



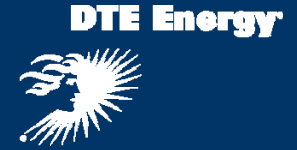
Demand Response Overview and Pilot Concepts

July 26, 2007

DTE Energy



Demand Response Document Overview



- **Direct Load Control vs. Passive Load Control**
- **Significance of Demand Response**
- **Demand Response Pilot Drivers**
- **Demand Response Pilot Concepts**
- **Pilot Technologies, Benefit, Customer Acceptance, Education**

Demand Response

Direct Load Control vs. Passive Control



Demand Response (DR) – An action taken to reduce load when:

- Contingencies (emergencies/congestion) occur that threaten supply-demand balance, and/or
- Market conditions occur that raise supply costs

Direct Load Control vs. Passive Load Control

Direct Load Control

- **Utility has physical control to interrupt or reduce customer load**
- Control device at customer premise
- Interruptions may be for economics, voltage control or emergencies
- Rate incentive to customer
- Examples include:
 - Interruptible Air Conditioning
 - Interruptible Water Heating

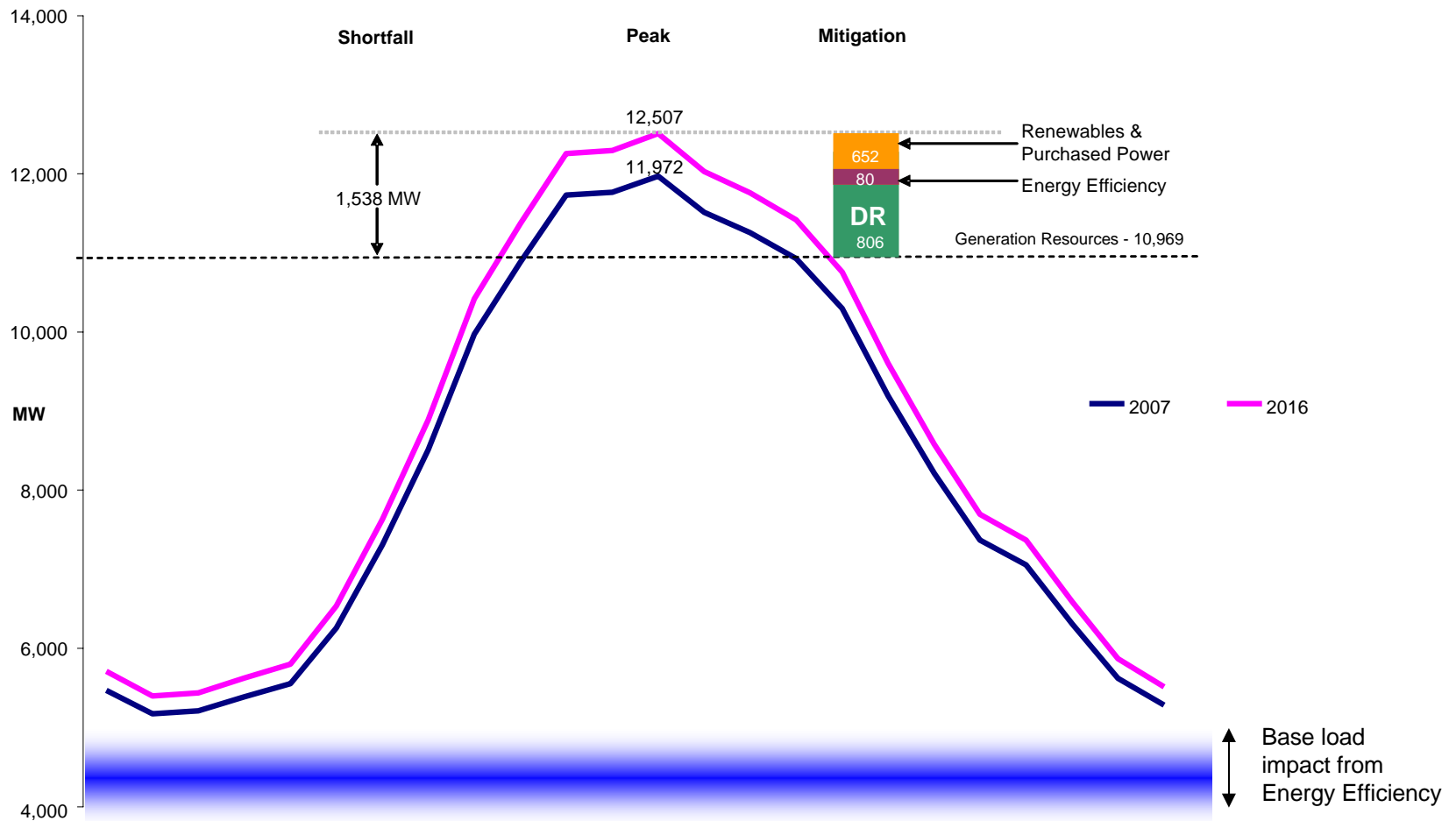
Passive Load Control

- **Customer controls load reduction based on notification from utility**
- Rate incentive to customer
- Rate penalties for failing to shift or curtail load
- Interruptions typically for emergencies
- Examples include:
 - Alt. Metal Melting/Process Heat
 - Industrial Interruptible Supply

Significance of Demand Response (illustrative example)



Peak Day Generation Shortfall Analysis 2007 vs. 2016





















Demand Response Pilot Drivers

- Provide load reduction resources to lower peak period demand
- Promote customer awareness of:
 - peak period prices
 - managing energy use
- Promote customer satisfaction
- Use AMI and new technologies to provide energy management resources to customers
- Remove perceived customer barriers to demand response product acceptance
- Provide pilots for all major rate categories – Residential/Commercial/Industrial
- Develop programs that provide utilities with practical load management alternatives
- Develop programs that will:
 - adequately manage the increasing peak demand in Michigan, and
 - reduce the need to build base load power plants
- Utilize the internet to provide customer specific information related to:
 - usage data
 - price signaling
 - education



Demand Response Pilot Concepts















Pilot available to:  Residential  Commercial  Industrial  EE component

-   a) **Time-of-Use with multi period price periods:** Price periods include seasonal, off-peak, shoulder period and critical period. Customer signaling and/or control via smart thermostat.
