Scoping Study on Industrial Regulation

Nasr Alkadi, Ph.D.

Michael Starke, PhD

Oak Ridge National Laboratory

CERTS Internal Program Review

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U.S. DEPARTMENT OF ENERGY

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Project objective:
Scoping of Regulation Reserves in Industrial Sector

1. Develop an estimate of the amount of regulation that could reasonably be expected from ***industrial loads*** based on publicly available information.
2. Analyze the potential impact of regulation on the manufacturing process.

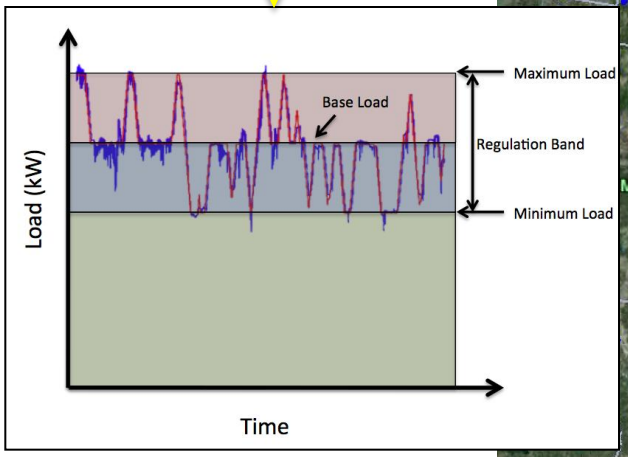
791 AL Smelters – SIC 3341

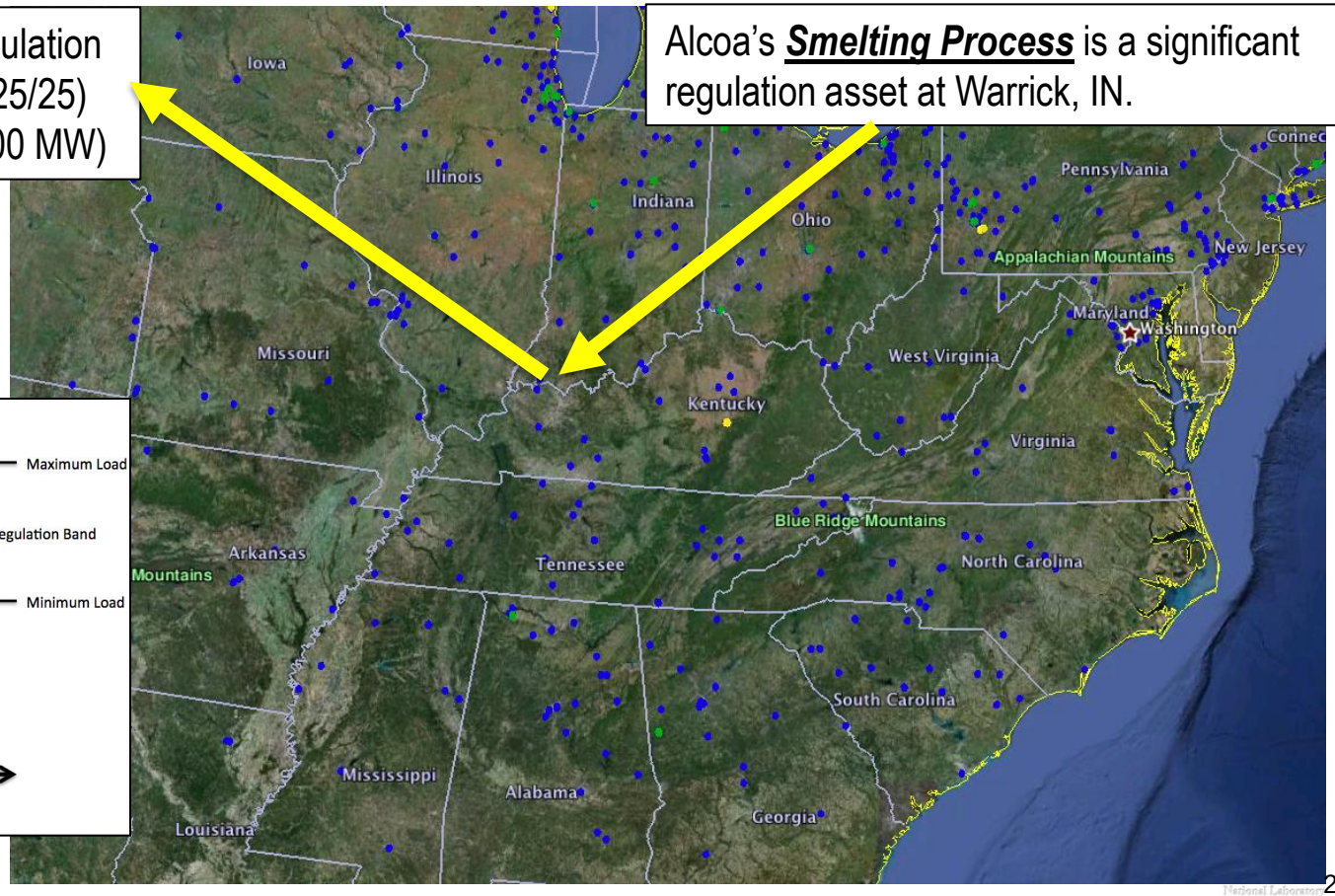
Practical Example

MFG Process SIC 3341 **(Secondary Smelting and Refining of Nonferrous Metals (aluminum)**

- Alcoa has demonstrated Regulation Band in the 50 MW range (25/25)
- Represents ~10% of BL of 500 MW)

Alcoa's ***Smelting Process*** is a significant regulation asset at Warrick, IN.



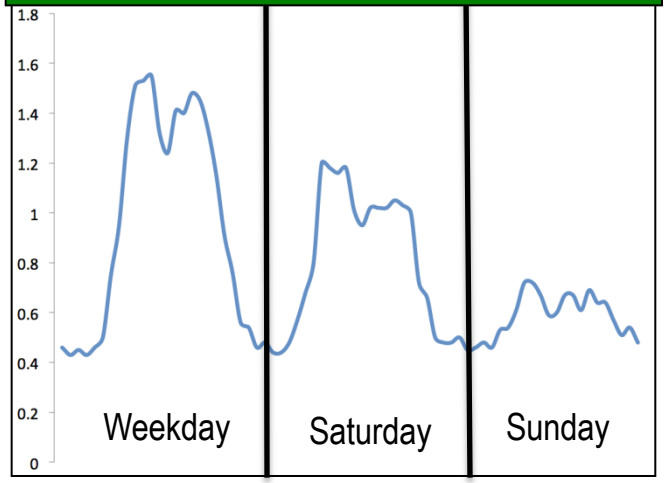


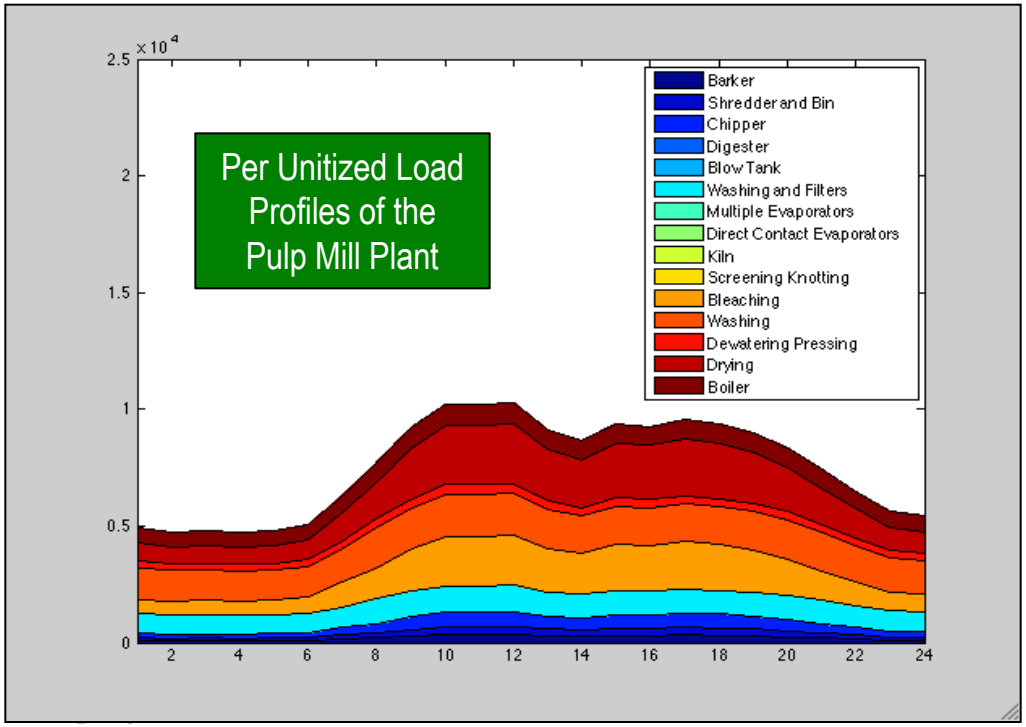
Major Technical Accomplishments:

