Follow link to "Version 1.0 is in Development" under "Electric Vehicle Supply Equipment"*

- Audio provided via teleconference:

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  - Phone lines will remain open during discussion
  - Please mute line unless speaking
  - Press *6 to mute and *6 to un-mute your line

Webinar Agenda

- Introductions and Recap of ENERGY STAR specification development process
- Purpose of Memo
- Changes to Specification and Test Method
  - No Vehicle Mode
  - Multi-port Testing
  - Display Brightness
- Connected Functionality
- Marketing Efforts
- Timeline and Open Discussion

Introductions

Time	Topic
1:00–1:10	**Introductions and Specification Development Recap**
1:10–1:20	Purpose of Memo
1:20–1:40	No Vehicle Mode
1:40–2:00	Multi-port Testing
2:00–2:20	Display Brightness
2:20–3:00	Connected Functionality
3:00–3:20	Marketing Efforts
3:20–4:00	Timeline and Open Discussion

Introductions

Verena Radulovic
U.S. Environmental Protection Agency

Barney Carlson
Idaho National Laboratory

Matt Malinowski
ICF International

Ted Bohn
Argonne National Laboratory

Emmy Feldman
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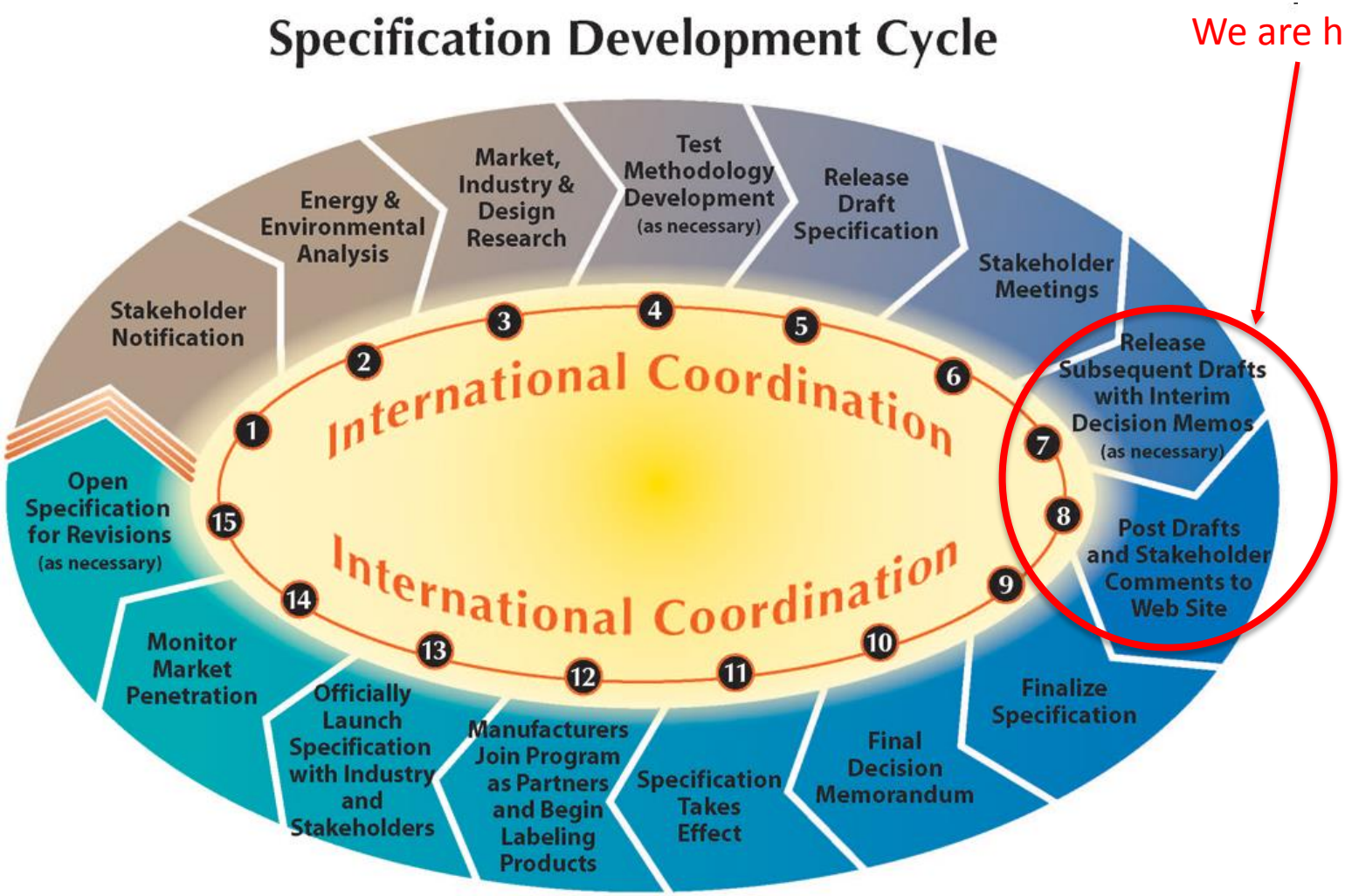
Doug Frazee
ICF International

Bruce Nordman
Lawrence Berkeley National Laboratory

Alan Meier
Lawrence Berkeley National Laboratory

Recap of certification program



Timeline to this point

Event	Date
Scoping Report Published	*September 2013*
EVSE Specification Development Launch and Draft 1 Test Method Published	*June 19, 2015*
Draft 2 Test Method Published	*October 6, 2015*
Draft 1 Specification and Draft 3 Test Method Published	*March 1, 2016*
Draft 2 Specification and Final Draft Test Method Published	*August 26, 2016*
Draft 2 Specification and Final Draft Test Method Webinar	*September 15, 2016*
Draft 2 Follow-up Memo Published	**October 28, 2016**
Draft 2 Follow-up Memo Webinar	**November 7, 2016**

Purpose of Memo

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1:00–1:10	Introductions and Specification Development Recap
1:10–1:20	**Purpose of Memo**
1:20–1:40	No Vehicle Mode
1:40–2:00	Multi-port Testing
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Purpose of Memo

- EPA released a Draft 2 Follow-up Memo on Friday, October 28th outlining three revisions to the specification and test method
  - No Vehicle Mode Criteria
  - Multi-Port Testing
  - Display Brightness Testing

- These have been incorporated into a Final Draft which will be distributed to stakeholders within the next month

- The memo explains the changes and reasons for the changes. The appendices of memo show how these changes will look when incorporated into the specification and test method.

No Vehicle Mode

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No Vehicle Mode

- EPA received feedback that:

1. The term ‘Off Mode’ was confusing to describe the state in which the EV is not present but the EVSE is connected to external power

2. There should be energy efficiency criteria for this mode because EVSE spend a significant amount of time in this condition

~~Off Mode~~: Condition during which the equipment is connected to external power and is only providing tertiary function(s). ~~Off Mode~~ is intended to be the lowest-power mode of the EVSE that can only be entered or exited through manual intervention.

