Energy Wise Rewards™

Implementing Direct Load Control: Lessons from the Field

Presented by: Susan Marinelli
November 15, 2019
Demand Side Management

Conservation

Energy Efficiency

Demand Response

Load Shape Impact of Residential Direct Load Control

An Exelon Company
Types of Demand Response for Grid/Customer Needs

- Daily Energy Efficiency
- Time-Of-Use Energy
- Daily Peak Load Managed
- Day-Ahead (slow) DR
- Real-Time DR

Increasing Interactions with Grid (OpenADR & Smart Grid)

- Service Levels Optimized
- Time of Use Optimized
- Service Levels Temporarily Reduced

Increasing Levels of Granularity of Control
Increasing Speed of Telemetry
## Policy Drivers of Demand Response Programs

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Deferral</td>
<td>• Delaying investments in new generation capacity to meet reserve requirements</td>
</tr>
<tr>
<td>Improved Reliability</td>
<td>• Developing curtailment capability to address short-term/emergency supply shortfalls</td>
</tr>
<tr>
<td>Deferral of T&amp;D Upgrades</td>
<td>• Delaying investment in specific, localized substations and feeders using DR as a demand side resource</td>
</tr>
<tr>
<td>Operational Cost Savings (Economic Dispatch)</td>
<td>• Reduction of system operating costs through fewer starts of peaking units, reduced need for spinning reserve from generators, and economic dispatch of DR resources</td>
</tr>
<tr>
<td>Integration of Intermittent Renewable Resources</td>
<td>• A possible alternative to new generation or a more economical way to provide ancillary services</td>
</tr>
<tr>
<td>Regulatory requirements</td>
<td>• Commission rulings to have ESPs fund and operate DR programs or achieve DR curtailment goals</td>
</tr>
</tbody>
</table>
Types of Demand Response Programs

- Dispatchable – call or control or bid in advance
  - Wholesale market directed economic programs
  - Wholesale market directed reliability programs
  - Direct Load Control, e.g., automatic appliance shut-off
  - Interruptible Rates, i.e., lower rates for directed reductions

- Non-Dispatchable / Price-Responsive Demand = pre-set
  - Critical Peak Pricing – scheduled
  - Peak Time Rebate – built into a rate
  - Time-Of-Use Pricing – annual scheduled
  - Dynamic Pricing – all of the above
Manage Load through multiple types of DR

Peak-Day Load Shape
Before and After Load Control

- Use more DR resources
- Use few DR resources

- 250 MW
- 1000 MW
- 500 MW

Megawatts
8,000 9,000 10,000 11,000 12,000

Hour
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Megawatts
Demand Response Evolution

- **DR 1.0**
  - Largely manual control
  - Interruptible tariffs for large C&I
  - 1-way Direct Load Control for Residential
  - Used for Capacity Planning & Emergencies

- **DR 2.0**
  - Introduced To Wholesale Markets
  - Increased automation
  - Increased Precision
  - Eventually Ancillary Services
  - Behavioral/voluntary Options
  - Smarter Equipment
  - 2-way communications
  - Some Near Real-Time Visibility

- **DR 3.0**
  - Provide Multiple Grid Services
  - Respond to Controls and/or Price Signals
  - Distribution & Transmission Relief
  - Introduction of Storage
  - Migration to DER

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[PLMA Logo]

[pepco Logo]
Energy Wise Rewards Program Evolution

- 2008: EmPOWER MD
- 2009: Launched the Energy Wise Rewards direct load control program with company-installed one-way (paging) web-programmable thermostats and outdoor switches
- 2013: Launched critical peak pricing program, Peak Energy Savings Credit
- 2015: Expanded customer choice by offering two-way (Wi-Fi) communicating thermostats
- 2017: Explored a targeted demand response pilot
- 2019: Expanded customer choice to include mass-market smart thermostats and to enroll in DR and Thermostat Optimization
- 2020: Continue to expand smart thermostat options
- 2020+: Evolve with changing communication protocols
Energy Wise Rewards – District of Columbia

- Peak-energy management program
- Choose a device
  - Energy Wise Rewards Wi-Fi or paging programmable thermostat
  - Outdoor switch
- Choose a cycling level – 50%, 75%, 100%
- Participate in Peak Savings Days – weekdays, 12-8 p.m., June through September
- Receive bill credits based on selected cycling level
Energy Wise Rewards – Maryland

- Choose a device or “bring your own device”
  - Opt for an Energy Wise Rewards device
  - Enroll your ecobee, Honeywell, or Emerson smart thermostat in Energy Wise Rewards* and Thermostat Optimization

  *Nest smart thermostat can enroll in Spring 2020

- Receive day-ahead notices via email, phone call, or text to reduce energy use

- Participate in Peak Savings Days – weekdays, 12-8 p.m., June through September
  1. Take steps to reduce energy use
  2. Automatically cycle your central air conditioner through Energy Wise Rewards

