Integrating Energy Efficiency and Demand Response

Energy Efficiency and Active Demand Management

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Johnson Controls, Inc.

ACEEE Energy Efficiency as a Resource
National Conference - September 23, 2013

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Agenda

- **Energy Efficiency, Conservation and the Smart Grid**
- **EE + Active Demand Management: Value to Grid and Utilities**
- **Public Policy & Legislation**
- **Case Study: Pennsylvania Act 129**
- **Customer Experience and Observations**
- **Results, Lessons Learned**

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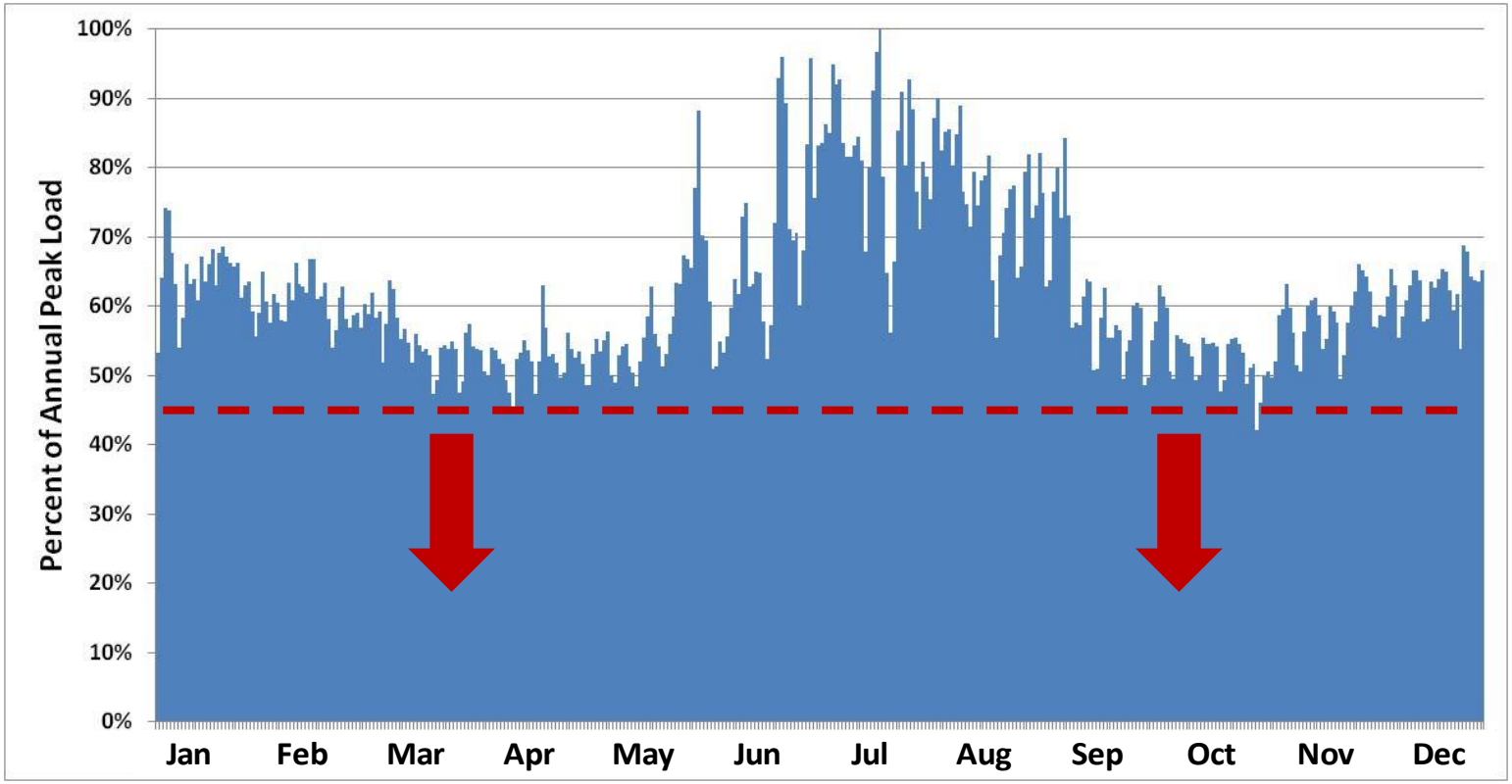
Traditional EE Targets Overall Loads



