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Tesla Comments - 2019 ZNE Residential Standards Apr 20 Workshop

Additional submitted attachment is included below.

TESLA

May 5, 2017

Commissioner Andrew McAllister and Energy Commission Staff
California Energy Commission
Dockets Office
Re: Docket No. 17-BSTD-01
1516 Ninth Street
Sacramento, CA 95814-55 12

RE: April 20, 2017 Staff Workshop 2019 Zero Net Energy Residential Standards

Dear Commissioner McAllister and Energy Commission Staff:

We are writing on behalf of Tesla, which acquired SolarCity, to share our comments in response to the 2019 Zero Net Energy (ZNE) residential standards workshop that took place on April 20, 2017.[1] Tesla appreciates the California Energy Commission (CEC) staff's early engagement of stakeholders in the process of developing the 2019 Title 24 building standards. Upon reviewing the information provided during the April 20, 2017 workshop, Tesla focuses its comments below on addressing the following items:

- **Characterization of Solar Photovoltaics (PV)** – Recommendation to clarify statements regarding the duck curve.
- **Model Solar PV Ordinance –** Recommendation to move forward with the development of a model solar PV ordinance in an expeditious manner.
- **Solar PV Plus Storage Compliance Mechanism** – Recommendation to incorporate a credit mechanism for solar plus storage within the Energy Design Rating (EDR) score and clarify capabilities of behind the meter storage systems.
- **Model Water Heating Ordinance** – Recommendation to support a framework for developing a model ordinance for grid enabled electric water heating paired with renewables and re-examine the load flexibility valuation.
- **Model Electric Vehicle (EV) Ready Ordinance** – Recommendation to develop additional model ordinances for localities beyond solar PV such as for EV readiness.

An underlying theme throughout our comments below is the need to ensure that California achieves its ZNE and greenhouse gas (GHG) emissions targets and at the same time properly values the grid integration benefits various technologies such as storage can provide without prematurely determining winners and losers. To that extent, we also encourage the CEC to evaluate the opportunity for an EV charging tradeoff within the performance based method for moving toward meeting the ZNE standard in 2020. At this point, we have not developed a proposal for how to best incorporate EVs but welcome the opportunity to further explore this concept and reserve the opportunity to submit future comments on this subject.

[1] SolarCity previously submitted comments on the 2019 Time Dependent Valuation (TDV) Update on June 3, 2016. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/16-BSTD-06/TN211717_20160603T134356_Damon_Franz_Comments_SolarCity_Comments__Updates_to_2019_TDV.pdf

Characterization of Solar Photovoltaics (PV)

In the presentation that CEC staff provided during the workshop, it is evident that solar PV will play a critical role in meeting California's 2020 ZNE goal. The analysis developed by Energy and Environmental Economics (E3) and CEC staff clearly demonstrates that solar meets the cost effectiveness standards under the current proposed 2019 methodology. We therefore support staff's recommendation to add a solar requirement under the 2019 prescriptive approach. While a separate EDR score for PV may at this point be the simplest method for complying with the performance based approach, we recommend adding additional flexibility for builders to achieve the total home EDR score by incorporating a solar plus storage tradeoff credit. This proposal is discussed further below.

Additionally, when referring to the increase in residential solar PV that could be deployed across the state under the proposed 2019 code, the need for grid harmonization is consistently stressed throughout the CEC staff's presentation. Specifically, the presentation states that the "electrification of homes, which results in a larger PV array, must be coupled with grid harmonization strategies to avoid aggravating the duck curve issues and to realize the expected environmental benefits."[2]

Although we do not dispute the need for grid harmonization strategies, Tesla notes that all new solar PV customers of the Investor-Owned Utilities (IOUs) in California are already required to adopt grid harmonization strategies in the form of Time-of-Use (TOU) rates, which will increasingly send price signals to those customers incentivizing them to shift load to times when PV production is greatest and avoid using energy during the evening ramp. These rates will further incent customers to adopt battery storage, programmable thermostats and other devices that can help with grid harmonization. Non-solar customers are not required to go on TOU rates. Therefore, requiring solar in the code update essentially requires occupants of new homes in California to be subject to economic signals reflecting grid harmonization needs.[3]

Furthermore, staff's presentation overlooks the fact that a significant part of the over-generation issue is caused by inflexible fossil and other thermal generators that continue to run even as renewables are being curtailed. The retirement of thousands of megawatts (MWs) of once-through-cooling units and the Diablo Canyon Nuclear Power Plant in the coming years should help alleviate this problem. Beyond retiring inflexible resources and replacing them with flexible ones, there are a significant number of additional grid harmonization strategies already under development at the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO), including the energy storage mandate, Integrated Resource Planning (IRP) process, flexible resource adequacy proceeding and demand response proceedings. All of these efforts are intended to allow the state to continue adding renewable generation to help meet the state's ambitious climate goals.

