Demand-Side Management (DSM) & Demand Response (DR) in Colorado: Lessons Learned

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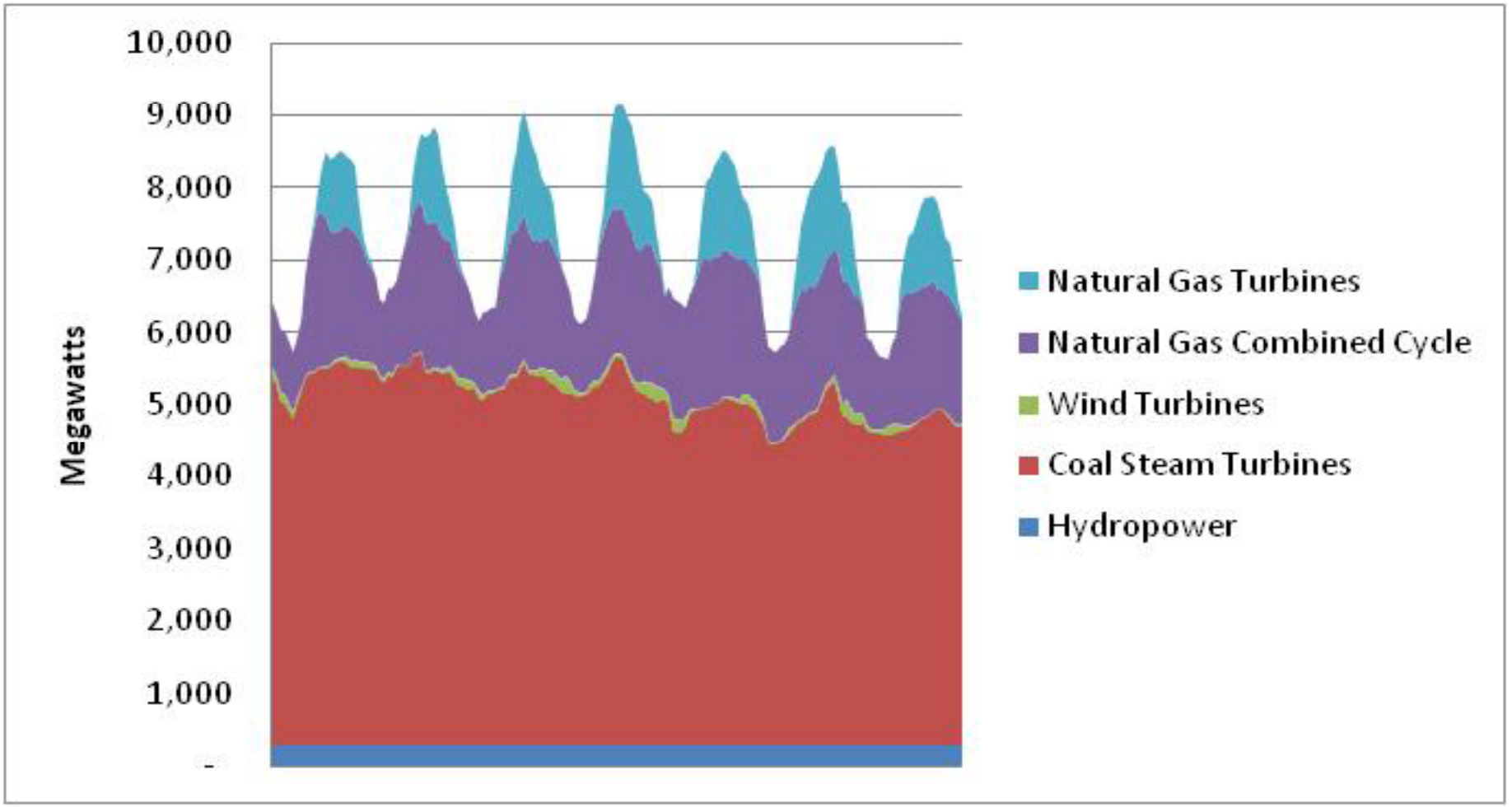
Objectives:

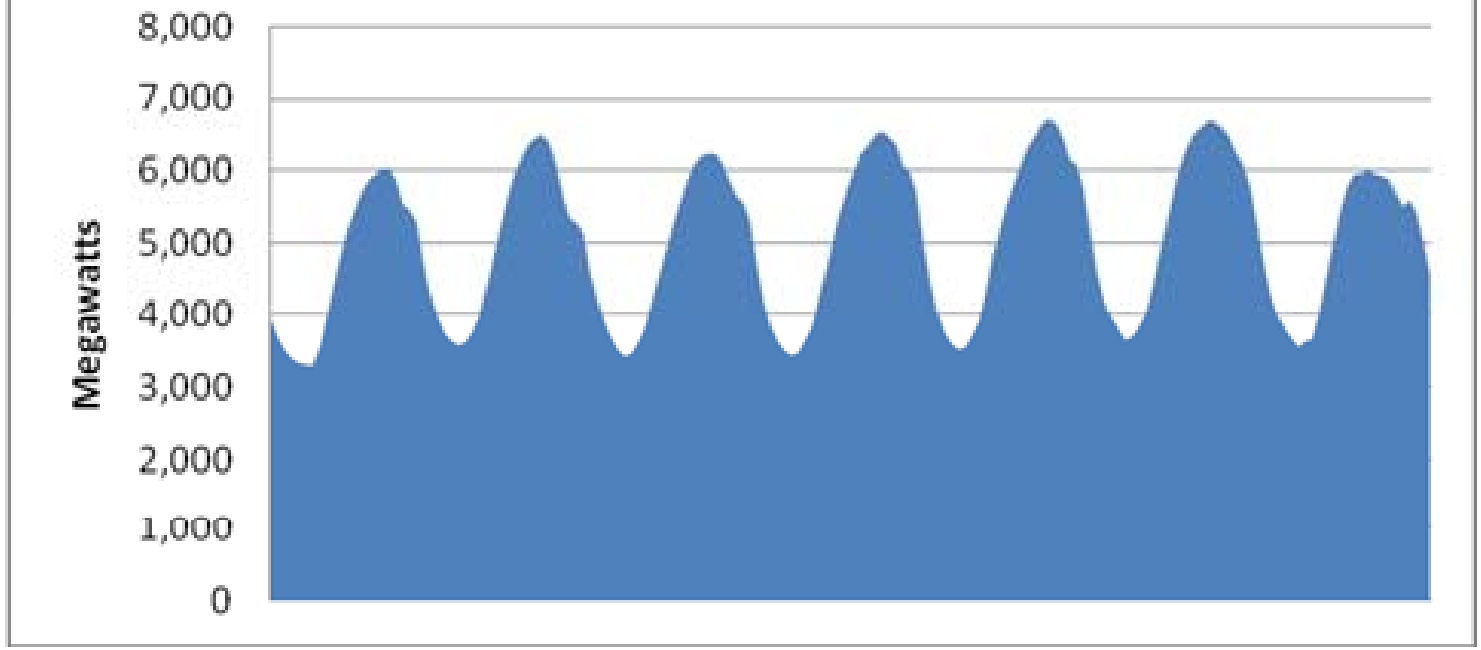
- Updates Since May 2009 (Lessons)
- Present CO Emerging DSM/DR Portfolio
- Note Similarities/Differences in Experience
  - Colorado and Jordan
- Offer Topics for Discussion

