DTE Energy
Plug-In Electric Vehicles and Infrastructure

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DTE Energy
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• DTE Energy Background
• History of Electric Transportation in Detroit
• PEV Environmental Impact
• PEV Grid Impact
• DTE Energy Electric Vehicle Program
  • EV Rates
  • Customer Communication
DTE Energy – Electric & Gas Regulated Businesses

- Tenth largest US electric utility
- 7,600 square mile service
- 2.2 million customers
- $4.9 billion in revenue
- Gen Capacity: 11,080 MW
- Annual Sales: 50,000 GWH

Detroit Edison

- Eleventh largest US natural gas utility
- 14,700 square mile service territory throughout Michigan
- 1.3 million customers
- 679 bcf of gas sales
- $1.8 billion in revenue

Michcon
System Peak Load: 12,762 MW
Annual Sales: 50,000 GWH
Distribution Substations: 662
Distribution Circuits: 2,808
  - 1,876 @ 4.8kV
  - 932 @ 13.2kV
Distribution Circuit Miles: 38,939
  - 20,184 @ 4.8kV
  - 18,755 @ 13.2kV
Subtransmission 802 @ 24 kV
  - 2,743 @ 41.6kV
In 1914, Detroit was the first American city to use electric taxi cabs.

Detroit’s first electric taxi accumulated more than 46,000 miles in its first two years of operation.

Note the curb-side charging port and main charging stations.
Detroit Edison & Electric Vehicles

Electric AMC Pacer wagon

Subaru electric van

Ford Ecostar

Ford Escape Plug-in

1960’s

1970’s

1980’s

1990’s

2010

30 families participated in a study on the use electric VW Rabbits

“Park & charge” credit card system, tracked energy usage and parking time for billing

Chevy S-10 Pickup

Chevy Volt

DTE Energy
Why is it different today?

- The battery ...
- Standard plug (J772) ...
- The environment ...
- Domestic fuel source ...
- Lower operating cost ...
- Extended range PEV. Range anxiety ...
- Energy independence ...
- Every automaker is doing it ...
Your Local Electric Utility

- The fuel company for the electric vehicle

For Michigan there is an overall GHG reduction driving PEV’s (UofM study)
State of Michigan assessment 2010 to 2030

In all scenarios, PEVs decreased statewide GHG emissions by 0.4% to 10.9% & displaced 0.6 to 9 billion gallons of gasoline

A 46% reduction in annual GHG emission substituting nuclear generators for some of Michigan’s predominately coal base load power plants

Criteria air pollutant emissions were reduced in most scenarios
Environmental Assessment of PEVs
Well-to-wheel analysis

- Total GHG - electric and transportation sector

- Criteria pollutants change from zero PEV case

- PEV adoption rate scenarios through 2030
  - Low = 3.2%; Medium = 13.3%; High = 42.6%; Max = 73.3%
Electrical system demand in Michigan, one week in January, 2030
Uncontrolled or On-Peak Charging
- The customer plugs in their vehicle upon arrival at home from work
- 80% of customers arrive between 3 and 8pm
- Level 1 and Level 2 charging studied at 5 to 30% adoption

Controlled or Off-Peak Charging
- Charging start time is controlled by the vehicle, EVSE or the utility
- Level 2 charging studied from 7pm – 1am
PEV Load Impact on DTE Energy’s System

Summer Load: On-Peak versus Off-Peak

10% PEV Adoption

On-Peak Charging

Off-Peak Charging

Based on SE Michigan arrival time at home from work.
Charging Impact on Distribution System
Heavily Loaded Circuit – Worst Case Scenario

PEV Impacts on the Distribution System
On-Peak vs. Off-Peak Charging

- Red bars – Percent overloaded transformers with uncontrolled charging
- Green bars – Percent overloaded transformer with controlled charging starting at midnight

*There are a total of 125 distribution transformers on the distribution circuit*
Circuits in early adopter areas
- 93 circuits studied
- 4.8 kV circuit have greater number of overloaded transformers than 13.2 kV circuits
- 4.8 kV circuits are dominated by 25 kVA transformers

