COMMENTS SUBMITTED TO THE U.S. SENATE ENERGY AND NATURAL RESOURCES COMMITTEE CONCERNING THE DESIGN OF A CLEAN ENERGY STANDARD

Executive Summary

A clean energy standard (CES) cannot achieve its essential purpose unless it is accompanied by an energy efficiency standard. Simply adding new generation assets to the grid no matter how clean will not decrease greenhouse gas emissions and other electricity-related pollution, it will increase them. A properly constructed CES must both encourage a suitable ratio of clean to less clean electricity generation and encourage greater efficiency by reducing the total amount of grid infrastructure necessary to provide electricity to consumers.

Energy efficiency can be defined in many different ways. Defining efficiency as using less electric energy overall would be contrary to the national interest and undermine economic growth. A better approach to efficiency is to define it as reducing electricity load at peak times during the day relative to load at non-peak times.

The U.S. electricity grid is a highly complex system the basic features of which were designed in the late 18th Century. Because electricity must be consumed within the nanosecond it is produced, the grid is constructed, and generation, transmission and distribution assets must be built, to service the theoretical maximum consumer demand for electricity at peak times. This level of infrastructure deployment is far in excess of what is necessary to meet the average consumer demand for electricity. The deployment of these excess assets adds billions of dollars to consumer electricity bills and is the source of much of the environmental degradation that the American public associates with electric power.

The National Alliance for Advanced Technology Batteries (NAATBatt) proposes that utilities be permitted to satisfy at least fifty percent (50%) of their CES requirements by reducing their respective Peak Ratios (i.e., the ratio of electricity used during the 120 peak minutes over total electricity used over the course of a day averaged over a year) from historic levels.

Utilities would have many ways to reduce Peak Ratios, including smart metering, consumer education and dynamic electricity pricing. NAATBatt expects, however, that distributed energy storage will ultimately prove to be the mechanism of choice. Using energy storage in distribution systems to level electricity load would have multiple benefits. Those benefits include reducing costly power interruptions, facilitating non-disruptive distributed generation, encouraging vehicle electrification, increasing manufacturing employment and helping our old, centralized 18th Century grid evolve into the distributed system of efficient and secure microgrids that power experts have long predicted and advocated.

April 11, 2011

Response to Question 2. What resources should qualify as "clean energy"?

- ***What is the role for energy efficiency in the standard? If energy efficiency qualifies, should it be limited to the supply side, the demand side, or both? How should measurement and verification issues be handled?***

Pursuant to the Senate Energy and Natural Resources Committee Clean Energy Standard (CES) White Paper, the National Alliance for Advanced Technology Batteries submits the following response.

1. Interest of the National Alliance for Advanced Technology Batteries

The National Alliance for Advanced Technology Batteries (NAATBatt) is a not-for-profit trade association of advanced battery manufacturers and related supply chain companies dedicated to building market capacity for advanced energy storage technology in the United States. The principal goal of NAATBatt is to reduce American petroleum dependence by reducing the cost of large format advanced batteries used in advanced automotive and grid-level storage applications. Lowering the cost of advanced battery technology is the single most important thing that can be done to reduce long-term dependence on imported petroleum and encourage the electrification of motor vehicles in the United States. NAATBatt works to promote the development of new technologies, develop new markets for energy storage, and encourage public policy that will make advanced battery technology more affordable. More information about NAATBatt can be found at www.naatbatt.org. The views expressed in these comments reflect the views of NAATBatt and not those of any NAATBatt member company.

2. Clean Energy Standards and Energy Efficiency Standards are Inseparable

A clean energy standard (CES) seeks to increase the proportion of clean generation assets used to produce and transmit electricity onto the grid. As such, a CES is an equation in which the numerator is the amount of electricity generated by clean sources of energy and the denominator is the total amount of electricity generated from all sources. However, if the ultimate goal of a CES is to reduce greenhouse gas (GHG) emissions and other forms of pollution associated with electricity infrastructure, simply changing the ratio of clean to non-clean generation assets will not necessarily achieve that goal. To reduce environmental pollution, the total amount of emissions and other environmental degradation produced by electricity infrastructure must be reduced or at least limited. In short, a CES cannot achieve its objective unless it also deals with the denominator of its equation.

