Council of Industrial Boiler Owners

CIBO's 37th Annual Meeting ♦ October 21-23, 2015

Ponte Vedra Inn & Club ♦ Ponte Vedra, Florida

Transitioning To A New Energy Era

Electricity in the New Era

John P. Hughes

President & CEO

Electricity Consumers Resource Council

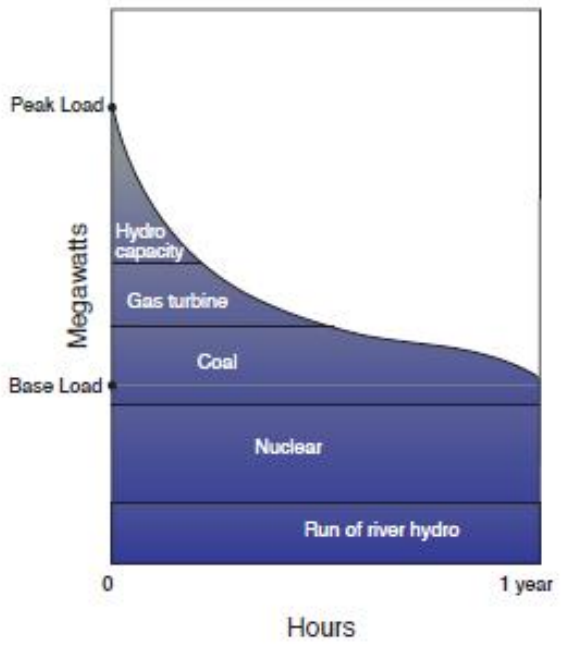
Washington DC

Electricity Consumers Resource Council

- The national association representing large industrial users of electricity.
- Established in 1976 as the federal government began to address electricity issues, and industrial users realized that they could advocate policy more effectively by forming a united front.
- Industrial users also hoped to create a technical resource for useful data and information that could be shared by member companies.
- Founding principles for economic regulation are based on cost causation.

ELCON

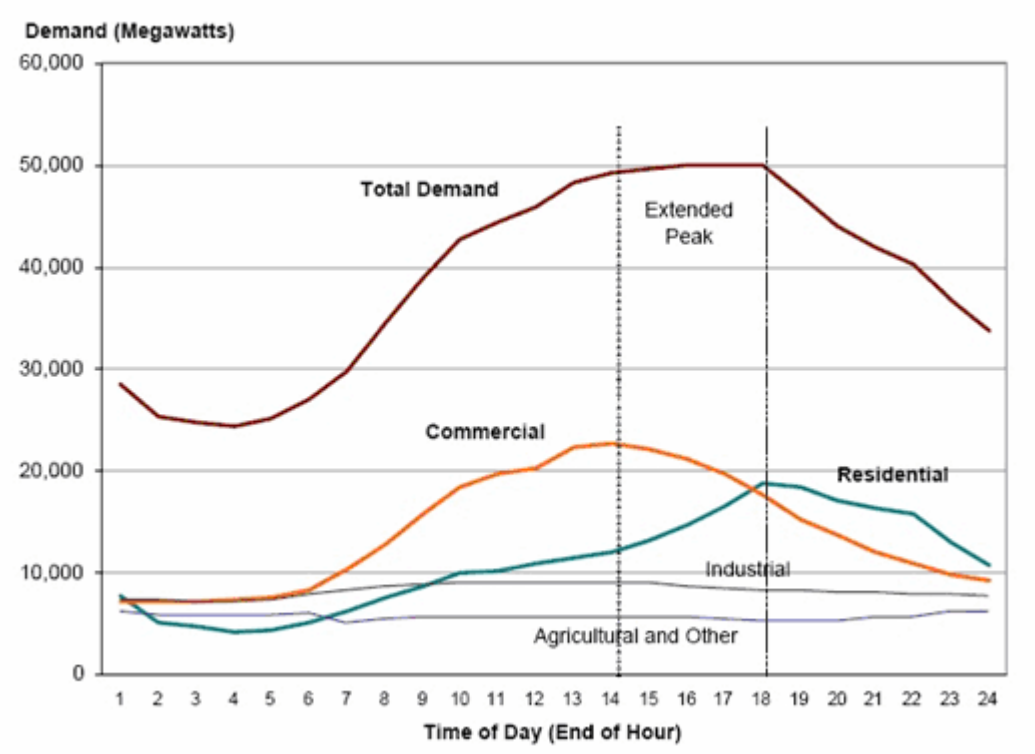
A Recap: Load Duration Curve
How Electricity was Traditionally Produced, Delivered & Consumed



- Generating units with lowest operating costs are generally dispatched first. They invariably have the highest capital cost.
- Utilities dispatched mostly their own generation, delivered the power over their own T&D wires, and serviced end-use customers at a utility-owned meter.