-    b) **Time-of-Use with customer education:** Same offering as above with education provided to customers on how to alter usage behavior and lower energy consumption.
-    c) **Critical Peak Period (CPP) – Passive Demand Response:** Customer notified day ahead with critical peak price. Customer has the option to lower demand for a pre-determined incentive or pay the critical peak price. Notification via smart thermostat, email, web, pager, phone.
-     d) **CPP – Direct Load Control:** Based on pre-established price points customers would have temperature setting for air conditioning remotely increased via smart thermostat. (2° increase in Residential IAC typically equals ~1 Kw of load reduction)
-     e) **CPP with Baseline Block:** During critical price periods customer use would only be charged at critical price for energy used over the customers pre-established baseline usage level



Demand Response Pilot Concepts

Pilot available to:  Residential  Commercial  Industrial  EE component

-    f) **Real Time Pricing (RTP):** Customer supply charges based on real time market price. Market price is MISO location hourly marginal price (Detroit Edison load node).
-    g) **RTP Pricing for Critical Peak Hours:** Customers charged at applicable rates, adjusted for incentives, excluding Critical Peak Hours which are based on real time market price.
-  h) **Smart Appliance Energy Management:** Utilize smart appliances that deliver on/off peak notification or critical price signaling to customers who may then chose to set the appliance for operation during off peak periods or following the critical price period rather than during peak/critical price periods.
-     i) **Ice Storage Air Conditioning:** During low cost off-peak hours ice systems capable of using ice for air conditioning are frozen for use as a cooling system during on-peak air conditioning hours.
-    j) **On-Peak Advanced Battery Storage:** Similar concept to Ice Air using batteries in place of ice. Batteries charged during off-peak hours and used to operate appliances during on-peak or critical peak hours.



Demand Response Pilot Concepts

Pilot available to:  Residential  Commercial  Industrial  EE component



- k) **Direct A/C Control with Smart Thermostat:** Next generation interruptible air conditioning program where direct load control is achieved by increasing the thermostat setting remotely rather than utilizing cycled interruptions to the air conditioners compressor. A thermostat setting increase of 2° has essentially the same impact to customer comfort and load reduction as a 15 minute on, 15 minute off cycling program.