Colorado Electricity System: Summer Demand Profile

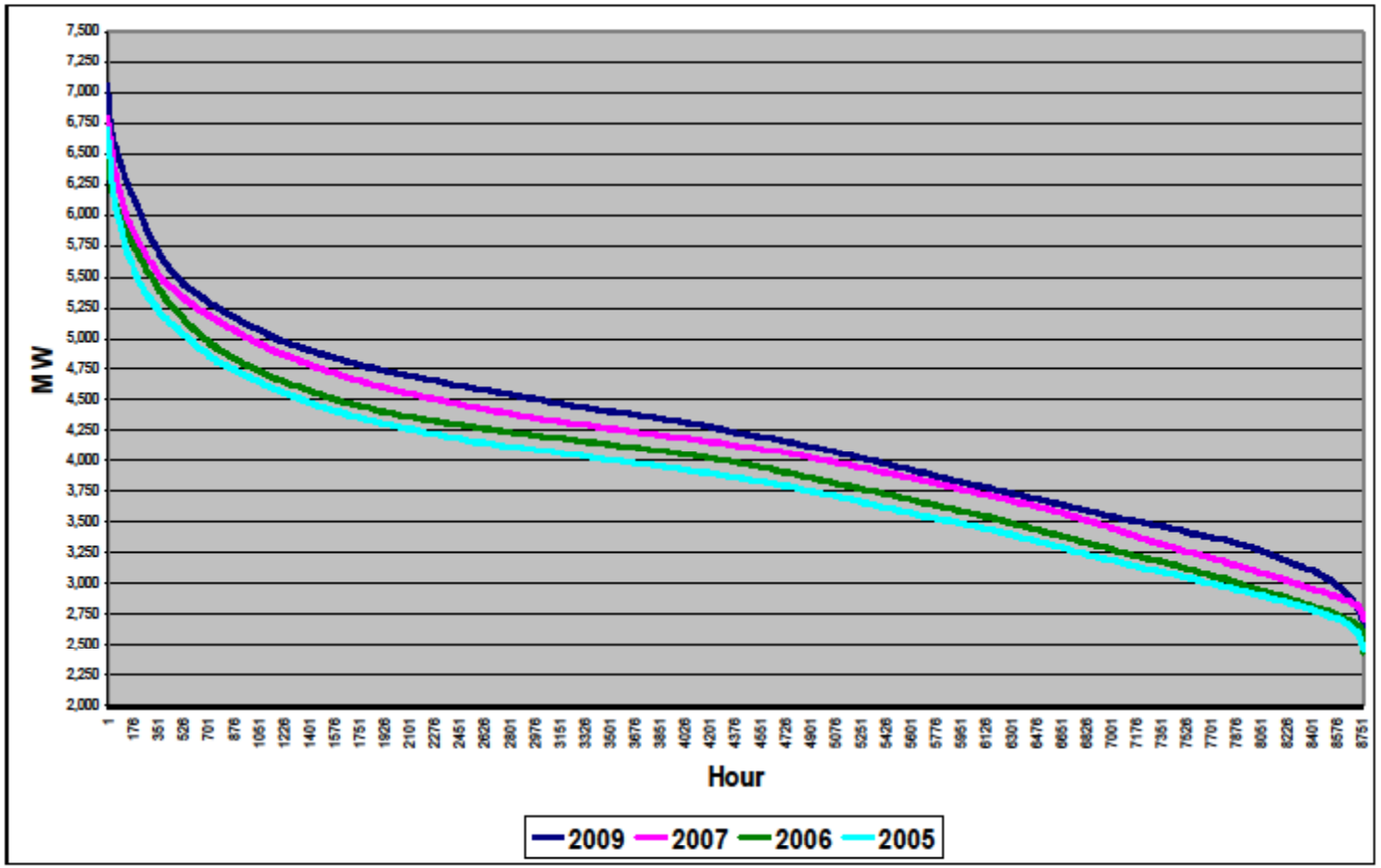


One Summer Week; Source: Ventyx Consulting
(R. Johnson, Ph.D., presentation to PUC , 4/29/10)

