DTE Energy: 
Distributed Energy Resources 
Experience and Roadmap

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DTE Energy is an Integrated Energy Company

**Strong, Stable and Growing Utilities**

~80% of DTE Energy’s 2011 Earnings

**Detroit Edison**
- Electric generation and distribution
- 2.1 million customers
- Fully regulated by Michigan Public Service Commission (MPSC)

**MichCon**
- Natural gas distribution
- 1.2 million customers
- Fully regulated by MPSC

**Complementary Non-Utility Businesses**

~20% of DTE Energy’s 2011 Earnings

**Gas Storage & Pipelines**
Transport and store natural gas

**Power & Industrial Projects**
Own and operate energy related assets

**Energy Trading**
Generate economic value and provide strategic benefits

**Unconventional Gas Production**
Production of shale natural gas and oil in Texas
DTE Energy Holdings Map

Assets: $26 billion
Revenue: $8.8 billion
Net Income: $720 million
Employees: 9,895
DTE Energy – Electric & Gas Regulated Businesses

**Detroit Edison**
- Tenth largest US electric utility
- 7,600 square mile service
- 2.1 million customers
- $4.9 billion in revenue
- Gen Capacity: 11,084 MW
- Annual Sales: 50,000 GWH

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

(Diagram showing overlap territory, electric only territory, and gas only territory)
The Evolution of the Electric Utility System

One way power flow, limited renewable resources and simple interaction with load

Two way power flow, multiple distributed resources and stakeholders
Disruptive Technologies bring to market a fundamentally different value proposition than previously available (based on a different set of product attributes), leading to the emergence of new products, the re-definition of an industry’s value network, and a shake-up in its competitive structure.

Source: Arthur D. Little
Distributed Generation strengthens and supplements the electric grid

• Deferred T&D expenditures
  – Allows for a delay in T&D projects until demand warrants

• Interim T&D solutions
  – Provides a temporary solution when projects are delayed due to NIMBY

• Emergency Capacity
  – Provides a “JIT” solution for localized outage or overload situations

• Maintenance
  – Allows power continuity when conducting routine maintenance
Asset Utilization Opportunity

Pioneer DC 9796
Percent Load vs. Percentage of the Year

- Load Factor Percentage (%)
- Percentage of the Year (%)
Local capacity need (Peak Shaving Application)

Problem:
Transformer Or Circuit Overloaded

Solution:
Line Support Using Distributed Energy Resource(s)

- Generator Data
- Control Data: • Start/Stop • Output Level
- Circuit Load Current
- Transformer
- Site Controller
- Distributed Energy Resource

Substation
1 MW DG
DG Communication Architecture

- Detroit Edison System Operations Center (DMS)
  - PI Server
- DR-SOC Distributed Resources-SOC
- Distribution Substation
- Distribution Circuit
  - DER Site Controller
  - DG
- ICCP
- Internet (SSL)
- SCADA
Automatic Load Following

Grosse Ile 7-13-2005 Multi-Point Trend report

- Circuit Emergency Rating
- Circuit Normal Rating
- Distribution Circuit Load
- Generator Output
DER – DG Solutions Projects
DOE DER Integration - Phase 3

Project in three parts

1. System study to determine the benefits of customer DER penetration limits on distribution
2. Intentional islanding at the system level and circuit level
3. Fuel cell inverter development and testing to IEEE 1547.1
Virtual Power Plant – Dispatchable Customer Generation (DCG) Program

• Create a 300 MW Virtual Power Plant over the next 10 years using customer generation
• Approximately 200 customers
• 20 MW in 2009
• 30 MW/year beginning in 2010
• Low cost peaking plant
• Provide maintenance, fuel cost, paralleling switchgear and monitoring
• Being reviewed again in 2012
Communication Architecture
Aggregating for Day Ahead – DOE OE funded

Day Ahead
Request for Day Ahead Forecast
Economic Algorithm
Next day hour by hour offer
Receipt of acceptance
Hour by hour control
Settlement

Day Ahead
Next day hour by hour forecast
Power Flow for overload & low voltage
DG constraints & requirements
Load and DG level by hour
Participation in Market Display

Utility – Aggregator Business Model

Merchant Operation Center (Detroit Edison)
Internal Dedicated Link

Detroit Edison System Operations Center
DEW PI Server

MISO
Internet

Energy Aggregator (DR-SOC)
Internet
ICCP, Web Services

Distribution Circuits

DER Site
DER Site Controller
DG
DG
DG

Communication by the utility to the generators may or may not be in place. The energy aggregator has full communication to all generators through the internet.
Intentional Islanding

Rural substation with automatic islanding for reliability
An inverter system was designed, tested and operated in parallel to the grid for over one year.
Electric Utility Energy Storage Applications

Large Central Storage
100’s of MW
Or
In conjunction with Wind Farm Firming

Substation or Circuit Level Storage
1 - 2 MW

Storage Close to Customer
25-50 kW
Ludington pumped storage facility stores renewable energy

- Began operation in 1973
- 27 billion gallon water reservoir
- Currently produces enough energy to power 1.4 million homes
- $800 million upgrade underway
- Will increase generating capacity from 1,872 MW to 2,172 MW
- Stores renewable energy produced at off-peak hours
PV and Battery Storage Integration

Location
- Monroe County Community College
- 23 miles Southwest of Detroit

System
- 500kW PV
- 500kW – 30min (250kWh) Storage
- Dynamic 4-Quadrant PCS / Grid Interface
- Installation / Operation Sept 2012
- 20 Community Energy Storage Systems – Distributed
- Two will be used EV batteries
Community Energy Storage (CES)

- Proof of concept of an aggregated CES; demonstrating the following capabilities:
  - Voltage/VAR Support
  - Circuit load leveling
  - Islanding during outages – Backup power
  - Frequency Regulation - AGC
- Demonstrate secondary-use EV batteries
- Identify gaps, areas of improvement, and provide suggestions on how CES devices and control algorithms can be standardized
- Provide a functional and economic analysis for using the CES system in electric utility applications.

<table>
<thead>
<tr>
<th>Key Parameters</th>
<th>Value</th>
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<tbody>
<tr>
<td>Power</td>
<td>25 kW</td>
</tr>
<tr>
<td>Energy</td>
<td>50 kWh</td>
</tr>
<tr>
<td>Voltage</td>
<td>240 / 120V AC</td>
</tr>
<tr>
<td>Battery - PHEV</td>
<td>Li-Ion</td>
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<tr>
<td>Round trip efficiency</td>
<td>&gt; 85%</td>
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Solar Energy & Hydrogen Technology
Plug-in Electric Vehicles

- DTE Energy has a long history working with the automotive industry
- PEVs are environmentally friendly
- The grid is ready today … but early planning is important for the future
- Vehicle to grid support
- Intelligent charging is the key
Summary

- Need support of senior level people
- Need internal champion
- Use new technology projects to engage employees
- For DER to be sustainable it needs to be a cost effective solution to a problem
- The solution can be on either side of the meter
- The use of Distributed Energy Resources will evolve
Thank you!