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Demand Response in Organized Electric Markets
Technical Conference

**Panel Discussion – Demand Response in Organized Markets – Barriers
to Comparable Treatment and Solutions to Eliminate Potential Barriers**

Summary Remarks
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Alcoa is a global producer of alumina, primary aluminum, and fabricated aluminum products that include mining, refining, smelting, casting, rolling and end product operations throughout the world. Alcoa currently operates eight aluminum smelters and associated fabricating facilities in the continental United States which consume about 2,500 MWH of electric power each hour. Alcoa's largest capacity US aluminum smelter (Warrick Operations) is a wholesale energy customer located within the Midwest ISO footprint. Alcoa also operates (11) other manufacturing facilities that are retail customers inside the Midwest ISO purview.

As an aluminum smelter, Warrick Operations has a very high load factor. Its peak load is 540 MW's but there exists at the plant site sufficient behind-the-meter generation to entirely cover the plants internal demand. So, when our aluminum manufacturing is operating at full capacity and all of our internal generation is on-line, we are perceived by the MISO operators as zero load on the MISO system.

Warrick Operations competes in a global commodities market with competitors who are located in countries with significantly lower purchase power and labor costs. With electricity as one of the single largest component costs of smelting aluminum, Warrick's long term viability is dependent on maintaining reasonably priced and very reliable energy. Failure to do so will result in the closure of this facility as has occurred in other Alcoa smelters in North America including plants located in the PJM market.

Reliable operation of the bulk power system is critical to Alcoa. A power interruption to Warrick Operations of more than 3 hrs in duration would create a lengthy business interruption and an economic impact of over \$70 mm. Because of this concern for local power grid reliability, Warrick has participated and successfully responded as an interruptible load for grid reliability issues.

Because of rising costs, Warrick Operations has to maximize the revenues it earns from its assets. Revenues from demand response programs, specifically emergency response programs, capacity resource processes, and the upcoming Ancillary Services Market, represent one of the few opportunities to mitigate rising fuel and electricity costs. Thus, the ability of organized markets to accommodate demand response resources is of considerable concern to Alcoa generally and to Alcoa's Warrick Operations in the Midwest ISO specifically.

For Warrick Operations as an end user, the start of the Real Time Energy Market in 2005 created a significant paradigm shift in the way we operate. The start up of that market

created opportunities for us that include: economic (less than internal cost of production) power purchases; the ability to balance purchase power strategies through the day ahead and real time markets during periods when our own generation was unavailable; and more significantly, the opportunity to balance the cost of aluminum production with market prices to reduce demand and either sell excess power or reduce purchase power. However, these mechanisms only serve as measures that partially mitigate increasing power costs generally. As the cost of raw materials and basic energy fuel sources has increased in recent years, our electricity-intensive business has struggled to remain competitive. We have not seen conclusive evidence that the organized power markets are delivering benefits (in the form of lower power prices) to end use customers. If the trend line continues, rising electricity costs will force energy intensive manufacturers to shift production to states or countries that offer lower cost alternatives. And while Alcoa has been able to extract some value from selling electricity through the Midwest ISO's markets, it occurs at the cost of lost aluminum production, which is Alcoa's core business. The incremental gains do not come close to offsetting the overall impact of rising energy costs on the business.

The Midwest ISO's regional market has had significant impacts on how Alcoa operates Warrick Operations as an economic decision is continually made to either produce aluminum or sell internally generated power. As a price taker in the system, Warrick provides price responsive demand reductions (in addition to emergency demand response services) that have become an everyday activity, with load curtailments often occurring

on a daily basis. In 2007, Alcoa documented over 1800 local responses to market conditions within the Midwest ISO markets.

With the development of the Midwest ISO's Ancillary Services Market, Alcoa foresaw an opportunity to expand its market participation in the regional electricity market. We have worked with the Ancillary Services Implementation Staff at the Midwest ISO to understand how the Warrick Smelting load, together with our behind-the-meter generation, can become a registered resource to provide regulation and spinning reserves, and we have actively and successfully participated in operational testing. Alcoa has a unique industrial load that is well-suited to provide demand-side grid rebalancing (real power regulation), as well as other ancillary services. It is estimated that, as much as 0.7 quadrillion BTUs/year are consumed in the process of maintaining grid balance while none of that energy is delivered to the end user. Because of the multiple benefits, that include, releasing available generation resources for grid base load supply, more efficient use of these generation resources (i.e. boiler-follow mode of operation versus throttle control), need for fewer regulating resources (i.e. speed and accuracy of response), and improved economics for both the industrial and utility sectors warrants a significant focus on Demand Response Resources.