Load reduction brings overall consumption down but with no sense of time

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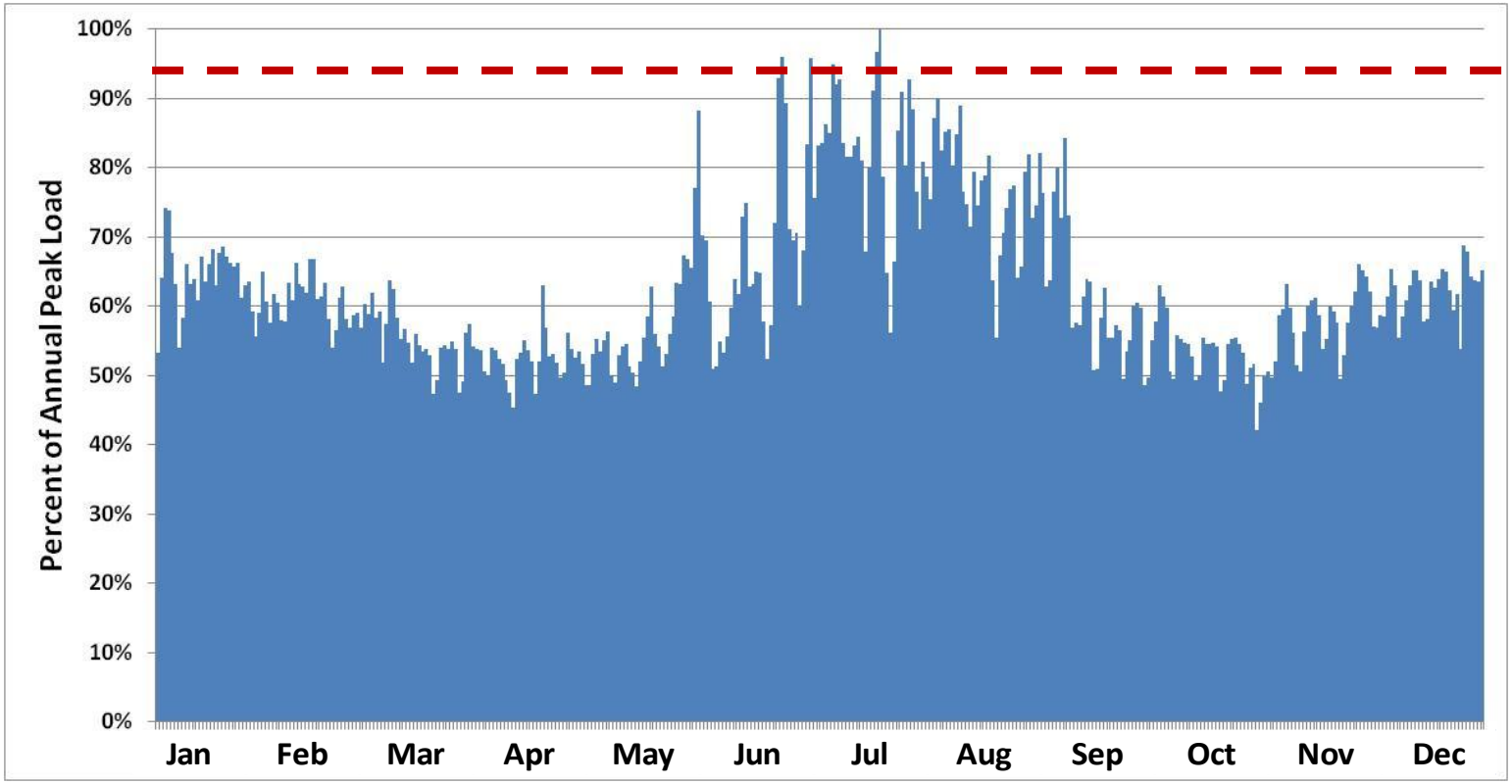
Traditional Demand Response Targets Top Peaks



