Comments in Response to:

Demand Response and Energy Efficiency Roadmap Workshop

ENBALA Power Networks®

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Company Profile

ENBALA Power Networks® (www.enbala.com) operates a technology platform that engages large-scale electricity users to participate in the real-time management of the power system. By capturing and intelligently aggregating inherent flexibility in how loads (such as water plants, cold storage facilities and other industrial, commercial and institutional facilities) use power, the ENBALA platform can offer robust, reliable and resilient demand-side management solutions to power system operators.

ENBALA is delivering a true Smart Grid application that links flexibility in electricity users to the real-time needs of the power system. ENBALA is providing Regulation Service in the competitive PJM wholesale electricity market and is providing a wind integration solution to New Brunswick Power for the PowerShift Atlantic Project.[1] In addition, ENBALA is at various stages of implementation with a number of other North American ISO's and utilities, most recently being awarded a contract this April to provide the IESO with +/- 4 MW Regulation Service through a competitive RFP process for Alternative Sources of Regulation. The ENBALA Power Network platform is extensible to many other services that can benefit the power system as it is capable of shifting loads in seconds, to minutes, to hours. It is ENBALA's interest to work with the California ISO to demonstrate the full value that demand side resources can contribute to the power system of the future.

Summary of Comments

ENBALA appreciates and supports the current efforts of the California ISO in developing the appropriate framework to encourage demand side resource participation in the wholesale market. Loads, when aggregated and intelligently controlled, can provide multiple value streams to address California's electrical system needs. However, market rules need to be implemented and/or changed to ensure we are maximizing this benefit to the system and there is no disadvantage for loads to participate. California needs to support this by:

- Developing market products and rules that are inclusive of demand side resources and aggregators
- Providing the right signals to drive investment
- Implementing these initiatives through pilots and funding opportunities now

[1] http://www.powershiftatlantic.com/overview.html

California and the Future of Demand Response

The power system everywhere is under stress. A combination of aging infrastructure, changes in generation mix, increasing penetration of renewable, legacy costs, and changing demand patterns create new challenges for how we operate the power system. These changes are manifested in the need to handle increased volatility in the power system, focus on the efficiency of generation assets, and above all else, system reliability. In addition, all these requirements need to be met while managing within very tight cost constraints. We cannot manage the power system the same way we did even 10 years ago. We need innovation and new solutions for the power system of the future. This has become increasingly evident in California with the projected impact of renewable energy production in the next 5 to 10 years.

Traditionally, Demand Response (DR) has been focused on supplying system capacity with occasional curtailment during peak hours. These events are infrequent (less than 5 to 10 times per year) and are coordinated with significant notice. However, demand side resources can be coordinated and intelligently controlled in such a way to provide the power system with much needed flexibility. The ENBALA platform enables load resources to be continually connected for real-time and bi-directional response. In contrast to traditional DR, load resources participating in a network are frequently called on to adjust consumption (thousands to millions of requests per year) with minimal or no impact on the operational effectiveness of the load.[2]

ENBALA has recently completed a study with the Oak Ridge National Laboratory quantifying the potential for loads to provide flexibility to the power system. A copy of the report titled *Demand Side Response from Industrial Loads* has been attached in the email. Results from the study show that there is an excess of 12 GW of flexibility available from industrial loads in the US, leveraging existing process storage to help manage the power system.[3]

In order for California to realize the benefits that load resources can contribute to the management of the power system the market needs to:

- Provide adequate price signals to drive investment
- Allow, support, and encourage aggregation
- Allow sub metering of loads
- Allow multiple Service Providers to participate with the same customers under different programs
- Define multiple market products to capture the full value they offer

[2] ENBALA Power Networks has established an innovative form of storage by leveraging commercial and industrial organizations' existing energy consuming assets —and the inherent process storage they offer — to create an aggregated network of demand-side loads. A detailed explanation of process storage is included in the Appendix.

Capacity Market

The market needs to provide adequate price signals to drive investment in the demand response market through a long term procurement process and price transparency. Loads, aggregators, and vendors need to know there is a long range opportunity. The key with this approach is to provide some indication of both the value and longevity of load participation in the market as hourly markets can be challenging for load participation. Loads prefer some reasonable indication of value over time to justify the time and expense of program participation.

