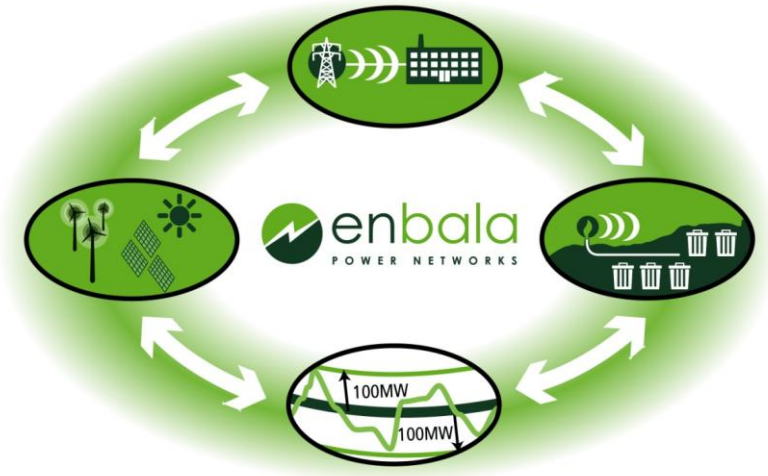
enbala POWER NETWORKS

Presentation to DoE Workshop
October 25-26, 2011



Smart Grid Solutions That Pay You

RED HERRING WINNER 50 CANADA

Canada's Top 10 Cleantech Companies Competition Winner

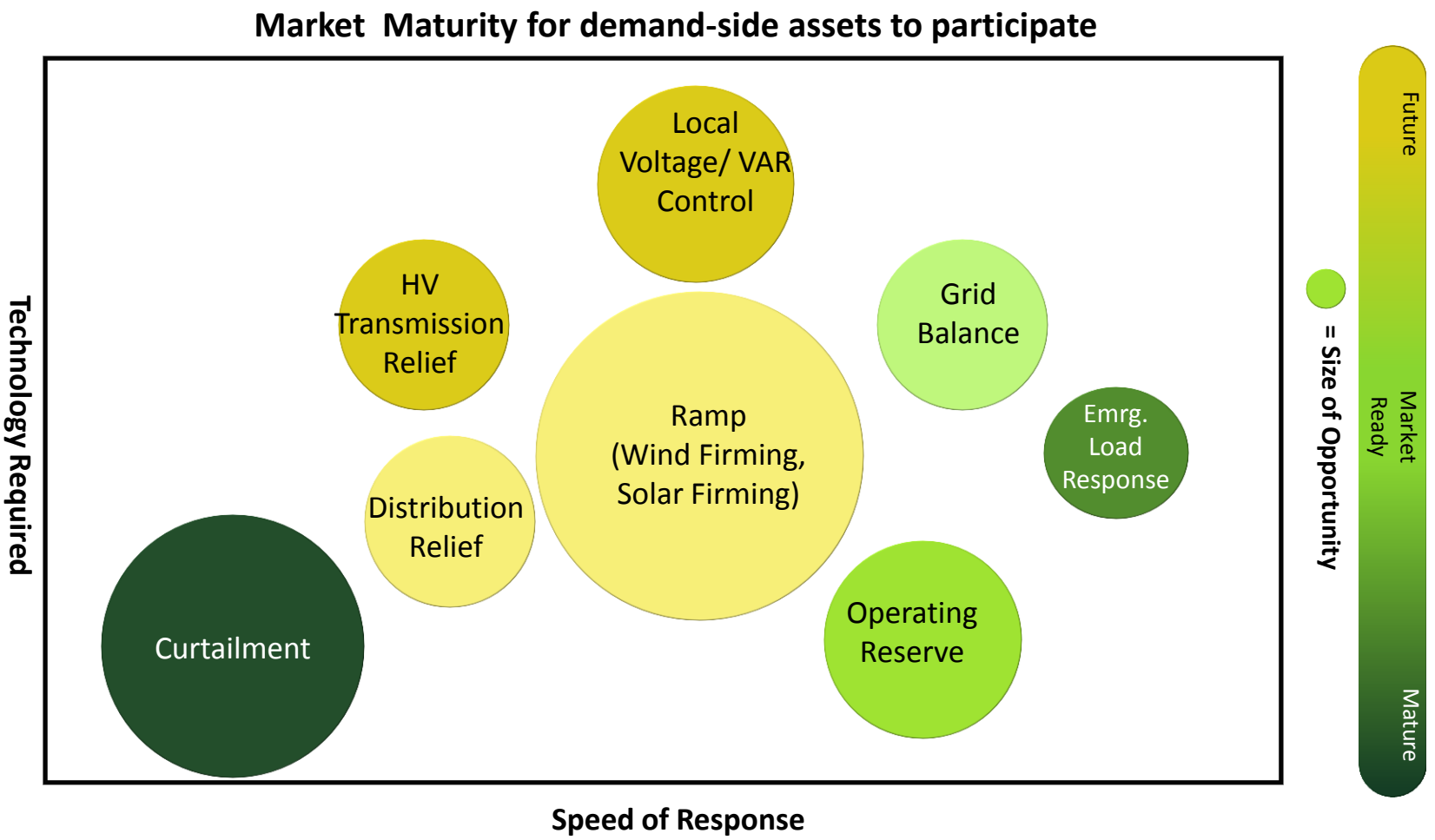
READY TO ROCKET 25

IDC CANADA'S TEN TO WATCH 2009

AI Water Top 50

Deloitte. Technology Green 15

Demand Side Management Universe



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Much Faster and more Frequent Response

(But, this is “just” an IT problem)

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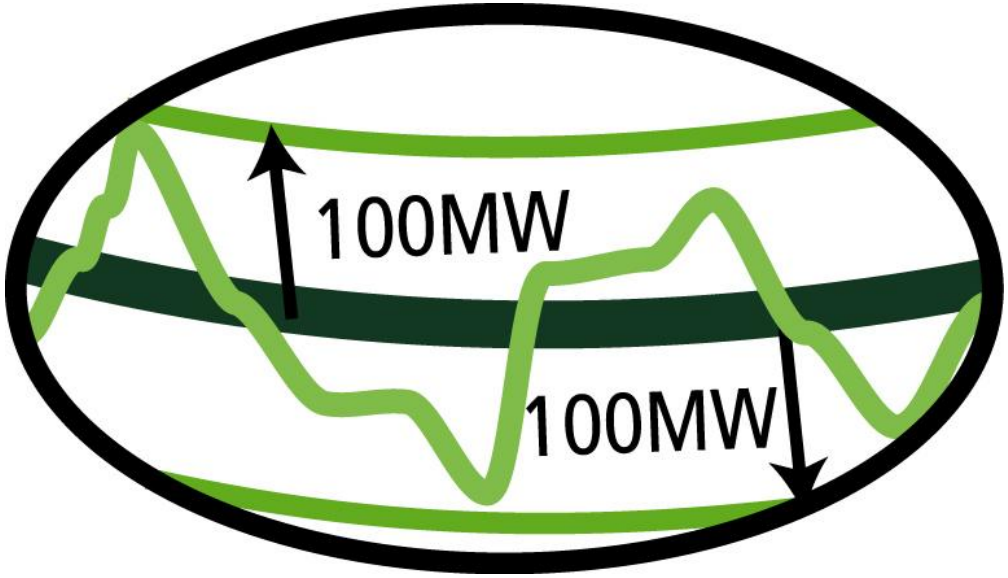
New DR products must be bi-directional

- Regulation represents required balance in the grid
- As likely to require the use of more power as curtailment



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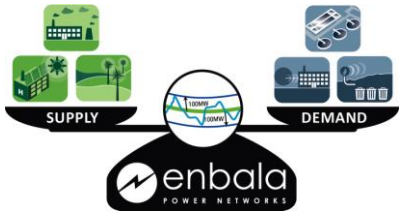
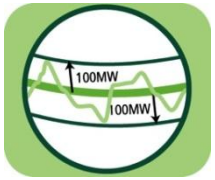
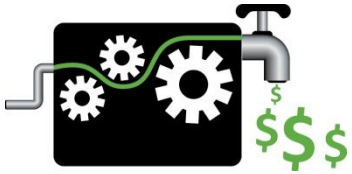
Much Less Intrusive to the Customer



Requirements are *more frequent* and have shorter notice



Requires intelligent capture of *inherent flexibility* in processes



Requires the ability to *define constraints* such that operational priorities rank first

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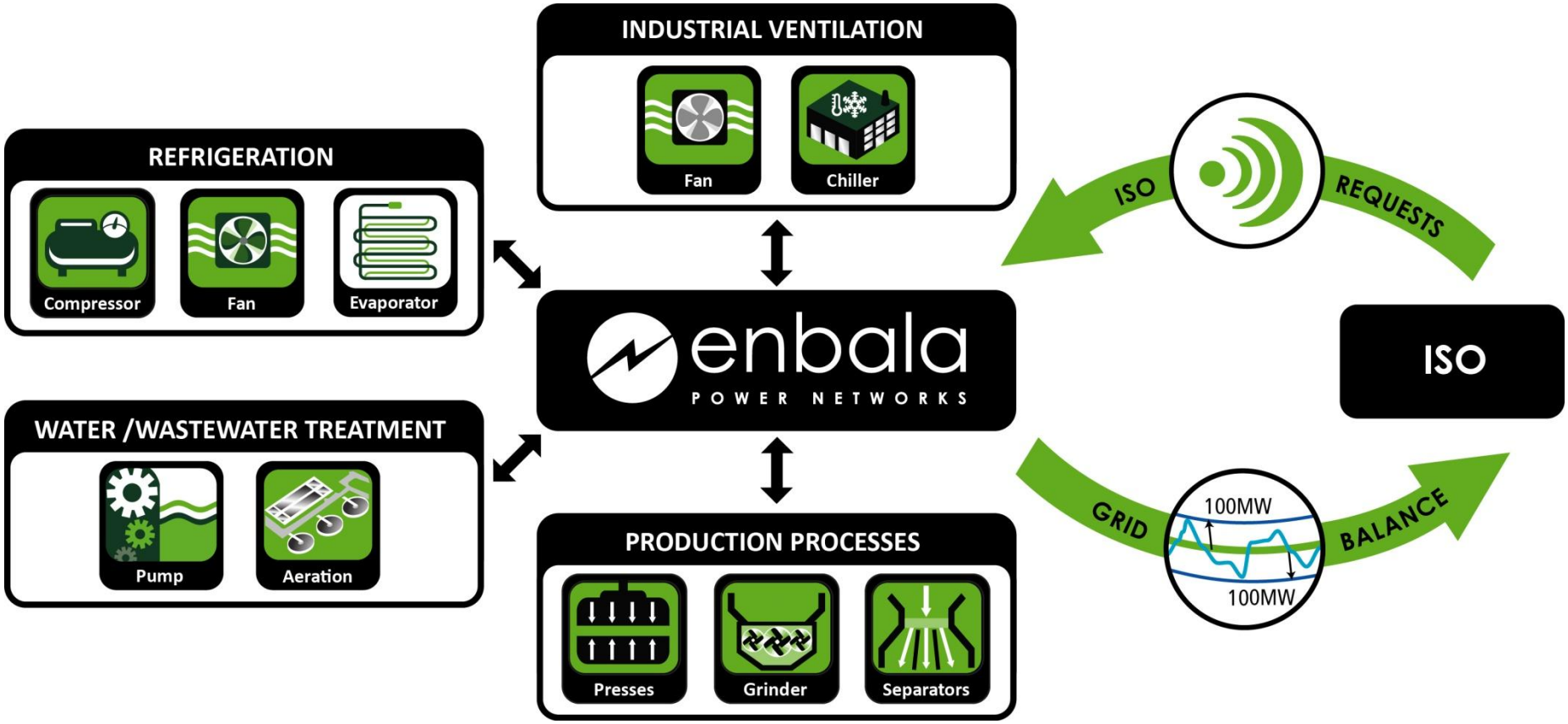
The Challenge for Loads