Emergency DR and simple peak shaving only impact a few days per year

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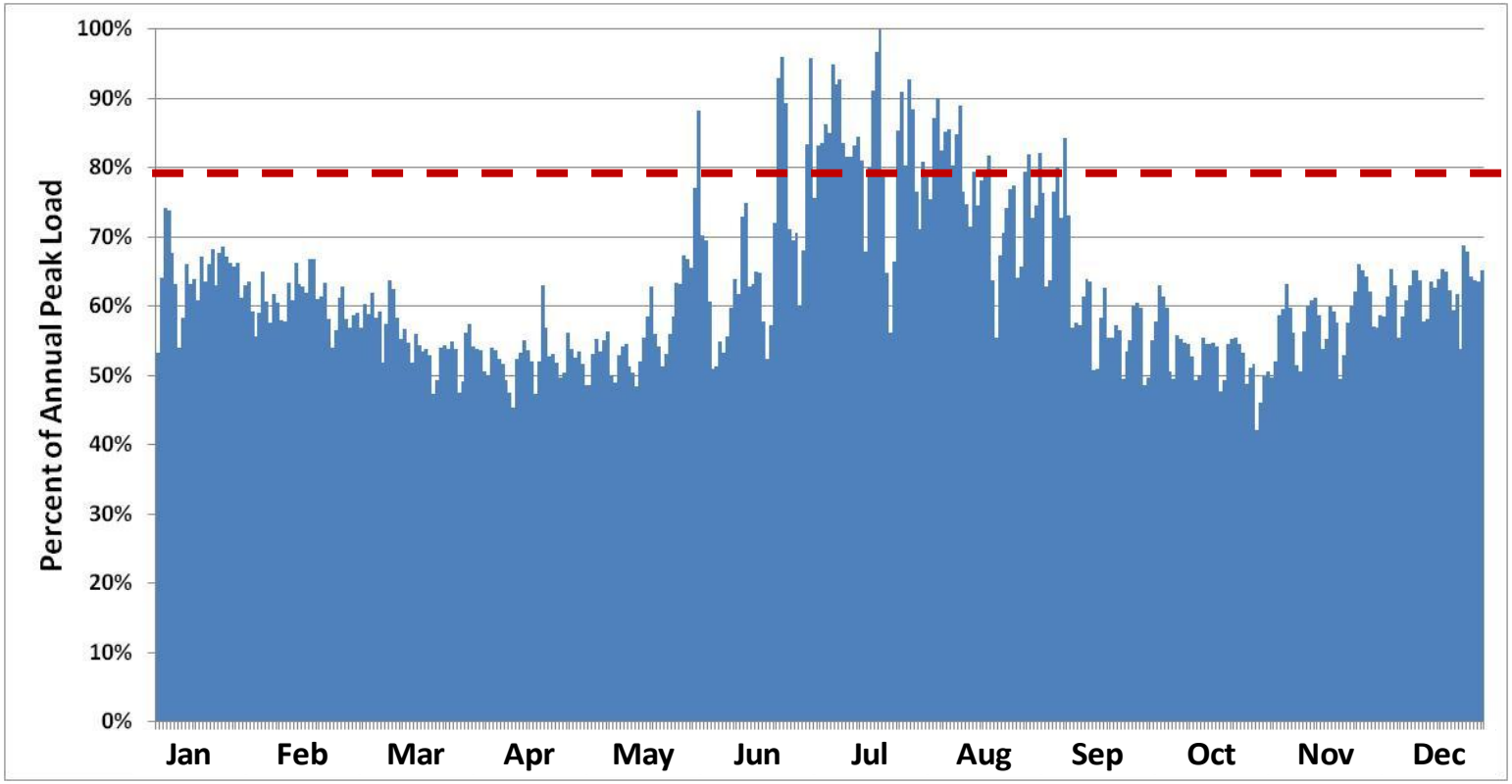
Active Load Management Drives Further Efficiencies



Line between DR and EE starts to get blurred, greater efficiencies achieved

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Three “Smart Grid” Elements to Consider

Energy Efficiency	• Installation of efficient equipment to lower energy consumption, reducing grid demand on a “permanent” basis
Energy Conservation	• The element of when and how energy is consumed, in the context of system reliability, pricing, and physical conditions
Integrated, Automated Communication	• Enabling the “smart” electricity grid to both talk and listen via either machine-to-machine or user interface

Active Demand Management: The Invisible Renewable

Demand Management: At the convergence of the three elements helping to driving Smart Grid innovation

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Bringing Active DR and Traditional EE Together

Pennsylvania Act 129 Case Study

Signed in 2008: Seven Pennsylvania Electric Distribution Companies (EDCs); mission to integrate a renewable portfolio, reduce energy consumption, and smooth out system peaks

Timeline: Goals and phased evolution though May 1, 2018

Act 129	Energy Efficiency	Active Load Management
Phase I	5/31/2011: 1% energy reduction 5/31/ 2013: 3% energy reduction	5/31/2013: Total of 4.5% reduction in peak over top 100 hours
Phase II	In place through 5/31/2015	Under review for future deployment

