DOE/OE Transmission Reliability R&D Load as a Resource (LaaR)

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Objectives

- ORNL is examining potential for manufacturing processes to provide regulation service. This includes:
  - Conducting modeling analysis (more detailed understanding on impact of industrial processes)
  - Embedded economics based on higher level estimates.
  - Expand analysis to understand implications across U.S. Industrial Sector for Plants
- ORNL is working with ENBALA to perform a Practical On Site Demonstration of Regulation Services in Selected Manufacturing Processes in PJM Territory.

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Technical Accomplishments

- Recruitment and Demonstration
  - Agreements in place with Plant and Enbala
  - All equipment has been installed at site.
  - Testing is nearing conclusion
- Modeling
  - Modeling of Induction Furnace completed last year;
  - water chilling loop/pumping model started.
- Analysis and Expansion to U.S.
  - Identification of available water chilling resources across PJM and other territories.

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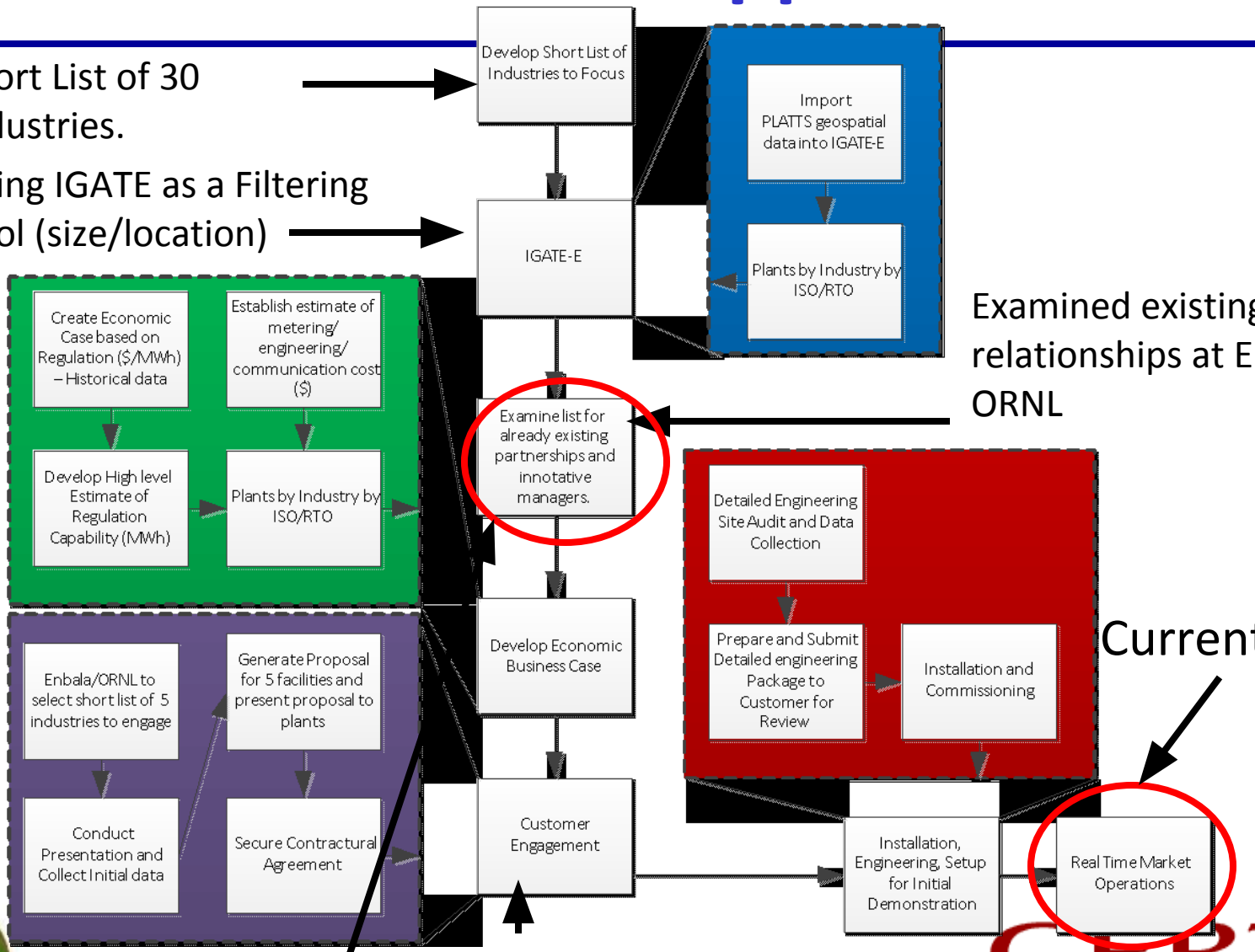
Outline for Approach

Short List of 30 industries.

