

CTA-2045-B Level 2 Guidance for Water Heater OEMs

This document and its companion document, “CTA-2045-B Level 2 command overview v20.xlsx” provide guidance for water heater manufacturers trying to implement and be certified for CTA-2045-B Level 2. These documents should only be used in conjunction with the CTA-2045-B specification document found at: <https://shop.cta.tech/products/modular-communications-interface-for-energy-management>

In particular, water heater manufacturers have expressed concern over implementing some of the commands such as: Grid Emergency, Critical Peak, Advanced Load Up, and Time Price Pairs. The concerns are that the water heater behavior is not specified in the standard. This was done by the CTA-2045 committee on purpose because it was felt that each water heater mfg would benefit from having the flexibility to respond to the CTA-2045 signals. However, over the 10 years of the CTA-2045 standard being implemented, some “good citizenship” responses have emerged and those responses have created expectations on performance with utilities. This document hopes to share those expectations and provide guidance to assist manufacturer’s implementing the standard.

Please also note that this document strongly recommends that manufacturers support CTA-2045.1. This specification defines the method where the firmware of the water heater can be updated through the Universal Communications Module. This is an important consideration in any Internet of Things connected product to support both bug fixes and feature additions. Obviously, the firmware on the water heater must be created in a modular way so that the CTA-2045 supporting portions of the firmware are separated from the normal water heater functionality so that any problem in the firmware update of the CTA-2045 portion of the firmware does not negatively impact the water heater functionality and safety. It should be noted that a number of utilities, OEMs and CTA module makers have already found the 2045.1 functionality to be helpful if not critical in rolling out a successful water heater program.

Globally, as shown in the spreadsheet (column A), the utilities expect good citizenship responses from the water heater. In particular this means having 3 types of Shed (reduction in energy use), and 2 types of Load Up (generally immediate use of energy, even if the water heater is in a ‘cooling non-energized state’, until setpoint is achieved). They also expect to be able to receive the power usage of the water heater, and the storage capacity. The Advanced Load Up command requires a different storage capacity to be reported given that it can ‘absorb more energy’ than the regular Load Up command. Also, CA Title 24 JA 13 has performance standards as to the amount of energy that can be absorbed by the two Load Up commands, and manufacturers would be wise to try to accommodate those performance standards as well.

Below are more details on each command.

1. Load Up – This was created to absorb energy instantly upon receipt of the event. Water heaters generally have a deadband to prevent short cycling of the heating functionality. The Load Up command expects the water heater to turn on immediately no matter

where it is in the cooling cycle, except obviously if the water heater just finished a heating cycle. This is effectively like making a much smaller deadband than the regular deadband. Once the water heater reaches setpoint, it is expected to continue this smaller deadband behavior throughout the event.

2. Advanced Load Up - this was created to follow upon the Title 24 JA13 specification from CA. It is assumed that any water heater mfg who implements Advanced Load Up will do so with a mixing valve only, so they will need to ascertain that a mixing valve has been installed before allowing the feature to work. The shiftable kWh has been defined in the JA13 specification, and the water heater that allows Advanced Load Up to be implemented should do the following:
 1. Be able to respond correctly to the signal "Advanced Load Up"
 2. Ascertain that a mixing valve has been installed
 3. Report in the Commodity Info command two levels of storage capacity - One if the Load Up command is used, and one of the Advanced Load Up command is used (the latter is expected to be a larger value than the former)
3. Shed – Immediately stop using power until the event is over unless internal algorithms determine that there is a risk of a cold water event to the customer. If the latter is the case, allow the water heater to come on long enough to prevent the cold water event. CA Title 24 JA 13 indicates whether the electric element can be used or not and should be implemented if possible.
4. Critical Peak – Similar to the Shed command, but the algorithm is expected to be more aggressive in risking a cold water event, which means that the water heater should use less power than the Shed event when a cold water event is at risk of occurring.
5. Grid Emergency - It is expected that the water heater will use as little energy as possible during this time, even if the water heater risks a cold water event. Typically, this means no electrical elements and no compressor for the duration of the event.
6. time price pairs – The CTA-2045 committee added time-price pairs because it needed to address the CA Title 24 JA 13 requirement to support Time of Use scheduling. The committee determined that (a) writing a Time of Use (TOU) specification was challenging, and (b) the end goal of Time of Use pricing is real-time dynamic pricing. The committee chose to leap frog the complications of Time of Use and go directly to supporting real-time dynamic pricing, because by doing so, it would also support the more limited use case of Time of Use. Clearly manufacturers of water heaters who want to sell their product in CA are required to support CA Title 24 JA13. In doing so, they must be able to support the ingestion of a TOU schedule and then have the water heater respond intelligently to this schedule.

TOU schedules are typically changed 2-4 times a year, and are implemented on weekdays and are often different on weekends and holidays. In other words, the water heater stores a 24/7 schedule that it uses to determine its activity, and it changes that schedule 2-4 times a year. The response is usually to Load Up to setpoint before the time of any increase in price, and then to Shed during the increased price time.

For CTA-2045-B Level 2, we recommend taking the same algorithms you are applying to

your TOU efforts and applying them to the time price pairs. You can assume the following initially:

1. The time price pairs will be delivered 24 hours in advance (typically near midnight) and cover the next 24 hours.
2. You should be able to ingest the time price pairs and 'translate them' to your TOU 24/7 schedule behavior.

The time price pairs command essentially gives utilities the ability to move from 4-6 month schedule changes to daily schedule changes, which will give them much more value for their fleet of water heaters.