- It is hard for loads to participate directly in most ancillary services markets
  - Responsiveness required is quite frequent, often bi-directional
  - The reality is that the load's primary objective outweighs participation in challenging markets

- Additional administrative challenges
  - Understanding the markets
  - Bidding requirements; real time monitoring; measurement and verification
  - Managing real time changes in availability and status

- Almost certainly requires some form of aggregation to help coordinate the response of many loads to deliver the robustness, reliability and resiliency required by the power system --- DER's

ENBALA Power Network



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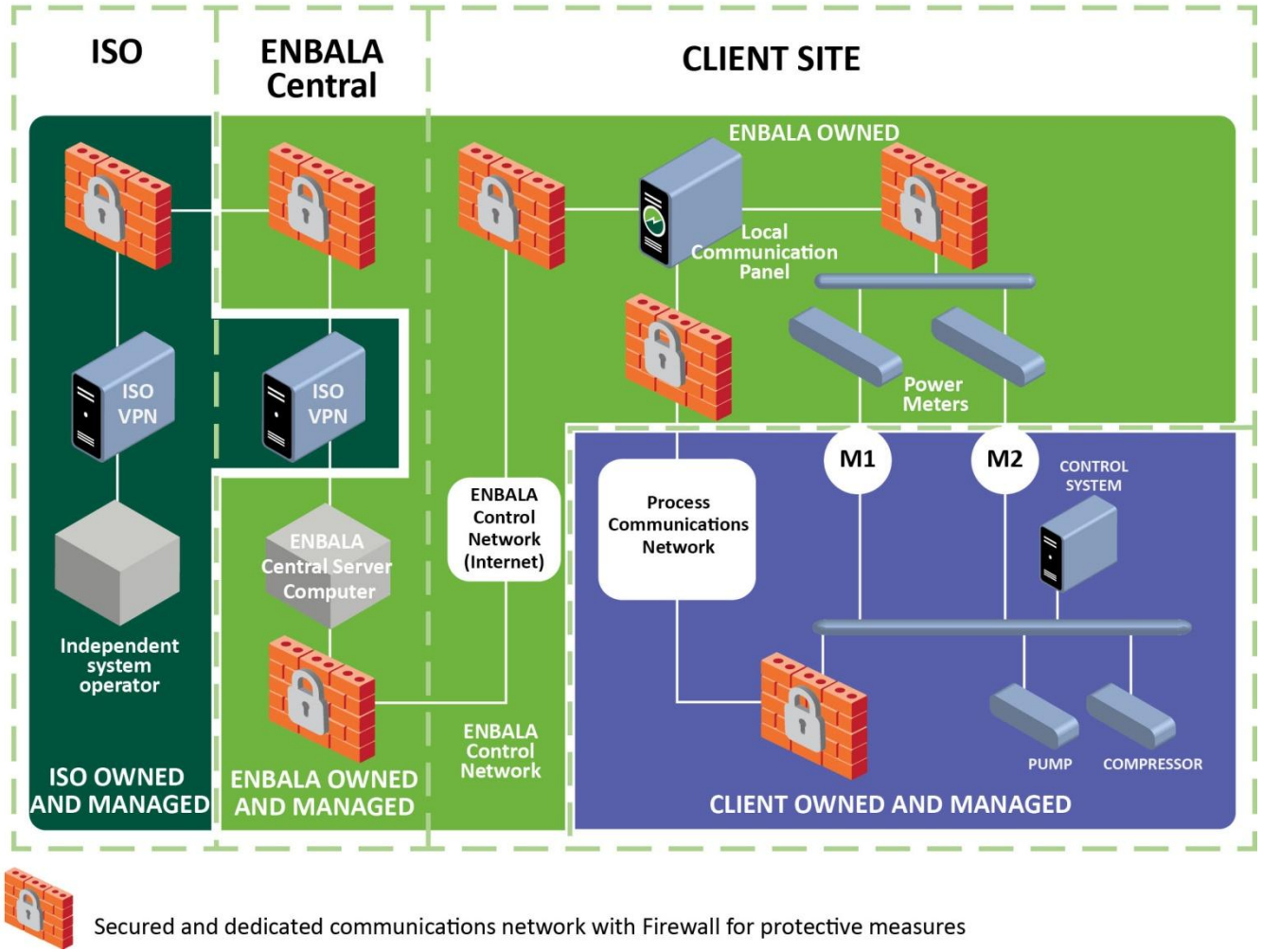
EPN Network Diagram



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Industrial Facilities Making a Difference

DEMONSTRATION

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ISO Signal

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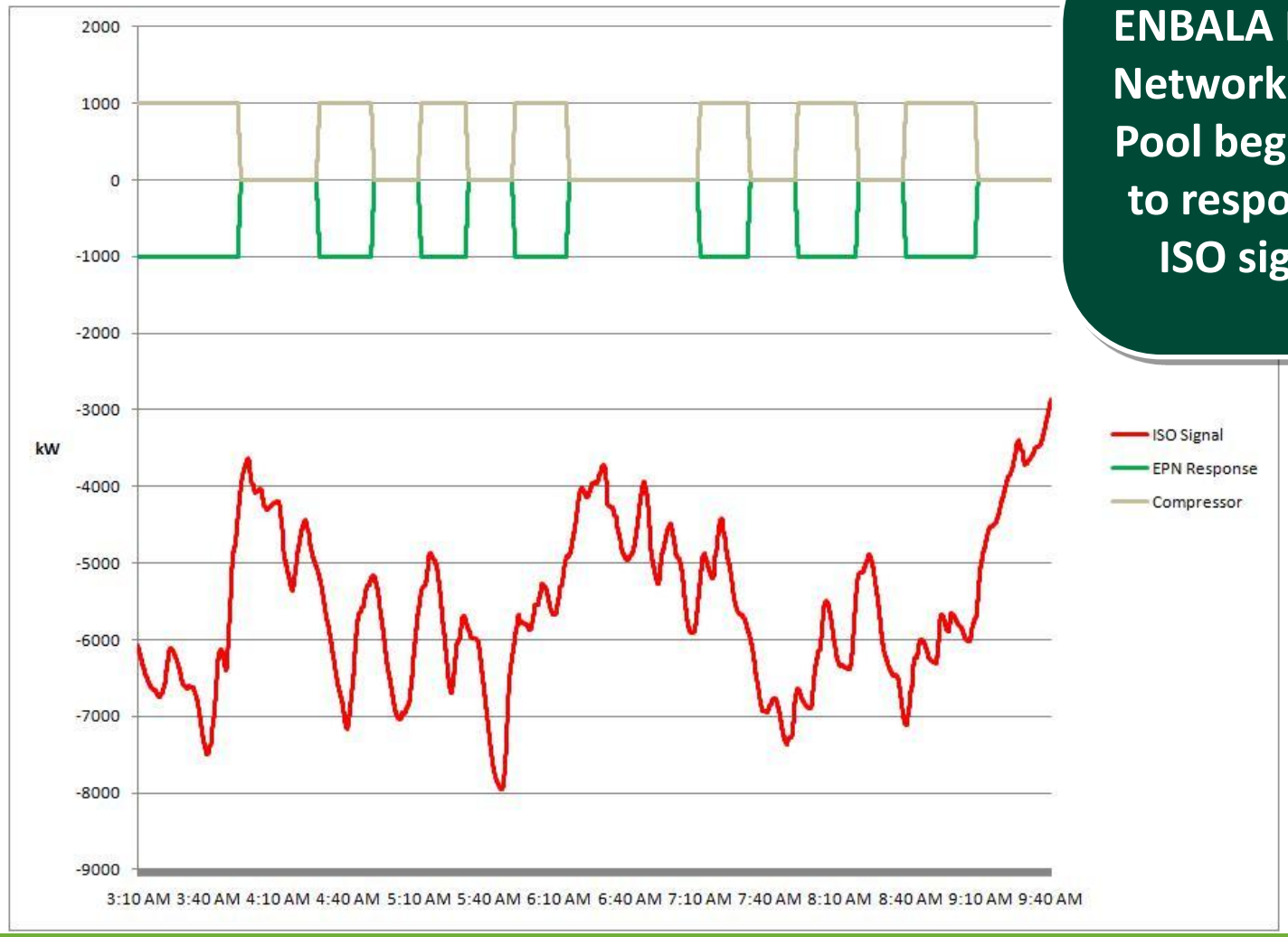
Resource Response



ENBALA Power Network Client Pool beginning to respond to ISO signal.