Using IGATE as a Filtering Tool (size/location)



Examined existing internal relationships at Enbala and ORNL

Current Status

Last Year

Hosted a number of phone calls with industry

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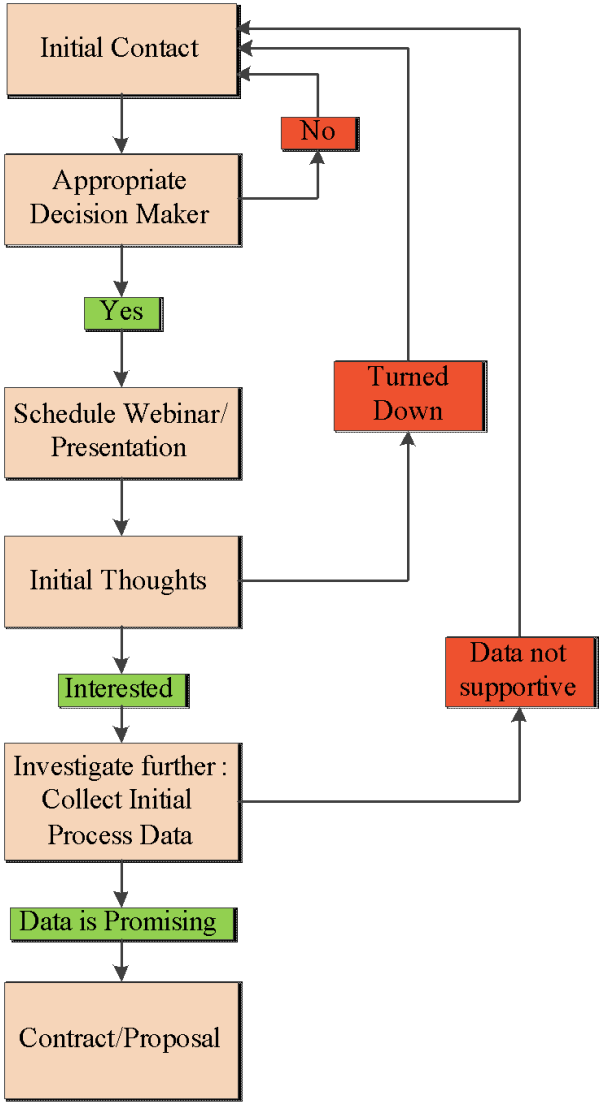
Customer Engagement



1. Initial Contact – Find company contact
2. Schedule phone call and presentation.
3. Host Webinar for discussion with both plant engineers and managers.
4. Company provides data for initial evaluation.
6. General Agreement and proposal developed.

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Challenges with Engagement

- Finding the ‘Right’ Contact
  - In many cases energy/sustainability managers were the initial point of contact
  - Need to engage a mix of decision-makers, from both the operations engineering and management side.
- Industry of followers…not leaders. No one wants to be the first.
- Consistent Misunderstandings and Need for More Understandable Terminology
  - During presentation the team referred to the word demand response, and the customer reply was frequently, *“We are already engaged in demand response (usually peak reduction or contigency based services)”*
  - *“can't do DR because of requirements for long shutdowns …”* Regulation does not involve shutdown but bidirection small changes in power consumptions fairly energy neutral

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Other Comments

- Other common misunderstandings and push back included:
  - "*give up control of process*" - Operator retains control - power change requests are sent within pre-agreed operating conditions and only the customers control system can allow the power change to occur
  - *"I do have not flexibility"...*aggregators typically with work with operator to identify natural flexibility in processes
  - *"I have not time to spend on this ..*" Facility only needs to spend 20-40 hours over a period of 2-3 months ..Aggregator does all the work
- Need for a terminology that reflects the customer-sided aspect of this type of demand response.
- Need for a definitive "value proposition" to pique customer interest.