For example, achieving an 80% CES ratio by simply adding new clean assets to existing generation infrastructure would increase the total amount of generation-associated pollution, not reduce it. Adding new clean generation, transmission and distribution assets to the grid might meet an 80% goal, but it would be a Pyrrhic victory. A constructive CES needs to incent the closure of older polluting power plants and reduce the need for related infrastructure, not just add new clean generation. A constructive CES should focus as much on energy efficiency as on the proportion of clean power generation deployed.

3. Energy Efficiency Should Be Defined as Reducing Peak Electricity Demand

Energy efficiency can be defined in different ways. Many define energy efficiency in terms of pure conservation: using less electricity means being more efficient. Today 28 states have enacted energy efficiency portfolio standards, many of which take this approach. But efficiency in electricity can also be defined in other ways, such as by the ratio of electricity used to productive work generated or by the ratio of total electricity infrastructure deployed to electric energy used.

NAATBatt would urge the Committee to reject any efficiency standard that attempts to reduce the total amount of electricity used. Discouraging electricity consumption runs contrary to important national interests and strategic goals. Greater electric energy usage correlates to increased economic activity and job growth. In addition, as the United States strives to break its addiction to foreign oil, encouraging the conversion of motor vehicle powertrains from petroleum to electric power is an important national strategic goal. Economic growth and U.S. energy security require that we encourage greater use of electric power, not less.

A better approach to energy efficiency is to focus on reducing the amount of electricity infrastructure used to produce the electricity that the U.S. economy needs to grow, prosper and remain secure. An initiative based on this definition of efficiency would center on reducing the peak use of electric power rather than on reducing the overall use of electricity.

The grid today is constructed to meet the peak electricity demand of the American public. Demand for electricity varies by season and time of day, with the largest peaks typically occurring during the early evening hours of summer months. Matching the peaks and troughs in demand with supply is an ongoing challenge for grid operators. It has been said that the U.S. electric grid is the most complex system ever devised by man. Much of that complexity is devoted to the ongoing task of matching supply to demand every second of every day.

As a physical matter, electricity must be produced within a nanosecond of the time that it is consumed. Electrons travel at the speed of light over transmission and distribution lines from generators to consumers. In order to accommodate peak times of electricity demand, grid operators must therefore build generation, transmission and distribution assets necessary to service the maximum theoretical electricity demand at any time. That maximum peak load is far in excess of what is necessary to accommodate average electricity load. These excess assets are the source of much of the environmental degradation that consumers associate with electricity production and represent a huge inefficiency in the grid.

The average capacity factor of power plants in the United States illustrates the nature and scope of the problem. The capacity factor of a power plant is the ratio between the actual output of that power plant over a period of time and its output if it had operated at full nameplate capacity during that entire time. In 2009, the average capacity factor for all U.S. power plants was 44.9 percent.[1] For natural gas generating facilities, which tend to be used as peaker plants, the capacity factor was only 7.8 percent.[2] The average level of production of the U.S. power

---

1 U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report;" Form EIA-923, Power Plant Operations Report," and predecessor forms.

2 Id.

industry therefore is only a fraction of the peak capacity installed and theoretically available.[3] This overcapacity exists for the sole purpose of being able to meet consumer demand for electricity during a relatively few peak hours each year.

Similar overcapacity exists in transmission and distribution infrastructure. In order to wheel power to consumers during the few peak hours each year, grid operators must permanently construct and maintain power lines, transmission cables, substations and distribution networks of far greater size and capability than that necessary to transmit and distribute electricity to U.S. consumers at non-peak times. These excess assets add billions of dollars to consumer electricity bills and account for much of the pollution and environmental degradation generally associated with electricity production.

Reducing the number of generation, transmission and distribution assets necessary to operate the grid is therefore an important economic and environmental goal. Grid infrastructure adds to GHG emissions, creates other forms of pollution, gives rise to safety and viewshed issues, and adds to consumer and governmental cost. To meet an 80% goal by 2035, a CES program must reduce the grid infrastructure that produces total electric power input. The best way to accomplish this is by encouraging technologies and practices that move electricity consumption from peak to non-peak times.

