June 1, 2015

VIA E-MAIL

CALIFORNIA ENERGY COMMISSION
Dockets Office, MS-4
ATTN: Docket No. 15-BSTD-01
1516 Ninth Street, MS-4
Sacramento, CA 95814

RE: Adoption of 15-Day Language for the 2016 Energy Efficiency Building Standards, Residential Appendices, RA4.4.9

To Whom It May Concern:

Navien, Inc. respectively submits the following comments in regards to the proposed 2016 Residential Appendices to Part 6, California Code of Regulations, Title 24.

Navien, Inc. discovered technical issues with the requirements outlined in Appendix RA4.4.9 for Demand Recirculation control that warrant further review as the intention of Title 24 would be violated if it is interpreted to require a thermo-sensor in the attic. While this location would be somewhat accessible and be as close to the end of the supply line as possible, it would stop the functionality of the sensor resulting in additional energy and water usage. Instead, Navien submits that the Code should focus on the functionality of the thermo-sensor based on the principal that it will shut-off the pump with a sensed rise in pipe temperature.

As written, the supplements to Title 24 provided to designers and installers are somewhat ambiguous and contradictory. This could result in confusion amongst installers and manufacturers. Moreover, from a practical sense, section RA 4.4.9, if interpreted in a certain way, actually results in less energy efficiency as explained below.

In regard to the ambiguity/contradiction, Residential Appendices RA4.4.9(d)2 states:

> *(d) Pump and demand control placement meets one of the following criteria.*
>
> > *2. The pump and controls are installed on the return line near the water heater and the thermo-sensor is installed in an accessible location as close to the end of the supply portion of the recirculation loop as possible (typically under a sink).*

The reason for this requirement is so that "the controls shall operate on the principal of shutting off the pump with a sensed rise in pipe temperature."

This provision, while calling for the most remote and accessible location should also have an implication that the sensor remain functional in its placement. The failure to include this implication leaves a situation wherein a sensor might be installed per code but left in a less than completely functional state.

Although not yet available for the 2016 Code, the 2013 CEC Compliance Manual for Water Heating Requirements sets forth a different explanation. Specifically, it states:

> *"Recirculation Systems – Demand Control – A demand-control recirculation system uses brief pump operation in response to a hot water demand "signal" to circulate hot water through the recirculation loop. The system must have a temperature sensor, typically located at the most remote point of the recirculation loop. The sensor provides input to the controller to terminate pump operations when the sensed temperature rises."*

Following the Compliance Manual guidance, it is only *typically* that the sensor is located at the most remote point of the recirculation loop. This allows for a different placement to allow for the functionality of the sensor. However, RA4.4.9(d)(2) could be interpreted more stringently to require a thermo-sensor in the attic which would diminish the functionality of the thermo-sensor in hot weather – while the attic pipe is hot, the water in the house supply pipe may not be, resulting in a non-functional situation, and a violation of the intent of the code to limit energy use for the purposes of recirculation as homeowners would be inclined to alter the functionality of the unit to get hot water in hot weather.

Specifically, if interpreted stringently, the following reasons make RA4.4.9(d)2 not applicable given the way certain recirculation loops are installed:

1) The thermo-sensor cannot be installed close to the fixture or "under a sink" as recommended as no circulation occurs at fixture branches.
2) The thermo-sensor cannot be installed on piping installed in the wall as it would not be accessible.
3) Therefore, the closest the thermo-sensor can be placed to the end of the supply portion of the recirculation loop as possible while still being somewhat accessible is in the attic. Of course, a thermo-sensor, which senses heat, will not properly function in the attic. This is particularly true as most new home construction in California is done "slab-on-grade." This leaves only two options for placement of the thermo-sensor so that it is accessible. The first is in the attic. Installation of the sensor within the attic only leaves for limited accessibility. Worse, installation of the sensor in the attic misses the intention of the code as the installation of thermo-sensors in the attic is the least desirable location considering the extreme attic temperatures would create sensor reads considerably higher than in other zones. This provides a sensor that is at the furthest point and somewhat accessible but not functional. The other location is to have the sensor integral or next to the pump or water heater. This results in an accessible functioning sensor that is not technically at the furthest most point, but is functional.

In order for a circulating system to properly work and deliver as consistent as possible temperature to the delivery point, it must have accurate feedback from a strategically placed thermo-sensor(s). As noted above in issue 3), installing a thermo-sensor in the attic is the least desirable location for feedback, yet could arguably be the only place allowable for RA 4-4.9(d)2 if the provision requires limited accessibility at the furthest remote point on the supply line. Considering extreme

temperatures in attic spaces during spring and summer months, although piping would be insulated, the temperatures sensed in the supply piping would be considerably higher than in other zones of the home where the supply piping shares adjacent walls with conditioned space. As a result, when a demand activation signal is received, the control may not respond as it is sensing an overstated reading of the supply water temperature. If the control does not operate, the delivery point will provide the end user with an unstable supply of hot water leading them to waste water and energy by purging and reheating the entire supply and branch piping. This negates any energy savings of this requirement and further increases the amount of water that is used, defeating the point of having a recirculation system.

In addition to the noted technical issues with these requirements, Navien, Inc. is unaware of any study conducted that proves that this type of remote temperature sensing strategy results in any energy savings nor does it represent an available "on demand" technology in the marketplace or a commonly used recirculation strategy. Based on Executive Order B-29-15 signed by Governor Brown in April 2015, CEC has committed to "..adopt emergency regulations establishing standards that improve the efficiency of water appliances..". While we applaud CEC's previous adoption of Demand Recirculation systems into Title 24, if the Reference Appendices are interpreted to require a thermo-sensor in the attic, then it creates a scenario that discourages both builders and manufacturers from providing the most functional, efficient and economically feasible recirculation solution. As such, Navien Inc. recommends reviewing and revising RA4.4.9 and related RA4.4.10 to ensure that manufacturers, designers and installers are not bound by requirements that render the system dysfunctional and/or more wasteful.

Based on the foregoing, the Residential Appendices should be re-written and/or interpreted to simply require that the thermo-sensor shall operate on the principal of shutting off the pump with a sensed rise in pipe temperature. There should also be a further clarification that the appendices imply that the location of the sensor will be placed in a location that leaves it functional. In the situation explained in 1-3 above, this would include placing the sensor next to or integral to the pump or water heater.

Thank you in advance for your consideration of our comments.

Sincerely,

Kevin Pirotin
Senior Technical Manager