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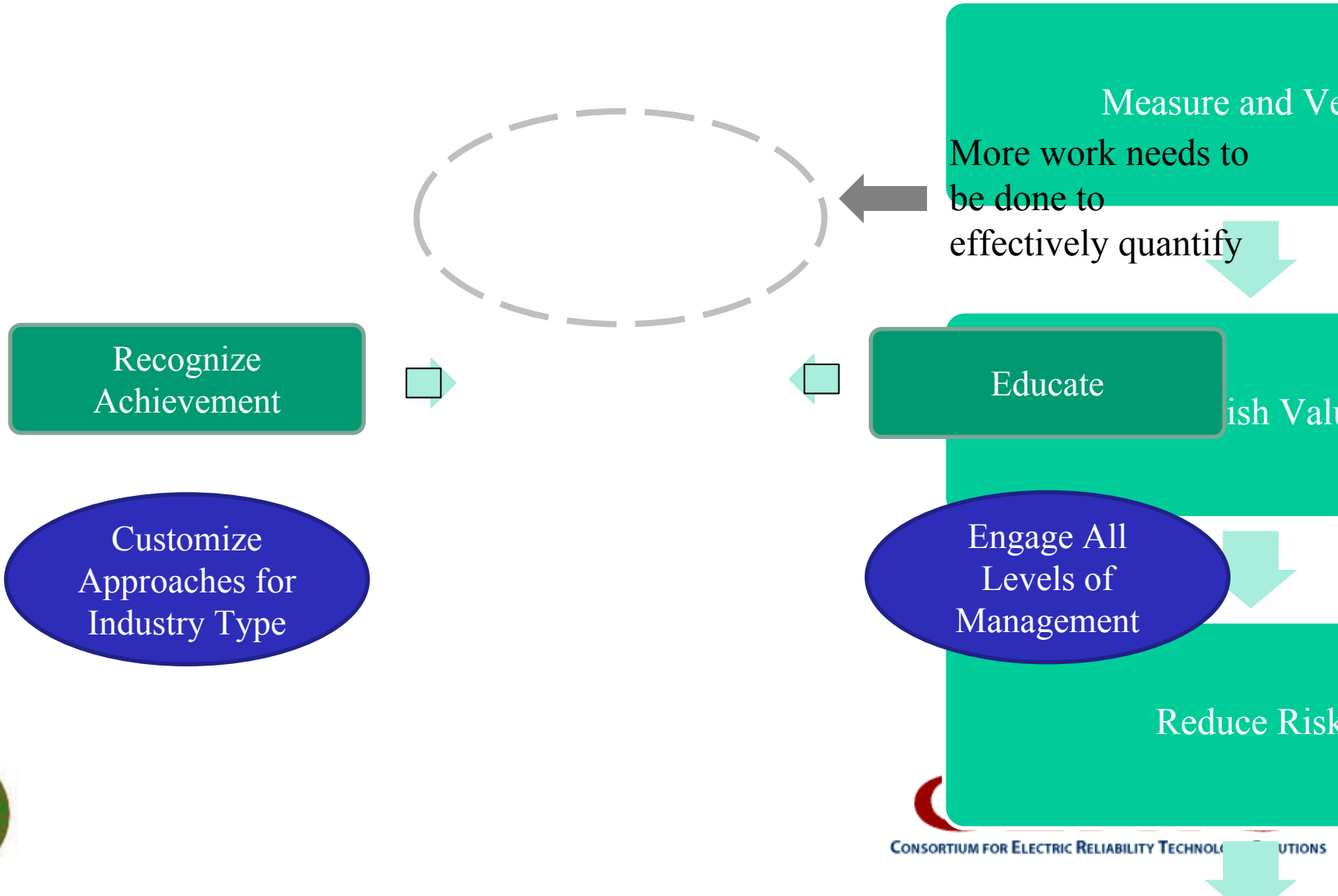
Elements of Effective Customer Engagement



Need for Customer "Pull"

- Utilizing customer loads as a grid resource requires that a quantifiable "value" is established for customer participation.
- The value must be large enough to overcome the perceived risks of losing any elements of control over their process or equipment.
- To date, no studies have been conducted on this.

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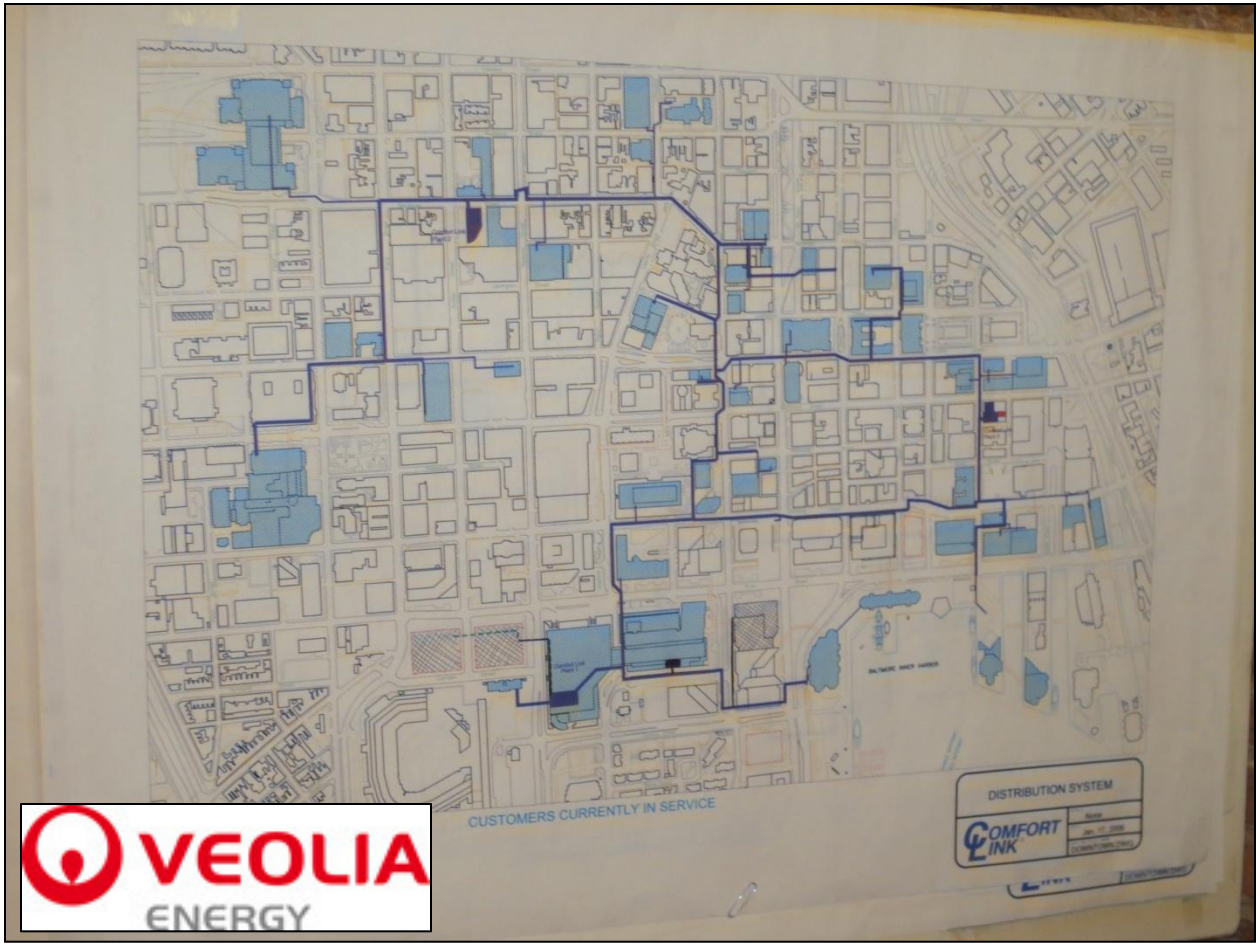
Case Study: Water Chilling Loop

