

Time-of-Use and Critical Peak Pricing

Considerations for Program Design
and the Role of Enabling
Technologies

Overview of TOU and CPP

■ Time-of-Use Pricing

- Customers pay different prices at different times of the day
- On-peak prices are higher and off-peak prices are lower than a “standard” rate
- Price schedule is fixed and predefined, based on season, day of week, and time of day

■ Critical Peak Pricing

- Very high “critical peak” prices are assessed for certain hours on event days (often limited to 10-15 per year)
- Prices can be 3-10 times as much during these few hours
- Typically combined with a TOU rate, but not always

■ Peak Time Rebate

- Like a CPP without TOU, but only one direction – Customer can get credit for load reduction, but no penalty if load increases
- Uses a customer-specific baseline – no “natural winners”

Steps to designing a TOU or CPP pilot program

- Define objectives for the program
- Identify the target population
- Create the time schedule
- Define the revenue neutral baseline
- Design the rate
- Define the evaluation process
- Develop marketing and implementation strategy
- Evaluate the pilot

TOU context questions

Two fundamental questions will frame the entire approach to TOU and CPP

- Is the goal to shift load, or is the goal to assign costs (or just because regulators said to do it)?
 - If prices are higher during peak periods and much higher during critical peak periods, then some would argue that customers who use more during those periods should pay more
 - There are serious political and customer service implications to this decision
- Will the program be mandatory or optional?
 - Mandatory fits better with a cost tracking goal, but raises “fairness” questions
 - Optional makes customers happier, but can be an efficient method for utility revenue erosion

Define TOU program objectives

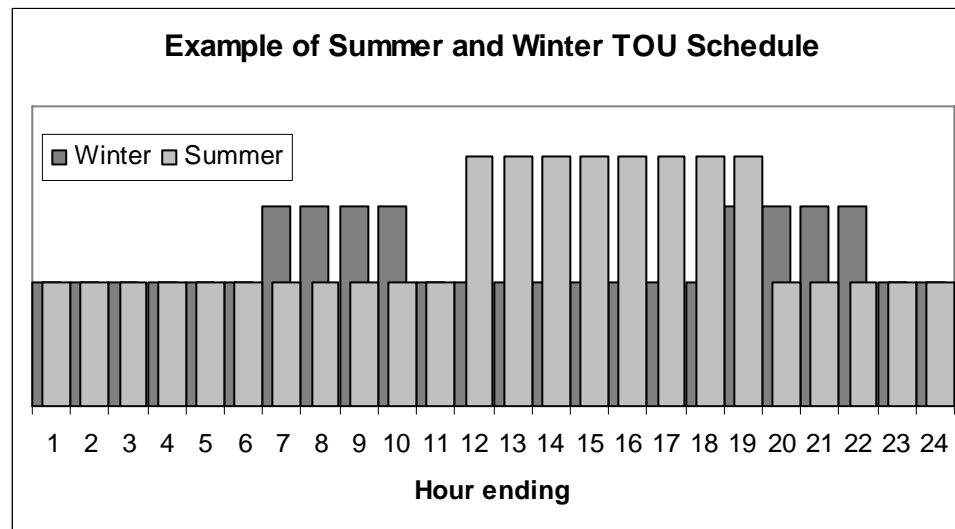
- We assume a voluntary program
 - Eliminates the need to deal with all the “fairness” issues
- Typically, the goal is to shift kW and kWh during summer on-peak period, then
 - Identify the total amount of kW and kWh
 - Estimate shift per customer
 - Implies a number of customers
 - Assess whether this is realistic

Identify and analyze the target population

- Target people who either have or can have the ability to respond
- If reducing summer peak use is goal, then focus on customers with central air
 - SRP program is for single-family homes that consume 1,300 or more kWh per month
- If reducing winter peak is the goal, then focus on electric heating or electric water heating customers