- Receive bill credits based on cycling level and amount of energy saved ($1.25 per kilowatt-hour)
Peak Energy Savings Credit – for Individually Metered Pepco Maryland, and Delmarva Power Maryland and Delaware Customers

- Customers earn a bill credit when they reduce electricity use below their 30-day baseline on Peak Savings Days
- No enrollment needed
- Customers receive a phone call, text, or email the day before a Peak Savings Day with specific hours to save energy
- Delaware customers receive a bill credit of $1.25 for every kilowatt hour (kWh) reduced below a 30-day baseline
- Maryland customers receive their guaranteed EWR credit plus the amount of the PESC credit that exceeds the EWR credit
Targeted Capabilities

- Topography mapping all active devices to:
  - Substation
  - Circuit

- Called in time of need
  - Construction, Emergencies, Switching
  - June 2017 DC; June 2018 MD; July 2019 DC

- Future consideration to offset infrastructure investments
  - Pilots?
Thermostat Optimization Program (EE)

- A cloud-based add-on offered at no additional cost to the participant that allows eligible smart thermostat(s) to make intelligent adjustments customized to each customer’s home.

- The algorithm is designed to save small amounts of energy each day, which can add up to big savings.

- The goal – a hands-off approach to saving energy without sacrificing comfort.
Virtual Energy Assessments through Device Data

Thermostat Data → Analytical Engine → System Diagnostics EE Recommendations

Weather (Indoor/Outdoor) → Analytical Engine

Energy Data (Monthly/AMI) → Analytical Engine → Demographics Propensity Analytics

System Diagnostics EE Recommendations + Demographics Propensity Analytics → Microtargeted Marketing Campaigns

SIGHTLINE™ POWERED BY NCI

15
<table>
<thead>
<tr>
<th>Location</th>
<th>Cycling Option</th>
<th>Installation Credit per device</th>
<th>Annual Reward Credit per device</th>
<th>Total Rewards First 12 Months per device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Delaware</td>
<td>50%</td>
<td>$40</td>
<td>Works with Peak Energy Saving Credit:</td>
<td>$40</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>$60</td>
<td>$1.25 per kilowatt-hour of electricity reduced</td>
<td>$60</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>$80</td>
<td></td>
<td>$80</td>
</tr>
<tr>
<td>Residential DC</td>
<td>50%</td>
<td>$30</td>
<td>$30 ($6 monthly)</td>
<td>$60</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>$45</td>
<td>$45 ($9 monthly)</td>
<td>$90</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>$60</td>
<td>$60 ($12 monthly)</td>
<td>$120</td>
</tr>
<tr>
<td>Residential Maryland</td>
<td>50%</td>
<td>$40</td>
<td>$40 ($8 monthly)</td>
<td>$80</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>$60</td>
<td>$60 ($12 monthly)</td>
<td>$120</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>$80</td>
<td>$80 ($16 monthly)</td>
<td>$160</td>
</tr>
<tr>
<td>BYOD Maryland</td>
<td>50%</td>
<td>N/A</td>
<td>$40 (8 monthly)</td>
<td>$40</td>
</tr>
<tr>
<td>Small Commercial Maryland</td>
<td>50%</td>
<td>$80</td>
<td>$80 ($16 monthly)</td>
<td>$160</td>
</tr>
<tr>
<td>Residential NJ</td>
<td>50%</td>
<td>$50</td>
<td>N/A</td>
<td>$50</td>
</tr>
</tbody>
</table>
# Energy Wise Rewards Program Results

<table>
<thead>
<tr>
<th>Pepco</th>
<th>Delmarva Power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>101%</strong></td>
<td><strong>99%</strong></td>
</tr>
<tr>
<td>of goal achieved, with</td>
<td>of goal achieved, with</td>
</tr>
<tr>
<td>223,929 active devices</td>
<td>38,869 active devices</td>
</tr>
<tr>
<td>participating in the</td>
<td>participating in the</td>
</tr>
<tr>
<td>Energy Wise Rewards</td>
<td>Energy Wise Rewards</td>
</tr>
<tr>
<td>Program</td>
<td>Program</td>
</tr>
<tr>
<td><strong>416</strong> active devices</td>
<td><strong>141</strong> active devices</td>
</tr>
<tr>
<td>participating in the</td>
<td>participating in the</td>
</tr>
<tr>
<td>Bring Your Own Device</td>
<td>Bring Your Own Device</td>
</tr>
<tr>
<td>(BYOD) Program</td>
<td>(BYOD) Program</td>
</tr>
<tr>
<td><strong>92%</strong></td>
<td><strong>91%</strong></td>
</tr>
<tr>
<td>or 414 active devices</td>
<td>or 140 active devices</td>
</tr>
<tr>
<td>participating in the</td>
<td>participating in the</td>
</tr>
<tr>
<td>Residential BYOD DLC</td>
<td>Residential BYOD DLC</td>
</tr>
<tr>
<td>Program also participated</td>
<td>Program also participated</td>
</tr>
<tr>
<td>in the TOP Program</td>
<td>in the TOP Program</td>
</tr>
<tr>
<td><strong>6,080</strong> active devices</td>
<td><strong>2,961</strong> active devices</td>
</tr>
<tr>
<td>participating in the</td>
<td>participating in the</td>
</tr>
<tr>
<td>Small Commercial Demand</td>
<td>Small Commercial Demand</td>
</tr>
<tr>
<td>Response Program</td>
<td>Response Program</td>
</tr>
</tbody>
</table>