- Veolia Energy operates Baltimore Chilling Loop
- 48 customers with more than 11.5 million square feet of conditioned space
- 38,550 tons of chilled water capacity



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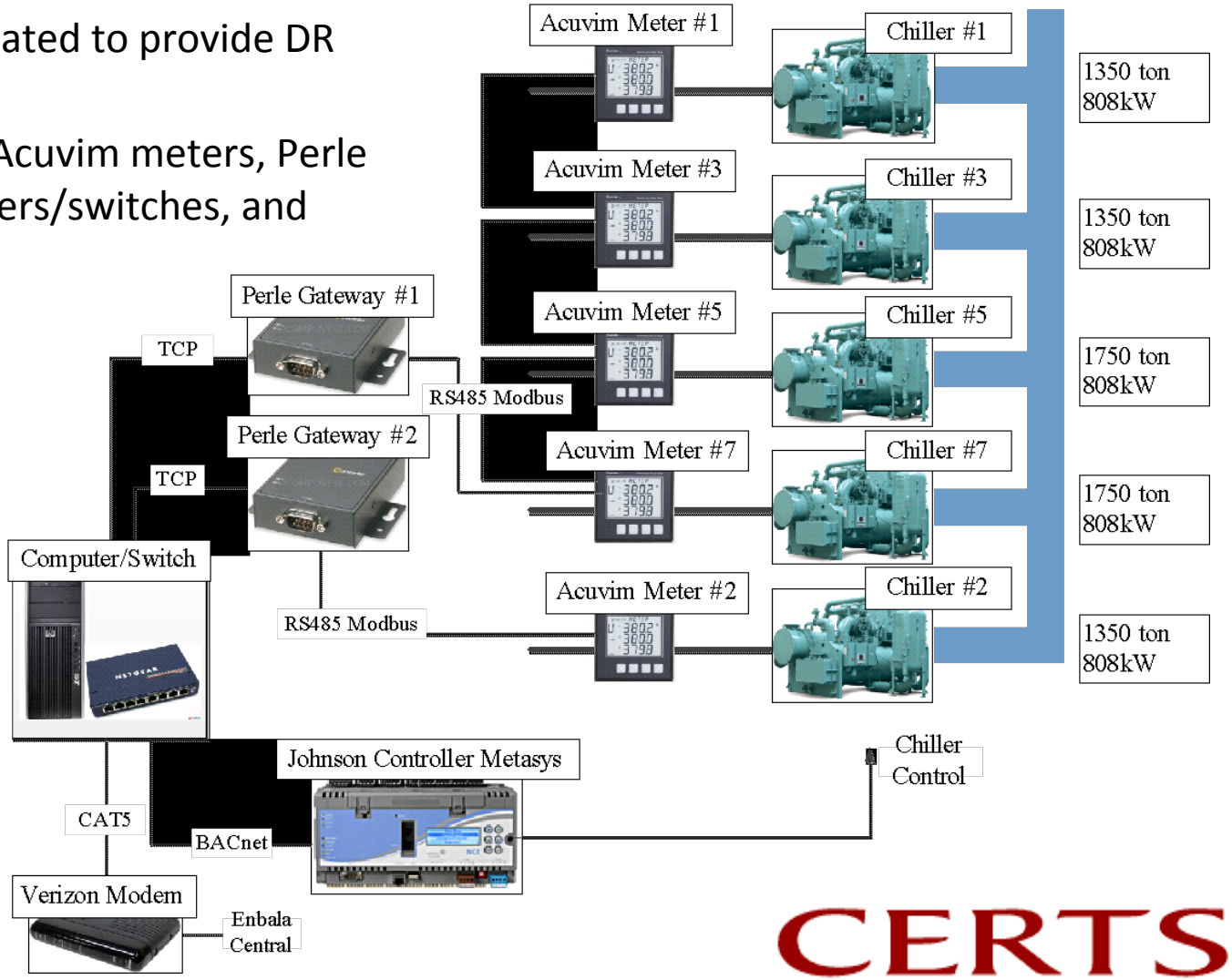
Hardware/Communications