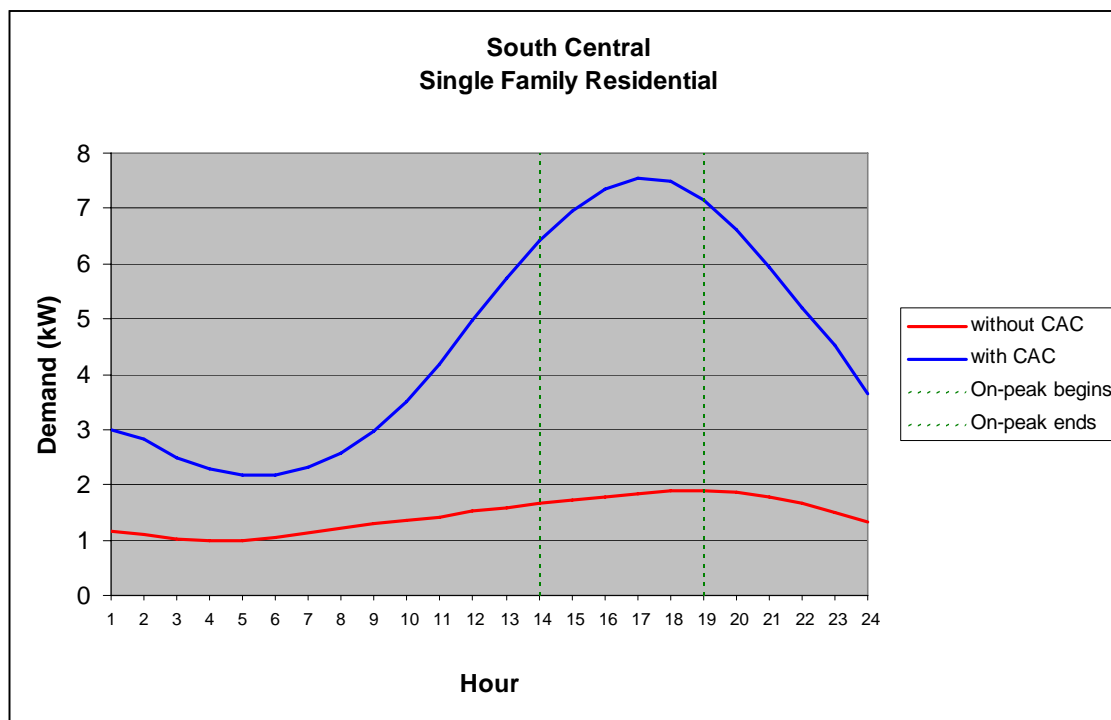
Create TOU schedule

- Typically based on utility cost structure
- On-peak time period is adjusted to be more attractive to customers
 - SRP started with 10 a.m. to 10 p.m. but changed it to 1-8 p.m.



Create revenue-neutral baseline

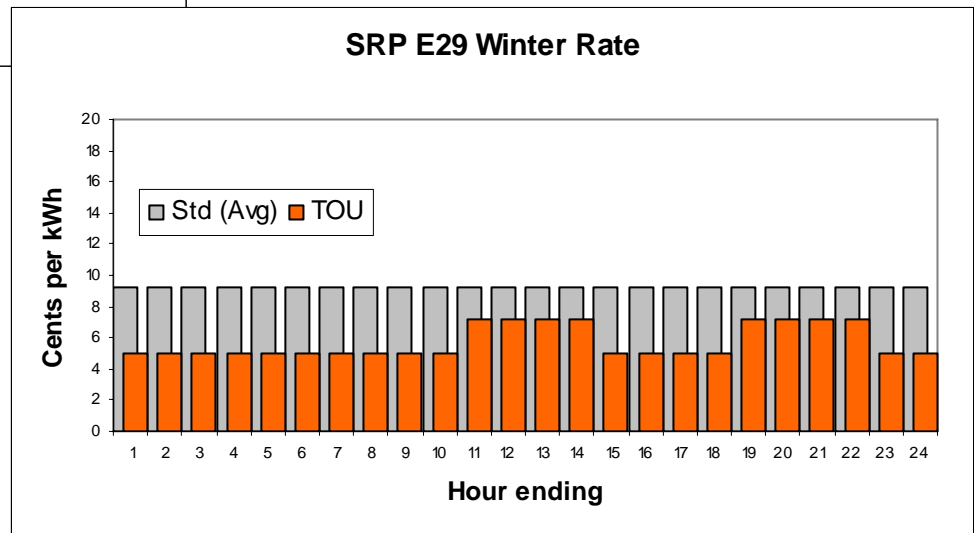
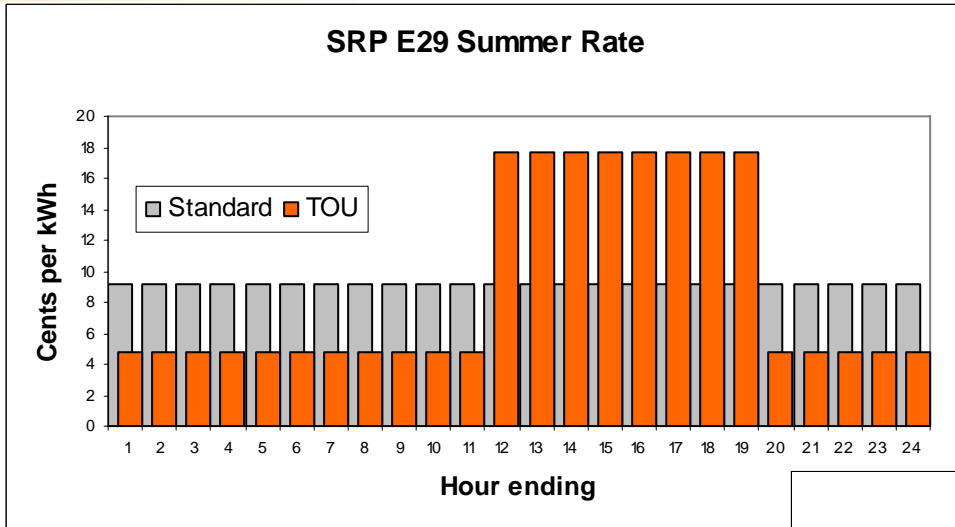
- If rate were mandatory, this step is required
- If rate is optional, is this a necessary step?
 - If so, revenue neutral for whom?