PSCO Load Curve:
7/27/2008 through 8/2/2008



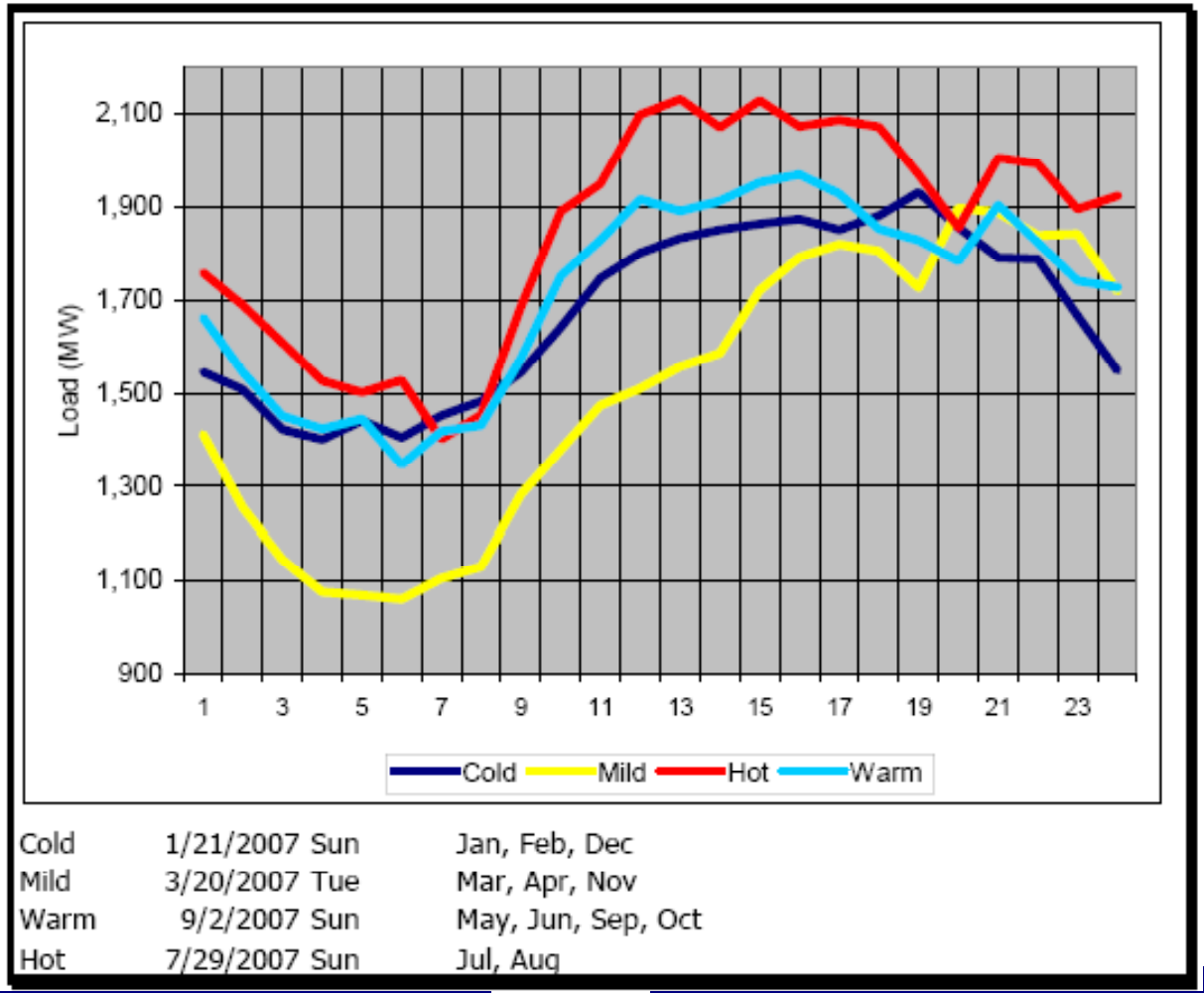
PSCo Hourly Load (MW)



Jordan Load Curve

(May 2009 presentation by Meqdad Qadous)

Figure 1: Daily Load Curves by Seasons in 2007



Cold	1/21/2007 Sun	Jan, Feb, Dec
Mild	3/20/2007 Tue	Mar, Apr, Nov
Warm	9/2/2007 Sun	May, Jun, Sep, Oct
Hot	7/29/2007 Sun	Jul, Aug

Knowing Sources of Demand is Key to a Strategic Response

(1999 CA data, as an example)