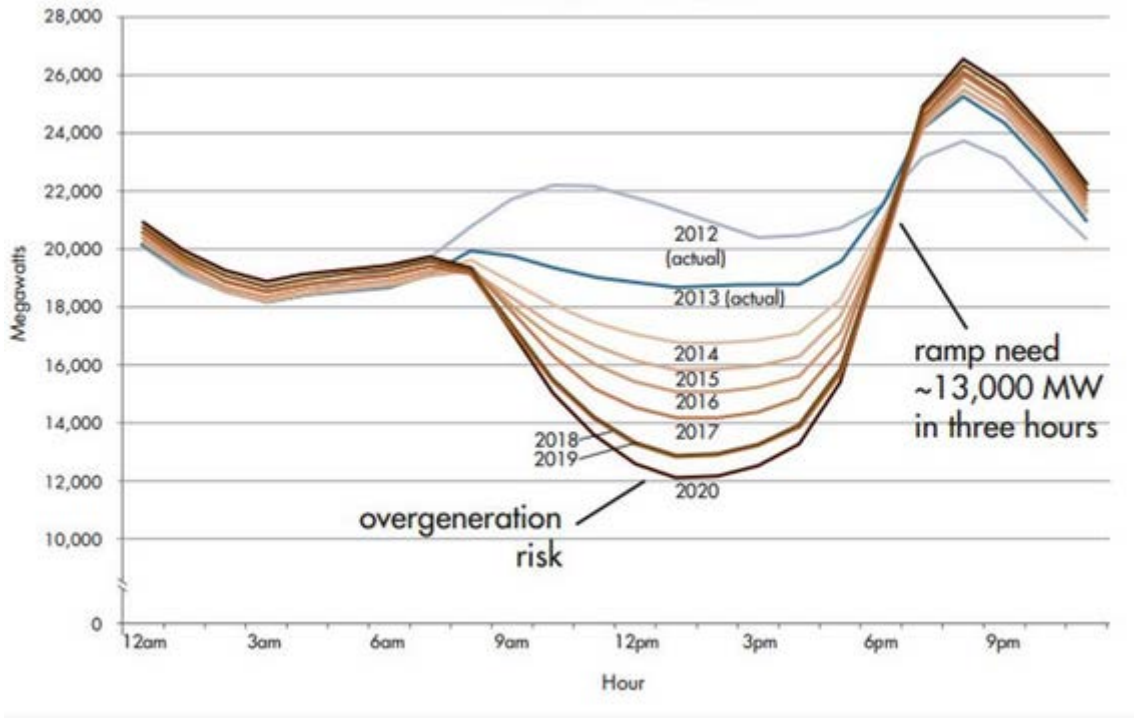
A Recap: Camel Curve

How was Electricity Produced, Delivered & Consumed



Duck Curve

Shows Steep Ramping Needs and Overgeneration Risk Resulting from High Penetration of Wind, Solar & DG



Electric Industry Restructuring 1996-2005

- The impetus for restructuring was economics – a sincere attempt to extract greater economic efficiencies by applying competitive market forces to the utility industry.
- The utilities' vertical business model was partially unbundled and independent grid operators (ISOs & RTOs) were established to enable and manage competitive energy markets.
- Results were, at best, mixed. The market design remains vulnerable to the residual market power of incumbent utilities and new merchant generators.
- It has also become a regulatory nightmare. The problem is termed "vertical foreclosure" – the failure of monopoly incumbents to sacrifice market share or to exit the business.

More Vertical Disaggregation

- Most of the changes that occurred during the restructuring that created ISOs and RTOs as “platforms for competition” were at the wholesale level as initiated by FERC with the cooperation of about half the states.
- The “New ERA” is primarily the same sort of initiative at the distribution (retail) level. It is a second round of industry restructuring with the intent of creating more competition, but a totally different kind of competition.
- One irony of the New Era is the replication in the distribution system of the two-way dynamics that PURPA allowed between cogenerators and the grid. As such, the changes may be relatively minor for CIBO members that own/operate QFs.

Changing Resource Mix

US Summer Generating Capacity (2014)

- 29% Coal
- 4% Petroleum
- 40% Natural Gas
- 9% Nuclear
- 9% Hydro
- 6% Wind
- 2% Other Renewables
- Some DSM

California's Great Leap Forward (SB17 et al.)