Design the rate

- Create a revenue neutral rate
 - Start with relevant class shape
 - For a two-tier rate, set one price and then compute the other
 - On peak rate should be based on actual utility costs
- Assess this rate—do we believe it will achieve what we want to achieve? For example,
 - Differential could be higher than cost to create a bigger incentive to reduce and/or shift load
 - Differential could be lower for political considerations
 - WPS had company buy-in for a higher differential to get a response, but the commission wouldn't approve it

Examples of TOU rates



Critical peak pricing (CPP)

- Typical goal of CPP is to more dramatically reduce load during the relatively few, very expensive hours
- Process is similar to TOU rate and program design with some considerations
- Typically, a CPP is added to a TOU rate
 - People are in a TOU mindset
 - Get more TOU shift when there is a CPP component

Considerations

- Target people who can or can develop the ability to respond dynamically
- Need to define the CPP time period (typically within or overlapping the on-peak period)
- Event days
 - Need to define the number of event days in a season
 - Challenge is to pick the days
- Revenue neutral takes into account the CPP events and hours
 - Not a trivial exercise with CPP

Comparison of CPP tariff structures

Company/ program name	Gulf Power Good Cents Select	WPS Thermostat Pilot	Ameren
Target population	Single family w/ central AC and heat, phone service	With central AC and in specific geographic area so could receive paging signal	St. Louis city and county; ≥ 1500 kWh use per summer month; high AMR reliability
# event days	Not to exceed 88 hours per year (1% of hours)	Up to 101 hours	10 event days
CPP period	Summer: 1-6 pm weekdays Winter: 6-10 am weekdays	Summer: 2-7 pm weekdays	Summer 3-7 pm
Price during CPP hours (cents/kWh)	Summer = 32.6 Winter = 32.6	Summer = 35	Summer = 30

Peak Time Rebate (PTR)

- Same goals and considerations as CPP – dramatically reduce load during the relatively few, very expensive hours
- Each customer has its own baseline calculated based on similar days surrounding event – no natural winners/losers
- Customer gets a bill credit for all reduction below their baseline
- “Safe” – **No penalty** if the customer uses more
- Can be “mandatory” since there is no downside for the customer
- Tested by City of Anaheim, to be implemented by SDG&E

Enabling technologies

- They automate the response
 - Makes response more reliable and consistent
 - Makes it easier for the customer
- Most popular when they have an override feature
 - But, don't have to make it too easy for customer (WPS example)
- Also add value under TOU-only programs
- There are many options
- Must include communication capability for CPP

Results of CPP pilots

- Gulf Power GoodCents Select (200 participants in pilot)
 - 3.8% conservation effect
 - Average peak load reduction during event was 2 kW in summer and 3 kW in winter
 - No demographic differences for participants
- WPS Thermostat Pilot (63 participants)
 - Peak load reduction at 6 p.m. was 0.5 kW on control days and 0.4 kW on non-control days
 - A four-degree rise in thermostat setting does not affect participant reported comfort

Results of CPP pilots (cont.)