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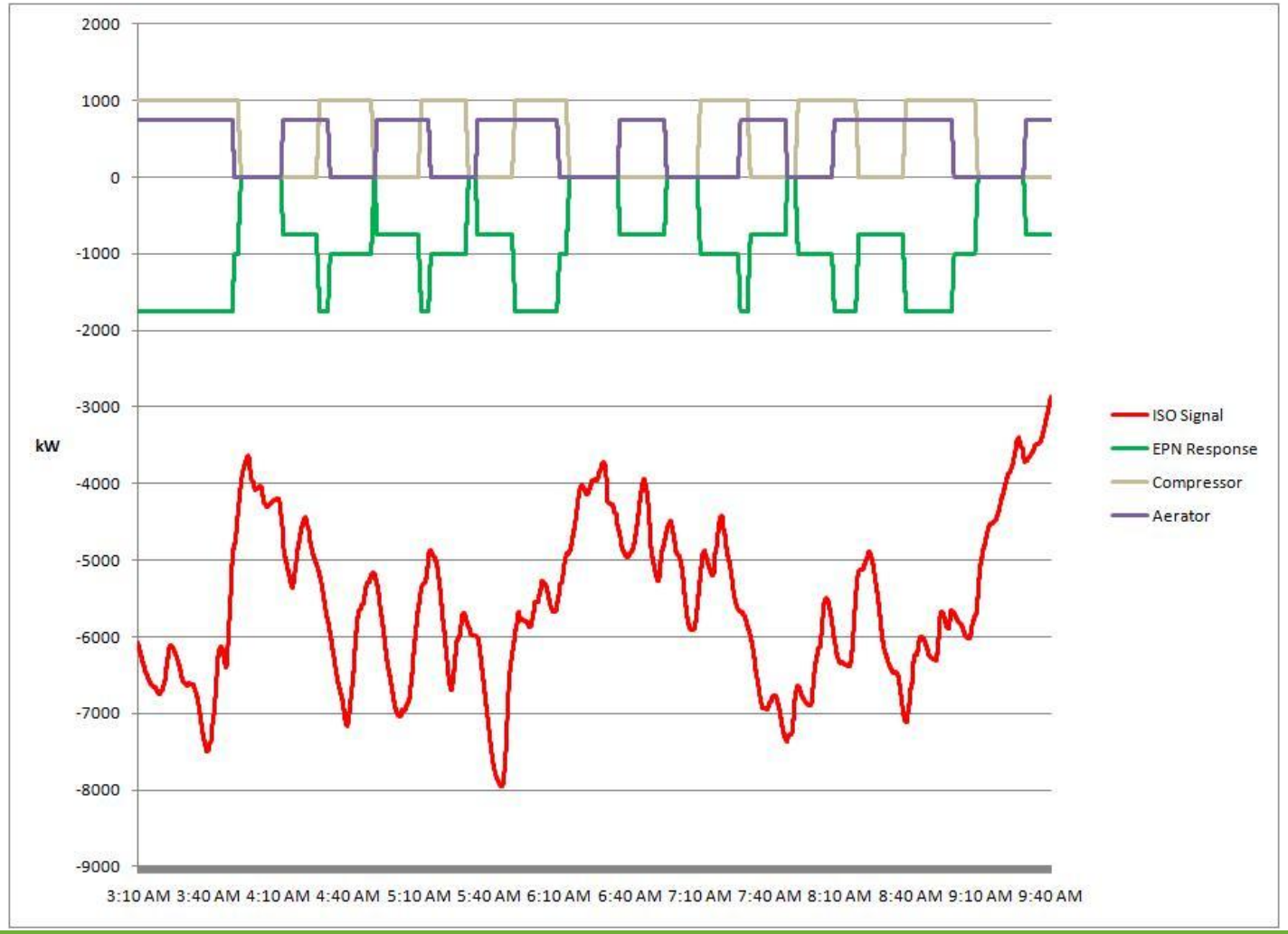
Resource Response



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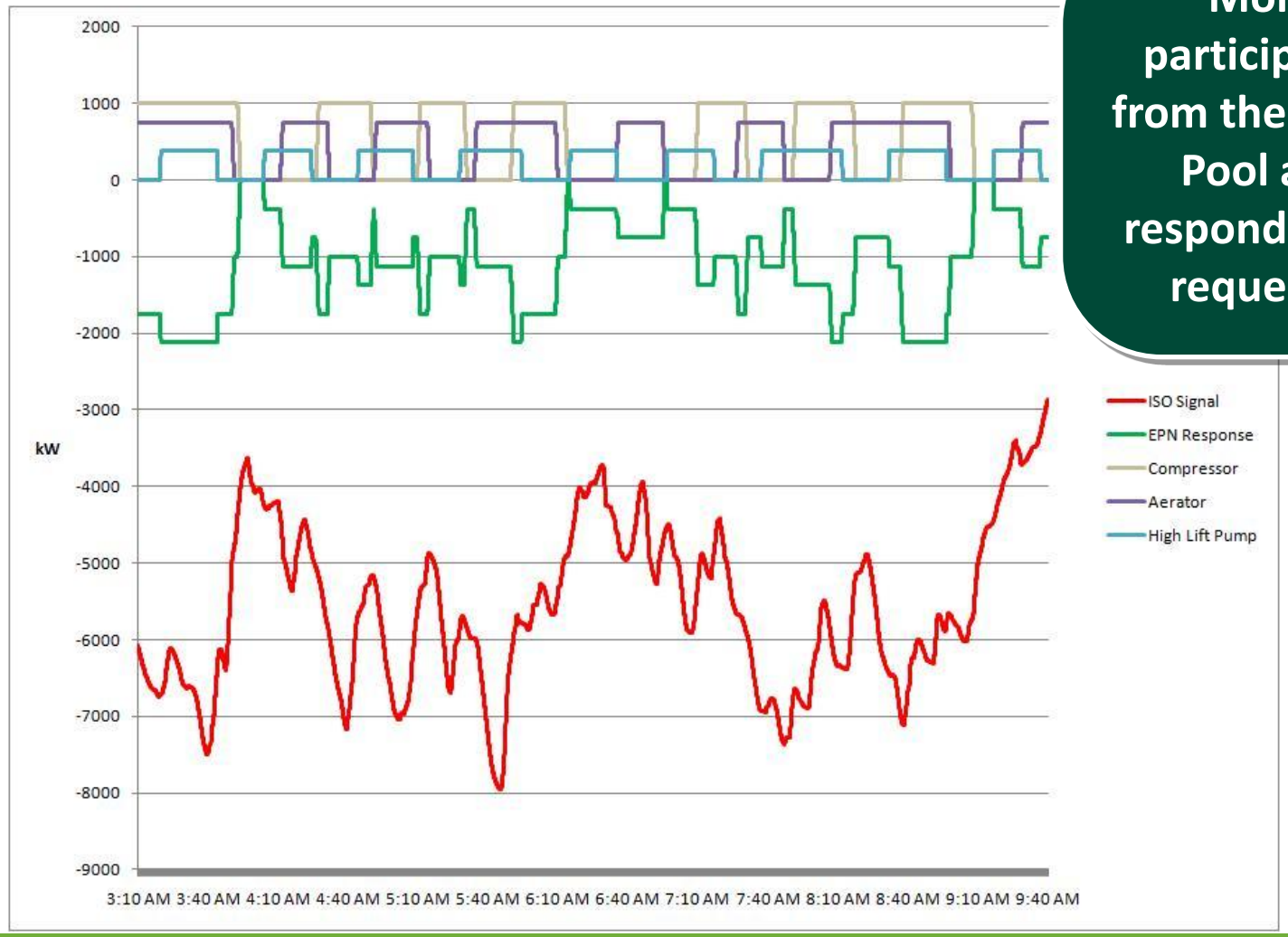
Resource Response



More participants from the Client Pool are responding to requests.

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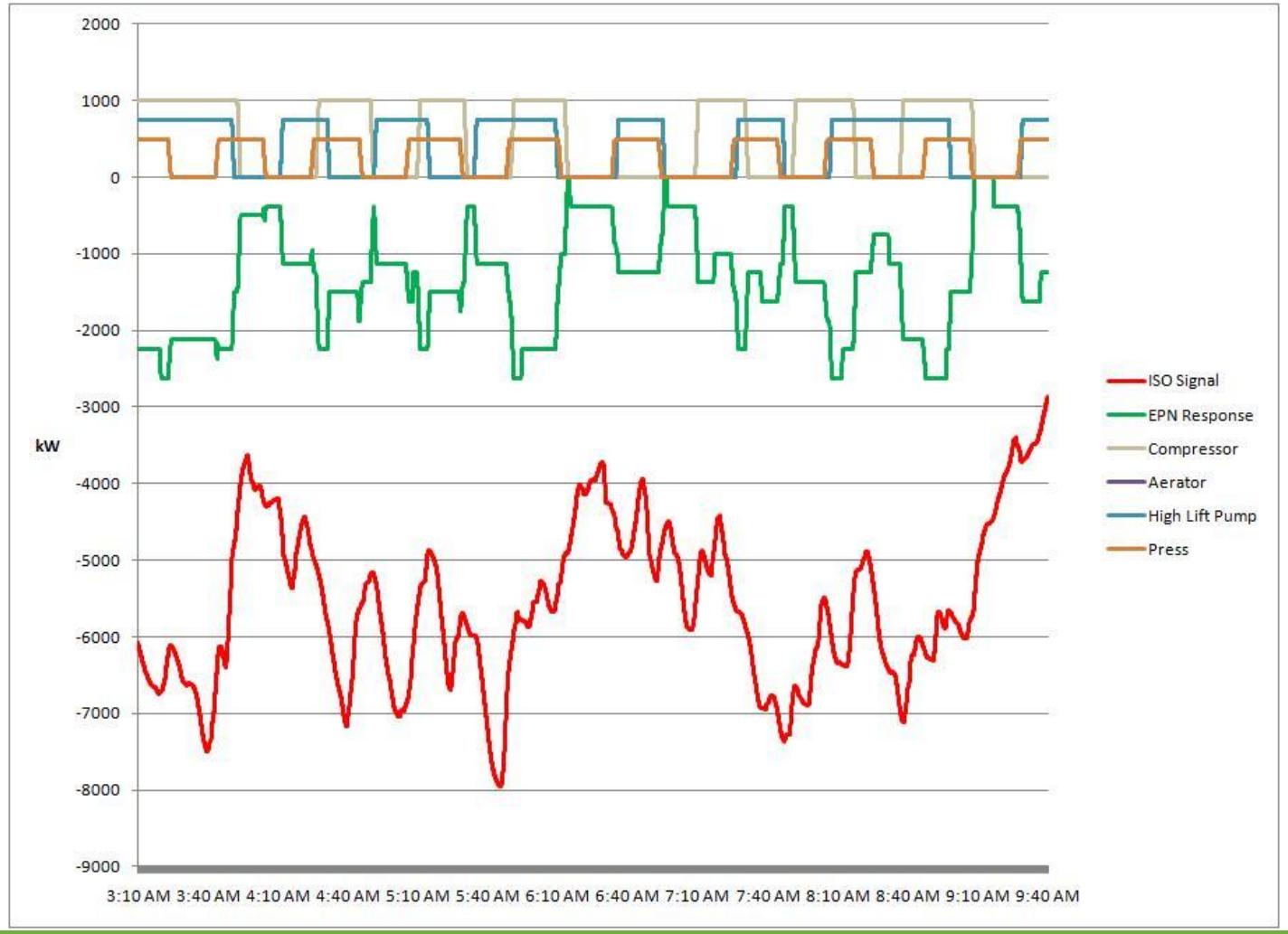
Resource Response