Finally, a bit of perspective is in order regarding the degree to which rooftop solar has contributed to the existing over-generation and duck curve issues, and how much rooftop solar is likely to contribute to these phenomena in the future. According to a recent consultant report, the duck curve thus far has been driven almost entirely by utility-scale solar, not distributed resources. Analyzing several years of CAISO data, the report from consultancy Scott Madden found that: "If the belly of the duck is formed by less visible distributed resources, one would see it manifested in both the system load and the net load. This is not the case in the California Duck Curve. Instead, we see a smooth system load and a concave net load, which is indicative of the influence of utility-scale solar rather than distributed generation."[4] This is not to say that rooftop solar customers should not do their part to help with grid harmonization – it is merely to point out the

[2] CEC staff presentation, April 20, 2017, Slide 5&8. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-BSTD-01/TN217286_20170424T162107_4202017_Staff_Workshop_Zero_Net_Energy_Strategy_Presentation.pdf
[3] Unless these customers are located in Publicly Owned Utilities' (POU) territories which may have different rate tariffs.
[4] "Revisiting the California Duck Curve An Exploration of Its Existence, Impact, and Migration Potential," by Scott Madden Management Consultants. October, 2016. http://www.scottmadden.com/wp-content/uploads/2016/10/Revisiting-the-Duck-Curve_Article.pdf

magnitude of rooftop solar deployed so far has not made a measurable contribution to the duck curve, and thus the future impacts of residential rooftop solar on grid issues are likely to be di minimis.

Model Solar PV Ordinance

Tesla supports the expeditious development of a model solar PV ordinance as we recognize the assistance it will provide to local cities in paving the path toward ZNE homes in 2020. By providing a model solar ordinance that meets cost effectiveness requirements and demonstrates a true reduction in energy consumption over that required by current 2016 Title 24 Standards, localities will save time and money when developing and enacting local reach codes. As discussed further below, we recommend releasing the solar PV ordinance first and then focusing on opportunities to develop additional model ordinances such as for water heating and EV readiness.

At this point, we do not suggest any specific technical modifications to incorporate within the proposed ordinance but reserve the opportunity to provide further input once other stakeholders' feedback has been incorporated. We would, however, point out that there may be rare situations where specific home architectural plan types may be positioned on lots in a manner that does not support the installation of parts or the entire solar system within the required orientation range. Those situations may then need to be deferred to section (D) "exceptions" as described in the model ordinance. [5]

Solar PV plus Energy Storage Compliance Mechanism

It is promising that throughout the workshop presentation CEC staff references the potential opportunities for energy storage as a part of local reach codes and the performance-based compliance mechanism. While we recognize that energy storage still needs to be properly evaluated to determine its potential value given current cost-effectiveness requirements, we are bullish on the opportunities for incorporating storage within the 2019 code update. Hence, we recommend that the CEC develop an EDR credit value for solar plus storage as well as stand-alone storage that applies to the overall EDR score.