- California Statewide Pricing Pilot
 - CPP-F had 500 participants statewide
 - Average peak-period energy use reduced by 13%, with a range of 7.6-15.8% depending on climate zone
 - Reduction on normal weekdays was 4.7% on average
 - CPP-V had 200 participants in two “tracks”
 - Track A were offered enabling technology (only 2/3 accepted) and Track C already had smart thermostats and central AC
 - For Track A, on-peak use decreased by 16% and critical peak use decreased by 25%
 - For Track C, on-peak energy use decreased by 27%
 - Two thirds of the reduction is attributed to the smart thermostat

Some excerpts on the EE-DR continuum

Energy Efficiency

- Permanent load reduction
- many hours
- no reduction or shift in customer value, comfort, or output

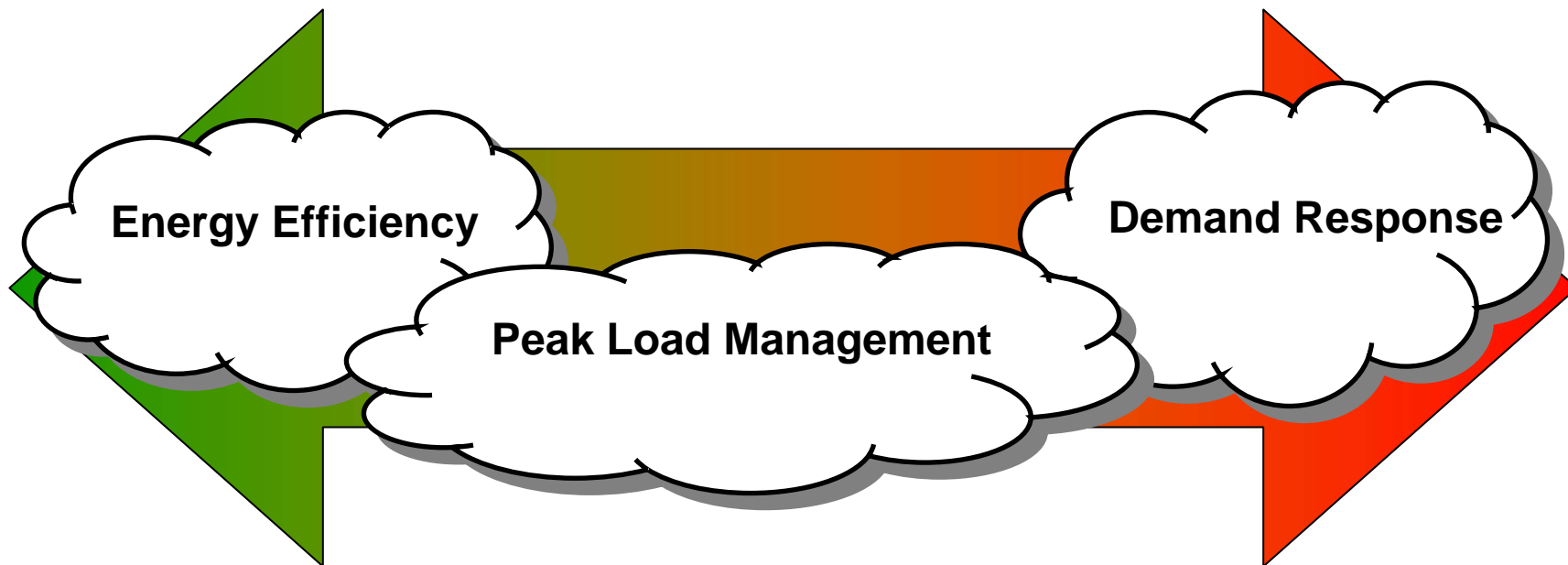
Demand Response (critical peak management)

- Temporary load reduction
- Very few hours
- May involve a reduction in customer value, comfort, or output.