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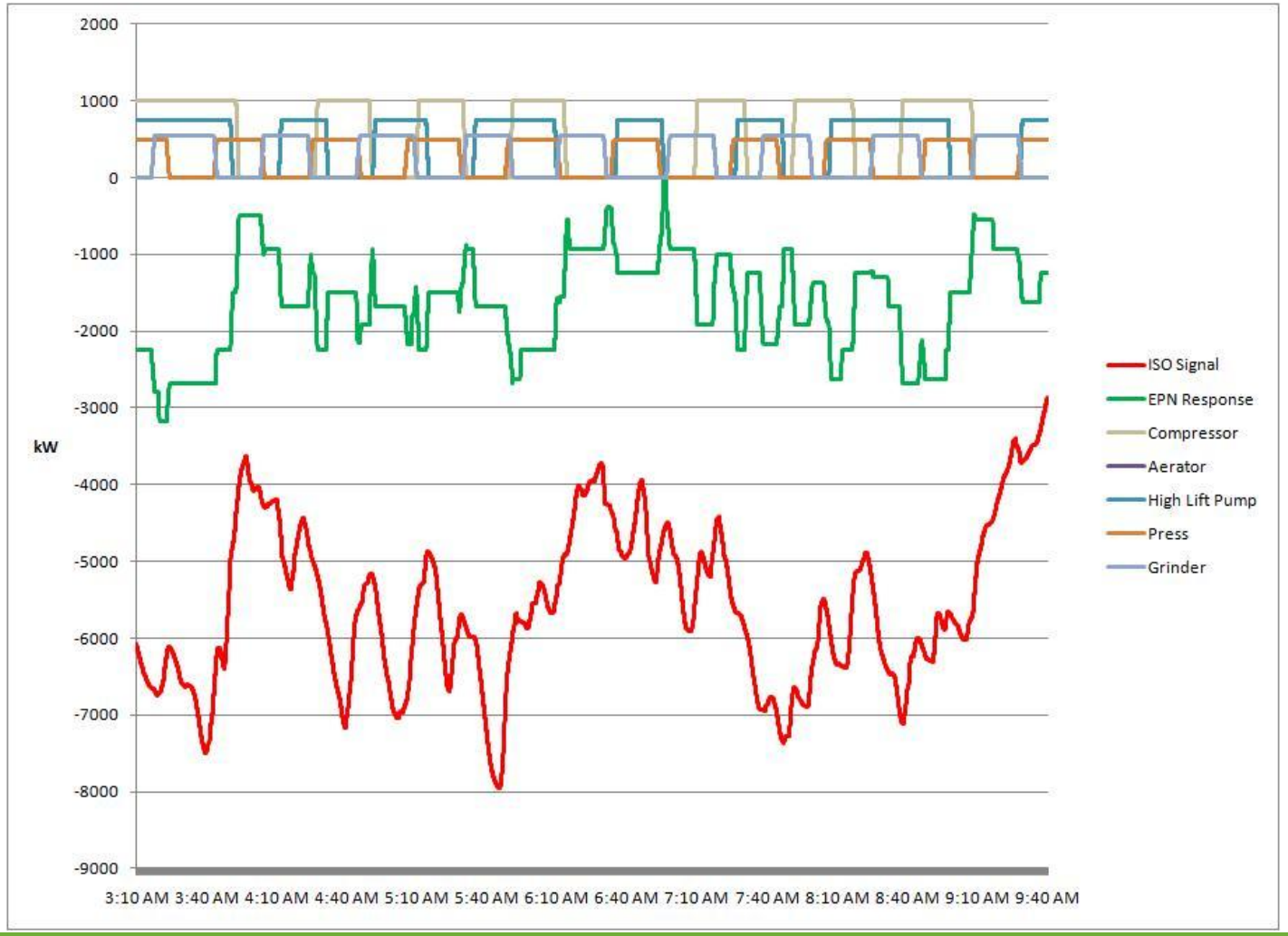
Resource Response



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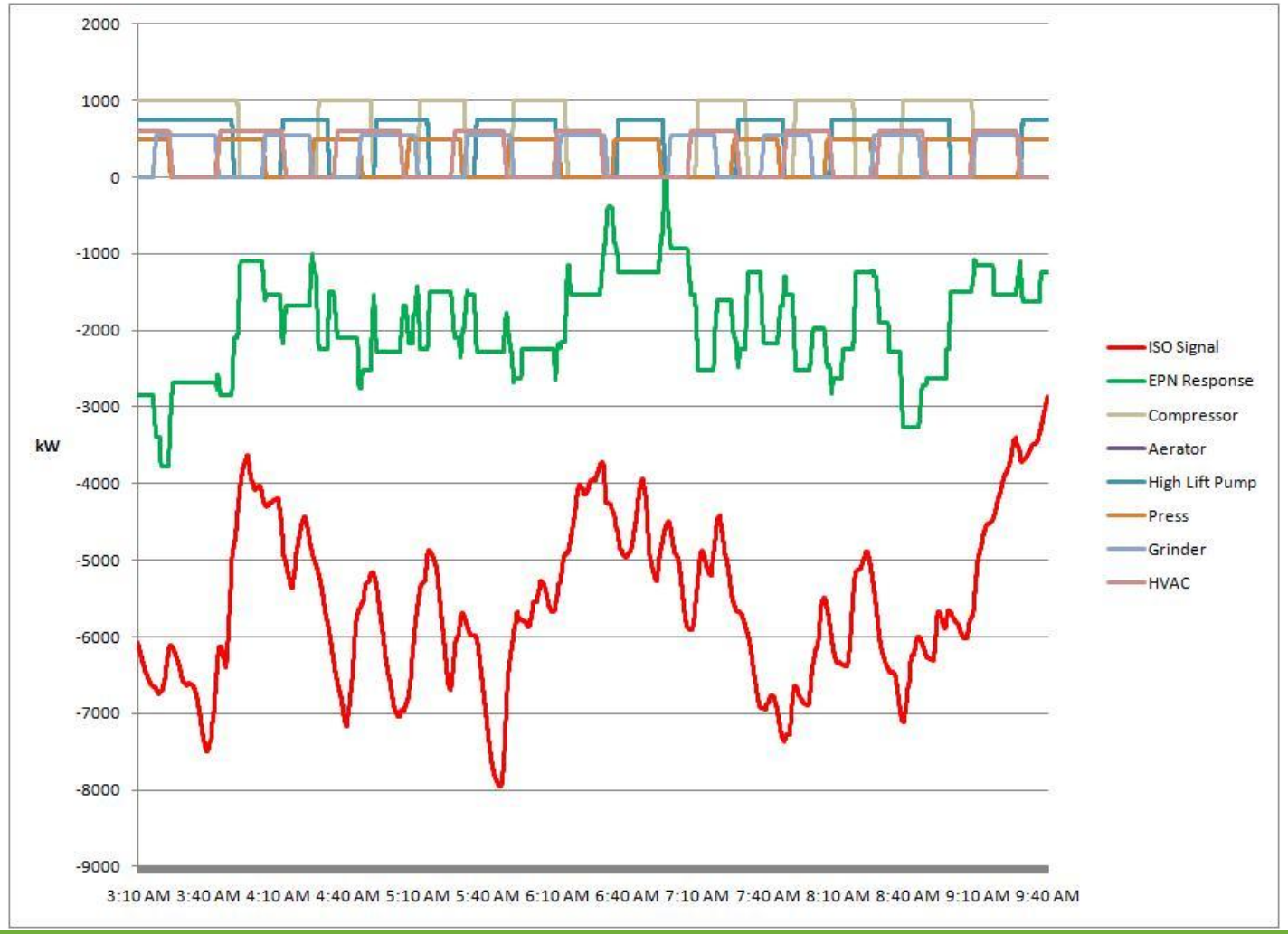
Resource Response