In Alcoa's experience, there are multiple barriers to entry into the Midwest ISO market that arise from the efforts to treat demand response resources in exactly the same manner as generation resources. "Comparable" treatment of demand response resources does not require "identical" treatment to generation resources, which is how the Midwest ISO staff

seems to have interpreted its mandate. The focus seems to have been on the apparent “reasonableness” of demand response requirements imposed by the Midwest ISO rather than the economic realities and “practicality” of implementation. In effect, the demand response requirements overall have been designed on the assumption that demand responders would be comparable to IPPs in their willingness to make investments to provide MWHs. Midwest ISO has tried to take market systems that were designed for collecting generation offers and dispatching the system, and trying to force fit demand response resources into this mold, rather than designing or modifying its systems to recognize the distinct characteristics of demand resources. The result more often than not looks a lot like trying to pound a square peg into a round hole. It also creates an environment that is not very end use customer friendly for loads that may have an interest in pursuing demand response opportunities. The result has been an a general absence of entities volunteering to be demand responders, as evidenced by the fact that Alcoa’s Warrick Operations is the only registered and participating Demand Response Type II within the Midwest ISO footprint.

A look at our experience is instructive. For Alcoa to participate in this new Ancillary Services market, Warrick Operations was required to install new telemetry, an Energy Management System, a control system for regulating pot-line load, a bidding interface and a new database system to facilitate interactions with the market at a significant cost to the plant. The cost to us for this equipment was in excess of \$750,000 for installation and does not include ongoing maintenance and operating costs.

In addition, the following are requirements of the Midwest ISO for participation in the new markets that we at Warrick Operations believe to be onerous and unnecessary:

1. Presently, the Midwest ISO energy market systems require that demand response resources be modeled identical to generators and is not robust enough to accommodate the physical realities of industrial customers and facilities with behind the meter generation. Due to behind the meter generation, Warrick Operations has a historic demand upon the system that is a net of zero MW's, but Warrick Operations has the ability to curtail aluminum production, while maintaining its generation, to provide negative net load into the system (the output of generators exceeds internal load). However, to function within the existing the Midwest ISO market systems, the program has to be "dummied" by our creating an additional – essentially artificial - resource node within the system. This node must submit a load into the Day Ahead market, even though a load does not exist because it is covered with behind-the-meter generation. So that instead of appearing as a single load, Warrick now appears as two loads, one that is a net withdraw (of the quantity of MW's equal to the amount of MW's that Alcoa will be participating with in the market), and another load that is a net injection into the system, equal and opposite to the “artificial load”. In other words, for Alcoa to offer 60 MW's services, the plant must submit a 60 MW load. Then the plant must self schedule MW's into the system to cover regulation bandwidth all because the Midwest ISO systems can not accommodate the dispatch of a negative load. Now, instead of settling from one node, the plant must create software expansions to submit bids at two nodes, upload metering

from two loads, and monitor settlements from two nodes, while ensuring that the net of two nodes remains equal and opposite to one another.

The requirement to model a single load as multiple loads is both confusing and unnecessary. Expecting loads to sort through and manage this process is a significant barrier, particularly when manufacturing loads are focused on their core business. This barrier could be eliminated by simply relying on the existing metering and modifying the Midwest ISO's market systems to recognize the true physical range of movement of loads. In other words, to accurately reflect the reality of the bulk power system. For instance, if Alcoa is at a net load of zero, the Midwest ISO could request a demand response reduction in our smelting load of 30 MW's. Alcoa's smelting control systems can respond and the plant would become a net exporter. Subsequently, if MISO requested an increase in our smelting load by 30 MW's, the control systems would respond appropriately on the smelter, and Warrick would become a net withdrawal of energy from the MISO system. Nothing more would be required. This approach is straightforward and results in modeling that is easily understood, balanced and would represent the physical realities of our relationship with the Midwest ISO.