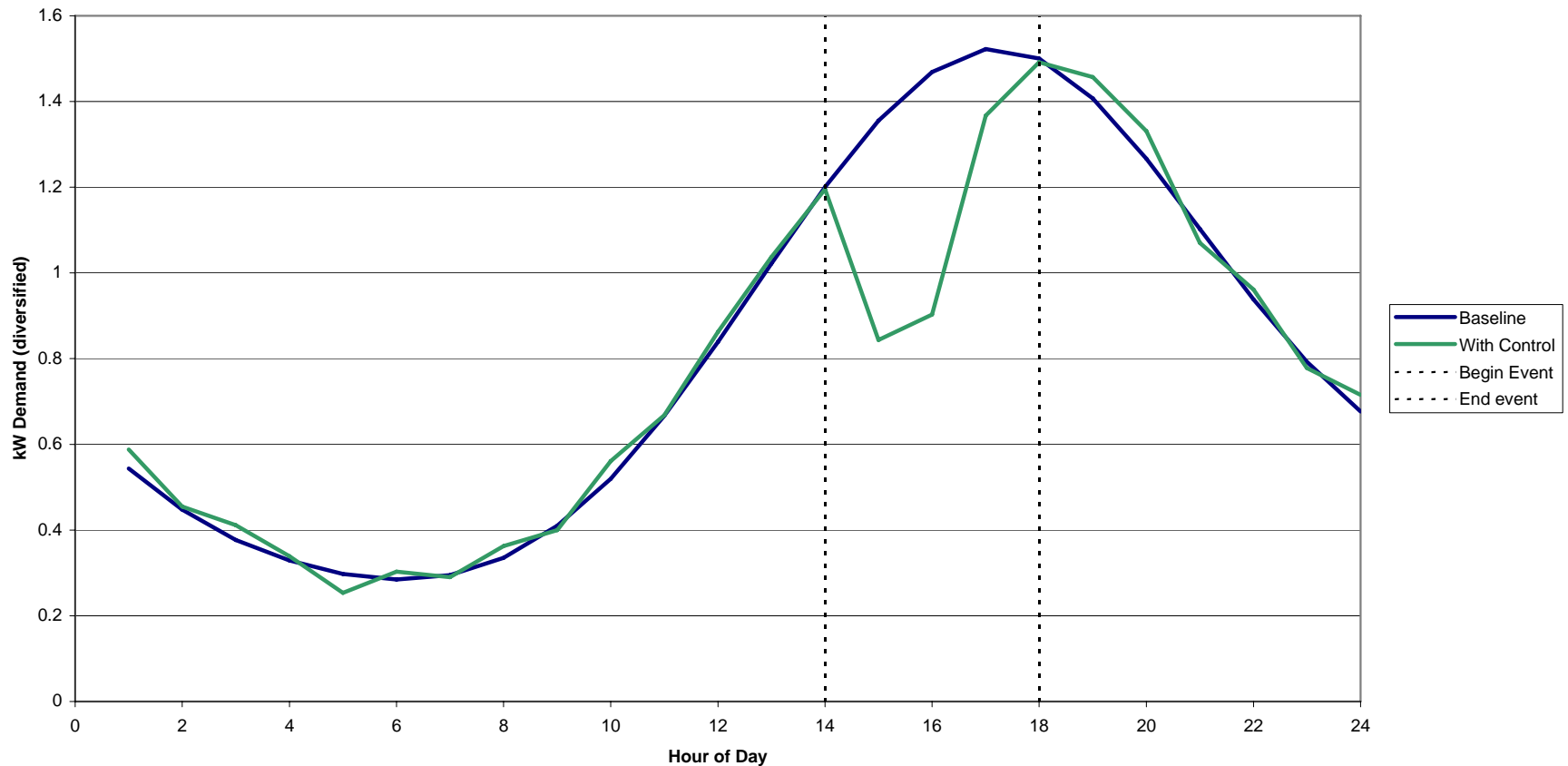
Peak Load Management

- peak shift or reduction on many days
- change in customer load profile
- shift or transfer of customer value or output