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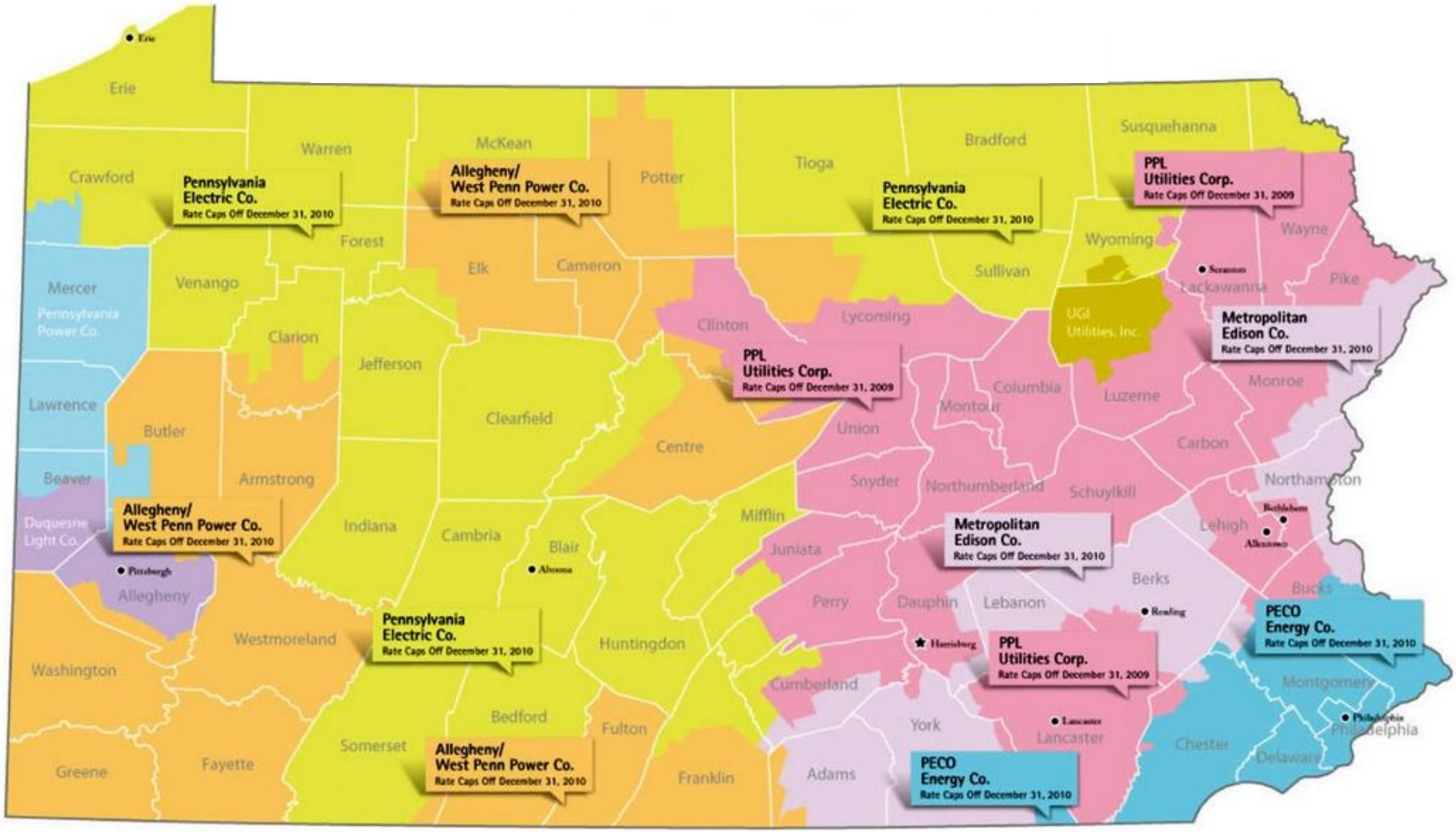
Pennsylvania Utility Service Territories



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Act 129 Payouts / Consequences

- **Energy Efficiency incentives via cash-back rebates**
- **Demand Response participation through conservation/ curtailment service providers (pay for performance)**
- **The Public Utilities Commission imposes fines if utilities miss**
- **Funding is through a surcharge to ratepayer base**

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Act 129 Peak Load Management vs. PJM Capacity

PA Act 129

- Multiple events (18 overall)
- Participation payout on MWH's of participation, versus ability to respond
- Hours called by the utility, not PJM; but may coincide with PJM event
- Not an emergency program, but peak shaving for EDC
- Layered on top of PJM
- Payout set by utility

PJM Capacity

- Emergency situations, up to 10 events, 6 hours max, mandatory load drop test
- Measurement of participation is based on firm service level ("drop to" amount)
- Events are called by PJM during times of grid stress or outage
- Standalone program
- Pricing set by forward auctions

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Results Overview: Planning & Program Design

90 separate dispatches (~18 per EDC) over 12 weeks

Johnson Controls and customers delivered 15,343 MWh (5 EDCs)

Customers performed better and more often than many had projected

- Diverse DR dispatchable portfolio of resources
- Small & large universities, K-12 schools, hospitals, office buildings, ball parks, huge industrials, water and waste treatment, data centers, and mixed use
- Customer load drops ranging from 100 kW to 60 MW
- Customers loved the program, and are active at the legislative level to reshape next generation
- Active dynamic customer engagement