Note: The vehicle-EVSE interface is in State A of SAE J1772, where the vehicle is not connected.
[3]

No Vehicle Mode Definition

- Stakeholders recommended that this mode be defined as 'No Vehicle Mode' to clarify that the EVSE is not physically connected to the vehicle.

- In the memo, EPA proposed replacing the term "Off Mode" with "No-Vehicle Mode", while keeping the same definition, which aligns with interface State A defined in SAE J1772

No Vehicle Mode: Condition during which the equipment is connected to external power, where the vehicle is not connected and is only providing tertiary function(s). No Vehicle Mode is intended to be the lowest-power mode of the EVSE that can only be entered or exited through manual intervention.

Note: The vehicle-EVSE interface is in State A of SAE J1772, where the vehicle is not connected.

No Vehicle Mode Criteria

- EPA reviewed the dataset and determined that No Vehicle Mode (or State A) power consumption is not always lower than that for Partial On and Idle Modes
- Based on this and stakeholder feedback, EPA proposed efficiency criteria in the Memo for No Vehicle Mode
- The criteria proposed is identical to the base criteria and allowances for Partial On and Idle Mode that were presented in Draft 2 (except for relay power)
- The dataset indicated that the addition of these criteria will continue to capture top-performing EVSE models.

No Vehicle Mode Criteria

3.2 No Vehicle Mode Requirements

Note: These requirements refer to the SAE J1772 State A.

3.2.1 Measured No Vehicle Mode power ($P_{NO\_VEHICLE}$) shall be less than or equal to the Maximum No Vehicle Mode Power Requirement ($P_{NO\_VEHICLE\_MAX}$), as calculated per Equation 1.

i. For products with ABC enabled by default, the average No Vehicle Mode power in high and low illuminance conditions shall be used in place of $P_{NO\_VEHICLE}$, above.

Equation 1: Calculation of Maximum Partial On Mode Power Requirement

$$P_{NO\_VEHICLE\_MAX} = P_{NO\_VEHICLE\_BASE} + \sum_{i=1}^{n} P_{WAKE\_i}$$

Where:

- $P_{NO\_VEHICLE\_MAX}$ *is the Maximum No Vehicle Mode Power Requirement;*
- $P_{NO\_VEHICLE\_BASE}$ *is the base No Vehicle Mode power allowance for all products, as specified in Table 2;*
- P_{WAKE_i} *is the No Vehicle Mode power allowance for each active, in-use networking/control protocol that provides remote hosts with the capability to wake the product from No Vehicle Mode, as specified in Table 2, for a total of n such allowances.*

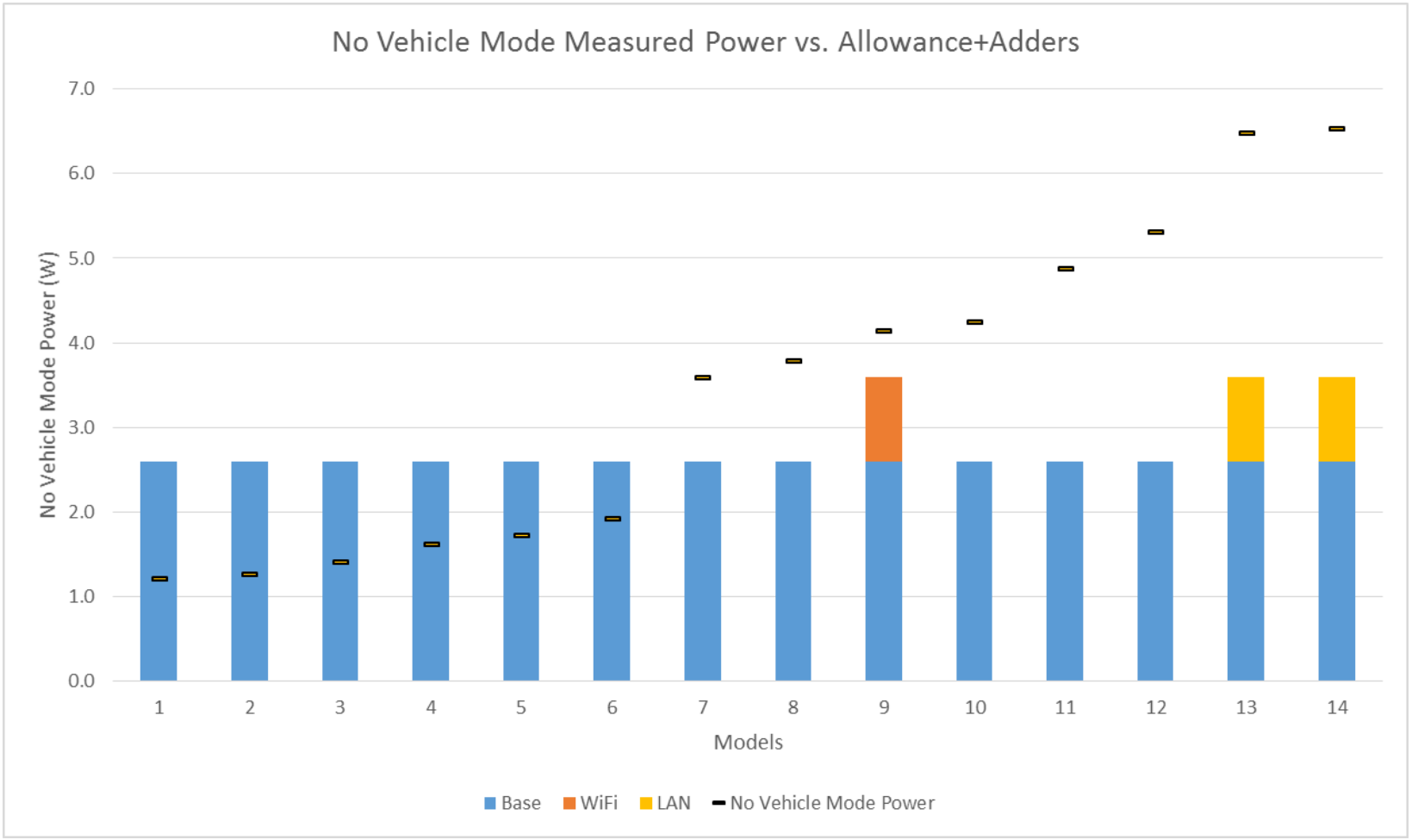
No Vehicle Mode Criteria

- Base allowance and allowances for networking connectivity and in-use display are identical to those presented in Draft 2 for Partial On and Idle Modes

Table 2: No Vehicle Mode Power Allowances

Product Function	No Vehicle Mode Power Allowance (watts)
Base Allowance for All Products ($P_{NO\_VEHICLE\_BASE}$)	2.6
In-use Wi-Fi or Ethernet Interface with Wake Capability (P_{WAKE_i})	1.0
In-use Cellular with Wake Capability (P_{WAKE_i})	2.0
Other In-use LAN (Local Area Network) Interface with Wake Capability (P_{WAKE_i})	1.0
In-use Display (P_{WAKE_i})	$(4.0 \times 10^{-5} \times \ell \times A) + 119 \times \tanh(0.0008 \times [A - 200.0] + 0.11) + 6.0$ *Where:* • *A* is the Screen Area in square inches; • ℓ is the Maximum Measured Luminance of the Display in candelas per square meter, as measured in Section 4) C) of the ENERGY STAR Test Method for Determining Electric Vehicle Supply Equipment Energy; • *tanh* is the hyperbolic tangent function; and The result shall be rounded to the nearest tenth of a watt for reporting.