But just as a CES requires peak reduction to achieve its essential purpose, so too does a peak reduction initiative require a CES. Peak reduction initiatives favor base load generation, which in the U.S. is largely provided by coal. While improving the efficiency of the assets necessary to operate the grid is important, it is equally important that increased efficiency be accomplished by closing older, more polluting plants rather than by closing or not deploying assets that operate using cleaner fuel. If a peak reduction initiative is adopted, a CES will be needed to ensure that new base load generation (which would in an efficient power grid provide the vast majority of electricity generation) is produced by clean rather than less clean generation assets.

The relationship between clean energy standards and peak reduction initiatives is therefore highly symbiotic. Both must be deployed together in order to achieve the goals of pollution reduction, economic growth and energy efficiency. Independent of each other, it is unclear whether either can attain those objectives.

4. Proposal for Incentivizing Reductions in Peak Demand

NAATBatt believes that a CES should include a component that incentives and rewards utilities for reducing electric usage within their service territories at peak relative to other times of the day. Focusing on daily variation in electricity use is proper. While demand for electricity also varies over longer periods, daily variation is the most easily managed by deploying enabling technologies, such as energy storage, and by encouraging modifications in consumer behavior.

It is important to note that electricity "use" should be defined as the amount of electricity that is generated and wheeled through the transmission and distribution systems at peak times in order

[3] U.S. Department of Energy, Energy Information Agency, "Energy Basics 101 Electricity Basic Statistics," http://www.eia.doe.gov/basics/quickelectric.html (accessed December 12, 2008).

to satisfy customer demand, rather than the physical use of electricity by the ultimate consumer. As noted below, one solution that utilities and grid operators may elect to meet peak reduction requirements is to generate and wheel power to consumers through the grid at non-peak times, storing the electricity locally in the distribution system, and then letting consumers use the power whenever they like.

Every electric utility tracks the electricity usage of its customers by time of day and can calculate the ratio of electricity usage during the peak 120 minutes of a day over electricity usage over the course of an entire day. The average of that daily ratio over the course of a year is referred to as the "Peak Ratio". NAATBatt believes that an individual utility should be able to obtain credit towards fifty percent (50%) of its CES obligations by demonstrating reductions of its Peak Ratio over historic levels.

Determining the precise Peak Ratio reductions that would be reasonable and feasible requires additional study and analysis. But Peak Ratio reductions would move the grid towards a system where centralized generation will be level and predictable, with load managed to that level on the demand side. In jurisdictions where adding new sources of renewable generation may be challenging, the credit for Peak Ratio reductions towards CES compliance could be greater than 50%, though it should never be 100%.

5. The Helpful Role of Energy Storage in Reducing Peak Ratios and Attaining other National Energy Goals

Managing electricity usage by consumers so as to permit level centralized generation, and the transmission and distribution of level and consistent amounts of electricity to consumers, will require aggressive demand side management. Several mechanisms are available to utilities to manage demand. Consumer education, smart meters and dynamic pricing of electricity are all methods that utilities may deploy to encourage consumers to shift electricity use to non-peak times.

Another promising approach, however, is using distributed energy storage as a demand side management tool. Distributed energy storage is the practice of locating batteries or other energy storage devices near the consumer, wheeling power into the storage device when convenient for the grid and letting the consumer use the power when the consumer wishes. Distributed energy storage systems may be located at substations, in consumer homes, in residential or commercial buildings, or in communities serving several homes.[4]

The revolutionary concept behind distributed energy storage technology is that it breaks the relationship between variable, unpredictable and occasionally irrational consumer demand for electricity and the grid. The consumer's primary relationship is now with a battery. The grid becomes merely a source of back-up power. The battery, under the control of the grid operator, may be charged at any time by power from the grid, which charging will be largely unassociated with the demands of the ultimate consumer.