Data as of 10/31/19
Energy Wise Rewards Program Results

## 2019 Peak Event Days

Here's how our customers helped make a difference...

<table>
<thead>
<tr>
<th>JULY</th>
<th>SEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>13</td>
</tr>
</tbody>
</table>

### $4,240,267

Total dollars earned by Maryland customers

### 3.5M

Total kWh saved

**12 MONTHS**

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Data calculated from 1/1/19 - 9/30/19

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**The Alliance to Save Energy** presented Pepco Holdings with the

**Stars of Dynamic Efficiency Award 2019**

Pepco and Delmarva Power received the award for demand-side management programs that leverage smart thermostats to help customers save energy during periods of peak energy usage.
EV Charging as a Demand Response Tool

Baltimore Avenue Connected Communities: Smart Roundtable

Presented by: Jason Tucker, P.E.
November 15, 2019
Plug-In Vehicle Adoption is Expected to Significantly Increase Across PHI’s Service Territory

- Maryland and New Jersey are both Zero-Emission Vehicle (ZEV) States in PHI’s service territory
  - 330,000 ZEV by 2025 (NJ)
  - 300,000 ZEV by 2025 (MD)
- Considerations of EV Charging Grid Impacts
  - Vehicle charging will increase residential electricity consumption (kW-h) by at least \( \frac{1}{3} \) for each vehicle\(^1\)

Co-location/clustering of EV chargers could have a significant grid impact if not managed effectively

\(^1\) ChargeEVC, Electric Vehicles in New Jersey Costs and Benefits, January 26, 2018
PHI is Implementing a Comprehensive Plug-In Vehicle Infrastructure Program in Maryland (EVSmart)

- Pepco and Delmarva Power are Implementing a Comprehensive Plug-in Vehicle (PIV) Infrastructure in Program
- Residential
  - 1,000 Rebates for L2 EVSE’s
  - 137 Discounted Installations for L2 EVSE’s *(Managed Charging Program)*
- Non-Residential
  - 250 Discounted Installations for L2 EVSE’s
- Public
  - 350 Utility Owned and Operated L2 and DCFC

**EVsmart**
Skip the gas pump and live life, fully charged.
Pepco’s Previous EV Charging Demand Response Program in Maryland

- Pepco Piloted a Residential Charging Demand Response Program in 2014/2015
- Most customers charged at night when rates were lower
- Seven (7) DR Events over the course of the pilot
  - 7 events; 3 chargers in-use
  - 1 customer opted out of event

Pepco’s Pilot provided evidence that passive incentives (i.e. TOU rates) and active managed charging events can have an impact on customer behavior

### PHI Pilot Demand Response Events

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Number of meter that received the DR event signal</th>
<th>Number of people charging during the event</th>
<th>Number Opted Out</th>
<th>Number of customers with reduced load</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/27/2014</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td>9/2/2014</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/21/2015</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8/3/2015</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8/17/2015</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/9/2015</td>
<td>2:00 p.m.-6:00 p.m.</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/25/2015</td>
<td>2:00 p.m.-3:00 p.m.</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PHI Pilot Average Weekly Load – PIV Charging

![Figure 4-11: LEAF Average weekly load shape (kW)](image-url)
The EVSmart Program will Provide Additional Insight Into Customer EV Charging Behaviors

- Pepco’s EVSmart Program is addressing PIV charging load in two ways
  - Passive
    - Development of rate structures to encourage off peak PIV charging
    - EV Only TOU Rate
  - Active
    - 137 Residential customers enrolled in “managed charging” program as condition of discounted installation incentive

- Utilizing “smart” charger to initiative events to reduce system demand
  - Reduce output of charger by 50%
Managed Charging in Practice – Multiple Customers on Same Transformer Adopt EV’s

If left unmanaged, EV charging in clusters could negatively impact Pepco’s distribution equipment during peak load hours.
Managed Charging Programs Can Help Reduce the Peak Load and Shift Load to Off-Peak Times

Managed Charging Programs allow Pepco to spread the EV charging load over a longer period and reduce system peaks.
Thank you, and keep in touch!

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