No Vehicle Mode Analysis



Multi-port Testing

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Multi-port Testing

- To account for testing commercial EVSE with multiple ports, EPA proposed the following modifications to the modal testing for models with multiple-ports:
  1. All Modes: All inputs shorted together; requires only one power supply and one power meter
  2. No Vehicle Mode: All outputs disconnected. Input power measured once and divided by the number of outputs to make the results comparable to those of a single-output EVSE

D) Measure and record UUT input power.

1) For single-output EVSEs: $P = I_{diff1} \times V_{in}$

2) For multiple-output EVSEs: $P = \frac{I_{diff1} \times V_{in}}{n}$, where *n* is the number of outputs.

E) Power shall be measured according to IEC 62301 Ed 2.0-2011; with the additional guidance in Section 4 of this document.

Multi-port Testing for Partial On Mode

3. Partial On Mode: All outputs connected to VEMs. Input power measured once and divided by the number of outputs

2) State B: Plug in the UUT output connection to J1772 vehicle inlet on the VEM. Connect all output cords to a corresponding number of VEMs. Verify S1 is open. Wait 2 minutes and then measure and record UUT input power:

   a) For single-output EVSEs: $P = I_{diff1} \times V_{in}$

   b) For multiple-output EVSEs: $P = \frac{I_{diff1} \times V_{in}}{n}$, where n is the number of outputs.

E) Power shall be measured according to IEC 62301 Ed 2.0-2011; with the additional guidance in Section 4 of this document.

Multi-port Testing for Idle Mode

4. On Mode, Idle Mode:
   - All outputs connected to VEMs and switched to State C simultaneously.
   - The input power is measured once for all outputs and the results are divided by the number of outputs. Any overhead power shared between the outputs will be divided by the number of outputs, so the resultant power draw may be lower than when not all the outputs are used simultaneously.

1) State C[2]: Plug in all UUT output connection(s) to J1772 vehicle inlet on a corresponding number of VEM(s). Switch all VEMs to State C by closing switch S1. Measure and record:

   a) For single-output EVSEs:

      i. UUT input power; $P = I_{diff1} \times V_{in}$

      ii. UUT output RMS current I_{out2} (to verify zero output current).

   b) For multiple-output EVSEs,

      i. UUT input power; $P = \frac{I_{diff1} \times V_{in}}{n}$, where *n* is the number of outputs

      ii. UUT output RMS current I_{out2} (to verify zero output current)

Multi-port Testing for Operation Mode

5. On Mode, Operation Mode:
   - All outputs connected to VEMs.
   - Outputs are switched to State C sequentially.
   - The input power is measured for each output and the results added together.

Note: To limit double-counting power draw common to all outputs, the previously measured Partial On Mode power shall be multiplied by (n-1), where n is the number of outputs, and subtracted from the above result. The available current shall be the maximum current that can be provided by the unit when a single output is being used. The unit shall be configured to provide this maximum current during initial set-up.

5.4 Operation Mode (State C) Testing[3]

A) …

B) …

C) Determine the UUT available current.

1) Conduct the UUT preparation procedure in Section 5.1.

2) For multiple-output EVSEs, the available current shall be the maximum current that can be provided by the unit when a single output is being used (i.e., no derating/current sharing). The unit shall be configured to provide this maximum current.

3) State C: Plug in the UUT output connection to J1772 vehicle inlet on VEM. Connect all output cords to a corresponding number of VEMs. If the UUT has multiple output cords, the outputs will be switched to State C sequentially. Close S1 in the VEM; for a multiple-output EVSE, switch that VEM to State C by closing switch S1, while keeping the remainder in State B (S1 open).

D) Warm-up …

E) Measurement

1) ...

2) The following measurements and calculated values shall be recorded after the 5-minute stabilization period:

…

i) For multiple-output EVSEs, Total Power Loss calculated as follows:

i. Measure power loss for each output (sum of the power loss measurements 5.5.E.2.e, f, and g), where i is the number of the output under test:

$$P_{loss_i} = I_{diff1_i} \times V_{in} + I_{in1} \times V_{diff1_i} - I_{out2_i} \times V_{diff2_i}$$

ii. Switch the VEM under test back to State B by closing S1.

iii. Connect the output power meter to the next VEM. And close S1 on the VEM putting it in State C.