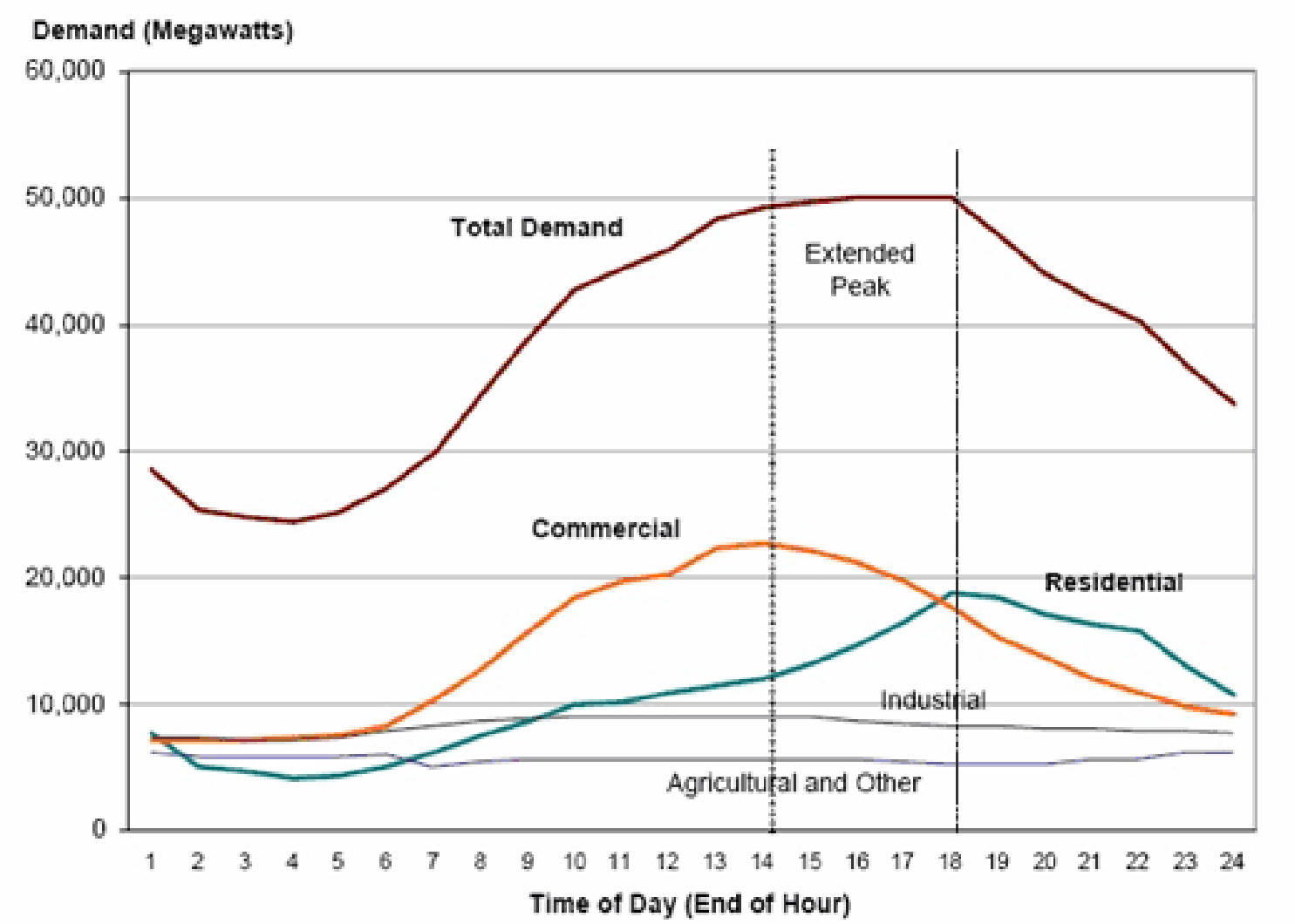
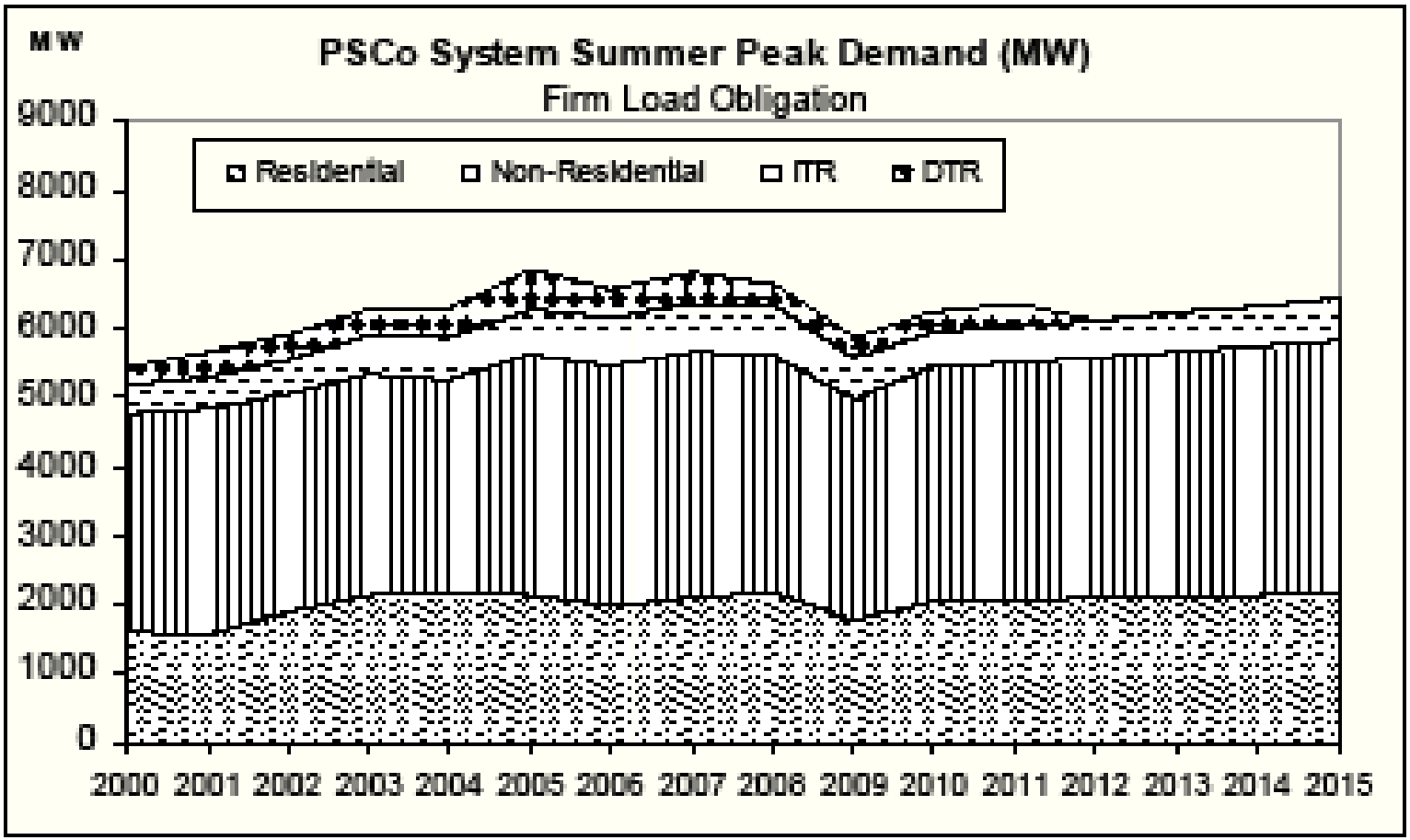