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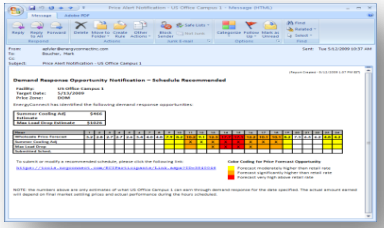
Customer Engagement Through On-Line Web Portal

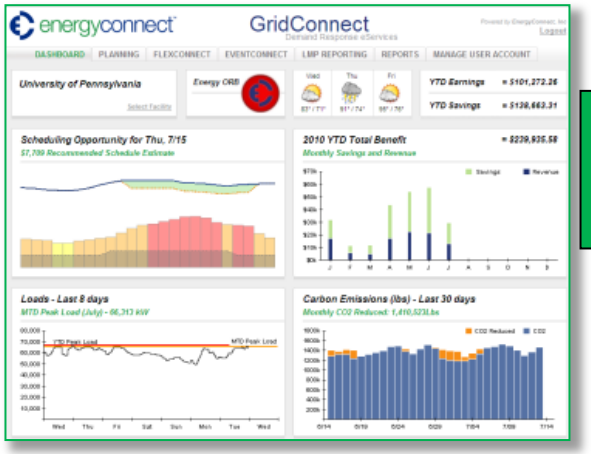


EventConnect

Event driven dispatchable demand response
(30 min to 1 day notification)

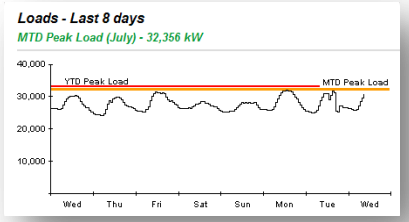
FlexConnect

Voluntary, price responsive demand management



DirectConnect

AutoDR interface to on-site Systems for automatic dispatch



Act 129 Scheduling

PA Act 129 Program Paying $400 to 500/MWh

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E-Mail Notifications Clearly Outlining Value to Customer

From: eservices@energyconnectinc.com
To: Boucher, Mark
Cc:
Subject: Price Alert Notification - College of Eastern West - 1000
Sent: Sun 5/6/2012 8:47 PM

ACT 129 ALERT:

PECO is forecasting an ACT 129 Event for the date and hours below. Please schedule curtailment activity accordingly. Note, hours

Go to FlexConnect Scheduling Page

Demand Response Opportunity Notification – Schedule Recommended

Facility: College of Eastern West - 1000
Target Date: 5/7/2012
Price Zone: PECO

EnergyConnect has identified the following demand response opportunities:

Lighting-HVAC Estimate	$4338	Submit this schedule
Emergency Estimate		
Weekend Ops Estimate		
Reduce Operations Estimate	$6250	Submit this schedule

Go to FlexConnect Scheduling Page

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
PECO ACT 129																*	*	*	*					
Wholesale Price Forecast	2.6	2.4	2.2	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.8	4.8	5.5	6.7	8.9	54.8	54.0	53.0	51.5	5.0	3.9	3.8	3.1	3.0
Lighting-HVAC													X	X	X	X	X	X	X					
Emergency																								
Weekend Ops																								
Reduce Operations														X	X	X	X	X	X					
Submitted Sched.																								

Color Coding for Price Forecast Opportunity

- Moderate Price Opportunity
- Medium Price Opportunity
- Very High Price Opportunity
- * ACT 129 Event

NOTE: the numbers above are only estimates of what College of Eastern West - 1000 can earn through demand response for the date specified.The actual amount earned will depend on final market settling prices and actual performance during the hours scheduled.