---

4 A discussion of community energy storage and specifications for community energy storage systems can be found on the Web site of American Electric Power at http://www.aeptechcentral.com/CES/

Breaking the relationship between the consumer and the grid will also be a first step towards creating the grid that will carry the U.S. energy system through the 21st Century. Experts have long recognized that the grid needs to evolve from a large, vulnerable, centralized system to a decentralized system of microgrids.[5] While reorganizing the electricity grid is beyond the scope of the comments requested, it is worth noting that an initiative to reduce peak electricity demand—which is a technological imperfection of the late 19th Century design of the grid—will help create the grid of the future.

In the immediate term, deploying distributed energy storage (DES) as a way to reduce Peak Ratios will have a number of benefits:

- DES systems will enhance the reliability of electricity service, as consumers will be able to obtain service either from their DES system or from the grid in an emergency. Power interruptions cost U.S. electricity consumers approximately $80 billion per year, much of which can be mitigated by DES systems.[6]

- DES systems will facilitate distributed generation systems in a way that will be non-disruptive to the grid. Many states want to encourage distributed generation and net metering by consumers as a way to encourage the integration of renewable energy and provide the possibility of rate relief to consumers. One of the complexities of net metering is the extreme complexity of allowing individual consumers to add power to the central grid in unpredictable amounts at unpredictable times. DES systems and the micro-grids that will likely evolve around them would permit consumers producing electricity through rooftop PV units or small wind systems to store such excess energy for their own future use or to sell it to neighbors without having to impact the central grid.

- DES systems will create ancillary opportunities for economic growth. While DES systems can use multiple storage technologies, including low cost and market ready lead acid batteries, DES systems may also deploy lithium-ion batteries of a type similar to those used to power plug-in electric vehicles. The great challenge to vehicle electrification in the United States is the high cost of large format lithium-ion batteries, stemming in large part from the inability of battery manufacturers to achieve economies of scale in the automobile sector. If a high volume market for DES systems using lithium-ion batteries was to develop, NAATBatt believes that the higher volumes alone would cause the price of advanced automotive batteries to fall by at least 35%[7], making electric vehicles more affordable and more attractive to American consumers.

---

5 *See* Chris Marnay and Giri Venkataramanan, Ernest Orlando Lawrence Berkeley National Laboratory, *Microgrids in the Evolving Electricity Generation and Delivery Infrastructure* (February 2006) http://eetd.lbl.gov/ea/emp/reports/59544.pdf ; Galvin Electricity Initiative, ***Microgrids: A Critical Component of U.S. Energy Policy***, http://www.galvinpower.org/microgrids**.**

6 Kristina Hamachi LaCommare and Joseph H. Eto, Ernest Orlando Lawrence Berkeley National Laboratory, *Cost of Power Interruptions to Electricity Consumers in the United States* (February 2006), http://eetd.lbl.gov/ea/ems/reports/58164.pdf.

7 Between 2000 and 2008, the price of lithium-ion batteries used in consumer electronics fell by about 35%, largely as a result of increases *in* battery production volumes during that period.

- The United States has substantial manufacturing capacity for advanced batteries that could be used for DES systems. The U.S. Department of Energy invested $2.4 billion of ARRA funds to build a large portion of that domestic capacity. As a consequence, DES systems purchased by utilities in order to comply with CES requirements will likely be made in the United States by American workers.

- The need to level electricity load is a need that exists equally around the nation; the peak power problem is inherent in the basic late 19th Century design of the grid and affects equally all jurisdictions. While certain areas of the country that do not have easy access to solar and wind energy may be prejudiced by CES requirements, DES systems can be deployed anywhere at costs that should be consistent around the country. Including a peak reduction requirement in a CES will significantly reduce any regional prejudice.

6. Conclusion

A clean energy standard cannot achieve its essential purpose unless it is accompanied by an energy efficiency standard. But the efficiency standard that should supplement a CES must focus on reducing peak electricity load, rather than on reducing total electricity consumption. In designing any CES program, the Senate Energy and Natural Resources Committee should permit utilities to comply with at least half of their CES requirements by demonstrating reductions in their Peak Ratios over historic levels. Distributed energy storage systems will play an important role in helping utilities level electricity load and will help the grid and the U.S. economy perform to their full potential in the 21st Century. Accordingly, NAATBatt respectfully requests that the Committee consider these comments.

# # #