Evaluation of first wave of Volt customer
- No over loaded circuits
- Potentially two overloaded
Home Charging - Sample
## DTE Energy Electric Vehicle Program for Residential Customers

### EV Rate (D1.9)\(^1\)

<table>
<thead>
<tr>
<th>Option</th>
<th>On-Peak</th>
<th>Off-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>14 cents kWh</td>
<td>3.5 cents kWh</td>
</tr>
<tr>
<td>Option 2</td>
<td>Monthly Flat Bill: $40</td>
<td>Limited first 250 customers</td>
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</tbody>
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Requires a 240 V separate meter circuit

### EVSE Incentive\(^2\)

Customers that enroll in our EV Rate qualify for up to $2,500* which covers EVSE, installation and separate meter wiring.

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\(^1\) RD1.9 requires 240v, separate meter.

Rate Schedule: On-Peak: 9 a.m. – 11 p.m. (Mon – Fri) Off-Peak: 11 p.m. – 9 a.m. (All day weekends and Mon - Friday)

\(^2\) Available for the first 2,500 customers that qualify, or until December 31, 2012.
Electric Vehicle Rate
Time of Use Rate

- 40% off the regular residential rate. On-peak 9 am to 11 pm. M-F. Everything else off peak.
- Flat $40/month rate
- Eligible for up to $2,500 towards charging station and installation

You can save up to $1,400 a year if you charge using our TOU Off peak rate

Electricity versus Fuel

<table>
<thead>
<tr>
<th>Annual Cost</th>
<th>Electricity</th>
<th>Fuel</th>
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</thead>
<tbody>
<tr>
<td>$0</td>
<td>$390</td>
<td>$1,840</td>
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<tr>
<td>$500</td>
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</tr>
<tr>
<td>$2,000</td>
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</tbody>
</table>

$2,335 -- $4/Gallon

Programming your vehicle for delay charge is very easy

Select Battery Charge Mode

- Immediately upon plug in
- Delayed based on departure time
- Delayed based on electric rates & departure time

You can save up to $1,945 saving -- $4/Gallon

1 Calculation based on the Chevy Volt; Assumptions: $3.15/Gallon, and 25mpg
For other calculations assumptions, please visit our PEV Calculator at www.dteenergy.com/pev
As predicted, PEVs are starting to Cluster...
Over 90% of DTE Energy Volt owners are participating in our program and selecting to share their information with us for distribution system planning.
Initial EV Rate Adoption, and Preliminary charging behaviors

### Electric Vehicle Rate Adoption

- **PEV RATE OPTION #1**
  - Time of Use (TOU)
  - 53%

- **PEV RATE OPTION #2**
  - Flat Monthly Bill $40
  - 47%

### Off – Peak Charging

(Avg % Usage during Off Peak per Customer)

- **Flat**
  - 55%

- **TOU**
  - 83%
Volt Demonstration Project Objectives:

• Evaluate and demonstrate various EVSE technology at numerous charging locations
• Utilize advanced metering infrastructure (AMI) to:
  • Monitor charging data at Volt charging locations
  • Demonstrate charging control techniques (i.e. demand response)
• Explore the development of residential and commercial charging and EVSE tariffs

Charger Installation Plans:

<table>
<thead>
<tr>
<th>Number Charging Stations</th>
<th>Residential</th>
<th>Work Place</th>
<th>Public</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>2</td>
<td>14</td>
</tr>
</tbody>
</table>

Volt Total: 10

Special Project(s):

• Participant in the OnStar Smart Charging demonstration
Set Weekday Rates

Establish the Start Date for the Rate Change for the Vehicles

Set the Peek and Off-Peek Rates Weekdays or Weekends.
Apply TOU Rates and Times to Single or Multiple Vehicles
Rate Results

Vehicles Updated Status Off-Peek Rate and Times for Weekend and Weekday
Conclusion

- DTE Energy has a long history working with the automotive industry
- PEVs are environmentally friendly
- The grid is ready ... but early planning is important
- Metering challenges