Text Alert Indicating Act 129 Event Called by Utility

Total Value of Opportunity Identified

Quick Link to DR Analysis and Scheduling Screen

Color Coded Hourly Pricing

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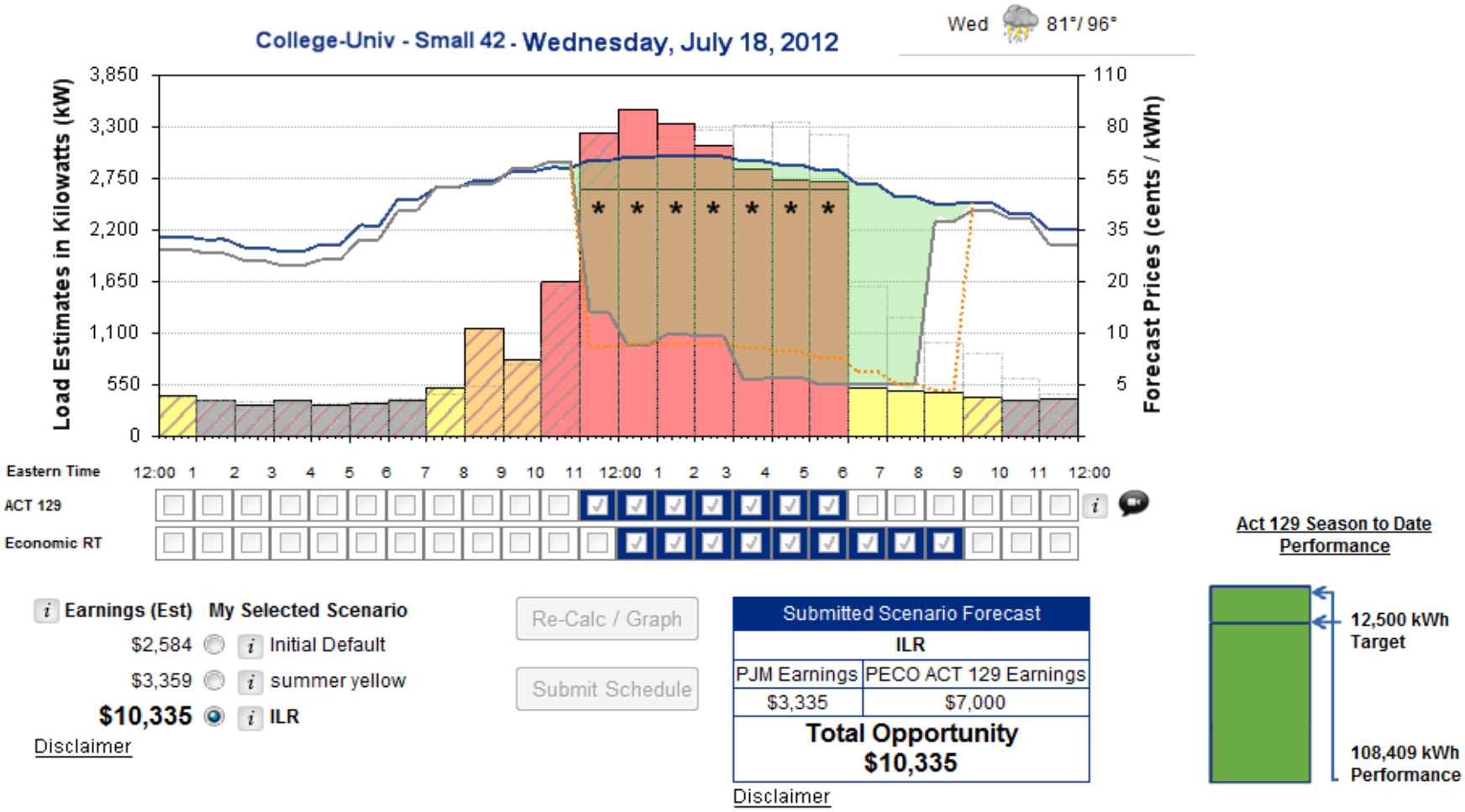
PA Act 129 in Action –
Scheduling and Performance Monitoring