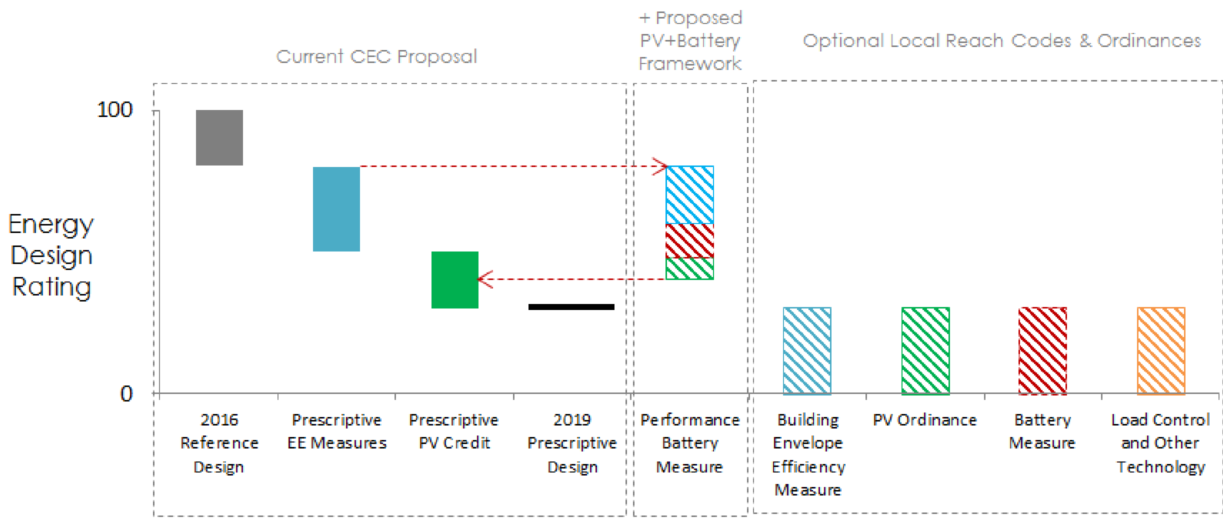
Storage allows energy from on-site renewables to be dispatched at times of greatest value for both the consumer and the grid. As a result, energy storage helps to flatten demand and supply peaks on the electric grid by balancing the difference in building load and on-site and utility scale renewable generation. Because electricity cost is correlated with emissions, using batteries to store energy when it is inexpensive for use when it is more costly can significantly reduce emissions. This value is amplified when pairing storage with solar systems. Energy storage coupled with PV is a fully dispatchable carbon free solution that will be critical to meeting the state's ZNE goals and overall GHG targets.[6] Solar PV paired with storage enables the generation and storage of renewable energy during the day, the discharge of the battery storage system when energy is more expensive during peak periods, and the ability to participate in utility grid services or potentially wholesale markets to maximize benefits for customers and the grid. Therefore, it is essential for the CEC to include storage under the performance based compliance mechanism for the 2019 update and not to solely defer to the reach codes.

<u>EDR Credit Value</u>

For the EDR tradeoff credit value for storage, we recommend analyzing two potential options: 1) solar plus storage and 2) stand-alone storage. Under the performance based approach, a builder should have the flexibility to include both solar and storage to meet grid efficiency and cost effectiveness standards and obtain an acceptable EDR target as determined by the CBECC-Res software. One mechanism to do this is to provide a tradeoff credit for solar plus storage above the 2016

[5] Proposed Model Solar Ordinance. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-BSTD-01/TN217291_20170425T110520_Draft_Model_Local_Solar_Ordinance_v5.pdf
[6] It is important to highlight that when couple with solar, storage can be controlled to charge 100% from the solar system.

standard energy efficiency requirements. The illustrative example below demonstrates how battery storage is used as a performance measure in conjunction with other efficiency measures to meet the efficiency portion of the EDR calculation while PV is added separately to reach the overall 2019 EDR value.



As outlined by CEC staff during the workshop, the proposed 2019 standards approach includes increasing efficiency requirements for high performance attics and walls.[7] Allowing solar and storage to offset the energy efficiency requirements under the performance based approach that goes beyond the 2016 standard efficiency requirements should not be counter to the loading order because it still enables the utilization of stringent energy efficiency measures first.

There is also a second scenario where standalone storage at a new home that is not paired with solar can provide value. For instance, during hours where utility scale renewables are generating, the battery can charge from the grid solar and during the later hours of the day when there is a need for additional generation, the battery can discharge to offset on-site load for the home and lower overall demand on the grid. In this scenario as well as the solar plus storage scenario, the battery is providing benefits and helping with grid harmonization efforts. Similar to other efficiency measures, the storage performs better on-peak and should be valued more highly than measures that do not given the TDV construct.

When determining the actual TDV and EDR value of battery storage, it is important to distinguish the solar PV kilowatt (kW) array size compared to the prescriptive design measures. In the standard design, PV is eligible for a certain amount of credit that we can assume is installed regardless of battery storage. When CEC staff discussed the opportunities for pairing solar with storage during the workshop, it was suggested that solar plus storage would reduce the prescriptive PV kW size requirements since solar plus storage is more effective at reducing TDV and thus can achieve the same PV credit with fewer kilowatts of solar. In this scenario, if a reduced amount of solar is in fact installed then the incremental value of the battery is the difference between the time in which the battery was charged by solar and when the battery was discharged during high TDV periods. Below is an illustrative example of the incremental value of storage on an average TDV basis in this scenario.