2. Real time telemetry requirements also form a barrier to entry for demand response resources. Alcoa has invested significant resources into purchasing and installing real-time metering on the smelting loads to supply to the Midwest ISO. While we recognize that the requirement for real time metering is probably required for providing regulation services, it is not necessary for a plant to respond with

services like real energy, spinning reserves and supplemental reserves. We agree that there must be a mechanism for verification of response and penalties for non-performance, but meaningful response does not require real-time telemetry or information at this granularity. For instance, the PJM's synchronous reserves market allows demand response resources to provide 1 minute interval data on an "after the fact" basis. The Midwest ISO has made no demonstration that it has to have information at this level. Again, this barrier arises from trying to treat demand resources just like a generator, which is pervasive under the Midwest ISO's rules. For larger loads, existing systems and local balancing authority metering could be used to derive the same information. Most industrial loads have not had this standardized requirement and would have to add this metering to participate where generators have functioned in regulated markets where the costs of metering were covered in expenses. While not proposing an economic endorsement, existing system and LBA metering could be used to derive the same information that confirms and documents system performance and responsiveness without the expense of telemetry. It should also be noted that the Midwest ISO's telemetry requirement, although apparently motivated by the planned ancillary service markets, also now exists as a barrier for demand response participation in the Midwest ISO's energy markets. In other words, even if you have no desire as a demand response to provide ancillary services, and are only interested in providing energy, you are still subject to telemetry requirements..

3. A forecast of resource availability is useful in the operation of the power system, but the Midwest ISO's requirement for a 5-minute interval forecast is overkill and

unnecessary. An hourly forecast could be used for the same purposes, especially given that settlements works off of hourly intervals. The forecast requirement places unnecessary burdens on the end-user to manage the forecast and equipment for continuous upload of the forecast. A 5-minute load forecast can be much more onerous for us to predict than a 1-hour load forecast because of intra-hour variations. Either way, the forecast does not determine the ability of the resource to respond and provide sufficient benefit for the system to justify its burden.

4. Additionally, the staffing burden on a manufacturing facility to actively manage the participation in demand response markets should not be underestimated.

Because of the significant potential at Warrick Operations, full time staff has been devoted to managing the market interface and opportunities within the Midwest ISO; however, many smaller loads will find it hard to justify the effort to manage this type of interaction with the market, simply because of the complexity of the process. The Midwest ISO – and the Commission – must to take a serious look at making it easier for loads – people whose primary business is not buying and selling in electric markets – to make their resources available when the economics warrant. Alcoa’s experience has been that integrated utilities are reluctant to establish meaningful opportunities for participation in demand response programs by their customers. Allowing third parties to aggregate retail customers will help eliminate some of these barriers and demonstrates why independent demand responders are important and why we believe the RTOs/ISOs should invest time and resources into developing and exploiting demand resources throughout their system, rather than simply making opportunities available through existing

systems. Alcoa supports the Commission's proposal to allow third party aggregation of retail customers to participate as demand response in RTO Markets.

Currently, Alcoa Warrick Operations is the only Demand Response Resource – Type II registered within the Midwest ISO. On March 19th and in subsequent closed loop operational tests conducted in May, the Midwest ISO successfully dispatched the Warrick Smelting Load to provide regulation into the system and our response was determined by Midwest ISO staff to be “very good”.

Warrick Operations represents a unique resource that can provide an economically competitive and environmentally positive contribution to the reliability of the Midwest ISO grid. Additionally, Alcoa has many resources throughout North America that can also supply valuable services to the grid and be a balancing factor in the supply and demand balance that is required for a well structured market.

We believe there are more opportunities available for Alcoa's facilities, but each is unique in nature and has the ability to provide unique services, that may not fit into the existing generator model. Unlike generators, which have many decades of standardized design and performance characteristics, demand response resources are unique and many unnecessary barriers to entry exist that deter new Demand Response Resources from participating in the market. While we have successfully moved forward with our Warrick facility, the current Midwest ISO rules and processes for demand resources will preclude

other Alcoa facilities from being able to economically justify participating in the Midwest ISO markets, even though these loads could create meaningful responses from our (11) manufacturing facilities, with loads of up to 70 MW's.

In summary, Alcoa is excited about the evolving opportunities for Demand Response Resources and proud to be working in conjunction with the Midwest ISO (and other RTO's) to supply energy and ancillary services, but we are also concerned about the current costs and operational impacts that are barriers to maximizing participation in these processes.