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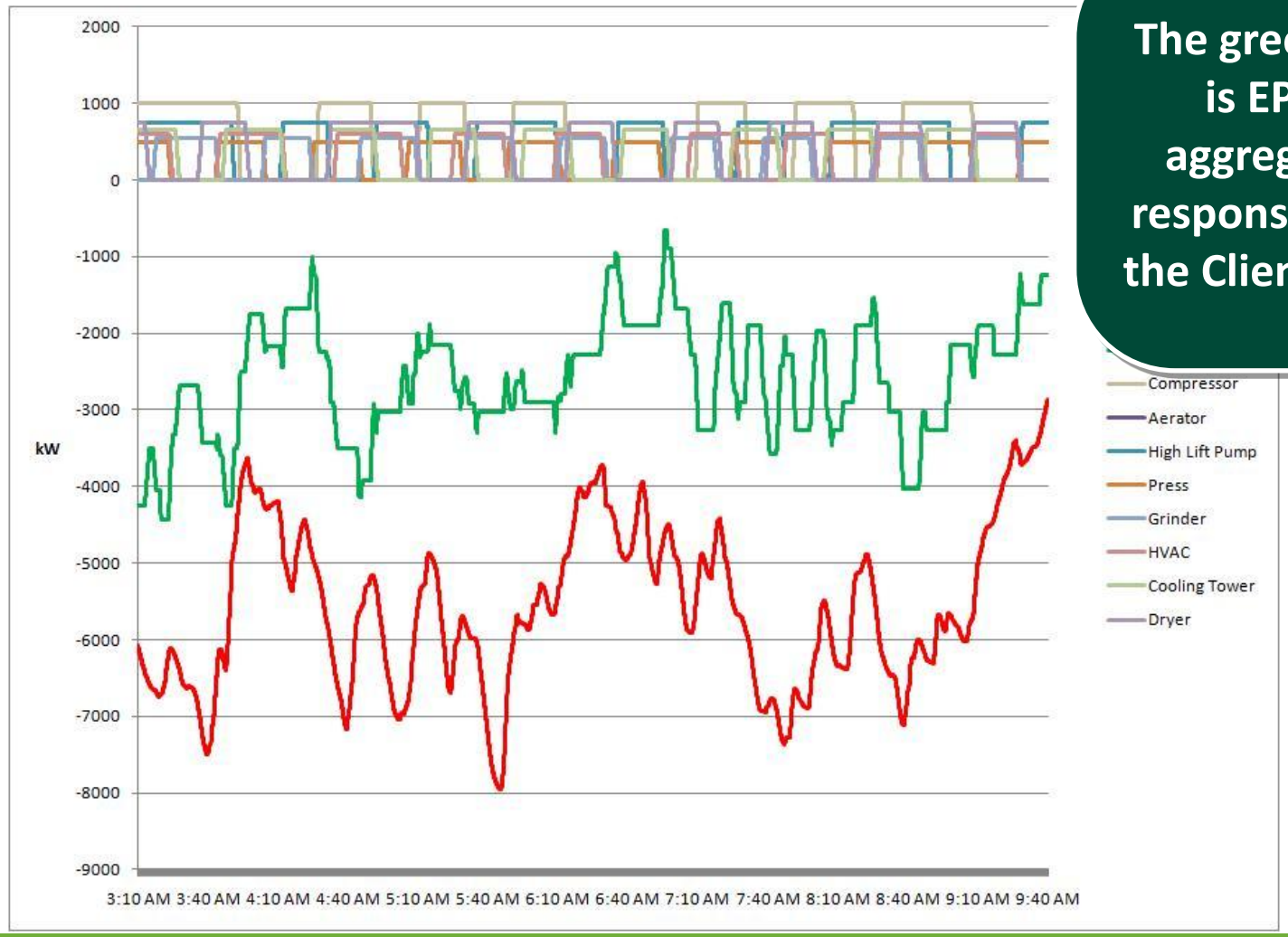
Resource Response



The green line is EPNs aggregated response from the Client Pool.

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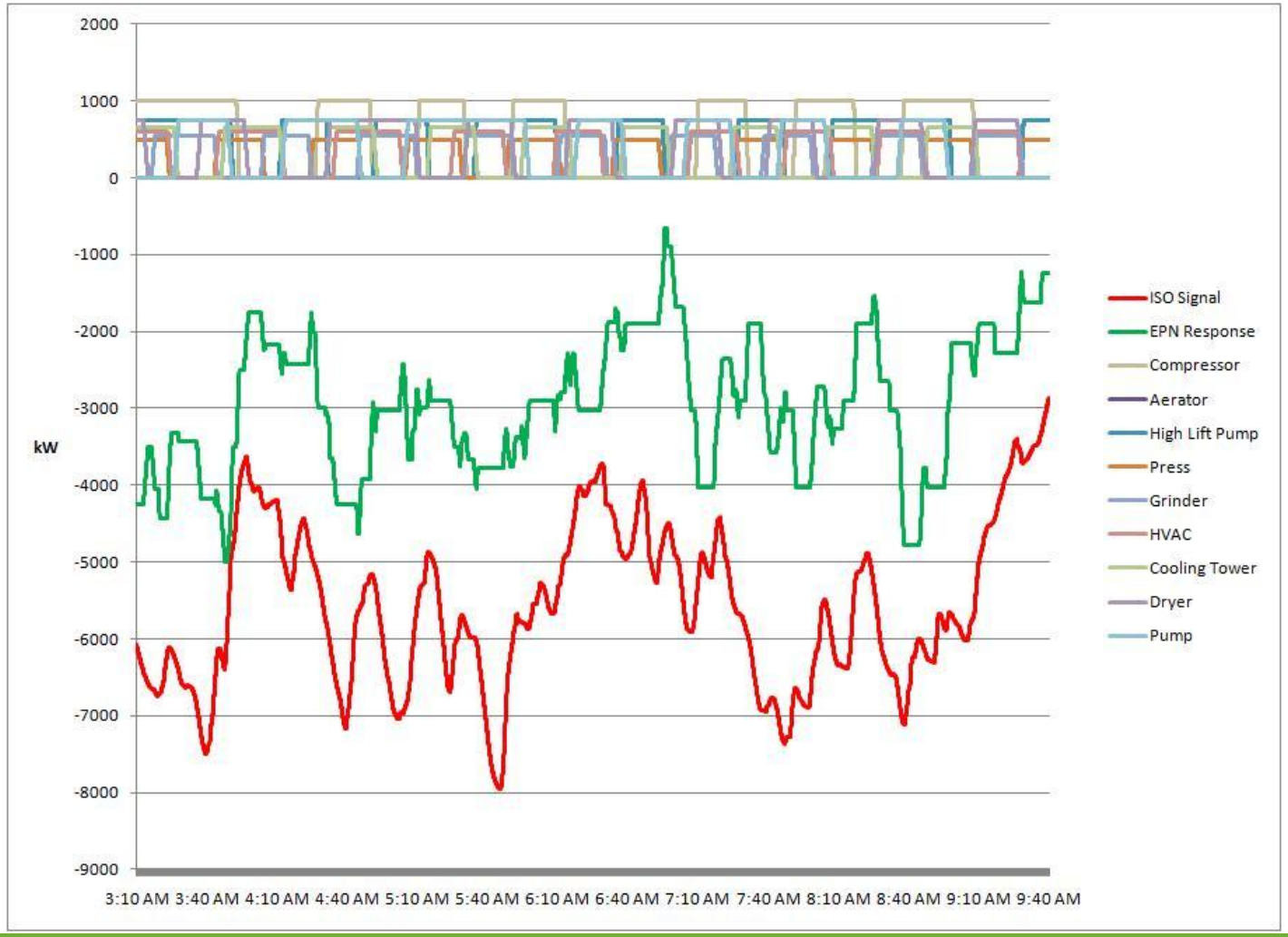
Resource Response



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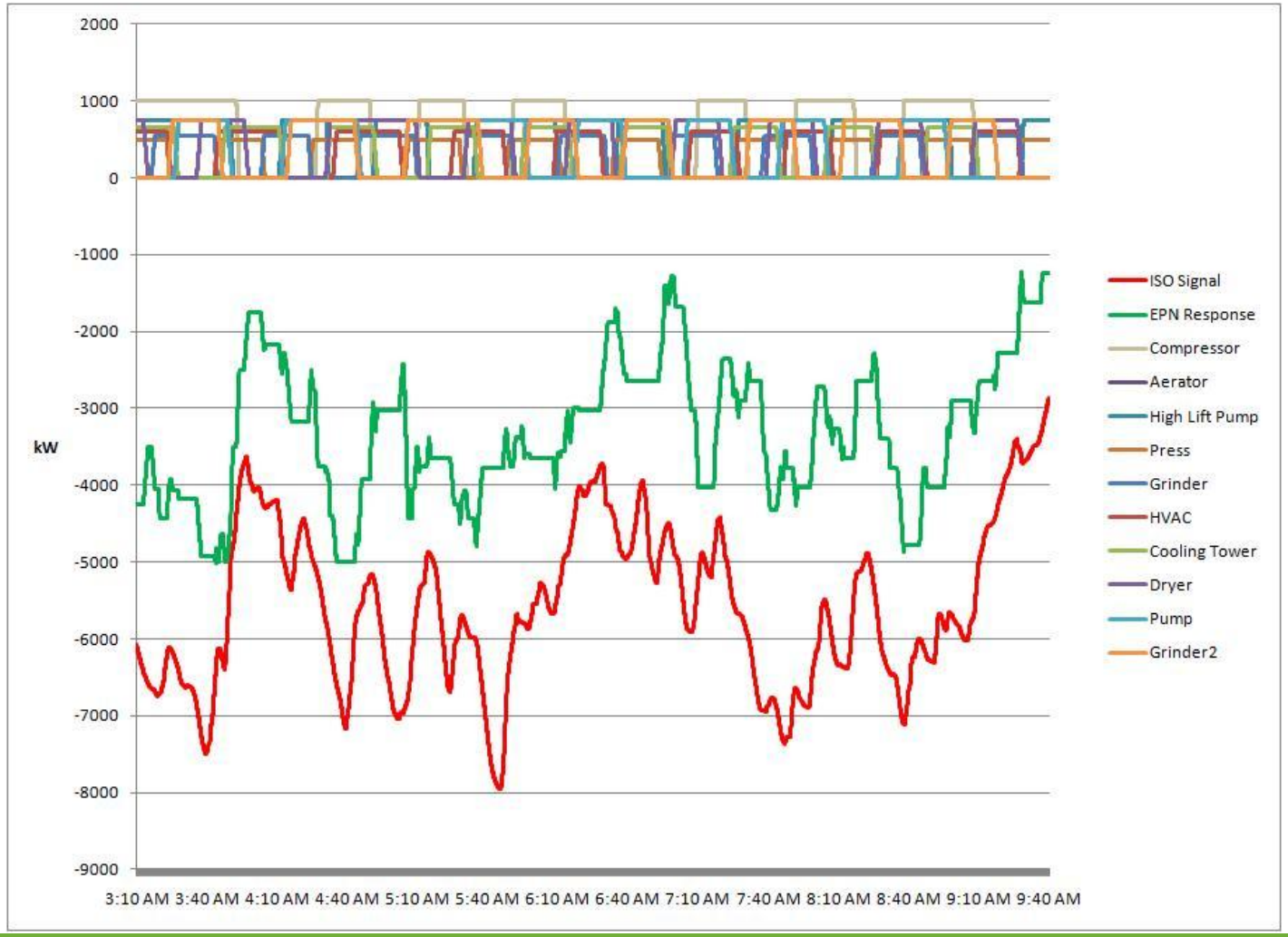
Resource Response