- Five chillers aggregated to provide DR opportunity.
- Enbala purchased Acuvim meters, Perle Gateways, computers/switches, and Verizon modem
- Subcontracted installation of equip at facility
- Worked with Johnson controls to incorporate setpoint requests through BACnet from Enbala central system.



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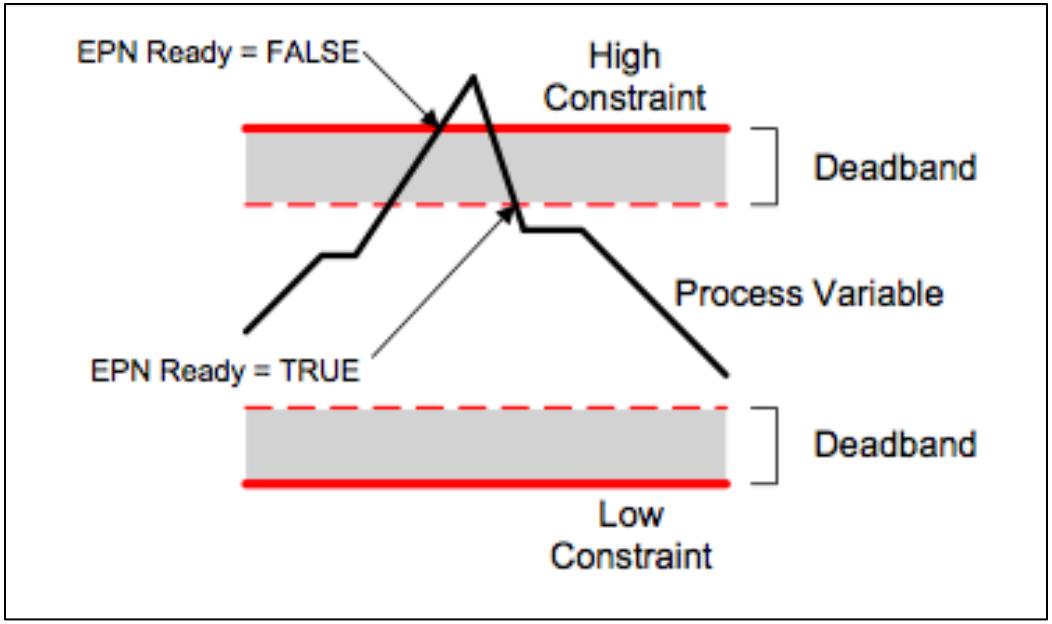
System Constraints And Potential

- Operational constraints for the water chill loop are temperature based.
- If the resource falls outside the temperature range, the EPN is set to false – resource is no longer available for Enbala control.
- Ensures that industrial customer feels comfortable with the process.

Chilled Water Loop Temperature (°F)		LCHWT	CHILLER RESPONSE
High Limit	39°F	TOO HIGH	INCREASED LOAD
Loop temperature	37°F< LCHWT <39°F	Within this defined temperature range, the EPN can request the loop temperature change to increase or decrease load.	
Low Limit	37°F	TOO LOW	DECREASED LOAD