Aggregation

The market rules need to allow aggregation of loads into a bundled product that can be offered to the market. Aggregation allows for a much greater level of load participation as it permits individual loads to participate on "their own terms" and puts the onus on the aggregator to deliver the performance and service agreed to. Furthermore, a load resource acting on its own in the market cannot offer the same flexibility, availability, and diversity of offerings as a network of loads. It is the fundamental concept of coordinating and intelligently controlling a *network of loads* that makes demand side resources so valuable in addressing the flexibility needs of the future. Understandably, there will be restrictions on how large of a geographical area for aggregation should be allowed based on the product (e.g. local capacity, voltage control) and system conditions (e.g. transmission constraints). However, wherever possible, these geographical boundaries should be made as large as possible. For example, regulation service providers should be allowed to aggregate across the ISO as they are providing a system-wide service.

Sub Metering

Sub metering is essential for more sophisticated demand side offerings. For example, for flexibility services it is necessary to be able to use only part of the load resource, adjusting its consumption between predefined bounds, so that the equipment can still perform its intended function (i.e. there is no direct impact to the operation of the facility). Sub metering could also allow load at a facility to be used for different services (e.g. an entire production line for occasional emergency DR, and ventilation equipment for real time flexibility).

Multiple Service Providers

Once demand side management offerings become more sophisticated, multiple technology and aggregation vendors will want to participate, sometimes with the same loads. The market needs to allow multiple service providers to register the same customers for different products (e.g. provider #1 registers the production line for emergency DR and provider #2 registers ventilation equipment to provide real time flexibility). The challenge is to develop rules that support this breadth because it is unlikely any one service provider will be able to deliver all of the products.

Multiple Market Products

California's net load curve is unique and it is likely that market products and the role for demand side participation will also be unique. For example, with regards to the flexible ramping product and flexible resource adequacy requirements currently being discussed in stakeholder processes, how do we encourage load to supply these? Loads can certainly deliver these products and at a lower cost to the consumer.

Conclusion

ENBALA highly supports the collaborative effort being undertaken by the CAISO, CPUC, and CEC to further the development of demand participation in California. ENBALA agrees with the high level objectives outlined in the CAISO's roadmap, agencies involved in the implementation, and the identified key processes.

We believe that it is crucial that the CAISO, CPUC, and CEC work towards a common goal to develop robust demand side participation in the wholesale market. Furthermore, all open proceedings should be included in the conversation so current rulemaking takes into account these stated objectives. Finally, we encourage the CAISO to look at opportunities to implement these initiatives through pilots to gain experience with the technical characteristics of load networks that are capable of providing real time flexibility to the power system.

Appendix

Process Storage

ENBALA Power Networks has established an innovative form of storage by leveraging commercial and industrial organizations' existing energy consuming assets —and the inherent process storage they offer — to create an aggregated network of demand-side loads. Process storage refers to storing energy in the form in which it will be used. This type of storage alters the pattern of power use in processes that work with various types of equipment (e.g. industrial pumps, aerators, fans, HVAC equipment, compressors), shifting when electrical loads consume energy to align with the needs of the power system.[4]

Process storage has similar operational characteristics to that of other storage technologies. The medium of process storage is dependent on the process being serviced by the load. Examples include: thermal energy associated with HVAC heating and cooling, and potential energy associated with pumping water to an elevated reservoir. Demand-side loads with process storage are able to *charge* by consuming more power when the grid has a surplus, and *discharge* by consuming less during periods when the grid has a deficit. Although loads cannot inject real power into the grid, from the perspective of the bulk electrical system a load reduction is equivalent to a power injection. Similar to other storage technologies, process storage has a state-of-charge, or a finite and measurable limit to how much time demand-side loads can be charged or discharged.

For example, a large industrial water pump must pump 10 MGD (million gallons per day) from a source to an upper reservoir. The upper reservoir gravity feeds a municipal drinking water system. The pumping station normally operates the pump at a power setpoint that meets the city's water demand, referred to as the baseline operation (see Figure 1 below). There is flexibility in the process of pumping water – when it can be pumped and the rate of power in which it can be pumped – as long as operational constraints on the equipment (i.e. reservoir is not overfilled) and the primary work function (i.e. 10 MGD of water is pumped to the reservoir) are satisfied.