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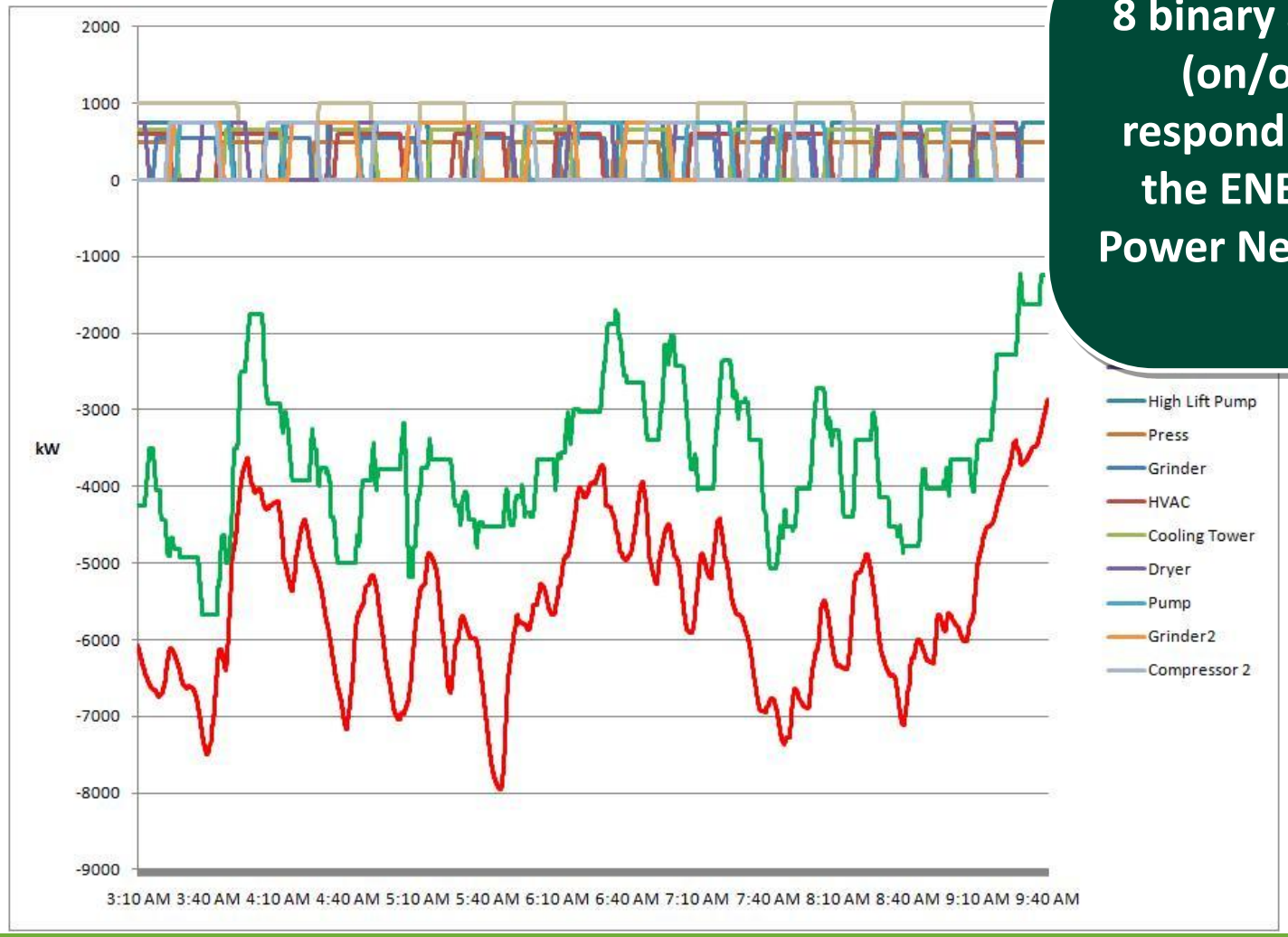
Resource Response



8 binary assets (on/off) responding to the ENBALA Power Network.

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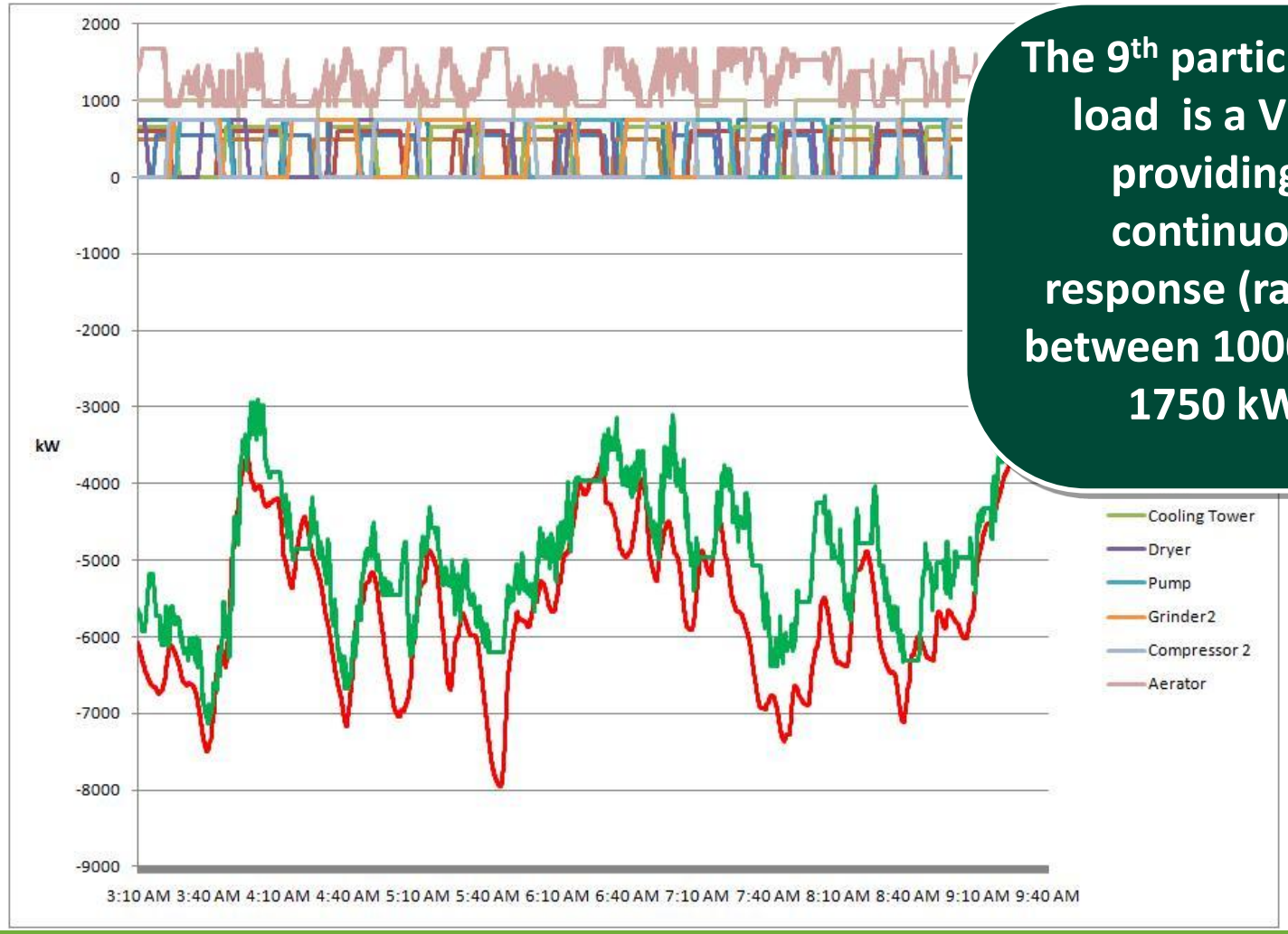
Resource Response



The 9th participating load is a VFD – providing a continuous response (ranging between 1000 kW – 1750 kW)

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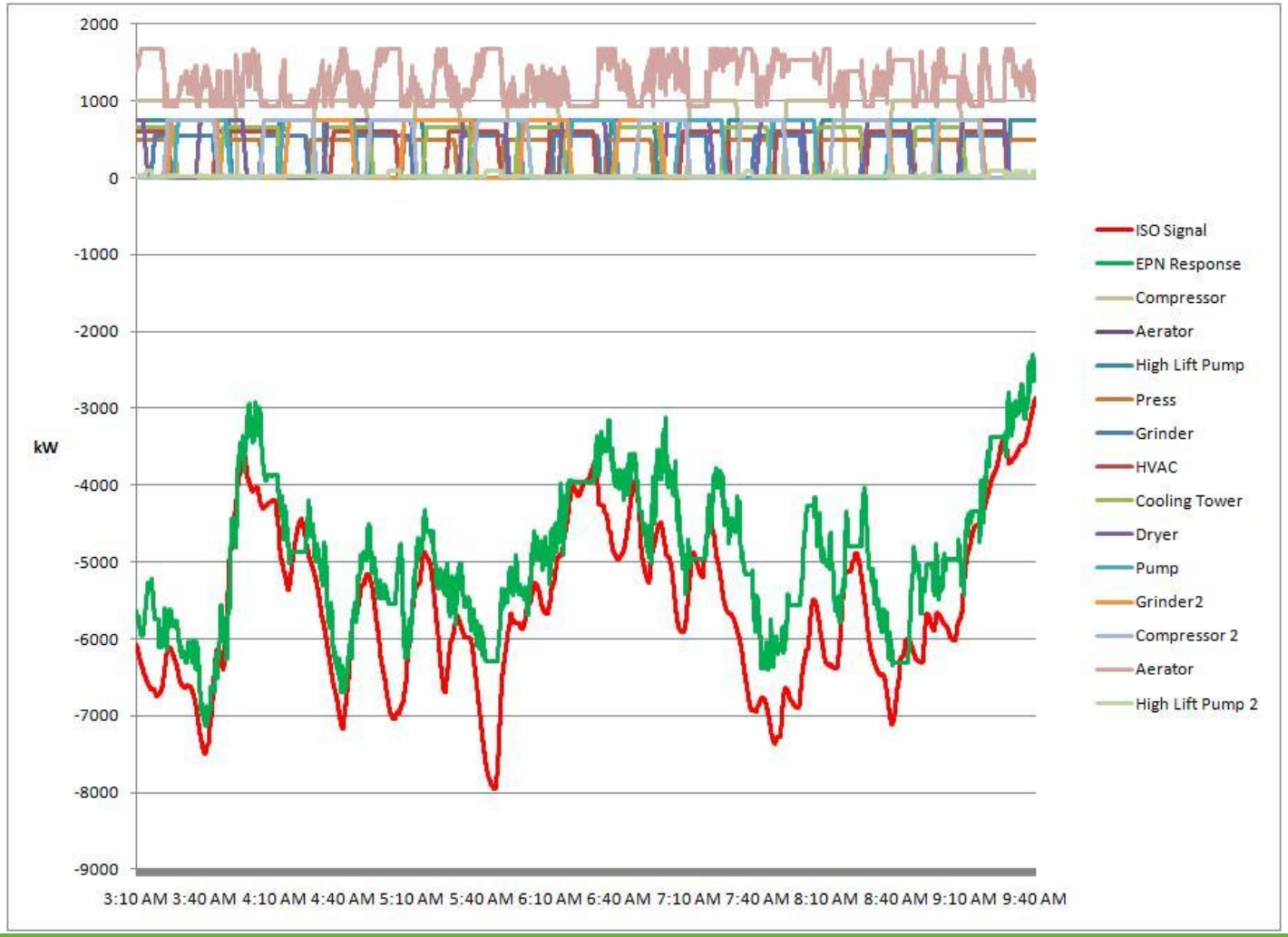
Resource Response