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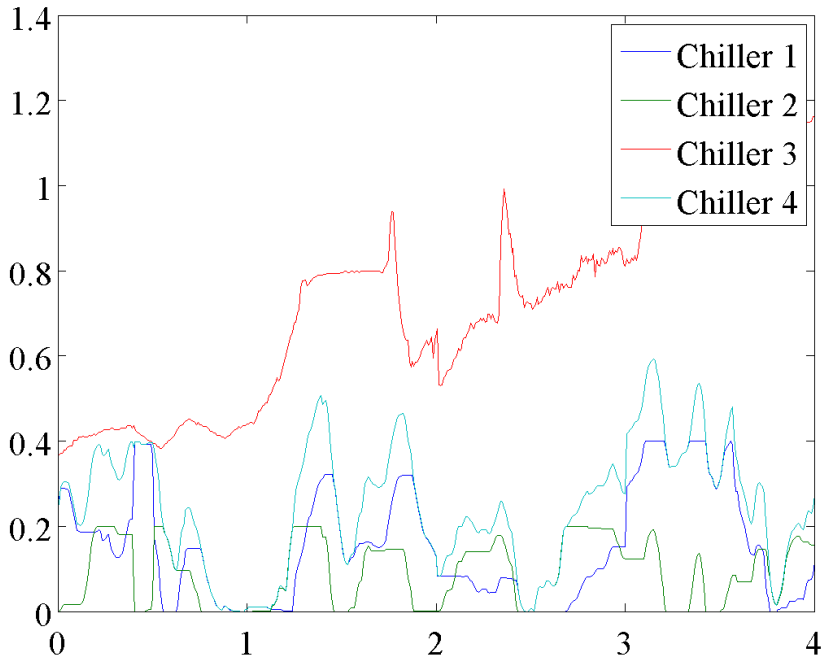
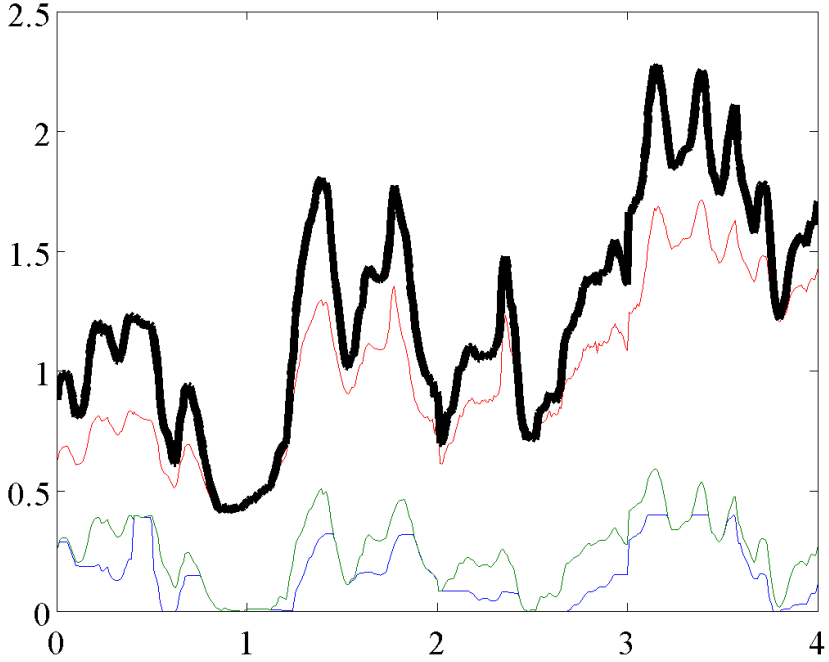
Initial Testing



- During site visit, on-site engineers and operators noted that even with Enbala controls performing actions, they saw no change on process or jumps outside of bounds.

- Example of the four chillers being controlled to deliver requested power for Enbala's network level. Aggregated signal shown.



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Conclusion on Water Chilling

- Water chilling loops appear to be great candidates for regulation resources.
- Exact quantification of how much (% in respect to rated) is still being quantified by tuning of the requested amount by experimentation.
- Integration into Enbala's network of loads providing regulation in PJM is still ongoing.
- Veolia Energy receives compensation from Enbala based on its level of availability and contribution in Enbala's network. Enbala takes the risk of complying with PJM regulation requirements.

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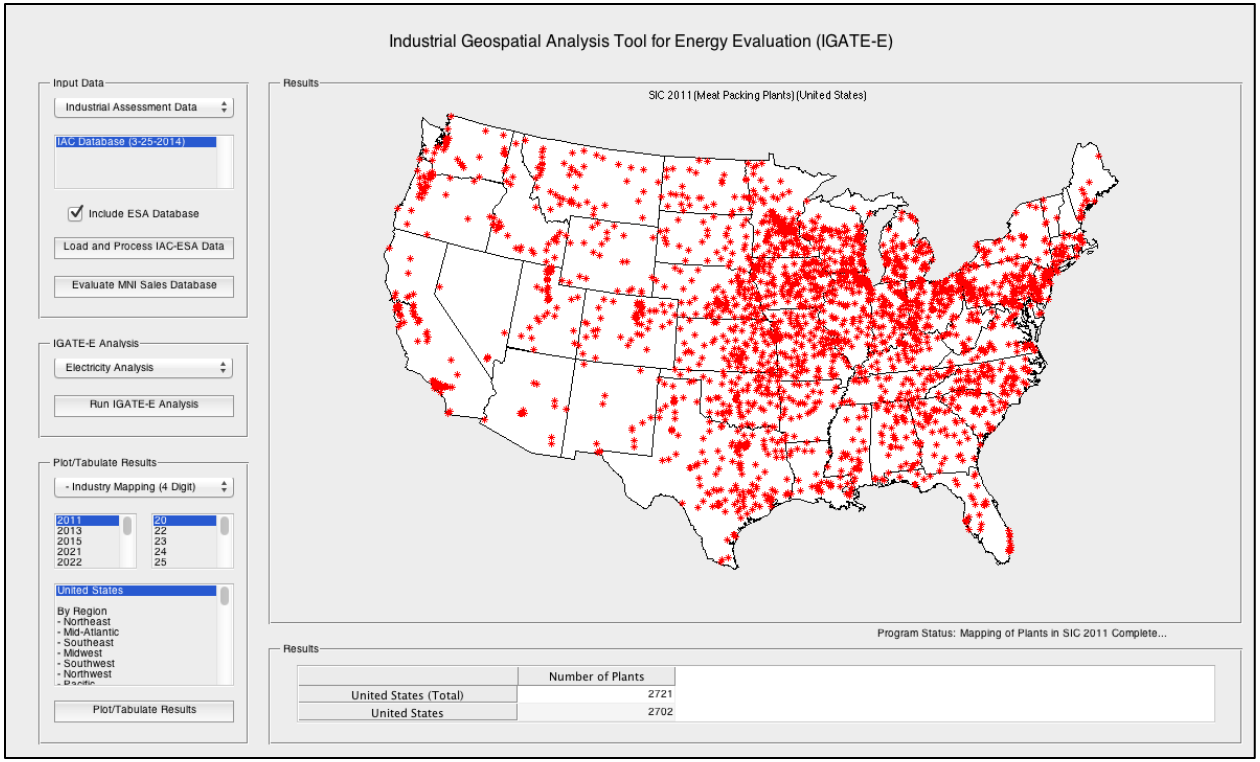
IGATE-E Background