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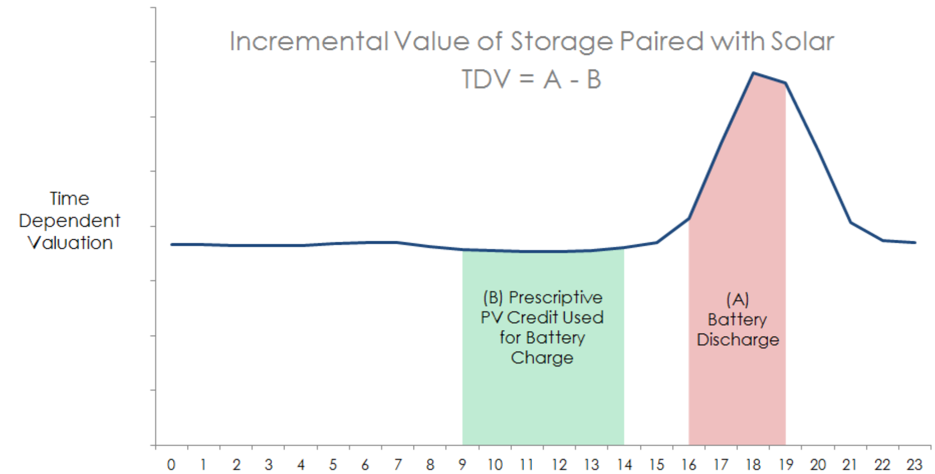
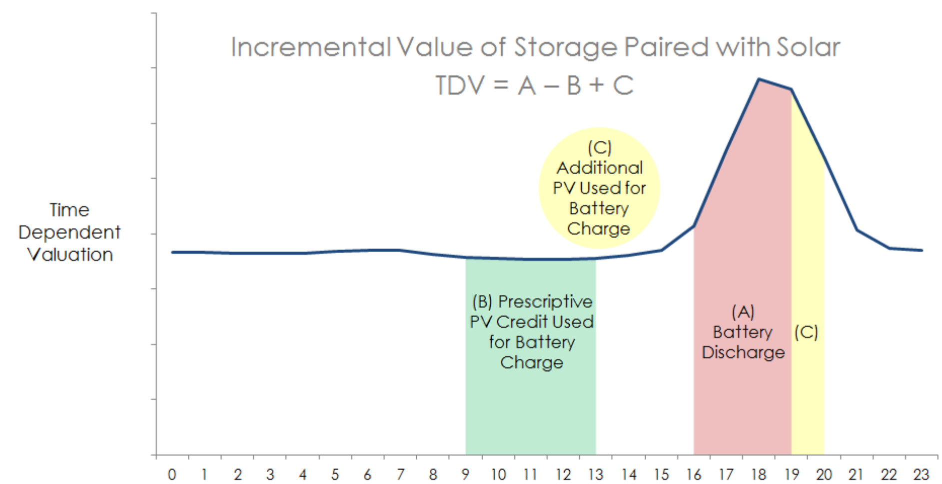
[7] CEC staff presentation, April 20, 2017, slide 15. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-BSTD-01/TN217286_20170424T162107_4202017_Staff_Workshop_Zero_Net_Energy_Strategy_Presentation.pdf



In another scenario a larger PV kW array size may be installed beyond the reduced PV with storage prescriptive amount in order to fully utilize the battery storage. In these cases, the additional PV installed with storage should be valued at an incrementally higher amount since the additional PV would not have otherwise been installed and is not eligible for the prescriptive PV credit. For example, if the standalone PV prescriptive size is 6 kW, the current approach proposed by the CEC staff may only provide a PV credit for 3 kW when combined with battery storage. Our proposal is that if 6 kW are in fact installed, the additional 3 kW beyond the prescriptive amount should be credited at the full TDV value under the performance battery measure. An illustrative example of this scenario is shown below.



In cases where the additional PV is providing TDV and EDR value, the total PV must not be sized to greater than the battery capacity. This scenario also assumes the battery to be 100% charged from on-site solar. This is supported by the fact that currently under interconnection requirements for net energy metering (NEM) solar plus storage customers, the customer has the option to attest that the battery is not charged using the interconnecting utilities' distribution system by checking a box in the interconnection agreement.[8] Additionally, the total PV generation should not exceed the total on-site electricity kWh consumption to avoid any conflict with customer net metering rules.