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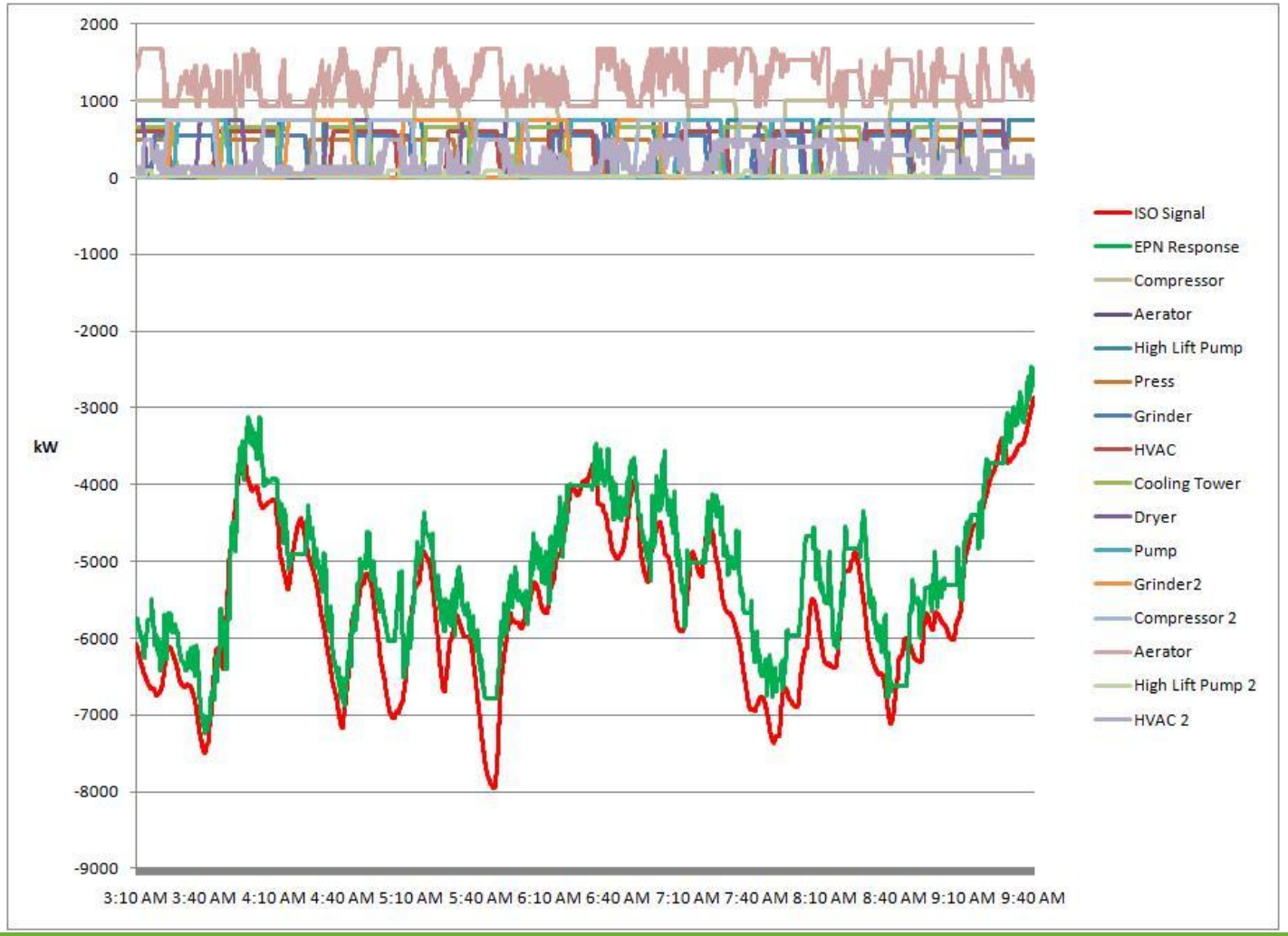
Resource Response



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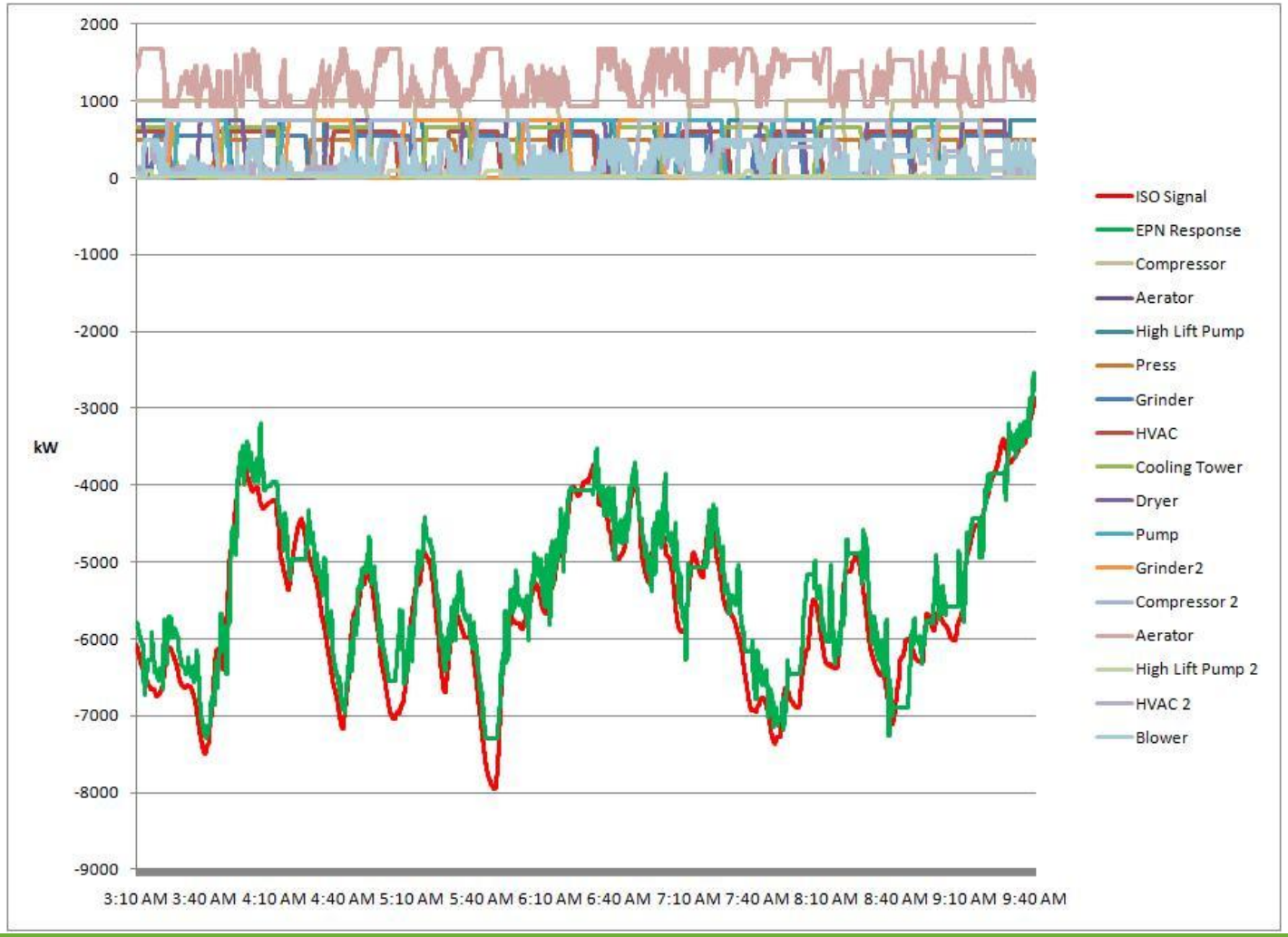
Resource Response