- IGATE-E tool developed at ORNL to help provide broad investigation of industrial loads.
- Merges public and private databases
- Developed in Matlab and continues to expand.



- Data is geospatially referenced.

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IGATE-E Development and Demo

Demand Response Flexibility Inputs

Industry Panel

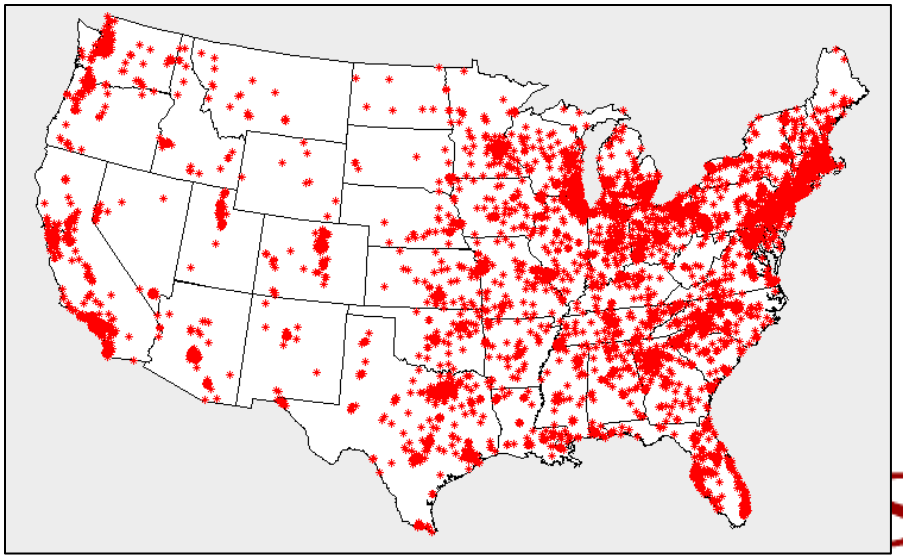
3221
3222
32411
32511
32512
32518
32519
32531
3272
32731
3274
3311
3313
33611
3364

Display DR Flexibility Inputs

Process Steps

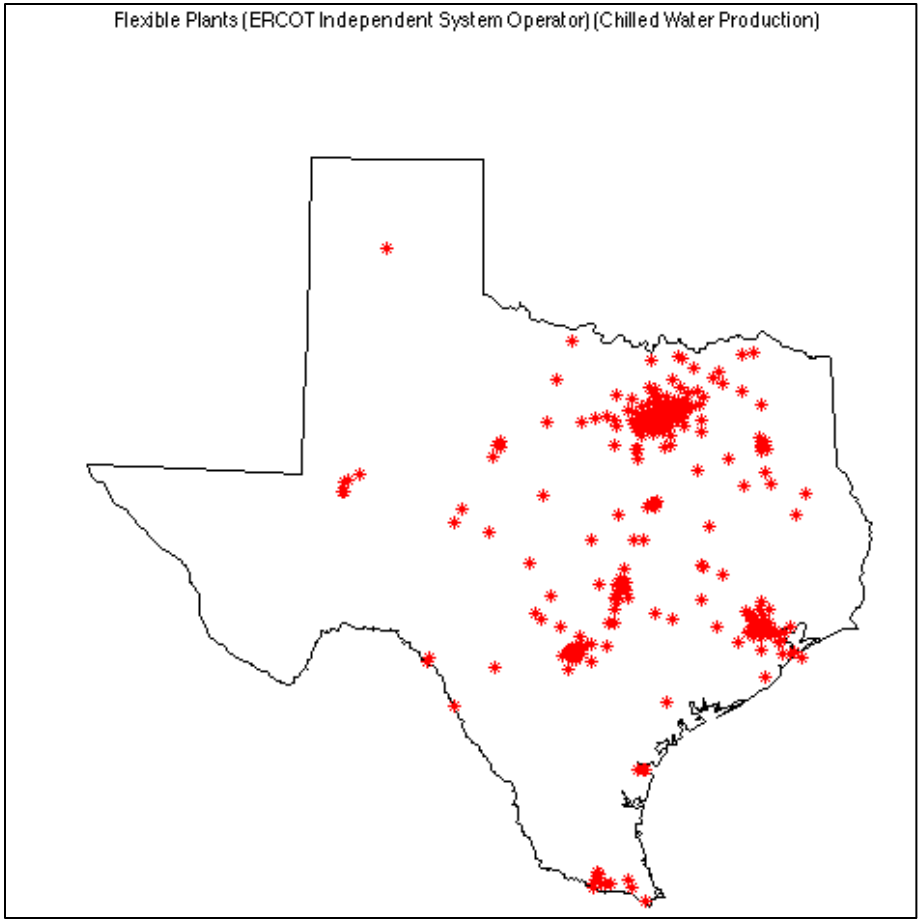
	NAICS Code	PROCESS TYPE	PROCESS STEP	DEVICE	% Process Step	% Flexibility
1	33611	MPL	Chilled Water Production	Chiller	0.1500	0.0203
2	33611	MPL	Chilled Water Production	Pump	0.1000	0.0015
3	33611	APL	Compressed Air	Compressor	0.1000	0.0100
4	33611	MPL	Industrial Ventilation	Fan	0.2000	0.0500
5	33611	EPL	Lighting	Lights	0.5000	0.0750
6	33611	EPL	HVAC	Fan	0.2000	0.0200