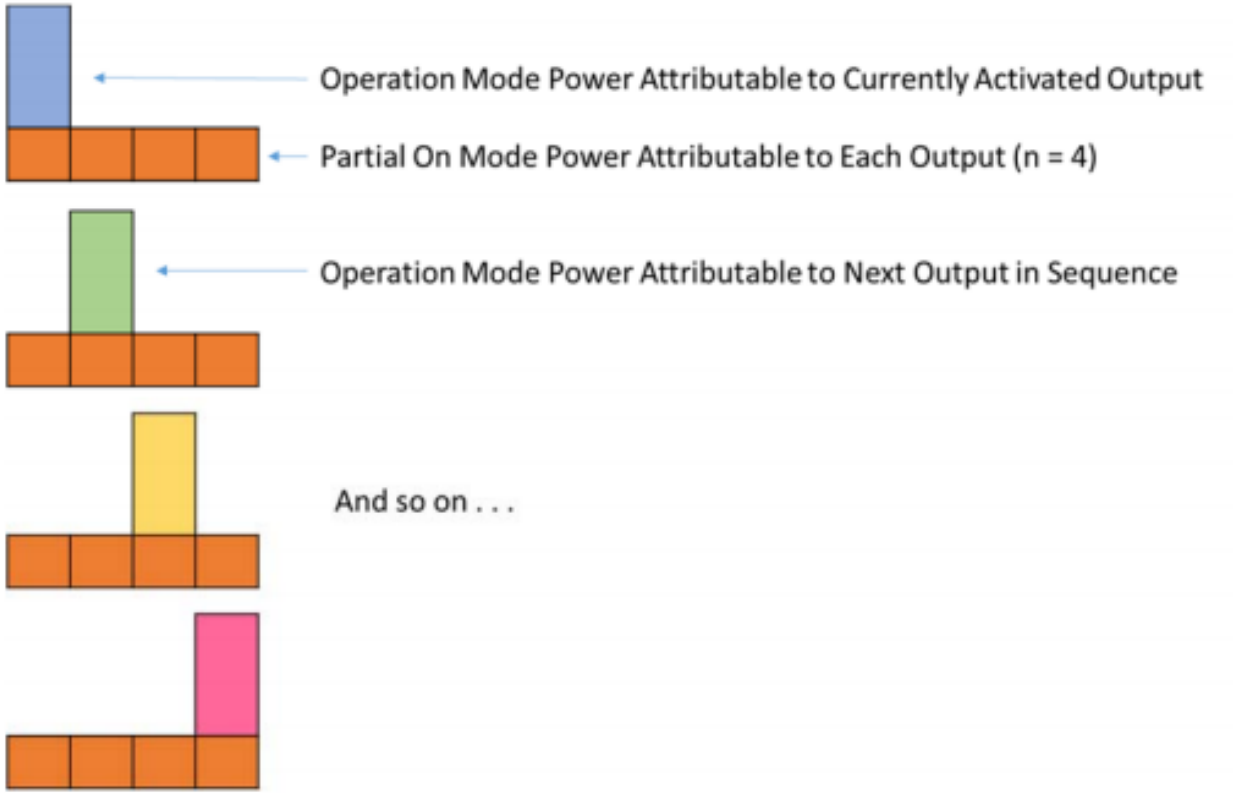
iv. Repeat steps i through iii, above, until the power loss from each output has been measured.

v. Sum the power measurements for each output and divide by the number of outputs, *n*.

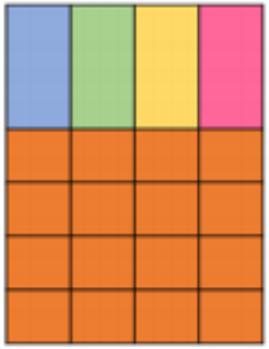
vi. After conducting the Partial On test, above, multiply the measured Partial On power by *n*-1 and subtract from the resulting power calculated above as shown below:

$$P_{loss} = \frac{\sum_{i=1}^{n} P_{loss_i}}{n} - (I_{diff1} \times V_{in})(n-1)$$

Multi-port Testing – Illustration for Operation Mode



Multi-port Testing – Illustration for Operation Mode



Add the n = 4 Operation Mode tests

Subtract (n-1) times Partial-on Mode power to limit double-counting overhead

Divide by the number of outputs; result is comparable to a single-output test

Multi-port Testing Approach

- The results of all tests will be divided by the number of outputs so that they will be comparable to single-output EVSE, allowing for the same requirements to be applicable
- This proposal will incentivize the use of shared functionality across outputs of a multiple-output EVSE
- In addition, this approach seeks to minimize testing burden by requiring no additional power meters compared to the single-output test, but rather just one or more VEMs, which are lower cost

Display Brightness

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3:20–4:00	Timeline and Open Discussion

Display Brightness

- With the Draft 2 Follow-up Memo, EPA has proposed additional guidance on setting up and measuring display brightness for models claiming the display allowance.
- These changes can be described as follows:

1. Clarify that models that cannot display the IEC three-bar pattern have their luminance (screen brightness) tested using the default image that appears as-shipped.

Note: In contrast to standalone Displays and Televisions; EPA expects that not all EVSEs will be able to display standard test patterns.

Display Brightness – Luminance Testing

C) Luminance Testing for Products with a Display: Luminance testing shall be performed for all products at 100% of screen brightness possible as measured in Section 6.2 of the ENERGY STAR Test Method for Determining Display Energy (Rev. Sep-2015).

1) If the UUT cannot display the three-bar pattern specified in IEC 62087:2011, Section 11.5.5, the UUT shall be tested using the default image that appears as-shipped.

G) Luminance Meters for Products with a Display:

1) Luminance measurement shall be performed using either
   a) A contact meter; or
   b) A non-contact meter.
2) All luminance and illuminance meters shall be accurate to ± 2% (± 2 digits) of the digitally displayed value.
3) Non-contact luminance meters shall have an acceptance angle of 3 degrees or less.

The overall accuracy of a meter is found by taking (±) the absolute sum of 2% of the measurement and a 2 digit tolerance of the displayed value least significant digit. For example, if an illuminance meter displays "200.0" when measuring a screen brightness of 200 cd/m^2, 2% of 200 cd/m^2 is 4.0 cd/m^2. The least significant digit is 0.1 cd/m^2. "Two digits" implies 0.2 cd/m^2. Thus, the displayed value would be 200 ± 4.2 cd/m^2 (4 cd/m^2 + 0.2 cd/m^2).The accuracy is specific to the illuminance meter and shall not be considered as tolerance during actual light measurements.

Display Brightness – Products without ABC

2. Clarify that models that ship without ABC enabled by default be adjusted to 65% of maximum brightness during the test (which is the brightness that was used when developing the allowance) to within the tolerances of the adjustments available on the EVSE e.g., if the EVSE provides settings resulting in 50% and 75% of maximum brightness, choose the 75% setting).

D) Display Brightness for Products without Automatic Brightness Control (ABC) enabled as-shipped: If the UUT has a display the brightness of which is controllable by the user and does not have ABC enabled as-shipped:

1) The display shall be adjusted to 65% of the maximum brightness available on the display during all testing, or a setting available that is closest to 65%, to within the tolerance of the adjustments available on the EVSE (e.g., if the EVSE provides settings resulting in 50% and 75% of maximum brightness, choose the 75% setting).
2) Following this initial set-up, power testing shall be conducted with the default image that appears as-shipped.

Display Brightness

3. Clarify that power testing be conducted with the default image that appears as-shipped.

EPA welcomes feedback on whether this will provide enough repeatability or whether a standards test clip or test pattern should be specified for those models that can support it in order to improve representativeness.