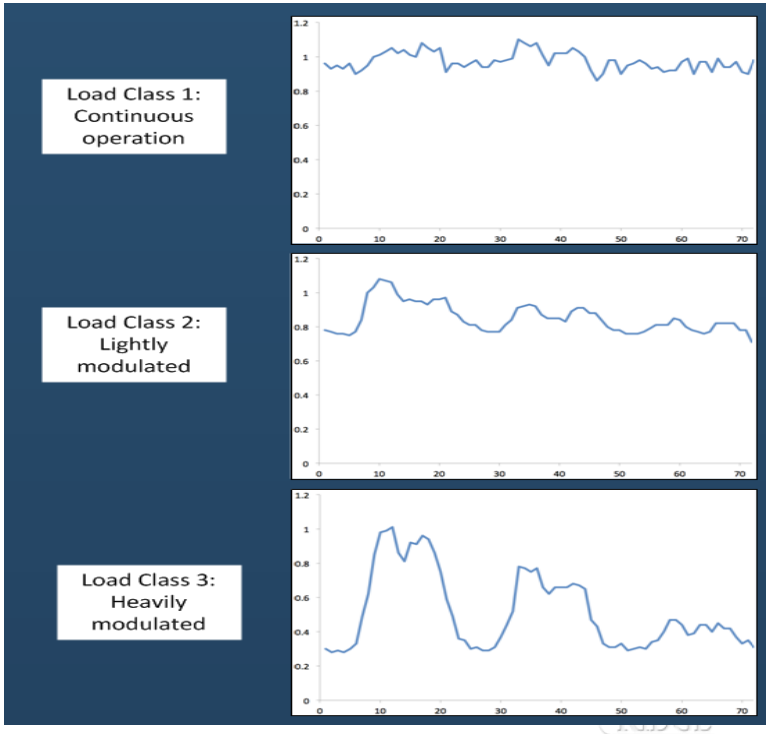
Breakdown of Process Steps
Ex1. Pulp Mills – SIC 2611

Step	Pulp Mills (Kraft Process)	% Total Electricity	Load Curve Classification (Class 1 to 7)	Load Charactrization
1	Barker	3.404255319	3	Mechanical I (Cutting, Pressing, Mixing, Separating ...)
2	Shredder and Bin	3.404255319	3	Mechanical I (Cutting, Pressing, Mixing, Separating ...)
3	Chipper	6.382978723	3	Mechanical I (Cutting, Pressing, Mixing, Separating ...)
4	Digester	0	0	NA
5	Blow Tank	0	0	NA
6	Washing and Filters	10.63829787	2	Mechanical II (Pumping - Moving - Transporting - Fans -..)
7	Multiple Evaporators	0	0	NA
8	Direct Contact Evaporators	0	0	NA
9	Slaker and Causticizer	0	0	NA
10	Kiln	0	0	NA
11	Screening Knotting	21.27659574	3	Mechanical I (Cutting, Pressing, Mixing, Separating ...)
12	Bleaching	17.0212766	2	Mechanical II (Pumping - Moving - Transporting - Fans -..)
13	Washing	3.829787234	2	Mechanical II (Pumping - Moving - Transporting - Fans -..)
14	Dewatering Pressing	25.53191489	3	Mechanical I (Cutting, Pressing, Mixing, Separating ...)
15	Drying	8.510638298	2	Mechanical II (Pumping - Moving - Transporting - Fans -..)
16	Boiler	0	0	NA
17	Electric Generation	0	0	NA

Classifications consist of different weekday and weekend profiles (TYPE 3)







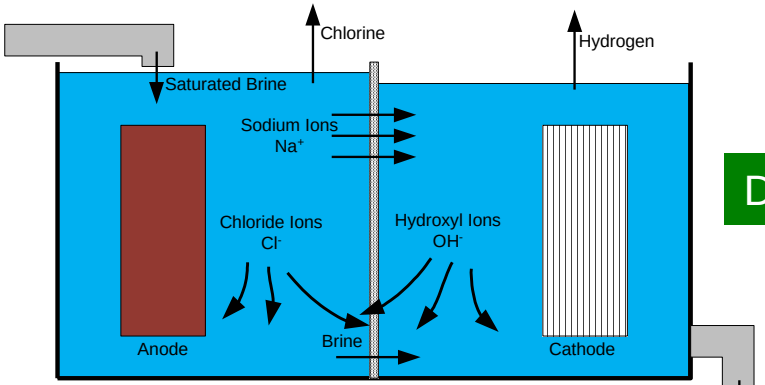
Major Technical Accomplishments:

Flexibility Analysis and Regulation Estimation

Ex2. Alkalie and Chlorine – SIC 2812, Cont.