- l) **Demand Bidding Program:** an internet based bidding program that allows customers with demands of a set value or greater (i.e. >100 kW) the opportunity to receive bill credits for reducing demand on critical peak days. Customers would receive day ahead notification of a critical peak day.



- m) **Limited Load Control:** Offers customers a demand response program with defined limits on the maximum hours of load reduction, the days of required reduction and/or the hours of the day load reductions may occur.



- n) **Per Event Credit:** Offers customers a pre-establish bill credit for each demand response event. This option could be used with the same concepts established for the Limited Load Control, Direct A/C Control and Critical Peak programs.



Demand Response Pilot Concepts

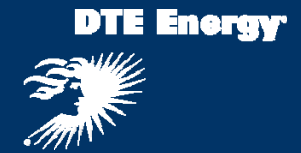
Pilot available to:  Residential  Commercial  Industrial  EE component



o)

Home Networks/Smart House: This energy management system provides customers with detailed use characteristic data, graphical displays, customer controlled analysis, by appliance use data, and the ability to control pre-set operating characteristics of appliances via the internet.

Pilot Technologies, Benefit, Perceived Customer Acceptance, Education



Pilot	Enabling Technologies	Customer Acceptance	Cost	DR Benefit	Education Required
TOU with multiple price periods	AMI, Smart Thermostat, Price Signals	Low-Medium	Medium	Shifts load to off-peak and promotes behavior shift	Low
TOU with multiple price periods and customer education	AMI, Smart Thermostat, Price Signals	Low-Medium	Medium-High	Promotes behavior shift and customer controlled savings	High
CPP Passive demand response	AMI, Smart Thermostat, Price Signals	Low-Medium	Medium	Promotes customer reduction via price signal	High
CPP Direct Load Control	AMI, Smart Thermostat, Price Signals	Medium-High	Medium	Controlled resource, energy & demand savings	High

Pilot Technologies, Benefit, Perceived Customer Acceptance, Education



Pilot	Enabling Technologies	Customer Acceptance	Cost	DR Benefit	Education Required
CPP Direct Load Control with Baseline	AMI, Smart Thermostat, Price Signals	Medium-High	Medium	Controlled resource, energy & demand savings	Medium
Real Time Pricing (RTP)	AMI, Price Signal device, web based data	Low-Medium	Variable	Promotes load shifting to lower price periods	Based on customer class
RTP for Critical Peak Hours	AMI, Price Signal device, web based data	Low-Medium	Variable	Promotes load shifting to lower price periods	Based on customer class
Smart Appliance Energy Management	AMI, Smart Thermostat, Price Signals, Smart Appliances	Low-Medium	Medium-high	Customer controlled – benefit during peak hours to be determined	High

Pilot Technologies, Benefit, Perceived Customer Acceptance, Education



Pilot	Enabling Technologies	Customer Acceptance	Cost	DR Benefit	Education Required
Ice Storage	Ice Storage System & control	Low	High	Customer controlled – benefit during peak hours to be determined	Medium-High
On-Peak Advanced Battery Storage	AMI, Battery technologies, price signals	Low	High	Benefit during peak hours to be determined	Medium-High
Direct A/C Control with smart thermostat	AMI, Smart Thermostat	Medium	Medium	Provides same DR benefit as existing IAC program	Medium
Demand Bidding Program	AMI, Smart Thermostat, Price Signals	Medium	Low - Medium	Consistency of DR benefit to be determined	High

Pilot Technologies, Benefit, Perceived Customer Acceptance, Education



Pilot	Enabling Technologies	Customer Acceptance	Cost	DR Benefit	Education Required
Limited Load Control	AMI, Smart Thermostat, Price Signals	Medium-High	Medium	Same as existing IAC	Low-Medium
Per Event Credit	AMI, Smart Thermostat	Medium-High	Medium	Same as existing IAC	Low-Medium
Home Networks – Smart House	AMI, Smart Thermostat, Home energy management system	Low-Medium	High	Barriers to acceptance and use – benefit to be determined	High