Connected Functionality

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Connected Functionality

- At some point in the automotive transition from fossil fuel to electricity, mass adoption of grid interactive EVs and EVSE, will be a prerequisite to enable a robust, stable and reliable electric grid.
- However, current EV market penetration is insufficient to enable economically viable DR programs. As such, EVSE manufacturers may not currently be investing in development of grid-interactive functionality.
- In draft 2, proposed optional Connected Functionality criteria recognizes products that:
    - include a communications link that can support DR via open communication standards,
    - enables 3rd party open access,
    - support consumer DR event override-ability, and
    - includes a summary description of DR capabilities

Connected Functionality

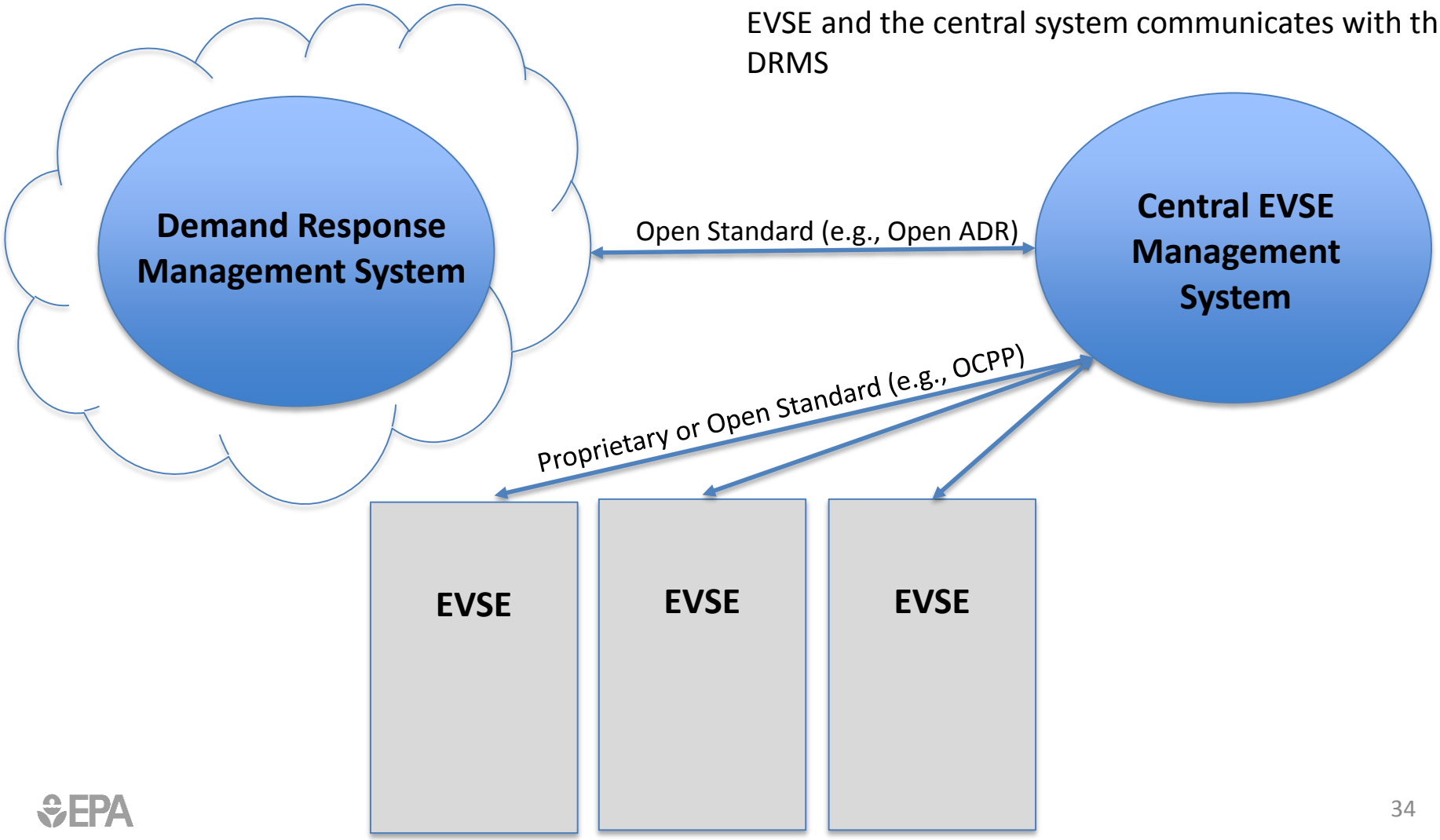
- Under this proposal, EVSE *need not ship with DR capability* so long as it is capable of supporting DR; for example, thru integration with a 3rd party service or via a software/firmware revision.
- EPA believes these criteria can help to stimulate the market for connected EVSE that provides connected features for consumers and commercial operators today and can support DR in the future.

EPA heard feedback from a stakeholder on including more prescriptive criteria for two-way communication capability and control functions that support DR.

- In the Final Draft, EPA is strongly considering including broad recommendations (not requirements) for DR capable EVSE to employ certain functionalities described by this stakeholder (e.g., bi-directional communications, direct load control, etc.) that can support one or more of the following scenarios:

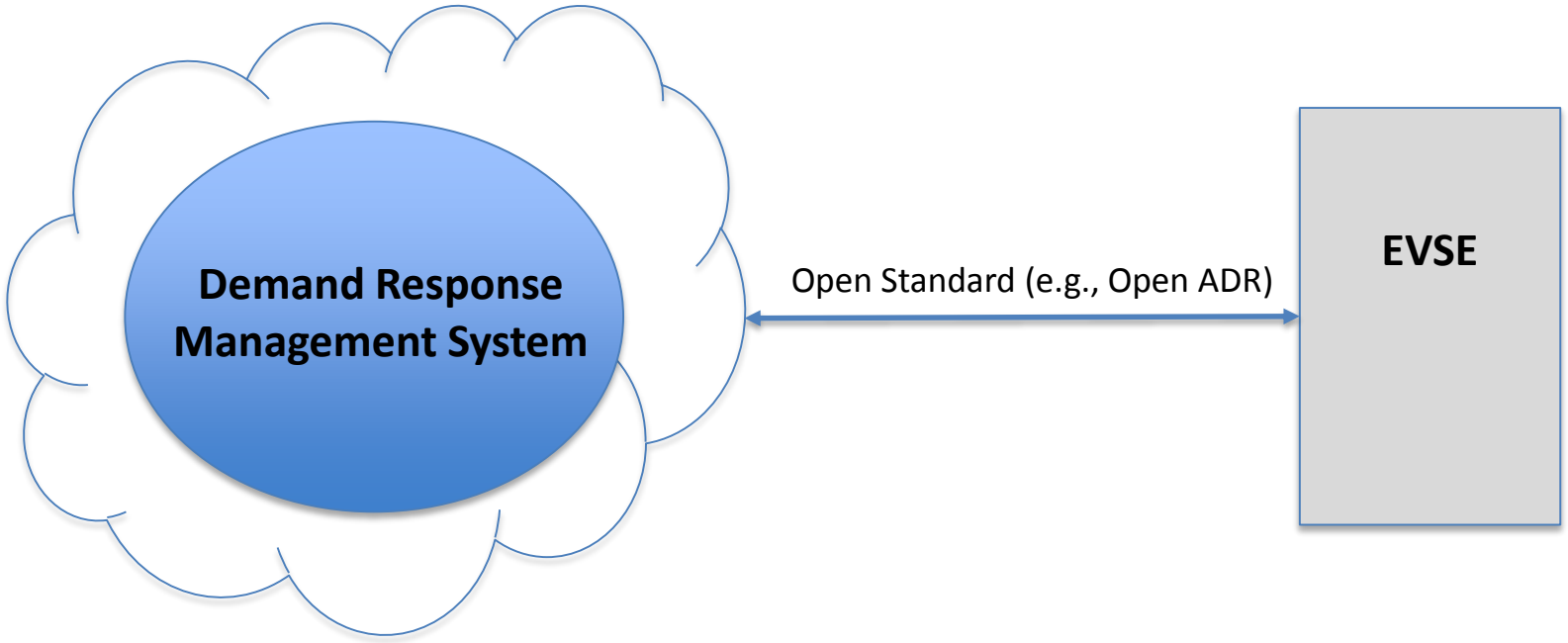
Connected Functionality

Architecture #1 (e.g., multi-family dwelling, workplace, etc.): A central management system manages multiple EVSE and the central system communicates with the DRMS