Target known flexible systems:

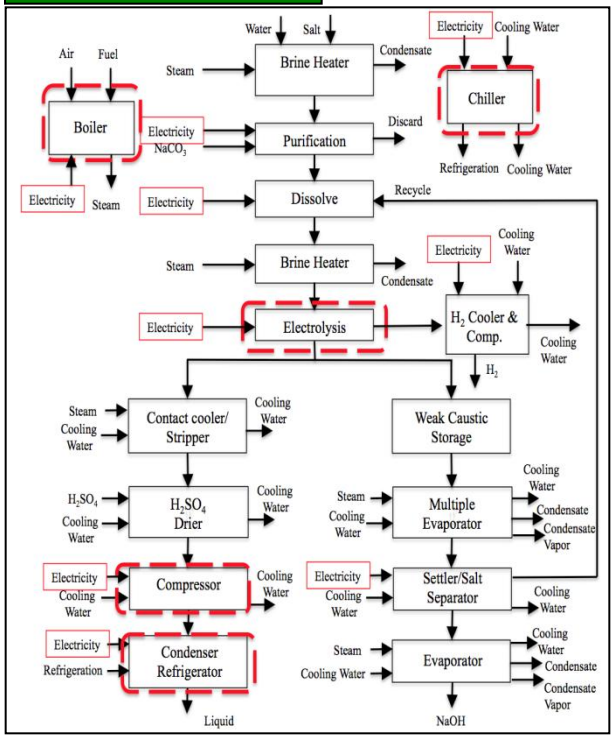
- Variable speed driven equipment or machine drives
- Thermal energy and process and product storage (heating processes and cooling)



Diaphragm Cell

$2NaCl + 2H_2O \rightarrow Cl_2 + H_2 + 2NaOH$

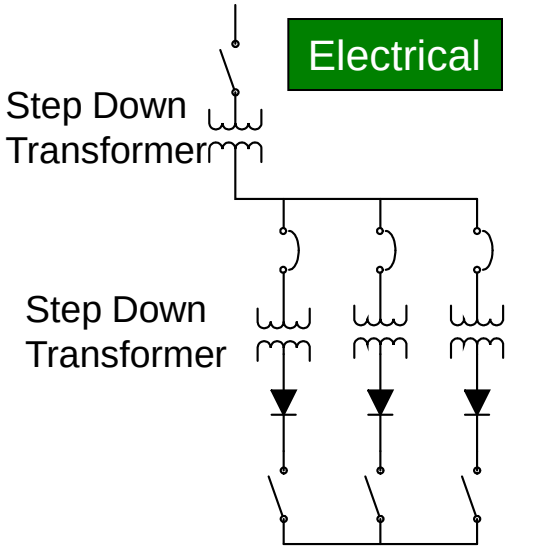
Process Steps



Description

- Direct current is supplied often through rectifier bridge to DC bus.
- The rectifier accounts for more than 90% of the total electrical load of the plant
- Control is available through tap-changers on transformers or other voltage regulating equipment.
- Pumps are also controlled to deliver saturated brine solution.

Electrical



Deliverables and schedule for activities to be completed under FY12 funding

Objectives:

1) Analyze the potential impact of regulation on the manufacturing process.
2) Look for potential demonstration cases.

Schedule:

1) Develop detailed model for demonstration of impact of performing frequency regulation on a single manufacturing process as platform and demonstration to industry. (December 12')
2) Engage partners for demonstration (December 12')
3) Publication discussing modeling and example case (January 13')

Risk factors affecting timely completion of planned activities

- Detailed modeling makes assumptions of process control and flow. Assumptions and modeling made to higher estimates. This model will be adapted to a specific facility once partner have been identified. Utilizes industry based software (AnyLogic) for proof of principle.
- Industry based partners may be difficult to convince. A model will provide a more confidence discussion and impact on process.

Early thoughts on follow-on work that should be considered for funding in FY13

- Look at how industrial load can support renewable integration
- Experimental Work including Measurements in Selected MFG Plants
- Look at converting SICs to NAICS as soon as Bridge Data becomes available through EZ DB/EIA/MECS
- Build from work done by Kirby and Milligan “Utilizing Load Response for Wind and Solar Integration and Power System Reliability”