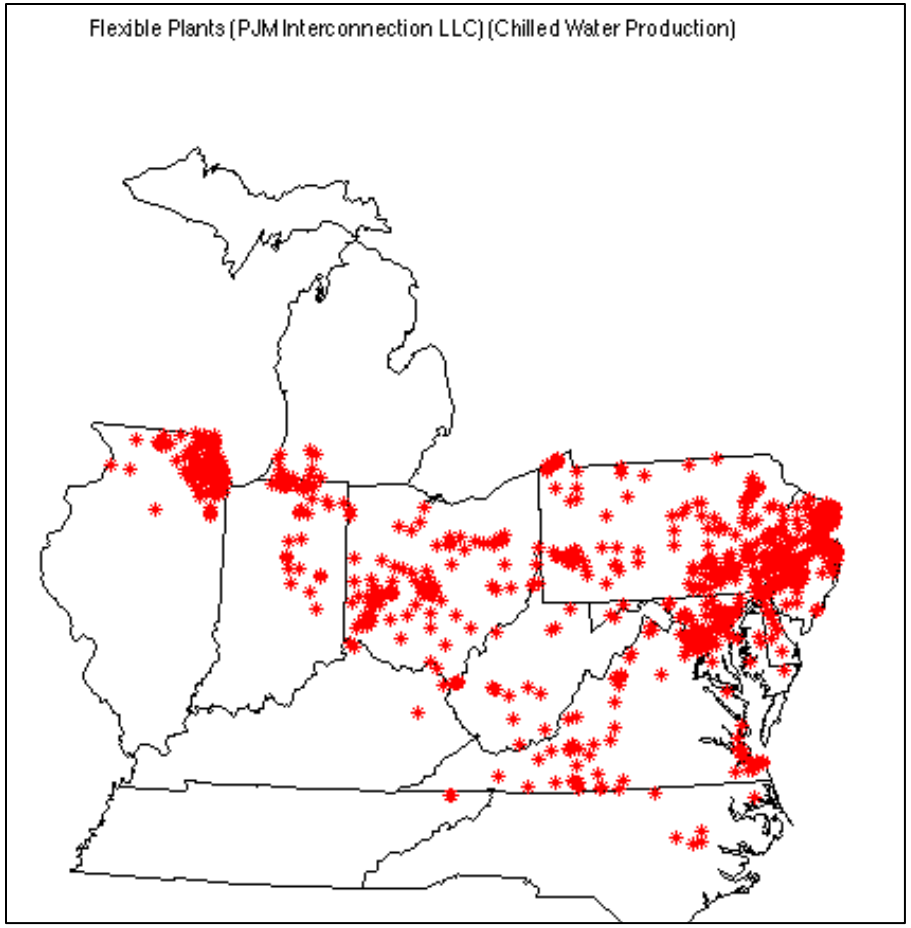
- Tool identifies processes that utilize chilled water loops.



- Maps to U.S. plants

PJM and ERCOT Water Chilling Loops





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Areas of Needed Research

" Load modeling in planning/operating studies is out of date and constitutes the largest risk in these studies. Poor load modeling means poor results. Amenable to R&D."

Quantify appropriate customer-side value for participation in resource-sharing scenarios.

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Current Activities and Near Term

- Finalize draft report on Water Chilling Plant Demonstration and Model
- Draft report on induction furnace model and onsite evaluation
- Draft report on update from Alcoa.
- Develop conference publications (expected outcome at least 3)

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Follow-on Work

- Continued Examination of Industrial Processes

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