Operation of Storage Systems

During the workshop, CEC staff raised the question of how to ensure that storage systems are being optimized to provide grid integration benefits when deployed at a new home. One option that staff identified is utilizing utility controlled behind the meter (BTM) storage to ensure systems are dispatched to meet grid needs. While utility control represents one option, there are several reasons why this is not necessary to maximize storage capabilities under Title 24.

First, as previously discussed, when coupled with solar, customers utilizing storage systems will be on mandatory TOU rates, which are an effective price signal directing the charge and discharge of storage to meet grid needs.[9] To the extent that TOU periods match actual real-time grid needs, then TOU should provide an effective operational mechanism to ensure that batteries are operated in a way that maximizes their value and emissions reduction potential. If TOU periods differ from actual grid conditions, however, giving the utility control over the customer's battery operation is not the appropriate solution – primarily because the utility might operate the battery in manner that is at odds with how the customer might wish to operate it for TOU mitigation or backup power. A better solution would be for the utility to provide the customer with a dynamic rate that more closely aligns with real-time grid conditions. Alternatively, the CEC or the utility could also provide a control profile that better represents real time conditions and a third-party can co-optimize the customer preferences with grid harmonization.

Second, in order to provide grid integration benefits during high value demand hours, it does not have to be the utility that is dispatching the storage. Third-party providers can also help customers get the most value from their storage systems and facilitate participation in wholesale markets by providing distributed energy resources (DER) aggregation services. Those aggregation services could include not just batteries, but also smart thermostats, water heaters and other appliances. Such an aggregator might be better suited than the utility to manage customer preferences for comfort and other needs. Finally, the argument that the utility must control the battery in order for it to have the greatest benefit is basically undermining TDV values, which should also incentivize batteries to operate during times of most value to the grid.

This is not to say that there is no role for utility control and management of batteries on the distribution grid. In all likelihood, however, it would make more sense for the utility to own and control larger batteries that serve multiple buildings on a distribution circuit. Such an arrangement might make sense in new housing development where builders choose not to provide batteries, or where distribution-located batteries would be particularly valuable – for example, in transmission-constrained areas. Having the utility control a central battery located on its distribution grid, rather than individual batteries behind customer meters would avoid potential conflicts between utility uses and customer preferences, and could potentially simplify operation and control.

In previous comments, we also noted that a performance verification mechanism for new technologies such as storage and water heating may be necessary to maximize grid integration benefits.[10]A number of options should be explored to ensure that the TDV values applied in the design phase accurately represent how the systems perform after installation in response to price signals or other controls. Examples of performance verification mechanisms include expanding TOU requirements to publicly owned utilities (POUs) or testing software used for control of technologies against an agreed upon standard. While these are two potential solutions, there are likely several other options that should be evaluated.

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[9] PG&E Interconnection Agreement, p. 46. Available at: https://www.pge.com/tariffs/tm2/pdf/ELEC_4889-E.pdf.
[9] Under the NEM successor tariff (NEM 2.0), all new solar customers in investor owned utilities (IOUs) territories are placed on mandatory TOU.
[10] SolarCity previously submitted comments on the 2019 TDV Update on June 3, 2016. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/16-BSTD-06/TN211717_20160603T134356_Damon_Franz_Comments_SolarCity_Comments__Updates_to_2019_TDV.pdf

Model Electric Water Heating Ordinance

In general, Tesla has been supportive of incentivizing fuel switching opportunities in order to move toward building decarbonization, including electric water heating.[11] As part of the 2019 standards update, the Natural Resources Defense Council (NRDC) is advocating for expanding upon the model solar ordinance proposed by the CEC to develop a model ordinance for renewable water heating. When solar PV systems are combined with smart load control such as electric water heaters, the water heaters are not consuming electricity during the hours that the current code assumes as outlined by the CEC hourly water heating schedules listed in the Alternate Compliance Mechanism (ACM) reference manual. Instead, water is heated during the day using solar energy and stored for later use. In this example, the current TDV methodology is applying peak TDV values to electric water heating consumption even though water heating would only occur during the day and be heated using solar energy. In order to remedy this issue, we support the CEC utilizing the framework outlined by NRDC for developing a renewable water heating ordinance.