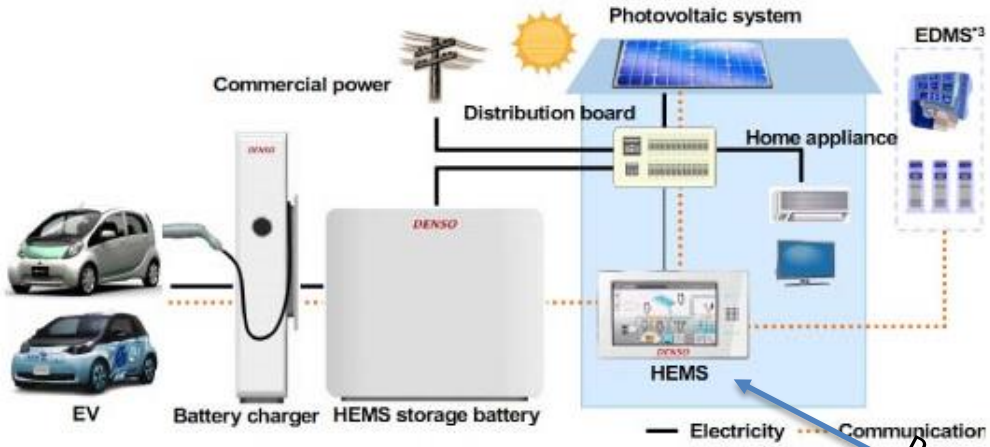
Connected Functionality

Architecture #2: The EVSE communicates directly with the DRMS (direct load management)

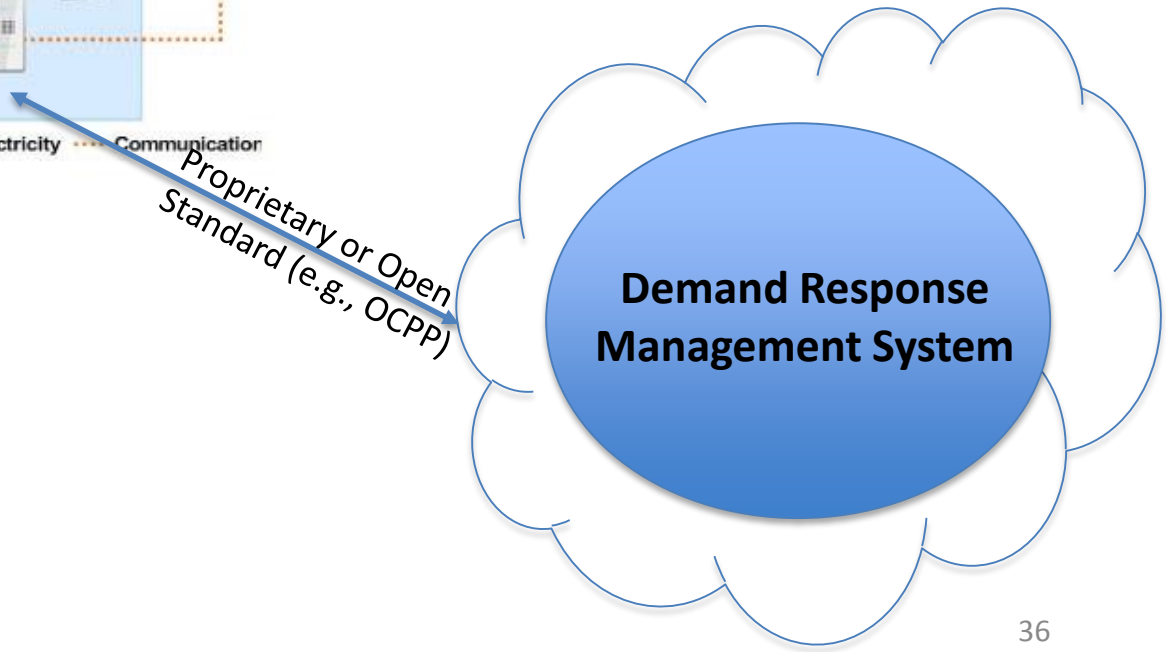


Connected Functionality

Architecture #3: Multiple DERs, including EVSE are managed by a HEMS which includes DR capability and can send/receive signals from a DRMS.



Source: carmag.co.za/technical_post/smart-ev-home-grid/



Connected Functionality

- To inform these recommendations, EPA encourages stakeholders to provide feedback on the current state of Demand Responsive EVs and EVSE
  - What proportion do connected products have of the current EVSE market?
  - What types of consumers are purchasing connected EVSE today? e.g. residential, municipal, commercial operators
  - What are the key use cases for connected EVSE?
  - What communications protocols/standards are manufacturers using at this time? Is OCPP being used broadly?
  - What are utilities doing today? e.g. DR pilot programs/demonstration projects that include EVs
  - Where is the market headed? What should EPA consider when developing recommendations for DR capable EVSE?

Connected Functionality

- The Electric Power Research Institute has informed EPA of a project that includes a publicly available Demand Response-Ready Electric Vehicle Service Equipment Specification
- Are there other similar and/or relevant efforts to develop Demand Responsive EV and EVSE? E.g. common command sets, communication protocols, open-standards, etc.