- 50% RPS (2030)
- 12,000 MW of Distributed Photovoltaics by 2020
- 1,325 MWs Energy Storage Installed by 2024
- 31,000 Customers to be enrolled in third-party DR Direct Participation
- DR Auction Mechanism

Smart Grid

- The technology basis of the New Era is often called “Smart Grid.”
- DOE’s definition of Smart Grid: “A class of technology people are using to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation.”
- The States generally see it differently.
- California’s statutory definition: “A fundamental change in the existing electricity infrastructure that utilizes advances in technology to create a better, safer, greener electricity supply.”
- “Greener” means reduce the carbon footprint.

Microgrids, Storage & Distributed Generation – The Theory

- A distinguishing characteristic of Smart Grid is two-way communications and power flows.
- The traditional utility grid had a one-way power flow and simple analog utility-customer interactions.
- The Smart Grid will have a two-way power flow with multiple stakeholder interactions. There intends to be a much bigger third-party role under contracts.
- Pieces of the utility's distribution system (including reliability) are being unbundled and outsourced. Every end user will interact with the grid.

“Distribution Edge”

- The interface between the electric utility’s distribution grid and the rapidly growing portfolio of energy assets, control systems, and end-use technologies that are available to customers.
- Examples of customer interactions:
  1. Generate electricity via on-site distributed generation such as solar PV and CHP.
  2. Control the timing and the amount of their electricity use in response to signals received from their utility or distribution system operator.
  3. Manage a portfolio of on-site resources—potentially including an electric vehicle, distributed generation, storage, and demand response.

Microgrids

- A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid and that connects and disconnects from such grid to enable it to operate in both grid-connected or “island” mode.
- The primary reason customers will need to build a microgrid is resiliency requirements, i.e., to retain service to facilities during electric system events. Can’t depend on utilities or ISO/RTOs any more. It is a hedge against the intermittent nature of wind and solar resources and extreme events such as hurricanes.

Energy Storage

- Energy storage is an essential component of Smart Grid. And the whole thing won't work without it.
- It is assigned a role at all voltage levels.
- It is also not cheap. Costs for the great majority of available battery technologies are prohibitive. Economically competitive batteries are the "killer app" and the "holy grail" of Smart Grid.
- California's aggressive energy storage mandate is an example of "market transformation" by regulatory fiat.

California Energy Storage Targets

By Point of Interconnection

Utility		2014	2016	2018	2020	TOTAL
SCE	Transmission	50	65	85	110	310
	Distribution	30	40	50	65	185
	Customer	10	15	25	35	85
	Subtotal SCE	90	120	160	210	580
PG&E	Transmission	50	65	85	110	310
	Distribution	30	40	50	65	185
	Customer	10	15	25	35	85
	Subtotal PG&E	90	120	160	210	580
SDG&E	Transmission	10	15	22	33	80
	Distribution	7	10	15	23	55
	Customer	3	5	8	14	30
	Subtotal SDG&E	20	30	45	70	165
	TOTAL	200	270	365	490	1,325

Who will Operate the New Distribution System ? Three Options

1. Existing distribution utilities continue to own and operate the distribution network and be the default providers of services and equipment.
2. Existing distribution utilities use automation and communication capabilities (Smart Grid technologies) to manage transactions on behalf of third-party contractors that provide services and equipment. The utility might still own reserves for reliability purposes.
3. Existing distribution utilities excluded from market participation but will be facilitators of the transactions of independent, distributed agents. Very similar to role of ISOs and RTOs in wholesale markets.

Federal Encouragement of Smart Grid

- Title XIII of the Energy Independence and Security Act of 2007 (EISA) -- $100 million per year, 2008-2012. Government agencies involved:
  - DOE - Lead agency, banker & program administrator
  - NIST - Develops interoperability framework & standards
  - FERC - Approves standards for interstate transmission & wholesale energy markets; Issued Policy Statement in 2009
- American Recovery & Reinvestment Act of 2009 -- $4.5 billion (Some programs required matching funds from private sector)

Federal Priorities Reflect Expansion of Objectives to Enable Bipartisan Support

- Self-healing from power disturbance events
- Enabling active participation by consumers in demand response
- Operating resiliently against physical & cyber attack (Inspired by Hurricane Sandy and hackers)
- Providing power quality for 21st century needs
- Accommodating all generation & storage options
- Enabling new products, services, & markets
- Optimizing assets & operating efficiently

Types of DOE Programs

- Smart Grid demonstration & deployment
- R&D
- Interoperability & standards
- Interconnection planning & analysis
- Workforce development
- Stakeholder engagement & outreach
- Monitoring national progress