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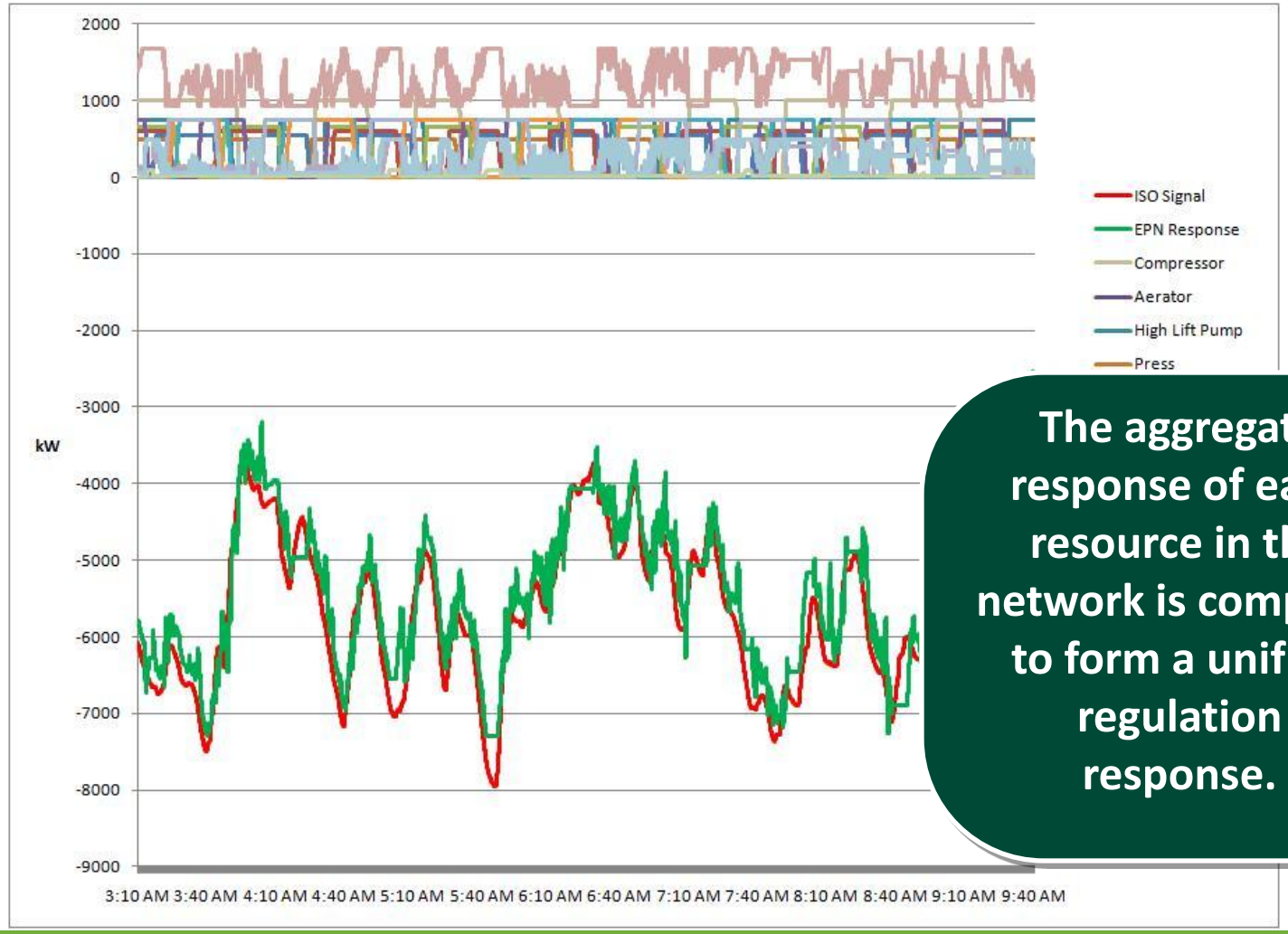
Resource Response



The aggregate response of each resource in the network is compiled to form a unified regulation response.

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Regulation – Resource Response

The aggregate response of each resource in the network is compiled to form the regulation response

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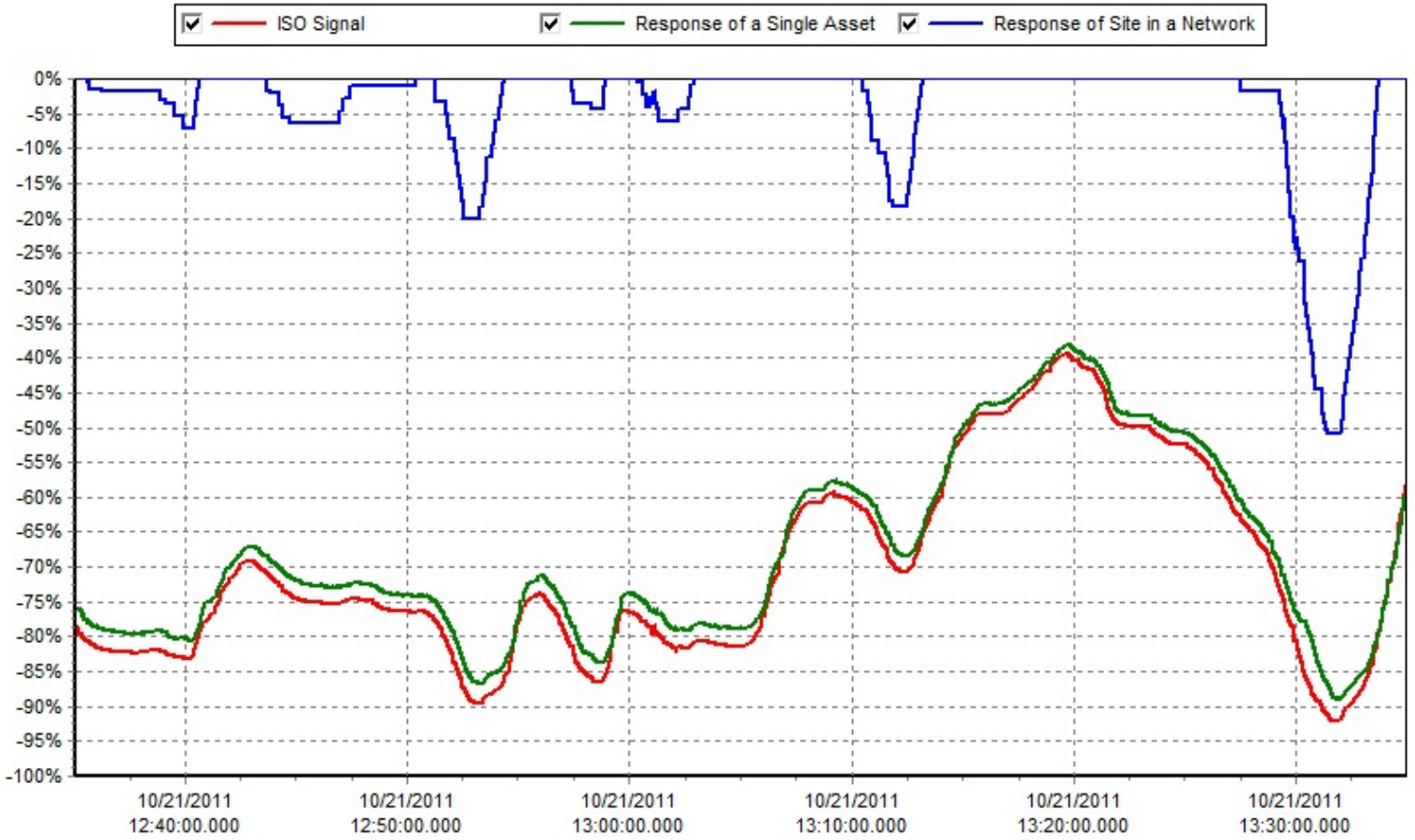
Real World Load Response



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Challenges to Delivering on the Promise

- Regulatory
- Drive and Focus in ISO's and Utilities
- Engagement of Loads
- Effectiveness of Typical Pilots

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Regulatory

- FERC Order 719 Requires ISO's to create a level playing field in ancillary services markets
  - Largely, they can (and do) claim to have done this
- In reality, most jurisdictions continue to have "technical, administrative" barriers to entry
  - Do not permit loads to aggregate to provide ancillary services
  - Aggregation rules are somewhat arbitrary and slow adoption
  - Operational systems (at ISO's) not upgraded for different resources to participate; reluctance to establish as priority
  - Do not allow multiple CSP's to participate with same clients (creating effective barrier to new entrants)
  - Layered rules: States require separate registrations

Drive and Focus of ISO's and Utilities

- Largely, ancillary services markets are functioning reasonably well (almost completely served by generation side assets)
- In most ISO's, other priorities, driven by larger stakeholders, dominate the agenda

- Almost everyone believes that loads can provide ancillary services, and most think it is a "good thing"
  - **But most are not focused on seeing more of it happen**

- Requires stronger support among policy makers
  - Minimum targets for demand side participation?
  - Encouragement in load participation?
  - Fortitude to understand and make

Engagement of Loads

- Recession of 2008 took the pressure off -- reduced scrutiny over energy bills
  - Reduced demand caused a reduction (generally) in electricity prices
  - Also reduced volatility in prices
  - Reduced corporate pressures to reduce energy costs
- Some (legitimate) concern over implications of participation in ancillary services markets
  - Requires more “connectness”
  - Requires new thinking and some effort (implies early adopters first)
  - Not sure whether it is “worth it”
- Most markets for ancillary services have experienced price declines
  - Less value -- certainly a concern for loads to participate
  - Less assured return -- participation in a market does not produce a guaranteed return
  - Different than traditional DR

Effectiveness of Typical Pilots

- Most pilots seem to focus on the communication
  - How to get the signal from the ISO to the load
  - Protocols -- demonstrate AutoDR
- This is the easy part!!
  - Necessary, but not nearly sufficient
  - “Just” an IT problem
  - This has been solved many times before, in many industries
- The hard part is managing the load’s response, *while respecting their operating parameters*
  - Any pilot that doesn’t do this, really isn’t addressing the core problem
  - Much more work needs to be done here

Suggestions for Research Targets

- Demonstration of Regulation at a vertically integrated utility
  - Measure value of Regulation to generator fleet (reduced O&M, reduced emissions per unit of energy, increased efficiency)
  - May require splitting AGC and dispatch system
- Identify best practices in regulatory environment
  - How to encourage multiple parties to deliver multiple ways for loads to participate in ancillary services (ie multiple CSP's, aggregation rules)
- Identify best practices in operating environments
  - Splitting Regulation signal into fast and slow components
    - Removing energy bias
    - Finding ways to allow energy limited (or neutral)resources to play (applies to both loads and limited energy storage devices)
  - Defining "what good looks like" -- and paying for it
    - Accuracy vs speed?

Suggestions for Research Targets

- Reducing Connection Costs
  - It costs ~$50k to intelligently connect a controllable load today (equipment, metering, engineering etc)
  - Limits participation to large loads
  - Small loads may be technically feasible of participation -- they are NOT economically feasible
    1. Identify existing infrastructure that could be repurposed for economic connection
    2. Work on stochastic approaches that require less expensive metering and management infrastructure

Questions & Comments?

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Thank You

Ron Dizy

President & CEO

416 419 6393

rdizy@enbala.com

www.enbala.com

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