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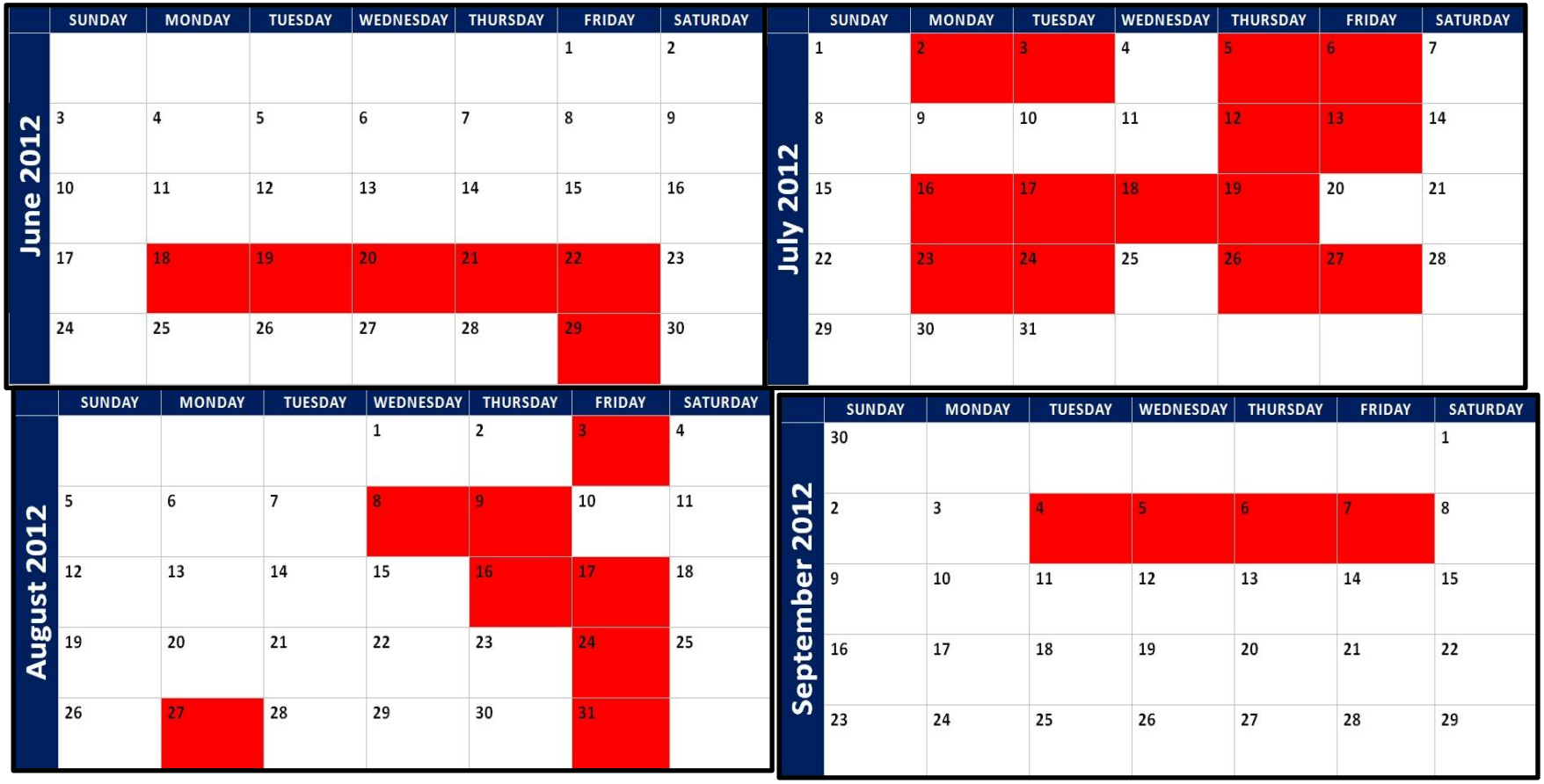
Act 129 Event History

5 EDCs, 12 weeks, 32 dispatch days



June 2012

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

July 2012

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

August 2012

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

September 2012

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
30						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

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PA Act 129 and Customer Success

Incentive levels and other motivating factors

- Act 129 funded by ratepayers and contracted to third party CSPs with expertise in this area
- Incentive levels were high enough for customers to care ($500+ per MWh)
- Customers knew the problem they were solving and value to grid

Smart Grid innovations as an enabling technology

- Real time metering with real time customer feedback
- Intuitive software built around dynamic pricing to incent and motivate
- Notification clearly quantified value prop in specific customer terms – not just a “price signal”

Making it easy and transparent

- Utilities gave CSPs flexibility in program design
- Flexible terms and day ahead notification allowed our customers to plan
- Curtailment planning counseling
- Assistance in automating the response
- Coaching, performance reviews and corrective actions

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Act 129: Peak Load Management – Lessons learned

Enabling legislation and policy has a role

- Regulators, legislators need independent expertise

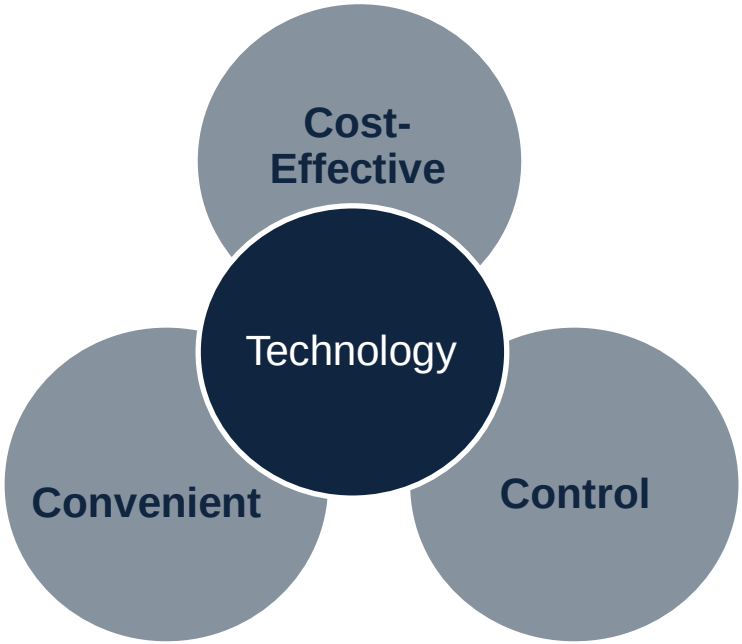
Johnson Controls experience: link DR resource, customer to utility

- **Situational awareness: technology, tracking, expertise in customers and & load response**

Our customer experience:

- Easy
- Cost effective
- Customer controlled, voluntary

Active Demand Management Technology Enabled All Three



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The EE and DR Virtuous Cycle

Implement
HVAC, lighting, controls, process improvements, scheduling, optimization, etc.