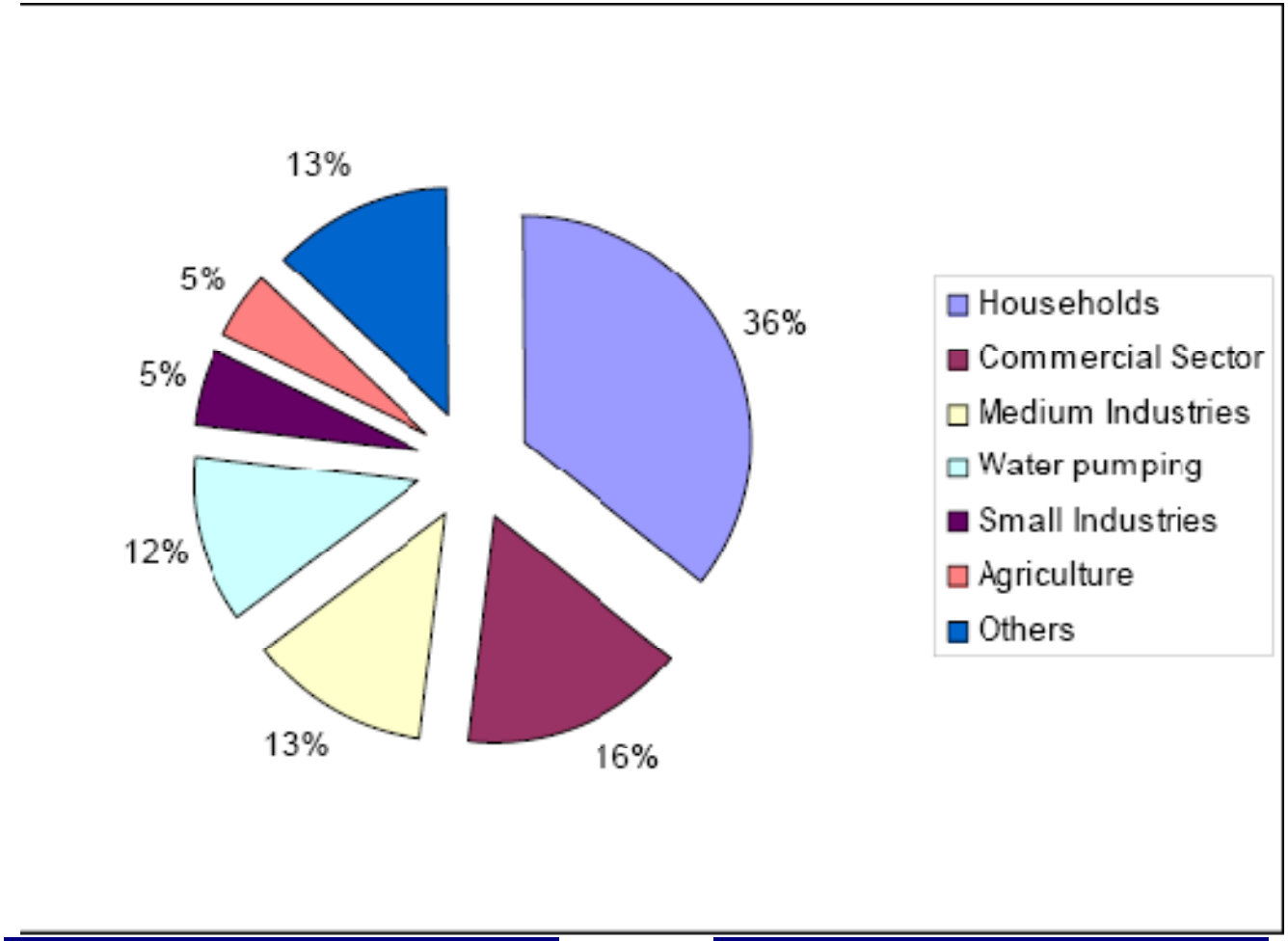
Figure 1.5.1 Actual and Forecasted Summer Peak Demand (MW)



"ITR" and "DTR" are resale of power.

Jordan Consumption Structure by Customer Groups: 2008

(Meqdad Qadous May 2009 presentation)



PSCo ELECTRIC LOAD FORECAST

(Sept. 09 Projections)

(All values in MW)	2010	2011	2012	2013	2014	2015
Dependable Capacity:	7941	7897	7850	7605	7795	7676
Native Load, w/ 100% DSM:	6608	6744	6128	6217	6318	6448
ISOC/EnerNOC:	-228	-254	-259	-264	-266	-264
Savers Switch:	-134	-150	-161	-171	-178	-173
Reserve Requirements:	1058	1081	1055	1078	1102	1129
Resource Need (long):	(637)	(476)	(1087)	(745)	(819)	(536)

Colorado's Demand Management and Load Control Strategies: 2010

- Price Signals & Other Financial Incentives:
  - Demand-Side Management (DSM) Programs
  - *Savers Switch* Program (Residential demand control)
  - Interruptible Service Option Credit (ISOC) – Comm/Ind
  - Third-Party Demand Response Aggregation – Comm/Ind
  - Tiered Rates (Residential)