Other Feedback

Two stakeholders recommended that ENERGY STAR exclude Level 1 EVSE from the scope of the Specification because Level 2 EVSE:

1. Provides faster charge times, is inherently more energy-efficient, and as a result represents a more flexible load that is more likely to be incorporated into DR systems.
2. Are likely installed by professional electricians, which helps to avoid faults
3. Are necessary for large battery BEVs
4. More efficiently satisfy overhead loads that are present during and after charging

Marketing Efforts

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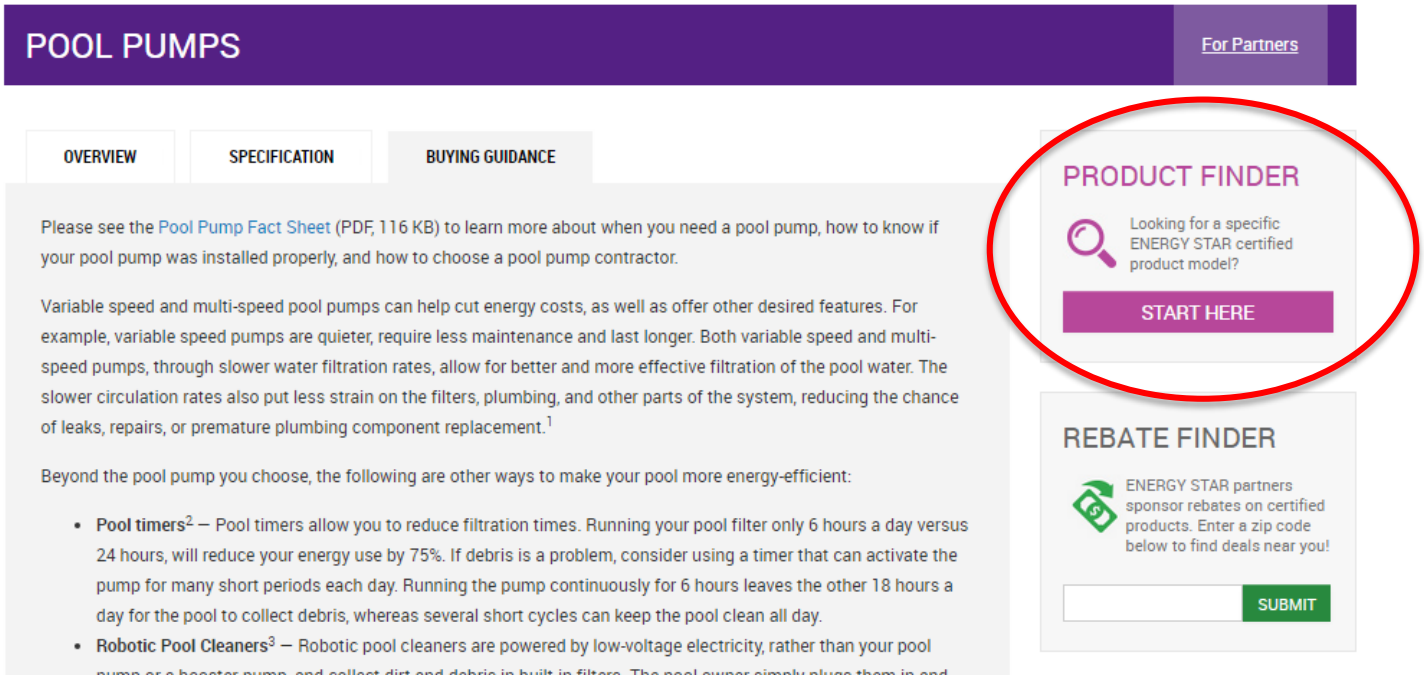
ENERGY STAR Marketing

- Upon finalization of a new specification, EPA determines various strategies for educating consumers and promoting those products that are ENERGY STAR certified, some of these strategies include:
  - Developing a consumer page that offers an overview, details of the specification, and buying guidance for purchasers



ENERGY STAR Marketing

TOOL	EXAMPLE
ENERGY STAR Certification Mark What is ENERGY STAR®? ENERGY STAR qualified products and practices help you save money and reduce greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and U.S. Department of Energy. ENERGY STAR Certification Mark after mouse roll-over	 Before mouse roll-over  After mouse roll-over

- Manufacturers can use the ENERGY STAR Mark and ENERGY STAR Graphics (according to the guidelines) along with other web-based tools to promote their products as ENERGY STAR certified

ENERGY STAR Marketing

- Developing tools, publications, and promotional materials that will showcase the benefits of choosing an ENERGY STAR product. Manufacturers and retailers are encouraged to use these materials to market ENERGY STAR products

It's time to Flip Your Fridge! Replacing an old refrigerator with a new ENERGY STAR certified model will save energy, save money, and help protect the climate. Save $260 in energy costs over the next five years. Save even more with a utility rebate. Double the environmental benefit by properly recycling your old fridge.

Visit energystar.gov/flipyourfridge for info on offers near you.

ENERGY STAR Marketing

- Holding events, such as the Partner of the Year Awards, to honor organizations that have made outstanding contributions to protecting the environment through energy efficiency.
- Holding promotions, such as the ENERGY STAR Day, where stakeholders have the chance to participate in ongoing ENERGY STAR marketing efforts using tools provided

Digital Media Kit: ENERGY STAR Day 2016

Participate in EPA's ENERGY STAR Day promotion by leveraging your digital media assets: Web site, social media - Facebook, Twitter, e-blasts, blogs, etc. Here's how:

Online:

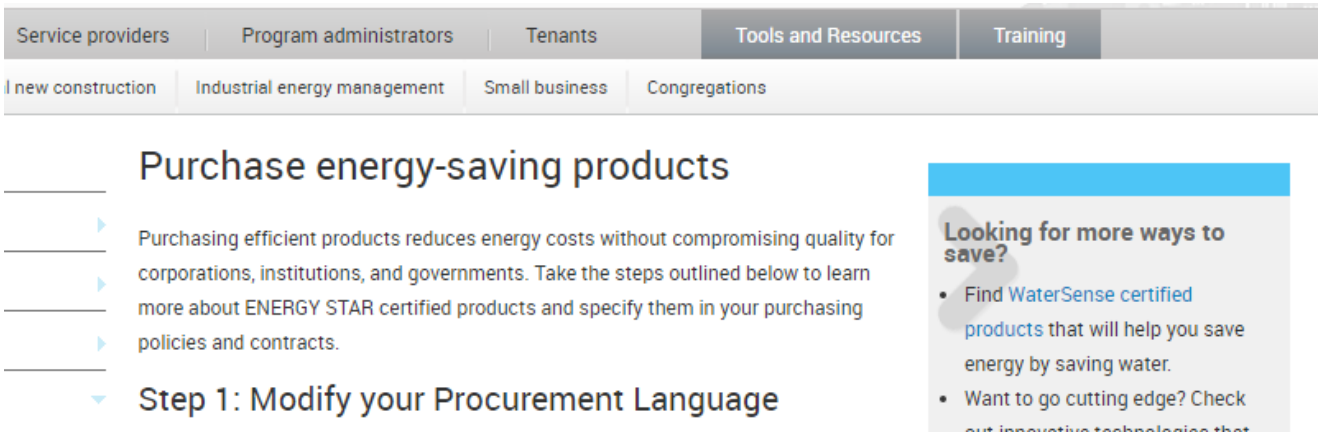
Use easy to integrate ENERGY STAR Day Web Buttons and Widgets to drive traffic to the ENERGY STAR Day educational content and your program offerings. These web buttons/widgets are small applications with a link to the ENERGY STAR Day promotional page. If you are interested in having the promotional page open up a new tab or window so the user can check out the content and then return to your organization's web page, see below for directions.