Understand & Plan
Optimize energy use for curtailment

Train, coach, reinforce, automate

Leverage earnings stream
Indentify new projects, EE rebates & savings

Continuously reinforce & review
Clearly tie action to payments

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Questions?

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…THANK YOU!

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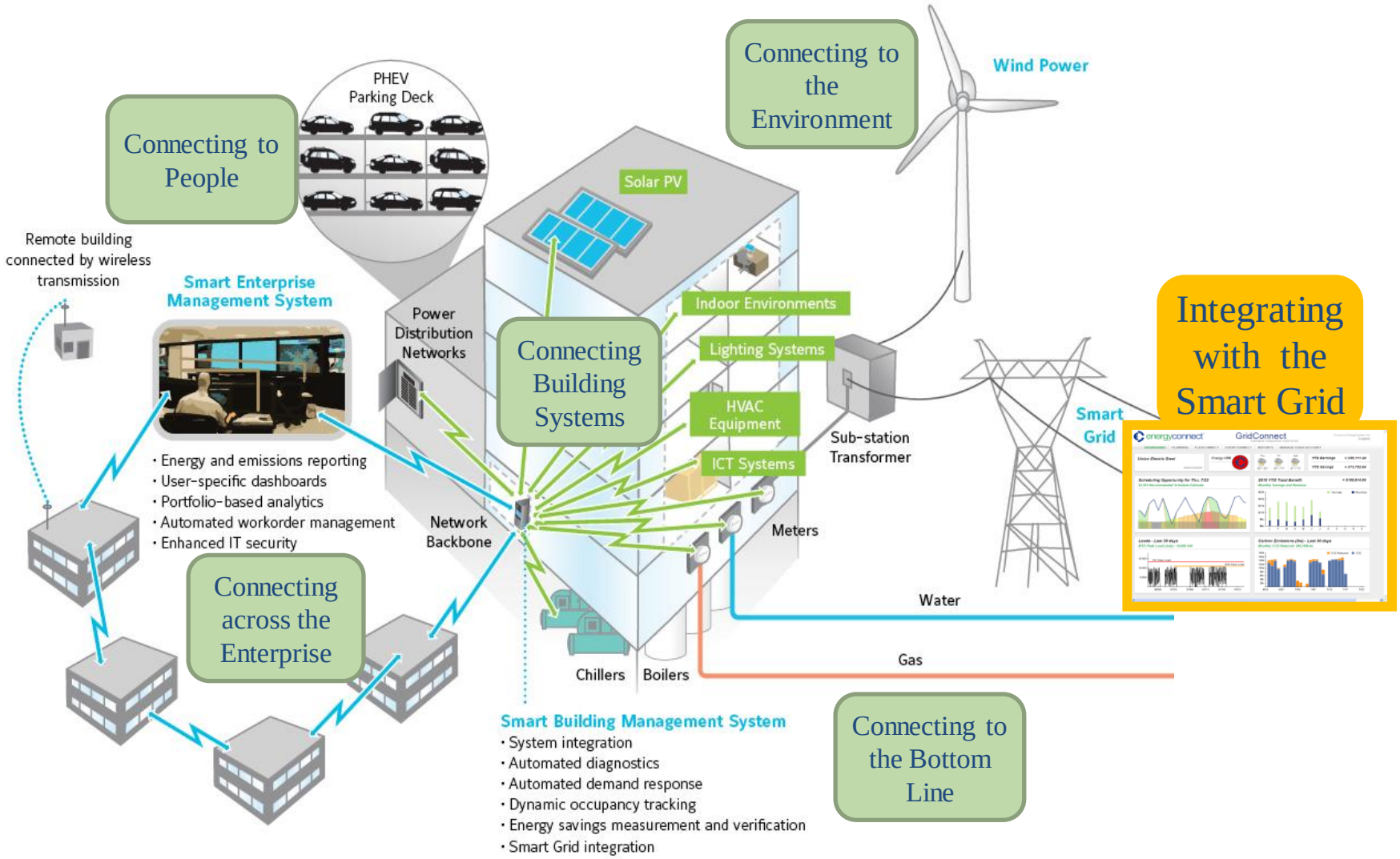
Integrating Smart Buildings with the Smart Grid



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