PSCo Demand-Side Management Programs - preliminary 2009 Results

PROGRAM	kW	PROGRAM	kW
Business		**Residential**	
Boiler Efficiency	na	Energy Efficient Showerheads	na
Compressed Air Efficiency	1,474	ENERGY STAR New Homes	10
Cooling Efficiency	3,035	ENERGY STAR Retailer Incentive	640
Custom Efficiency	1,372	Evaporative Cooling Rebate	3,803
Data Center Efficiency	571	Heating System Rebate	na
Energy Management Systems	47	High Efficiency Air Conditioning	1,623
Furnace Efficiency	na	Home Lighting & Recycling	3,307
Lighting Efficiency	7,989	Home Perform w/ ENERGY STAR	31
Motor & Drive Efficiency	3,681	Insulation Rebate	na
New Construction	5,506	Refrigerator Recycling	297
Process Efficiency	77	School Education Kits	54
Recommissioning	354	Water Heating Rebate	na
Segment Efficiency	80	Saver's Switch	22,218
Self-Directed Custom Efficiency	478	**Residential Subtotal**	**30,361**
Small Business Lighting	316		
Standard Offer	813	**Low-Income**	
Business Subtotal	**25,793**	Easy Savings Energy Kits	163
		Multi-Family Weatherization	28
		Non-Profit Energy Efficiency	17
		Single-Family Weatherization	175
		Low-Income Subtotal	**384**

2009 DSM Results; Public Service Co. of Colorado (excerpt)

Programs	ACTUAL RESULTS		GOALS	GOALS
	Net Gen kW	Net Gen kWh	Net Gen kW	Net Gen kWh
Business				
Boiler Efficiency	na	na	na	na
Compressed Air Efficiency	474	4,029,000	1,474	9,181,365
Cooling Efficiency	4,279	6,558,090	3,035	6,168,583
Custom Efficiency	925	10,179,028	1,372	7,467,223
Data Center Efficiency	-	-	571	5,920,281
Energy Management Systems	163	5,553,000	47	4,238,885
Furnace Efficiency	na	na	na	na
Lighting Efficiency	16,124	74,600,000	7,989	31,856,916
Motor & Drive Efficiency	3,783	24,351,000	3,681	20,711,411
New Construction	3,074	11,915,000	5,506	20,784,026
Process Efficiency	114	796,000	77	487,371
Recommissioning	257	4,723,000	354	3,947,516
Segment Efficiency	44	61,000	80	528,904
Self-Directed Custom Efficiency	-	-	478	2,182,451
Small Business Lighting	82	298,000	316	1,153,540
Standard Offer	-	-	813	1,766,186
Business Subtotal	**29,319**	**143,063,118**	**25,793**	**116,394,660**

COOLING EFFICIENCY PROGRAM – 2009
Electric Benefit-Cost per Customer kW ($/kW)

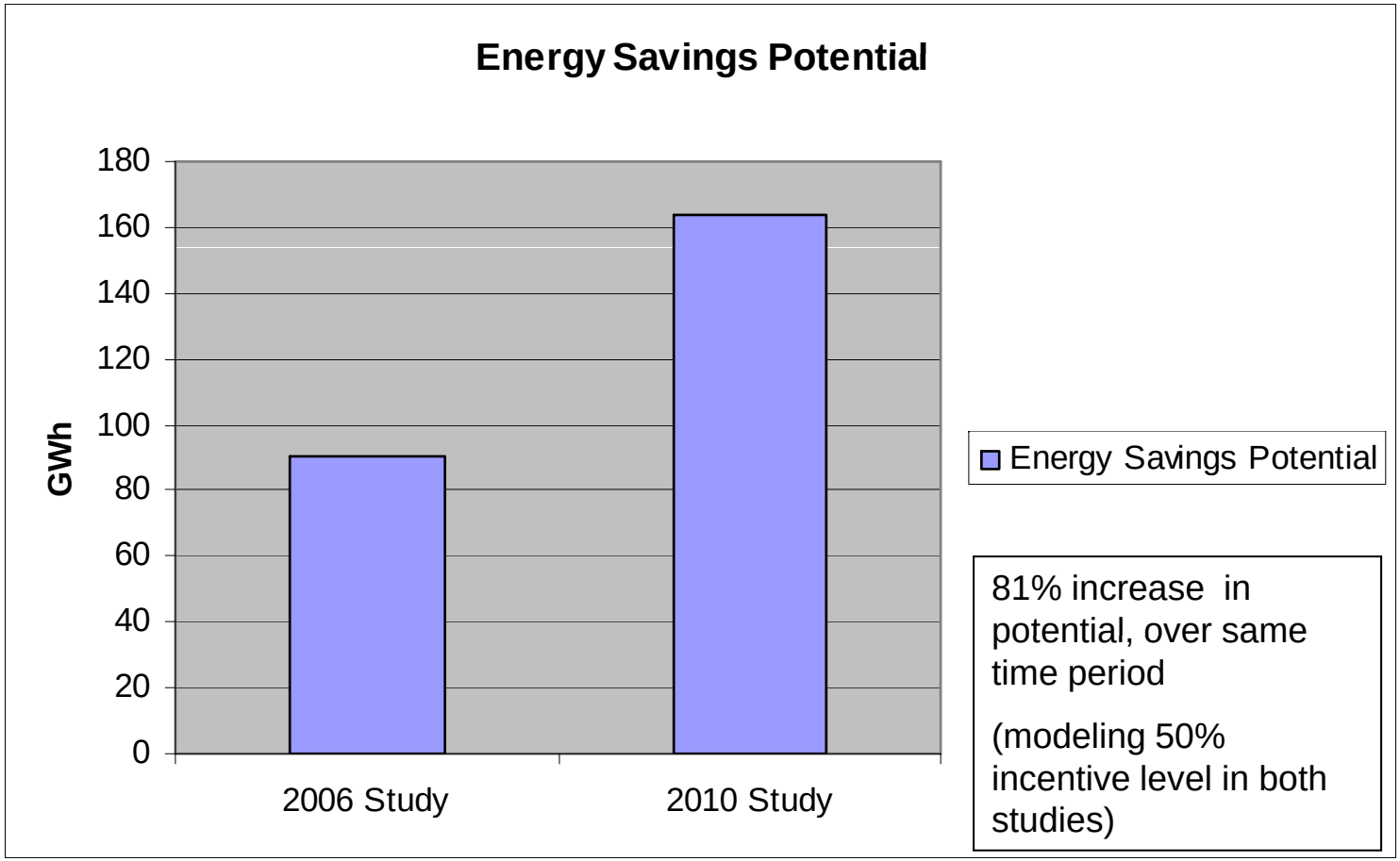
	Participant Test	Utility Test	Rate Impact Test	Modified Total Resource
System Benefits				
Generating Capacity		$1,227	$1,227	$1,227
Transm/Dist Capacity		$248	$248	$248
Marginal Energy		$1,062	$1,062	$1,062
Avoided Emissions		$291	$291	$291
Subtotal:		$2,829	$2,829	$2,829
Non-Energy Benefits 10%)				$283
Subtotal:		$2,829	$2,829	$3,112
Other Benefits				
Particip. Rebates & Incentives	$446			$446
Vendor Incentives				
Incremental Capital Savings	$0			$0
Incremental O&M Savings	$0			$0
Subtotal:	$446			$446
Reduction in Sales Revenue				
Electric	$1,545		$1,452	
Subtotal:	$1,545		$1,452	