ENERGY STAR EVSE Marketing Efforts

- Goal: Enable penetration of ENERGY STAR labeled EVSE in the market
- Outreach to key stakeholders and purchasers; for EVSE this includes utilities, state/local governments, and vehicle manufacturers
- Identify and target EVSE purchasers with progressive EV-promotion goals

ENERGY STAR EVSE Marketing Efforts

- Work with these organizations to further promote products that are ENERGY STAR certified (e.g., to include in utility or state/local government purchasing programs)
  - Work with procurement departments of major purchasers to specify and promote ENERGY STAR EVSE
  - Provide procurement language to outline the benefits of purchasing an ENERGY STAR certified EVSE



ENERGY STAR EVSE Marketing Efforts

- EPA is interested in determining a venue for a 'launch' for marketing efforts, such as an industry event – this normally takes place after finalization of specification
- For more information on marketing tools and resources for ENERGY STAR partners, visit https://www.energystar.gov/products/marketing_materials

Stakeholders are encouraged to submit feedback on potential venues for a new program launch or for ideas on promising approaches for program marketing for EVSE. Marketing staff can contact Peter Banwell at Banwell.Peter@epa.gov or Emmy Feldman at Emmy.Feldman@icf.com to share thoughts or with any questions.

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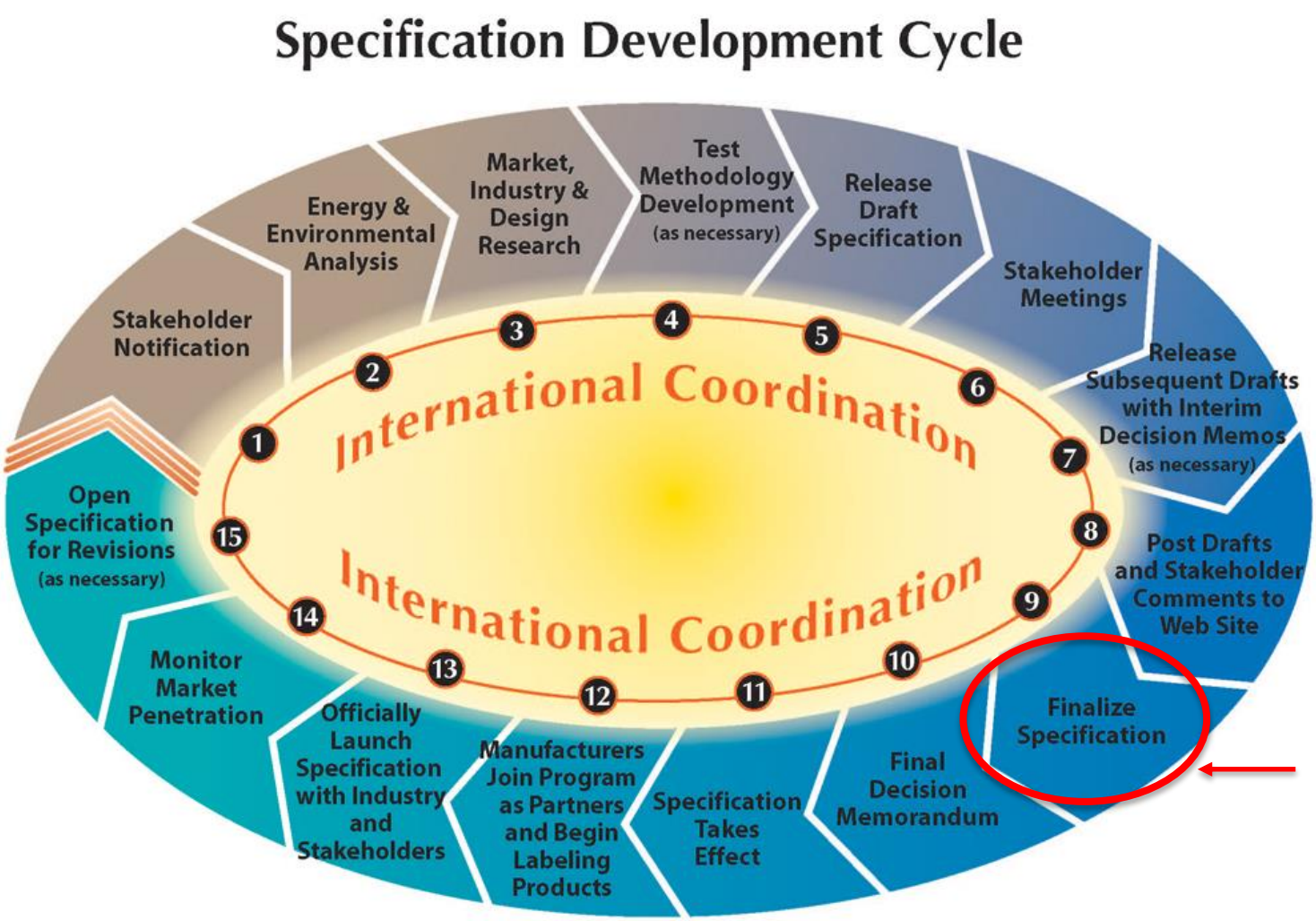
3:00–3:20	Marketing Efforts
3:20–4:00	**Timeline and Open Discussion**

Next Steps: After Data Assembly and Stakeholder feedback



We are headed here

Next Steps

Event	Date
Scoping Report Published	*September 2013*
EVSE Specification Development Launch and Draft 1 Test Method Published	*June 19, 2015*
Draft 2 Test Method Published	*October 6, 2015*
Draft 1 Specification and Draft 3 Test Method Published	*March 1, 2016*
Draft 2 Specification and Final Draft Test Method Published	*August 26, 2016*
Post-Draft 2 Memo Published	*October 28, 2016*
Post-Draft 2 Memo Webinar	*November 7, 2016*
Post-Draft 2 Memo Comments Due	**November 16, 2016**
Final Draft Specification Release	**December 2016**
Final Specification Release	**Before end of year**

Comments

- Again, comments and data are due on **November 16, 2016.**
- Please send all comments to:

EVSE@energystar.gov

- Unless marked as confidential, all comments will be posted to the EVSE product development page at www.energystar.gov/products/spec/electric_vehicle_supply_equipment_pd
- Accessible through www.energystar.gov/NewSpecs and clicking on "Version 1.0 is in development" under "Electric Vehicle Supply Equipment"

Thank you!

To be added to EPA's stakeholder listserve
to receive specification updates, please email:

EVSE@energystar.gov.

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www.energystar.gov/productdevelopment