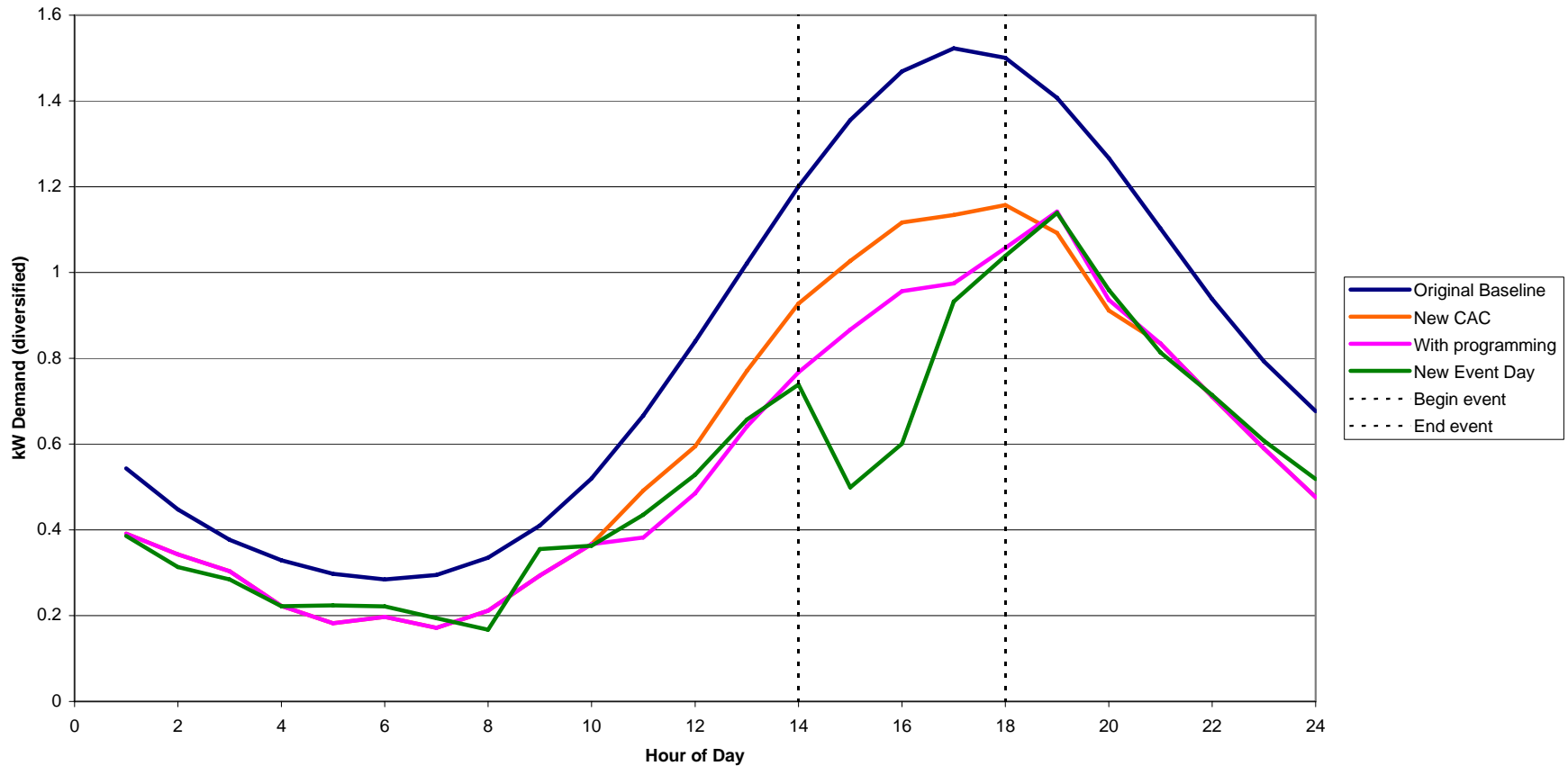
It's a continuum



Example – first year – only DR impact



Example – ultimate savings – all types



Effects in this example

- Customer invests in EE, Peak Load and DR technologies, all in response to a DR program
 - EE: High-efficiency air conditioner
 - Reduces overall energy consumption (kWh) when operating
 - PLM: Programmable thermostat
 - Adjusts temperature during on-peak periods
 - DR: Communications device within the thermostat
 - Controlled by utility during critical peak events
- Trying to measure separate impacts can also be a challenge, because of the interaction

So...Why Should We Care?

- Benefits can be significantly increased through integration
 - Long-term energy (kWh) savings through Energy Efficiency
 - Long-term system (kWh/kW) savings through Peak Load Management
 - Long-term capacity (kW) savings through Demand Response
- Customer benefits are realized sooner
 - Incremental investments results in larger savings
- Utility cost savings
 - Save on program costs, number of interactions
 - Long-term capital investment savings
- Increase customer satisfaction
 - Decrease customer annoyance
 - Provide comprehensive solution

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