Utility Program Costs				
Program Planning & Design		$19	$19	$19
Admin & Program Delivery		$36	$36	$36
Advertising/Promo/Educ		$25	$25	$25
Particip. Rebates & Incentives		$446	$446	$446
Equipment & Installation		$0	$0	$0
Measurement & Verification		$19	$19	$19
Miscellaneous		$0	$0	$0
Subtotal:		$545	$545	$545
Participant Costs				
Incremental Capital Costs	$1,353			$1,268
Incremental O&M Costs	$0			$0
Subtotal:	$1,353			$1,268
TOTAL BENEFITS:	**$1,991**	**$2,829**	**$2,829**	**$3,558**
TOTAL COSTS:	**$1,353**	**$545**	**$1,997**	**$1,813**
NET BENEFIT (COST):	**$638**	**$2,284**	**$832**	**$1,745**
BENEFIT/COST RATIO:	**1.47**	**5.19**	**1.42**	**1.96**

Custom Self-Directed DSM

- Target: Comm/Ind customers – aggregated peak load ≥ 2MW (single month) & ≥ 10 GWh/yr.
- Customer initiates project (proposal to utility)
  - Engineering modeling (new construction)
  - Calculations of energy and demand savings, non-energy benefits and estimated rebate
  - Proposed monitoring & control activities
- Pre- and post-installation metering when predicted savings ≥ 0.25 GWh
- Rebates: up to $525/kW or $0.10/kWh; maximum of 50% of incremental cost
- Customer data held as confidential

Market Potential Studies: 2006 v. 2010



PSCo/KEMA presentation: 2/18/10

Revised Natural Gas Price Forecasts

Year	2009-10 DSM Plan ($/Dth)	Current Assumption ($/Dth)	Increase (Decrease) ($/Dth)	Percentage Increase (Decrease) ($/Dth)
2009	$10.28	$3.41	($6.87)	(66.8%)
2010	$9.53	$4.81	($4.73)	(49.6%)
2011	$8.83	$5.17	($3.65)	(41.4%)
2012	$8.66	$5.47	($3.18)	(36.8%)
2013	$8.76	$5.72	($3.04)	(34.7%)
2014	$8.69	$6.03	($2.67)	(30.7%)
2015	$9.00	$6.48	($2.52)	(28.0%)
2016	$9.34	$6.97	($2.37)	(25.4%)
2017	$9.82	$7.28	($2.54)	(25.9%)
2018	$10.06	$7.52	($2.54)	(25.2%)
2019	$10.44	$7.81	($2.63)	(25.2%)
2020	$10.70	$8.07	($2.64)	(24.6%)
2021	$10.47	$8.28	($2.19)	(20.9%)
2022	$10.81	$8.53	($2.29)	(21.1%)
2023	$11.16	$8.76	($2.40)	(21.5%)

Impact of Changing Gas Price Forecasts on DSM Calculations*

DSM Business Program:	2011	2009
Boiler Efficiency	1.09	2.68
Custom Efficiency	1.34	2.42
Energy Mgmt Systems	1.07	1.69
Furnace Efficiency	0.52	4.25
New Construction	1.44	1.87
Process Efficiency	1.48	7.22
Recommissioning	0.74	1.38
Standard Offer	0.73	1.35
DSM Residential Program:		
ENERGY STAR New Homes	0.79	1.25
Heating System Rebate	1.41	1.85
Home Performance w/ ENERGY STAR	0.82	1.23
Insulation Rebate	1.11	1.72
School Education Kits	4.16	2.36
Water Heater Rebate	0.75	1.16

*and factoring in M&V results/field experience (2009)

Savers Switch

- Allows utility to cycle (residential) central air-conditioner compressor units on/off at brief (15-20 minutes) intervals by remote control.
- On “control days” program typically runs between 2 and 7 p.m.
- Generally, activation occurs on hot summer days.
  - Typically activated about 10-15 days every summer (June-August), and not on weekends or holidays.
- Residential customers in Colorado who enroll receive a $40 credit on their October utility bill each year they participate.
- About 100,000 installations in CO; able to avoid ~ 23 MW demand

Interruptible Service Option Credit

- Target: customers ≥ 300 kW of load
- Strategy: utility authority to stop serving customer (some portion of load)
  - Specific duration of interruptions (total # hrs/yr)
  - Specific advance notification (10 min; 1 hr)
- Customer compensation: calculated amount, less than cost of buying "spot" electricity to meet peak demand
- 2009: 180 MW of avoided capacity
- Targeted Industries:
  - Heavy Industrial (16)
  - Energy/Mining (4)
  - Government (10)
  - Agriculture (3)

See: T. Sheesley (PSCo) Aug. '09 presentation for more details

Third-Party Demand Aggregation

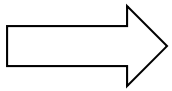
- Utility contract with Third-Party (EnerNOC)
- "Peak Savings" Program:
  - Customers enter contracts, committing to shed load
  - Load controlled remotely by EnerNOC
  - Target: ≥ 50 kW demand (ISOC min = 300 kW)
  - Loads Targeted:
    - Lighting
    - HVAC-related (rooftop units/chillers)
    - Production equipment (motors, pumps, compressors)
    - Entire production lines/facilities
    - Transfers to on-site generation
- 2009 (first year): 20 MW of avoided capacity under contract

See: B. Davids (EnerNOC) Aug. '09 presentation for more details.

