GG327-14
A103, A106.2.2.1, A106.2.5, A106.3.3

THIS CODE CHANGE PROPOSAL IS ON THE AGENDA OF THE IgCC ENERGY/WATER CODE DEVELOPMENT COMMITTEE. SEE THE HEARING ORDER FOR THE IgCC ENERGY/WATER CODE DEVELOMPENT COMMITTEE.

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Revise as follows:

A106.2.2.1 Heating equipment. For heating equipment, the part-load efficiency of the equipment shall be not less than 10 percent greater than the part-load efficiencies shown in the applicable tables of the *International Energy Conservation Code*, or ASHRAE 90.1, or the equipment shall be ENERGY STAR qualified, as applicable. Grid-interactive electric thermal storage heating systems shall be deemed to meet the requisites of this section where they are directly regulated by the grid operator to store energy during off-peak hours, to utilize available renewable energy or to provide balancing services for management of the electric grid.

A106.2.5 Service water heating equipment. The efficiency of the service water heating equipment shall be not less than 10 percent greater than the efficiencies shown in the *International Energy Conservation Code* and ASHRAE 90.1 or the service water heating equipment shall be ENERGY STAR qualified. Grid-interactive electric thermal storage heating systems shall be deemed to meet the requisites of this section where they are directly regulated by the grid operator to store energy during off-peak hours, to utilize available renewable energy or to provide balancing services for management of the electric grid.

A106.3.3 Service water heating efficiency. The efficiency of the service water heating equipment shall be at least 10 percent greater than the efficiencies shown in the *International Energy Conservation Code* and ASHRAE 90.1 or the service water heating equipment shall be ENERGY STAR qualified. Grid-interactive electric thermal storage heating systems shall be deemed to meet the requisites of this section where they are directly regulated by the grid operator to store energy during off-peak hours, to utilize available renewable energy or to provide balancing services for management of the electric grid.

Add new definition as follows:

SECTION A103
DEFINITIONS

GRID-INTERACTIVE ELECTRIC THERMAL STORAGE (GETS). An electric-powered heat storage system for space heating units and service water heating units that is controlled by electric system grid operators such as utilities, independent system operators (ISOs) and regional transmission organizations (RTOs).

Reason: During the first set of hearings for the first edition of the IGCC, there was much interest in Grid-Interactive Thermal Energy Storage and one of the panelist suggested that it sounded like GETS would be a good fit for the Project Electives section of the IGCC. Likewise, during the IECC code hearings in Atlantic City last fall, a number of the panelists expressed interest in GETS and stated they also thought GETS would be a good fit somewhere in the IGCC.

With that background, and without imposing any additional mandatory requirements, this proposal would add Grid-Interactive Electric Thermal Storage as one of the specifically identified means of meeting the requisites for project electives.

Section 601.2 of the IGCC states, "([t]his chapter is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy."

Grid-Interactive Electric Thermal Storage is such an innovative approach with a growing reputation among market participants as a solution to some of today's most pressing energy issues.

1. Building owners like GETS because it provides affordable and dependable space and service water heating for their structures.
2. Electric grid operators like GETS because it helps them balance energy supply and demand in real time, thereby increasing grid stability while simultaneously reducing costs, energy and emissions. Maintaining grid stability becomes more challenging

as the output of renewable energy generation (like wind and solar) is added to electric grids which explains why grid operators across the country (as well as the Federal Energy Regulatory Commission and the U.S. Department of Energy) have expressed their support for energy storage.

3. Renewable energy developers like GETS because it complements their projects by providing cost-effective energy storage when renewable energy production exceeds demand. Without adequate energy storage, these projects are often curtailed.

What is a Grid-Interactive Electric Thermal System ("GETS")?
For building owners and operators, GETS serve as traditional space and service water heating systems. GETS provide affordable and dependable space conditioning and domestic hot water. Nonetheless, GETS have significantly different operational and energy consumption characteristics from traditional space and service water heating systems as described in more detail below.

Thermal battery. Electric utilities dispatch their generators in the order from the most cost efficient (base load generation) to the least cost efficient (peaking load generation). GETS complements the efficient dispatch of generation by utilities by allowing the storage of energy that is produced more efficiently for use later, and by avoiding the requirement to operate less efficient generators at peak load conditions. GTS accomplishes this feat by charging (heating bricks, water, or other storage media) at times when utilities have excess capacity. Often this is at night but it can vary between utilities. Because the system is grid-interactive, an GTS can charge at times that are optimum for the utility, allowing utilities to efficiently manage their peak demands and their customer costs. Heat that is stored for later use effectively makes GETS a thermal battery.

Renewable energy. GETS is a unique complement to the generation of electricity from renewable energy like wind and solar. Many times peak power production from renewable energy sources does not coincide with a utility's demand for electricity. As an example, wind generation usually peaks at night when demand for energy is not usually the greatest. For that reason, Bonneville Power last year was forced to curtail the generation from wind generators at certain times because it didn't need all the electricity the wind generators were producing! GETS is a good fit for storing excess renewable energy and has been successfully deployed in Bonneville's service territory as well as the service territory of other electric utilities.

Reduces winter peak. When electrical demands on a utility's system grow, it is forced to dispatch less efficient generators to meet that demand, so to the extent demand is reduced the utility avoids costs (that would ultimately be passed on to customers) and saves energy. GETS allows the storage of energy produced by more efficient generators.

Replaces fossil fuel in utility grid control. When electrical demand on a utility's grid changes (up or down), the most immediate system response is for the grid's frequency to drift away from ideal (60 cycles per second). To control these frequency excursions, utilities have traditionally operated fossil fuels generators to add voltage to the grid to raise the frequency as it falls away from 60 cycles. Grid-interactive GETS can be dispatched in lieu of fossil fuel generators to remedy frequency excursions, thereby saving energy and costs. According to a Kema report, usage of a non-carbon emitting resource such as GETS for providing regulation services can reduce carbon emissions for regulation by nearly 65%.
GETS offer significant benefits to customers, including the ability to store renewable energy, the ability to reduce utility costs, and the ability to reduce the consumption of fossil fuel by utilities in the regulation of system frequency.

Bibliography:

See article at
http://www.pjm.com/about-pjm/exploring-tomorrows-grid/electricity-storage.aspx?p=1 for information on the value of ETS in the PJM Interconnection service territory.

See article at
http://www.sustainablebusinessoregon.com/articles/2012/04/bonneville-power-calls-for-first-wind.html?page=all for information on Bonneville Power curtailment of wind generation amounting to almost 100,000 MWH's in 2011.

See Kema Consulting report (Commissioned by the U.S. Department of Energy under the supervision of Sandia National Laboratory) noting significant reduction in carbon emissions at http://prod.sandia.gov/techlib/access-control.cgi/2008/088229.pdf.

See http://www.steffes.com/off-peak-heating/ets.html for more information on utility benefits of WTS, including energy savings associated with thermal storage and frequency regulation.

See Sandia National Laboratory website at http://www.sandia.gov/ess/ for information on the contributions of energy storage to electric grid stability.

For a detailed description of frequency regulation in North America see Department of Energy / National Energy Technology Laboratory Report Frequency Instability Problems in North American Interconnections, DOE/NETL-2011/1473, Final Report dated May 1, 2011 found at http://www.netl.doe.gov/energy-analyses/pubs/TransmissionFreqProb.pdf

Cost Impact: Will not increase the cost of construction.

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