Recovery Act-Funded Programs

As of October 2015

Program	Total Grants	No. Award Recipients
Smart Grid Investment (50% matching funds)	$3,482,831,000	99
Energy Storage Demonstration	$684,829,000	32
Workforce Development	$100,000,000	52
Interconnection Transmission Planning	$80,000,000	6
State Assistance for Recovery Act Energy Policies	$48,619,000	49
Enhancing State Energy Assurance	$43,500,000	50
Enhancing Local Government Energy Assurance	$8,0024,000	43
Interoperability Standards & Framework	$12,000,000	1

Pending [sic] Federal Legislation

- **Senate:** S. 2012 - Energy Policy Modernization Act of 2015. Sections 2301 thru 2311 deal with energy storage, grid architecture, grid modernization, microgrids, and distribution planning. Section 2310 requires transmission organizations to report to FERC on barriers to microgrids and distributed generation.
- **House:** Approved subcommittee bill included two new PURPA standards directing states to advance smart grid technologies.

Major State Initiatives

- **California** ’s Great Leap Forward addresses issues associated with the increased penetration of wind, solar and distributed generation, emphasizing the deployment of energy storage technologies.
- **Texas** focuses on the implementation of deregulated retail services and in effectively integrating large-scale wind generation including large-scale energy storage. ERCOT has an effort underway to “rethink” the entire existing set of ancillary services.
- **Illinois** is implementing its "Energy Infrastructure and Modernization Act" passed in October 2011.
- **Massachusetts** created a Commonwealth-wide Grid Modernization Plan .
- **New York**’s Public Service Commission initiated a Statewide Reforming the Energy Vision (REV) process in April 2014.

Smart Grid
Costs & Benefits

Long-term Cost Consequences of Renewable Resources

- Subsidies to renewable resources may never stop because the value of the energy produced decreases faster than the cost as renewable capacity increases.
- High renewable penetration leads to a discontinuity in marginal prices, after which the subsidy and tax grow extremely rapidly. Negative prices are the problem.
- If subsidies are inevitable, society would be better off if renewable energy producers were provided with financial instead of physical dispatch insurance.

Where are "Clean" Cost-effective Resources Going to Come From?

"Clean" Resource	Cost Consequences
New nuclear plants	Vogtle (46% share) costs have increased from $1.4 to $7.5 billion
Integrated gasification combined cycle (IGCC)	Kemper costs have swelled from $1.8 billion to $6.2 billion Edwardsport costs increased from $1.9 billion to $3.5 billion
Distributed Generation - Residential Solar (Cost per generated kWh)	Massachusetts…28.7¢/kWh California…19.2¢/kWh
Residential Energy Efficiency (EE)	Costs of EE investments are about double the savings [-9.5% annual rate of return]

Smart Grid Benefits by 2019

Source: McKinsey & Company

Type of Application	Type of Benefit	$ Billions
CUSTOMER APPLICATIONS	Shift Peak	16
	Energy Conservation	17
	Avoided Cost of Capacity	26
SMART METERS	Meter Data Over Network	7
	Advanced Metering Infrastructure	2
GRID APPLICATIONS	Volt-VAR	43
	Fault Detection	10
	Monitoring & Diagnostics	8
	Wide-Area Measurement	2
TOTAL		**$130 billion**

What is Really Motivating the New Era?

The Government View	Another View

• Customer empowerment
• Consumers want choice and especially control over their energy choices.
• New unregulated entities are entering the market to meet consumer needs with new products and services.
• Resiliency
	• End-user customers are being forced to:
	  • Conserve
	  • Self-generate or
	  • Be price responsive
	under threat of punitive pricing to achieve the objectives of the “green” community.

Restructuring Redux

- The first round of industry restructuring largely failed.
- Utilities had every incentive to stifle competitors, claim sunk costs, and use their access to regulators to "keep the game rigged in their favor." As long as a company with captive customers and regulator guaranteed ROEs is participating in energy service markets, it will distort those markets.
- There is great concern regarding the continued role of subsidies for supporting change. Subsidies create the illusion of success. And somebody has to pay for them.
- Will the fate of the second round be any different than the first?

ELCON

Conclusion for CIBO members

- It is not clear if residential and commercial consumers want to be actively engaged with all facets of power management. "Savings" in the New Era means sacrifice.
- The changes will impose greater risk to larger, non-residential customers –both supply risk (greater chance of electric/natural gas interruption) and cost risk. Consumers of all sizes become the providers of last resort for basic electrical services. They also must provide their own reliability services.
- Best long-term electric supply solution for CIBO members will be on-site self-sufficiency with a dual-fuel capability.