ENBALA works with operators at the facility to identify the flexibility in their process. In this example, as long the water level is within the high and low limits of the reservoir, the pump has flexibility in its range of power. This power range represents the available power capacity (kW)

[4] ENBALA's Grid Balance platform differs significantly to traditional demand response (DR) methods. Traditional DR is based on relatively infrequent events (typically just a few times a year) to help manage system peaks in extreme situations, such as very hot summer days. In these programs, loads are interrupted and curtailed using very basic communication methods (typically phone, fax, email or, occasionally, a communication signal). In contrast, ENBALA's solution has the capability to drive power consumption bi-directionally, and to manage loads frequently with minimal or no impact on the operational effectiveness of the load.

of this resource (i.e. the power range/capacity is 1500 kW – 1000 kW = 500 kW). Similarly, the reservoir has limits to how high and low the water level can get, which can be used to calculate the process storage energy capacity. In this example, the difference between the low and high water limit is 6 ft. (i.e. 33 ft. – 27 ft.). If the pump is operating at its maximum power rating (i.e. 1500 kW) it would take 2 hours to fill the reservoir. Therefore, the total available energy capacity (kWh) of this resource is 1000 kWh (500 kW x 2 hrs = 1000 kWh).

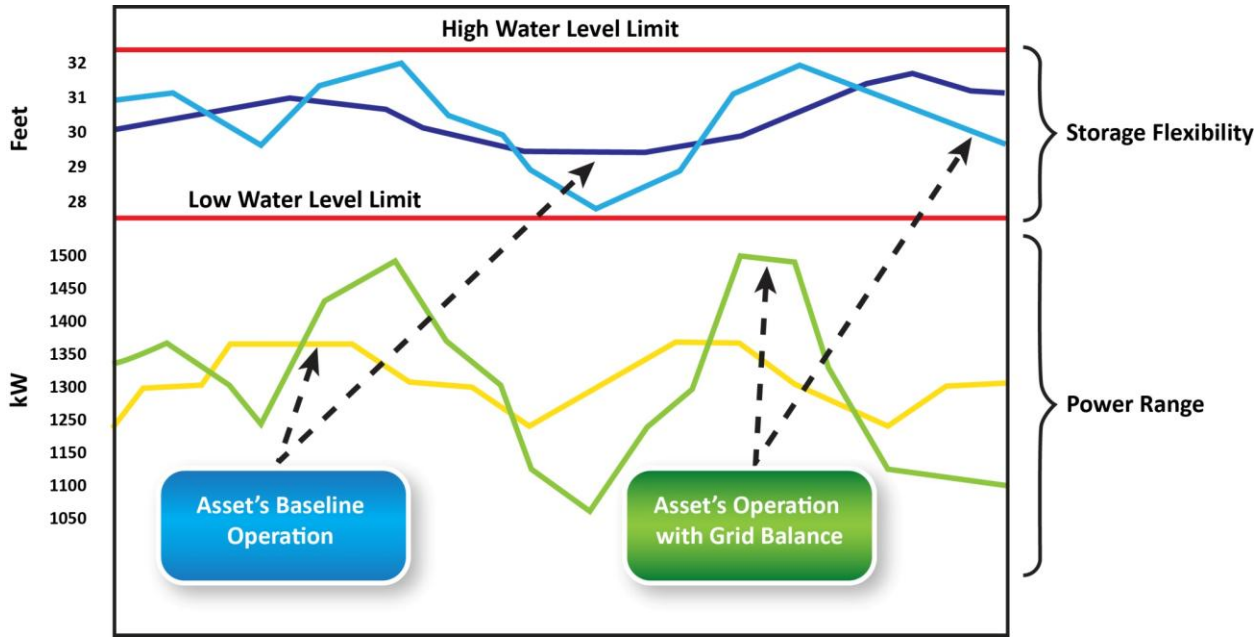

Figure 1 – Process storage concepts for a water pumping station.

ENBALA can offer this flexibility to the grid as process storage. By increasing the power of the pump above the baseline operation, ENBALA is effectively *charging* the storage system and the corresponding state-of-charge is represented by how full the reservoir tank is. Conversely, by decreasing the power of the pump below the baseline operation, ENBALA is *discharging* the storage system, and the state-of-charge decreases as the reservoir drains to its low level limit.

This is functionally equivalent to how a battery would operate during a typical charge/discharge cycle. However, process storage does not require any additional conversion steps, making the process close to 100% efficient.

ENBALA's network captures the inherent flexibility within facilities of large-scale electricity users and intelligently aggregates process storage, delivering this flexibility and reliability to the power system. Loads connect to the ENBALA Grid Balance® Platform through a locally installed Communications Panel via their existing automation platform. This enables the ENBALA Grid Balance Manager to recognize the real-time health and status of each network participant

(load), and deliver an aggregated response to the electricity system operator. Demand-side loads are paid for participation based on their inherent storage and flexibility to respond. Ultimately, ENBALA's innovative approach to electricity management increases efficiency, reduces energy costs, and lowers greenhouse gas emissions.