Tiered Rate Designs: ERC, Jordan

Domestic Tariff

1 – 160 kWh / Month	32 fils / kWh
161 – 300 kWh / Month	71 fils / kWh
301 – 500 kWh / Month	85 fils / kWh
Over 500 kWh / Month	113 fils / kWh



4th, 5th Stars Hotels Tariff

Day Energy Tariff	81 Fils/kWh, 07:00 - 23:00.
Night Energy Tariff	70 Fils/kWh, 23:00 - 07:00.
Maximum Demand	3.79 JD/kW/month

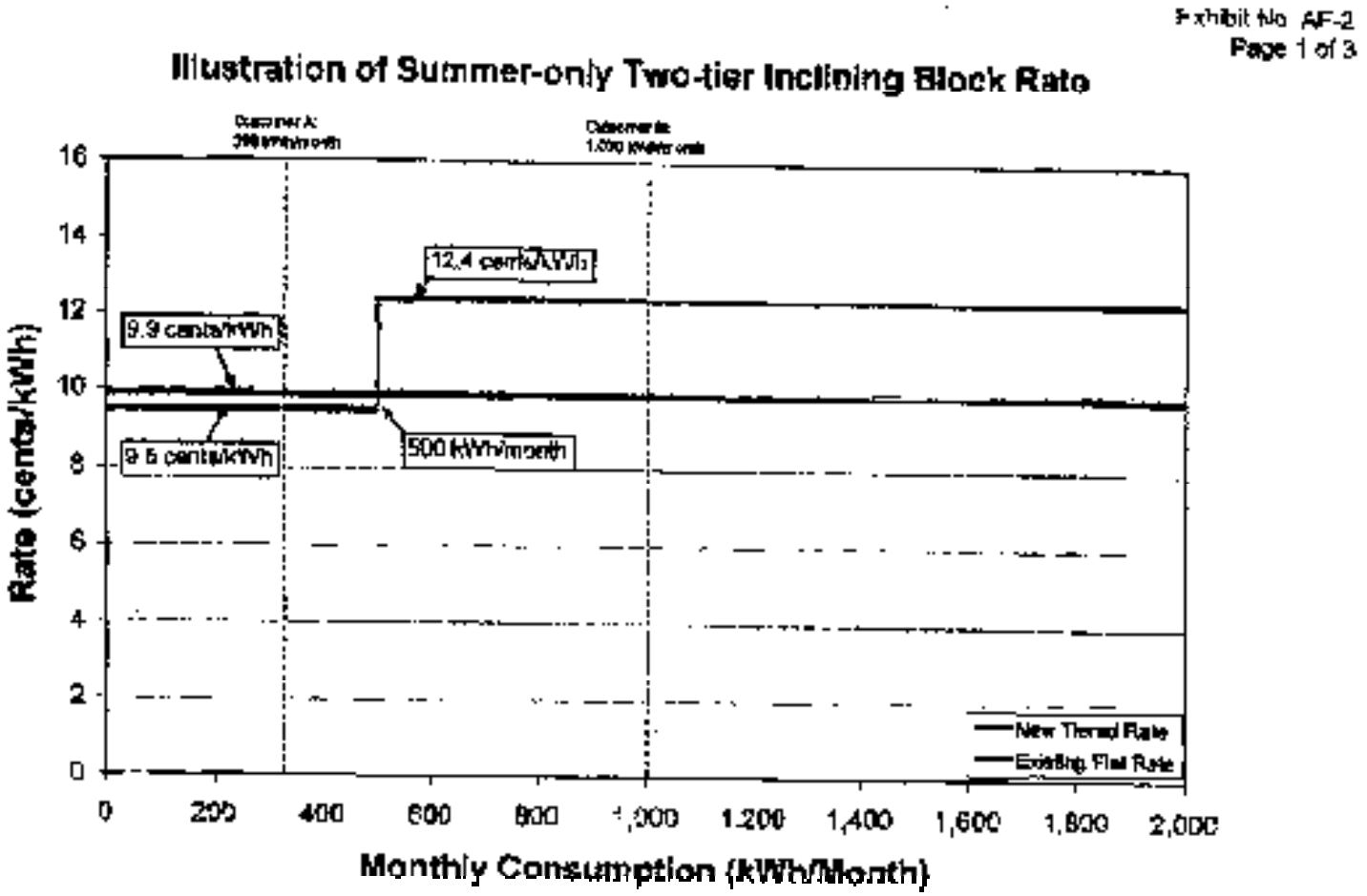
Souce: Khaldoun Habahbeh; May 2009 presentation

PSCo Tiered Rate Design (Effective June 2010)

- 2-tiered Residential Rate: June – Sept.
- First tier = first 500/mo kWh of energy use
  - Priced at the year-round "flat" rate (non-summer price)
- Second tier: kWh usage > 500/month
  - About 180% of first tier price (9¢/kWh vs. 5)

- Target: air conditioning usage – major contributor to summer system peak demand

Two-Tiered (Residential) Rate Design



For Discussion:

- Identifying the Targets/Objectives:
  - Peak Demand or Baseload Reduction
  - Disaggregating/interpreting demand curves
- Value of Multiple Strategies
  - Strength of a diversified DSM portfolio
  - Overlap of peak and base strategies
- Establishing Effective & Market Appropriate Price Signals:
  - Rebates (DSM)
  - Interruption tariffs/credits/contracts (DR)
  - Rate design (tiers/differentials)