While we support NRDC's framework, we also recommend that the CEC evaluate the potential for grid interactive electric resistance water heaters (ERWHs) paired with PV.[12] DNV GL recently conducted an economic assessment of various efficient gas and electric water heater technologies and found that "electric water heaters with grid interaction have the potential to be a cost-effective resource based on theoretical scenarios (See Figure 1-1 from report)."[13] The report is still in draft form and recognizes that additional assessments need to be done but presents a compelling case for grid interactive water heaters, the impacts of which could be even more beneficial when paired with PV. Lastly, while NRDC provides a preliminary cost effectiveness analysis for heat pump water heaters (HPWH), there is little analysis provided for the solar thermal water heating option. In addition to evaluating grid interactive electric resistance water heaters, we recommend conducting further analysis for the solar thermal option.

Model Electric Vehicle (EV) Ready Ordinance

Given the need for the widespread deployment of EV charging infrastructure across California to meet the state's GHG emissions and Zero Emissions Vehicles (ZEV) goals and the role EVs can play in meeting the ZNE goals by 2020, we recommend the development of a model EV ready ordinance. Although requirements for EV charging readiness are largely addressed as part 11 of Title 24, the California (CAL) Green Code, we raise the concept of a model EV ready ordinance in the context of the broader Title 24 residential standards development for the 2019 code cycle.[14]

Access to Level 2 charging in multifamily dwellings and workplaces is critical to realizing large-scale deployment of EVs. A Plug in Electric Vehicle (PEV) cost-effectiveness study for multifamily and nonresidential projects in July 2016 found significant cost savings for deploying PEV charging infrastructure during initial construction versus during retrofit.[15]

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[11] SolarCity comments to ARB, December 16, 2016. Available at: https://www.arb.ca.gov/lists/com-attach/118-sp2030disc-dec16-ws-UyBRNFUgUnhRCFc0.pdf; Petition for Modification, CPUC, February 28,2017, Available at: http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M179/K248/179248896.PDF

[12] While overall equipment efficiency is important, ERWHs typically have an EF of 0.90 or greater, it is important to consider the fast response load flexibility of ERWHs which enhances their ability to self-consume on-site renewables as well as respond to real-time grid signals.

[13] Water Heater Technology Economic Assessment: Draft Report, CPUC, March 2017, p.1. Available at: https://pda.energydataweb.com/api/view/1832/Water%20Heat%20Technology%20Economic%20Assessment%20_DraftReport_v3%20clean.pdf

[14] https://codes.iccsafe.org/public/document/details/toc/657

[15] Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report developed by Energy Solutions, July 20, 2016. Available at: http://fremontcityca.iqm2.com/Citizens/Detail_LegiFile.aspx?Frame=&MeetingID=1472&MediaPosition=&ID=2835&CssClass=

Given such findings, several cities including Fremont, Oakland, and San Francisco have started the path toward adopting more stringent EV ready ordinances that expand beyond the current 3 percent standard for multifamily dwellings.[16] In order for other cities to learn from their findings and follow a similar path, it is important to provide a model for localities to consider ahead of the 2019 code implementation in 2020. The Governor's Office of Planning and Research has provided some resources on its websites that can serve as a starting point but it appears that some of the documents such as "example building codes" are somewhat outdated by referencing the 2012 CALGreen Code and require further updating to assist localities going forward.[17] Therefore, we recommend as follow-on to the model PV ordinance, the CEC in collaboration with the California Building Standards Commission (CBSC) and California Department of Housing and Community Development (HDC) determine a venue for developing a model EV ready ordinance.

* * *

As the CEC continues to refine the proposed 2019 standards approach, in summary, Tesla recommends the following: 1) incorporate a credit for solar plus storage under the EDR framework, 2) adopt a model PV ordinance, 3) utilize the framework developed by NDRC to adopt a model renewable water heating ordinance, and 4) identify a forum for creating a model EV readiness ordinance. We continue to support having the state meet the 2020 ZNE goal but recognize that there are several challenges CEC staff will need to work with stakeholders to overcome in the next few years to enact this goal.

We appreciate the opportunity to comment on the proposed 2019 standards approach and look forward to continuing to work in partnership with the CEC to achieve the state's clean energy and GHG goals.

Sincerely,

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[16] CALGreen Code, Chap. 4, p.20. Available at: https://codes.iccsafe.org/public/chapter/content/2057/
[17] https://www.opr.ca.gov/s_zero-emissionvehicles.php