DTE Energy: Application of Distributed Resources

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DTE Energy Background
Distributed Generation Applications at DTE Energy
Energy Storage Applications
PV and Energy Storage
Community Energy Storage Project
Secondary use of EV batteries
DTE Energy –
Electric & Gas Regulated Businesses

**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
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.
Detroit Edison’s Renewable Energy Plan includes two pilot solar programs

**Residential & Small Commercial**
- Approximately 5MW or 1,500 customers through REC contracts
- Customer funds and owns solar photovoltaic system < 20 kW
- Provides financial incentives to make solar more affordable

**Commercial & Industrial**
- Approximately 15MW of Detroit Edison owned solar assets
- Lease large rooftops, ground-mounted and/or on DTE facilities
Distributed Generation at DTE Energy

Technology Testing

Substation Applications
Temporary & Maintenance

Distribution Solutions
Circuit Applications
Emergency & Temporary

Premium Power
Customer Partnership
Virtual Power Plant Applications

- Southfield Solar & Future H Power Park
- ZBB Flow Battery
- Substation Battery Replacement Project
- Adair ENI1000 1MW NG
- Union Lk ENR2000 2MW Diesel
- Substation Islanding ENR2000 2MW Diesel
- Emergency ENR2000 2MW Diesel
- Grosse Ile High School ENI1000 1MW NG
- Assumption Church ENI1000 1MW NG
- Wayne State Univ ENI 75
- Dialysis Center ENI 150
- Service Center ENI 150 & 75
Grosse Ile – Natural Gas ENI 1000
Problem:
Transformer Or Circuit Overloading

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
Automatic Load Following

Circuit Emergency Rating

Circuit Normal Rating

Distribution Circuit Load

Generator Output

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

Report date:
Report span:
Total days:
DG’s keeping the lights on during heat wave

July 22 – 23, 2011
1.5 MW DG

July 23, 2011
2.0 MW DG
Electric Utility Energy Storage Applications

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

In conjunction with Wind Farm Firming

Substation or Circuit Level Storage
1 - 2 MW

Storage Close to Customer
25 kW/ 50 kWh
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
Energy Storage Modes of Operation – Value Streams

- PV Output Leveling
- PV Output Shifting
- Frequency Regulation
- Circuit Peak Shaving
- Reactive Support
- Voltage support
- Islanding during outages
PV and energy storage integration
Ford Motor Co and Xtreme Power

• 500 kW PV
• 750 kW/2 MWh storage
• Within auto assembly plant
• Load shifting based on system load curve
• PV Output Leveling
• PV Output Shifting
• Frequency Regulation
• Reactive Support
• Voltage support
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 2011
- 20 Community Energy Storage Systems – Distributed
- Two will be used EV batteries
Community Energy Storage (CES)

• CES is a small distributed energy storage unit connected to the secondary of transformer serving a few houses or small commercial load
• Offers value similar to substation batteries when aggregated
• Buffers customer renewable generation
• Local voltage and var management
• Offers backup power to customers
• Can optimize battery life by deploying different control algorithms
• Makes PEV charging a less critical issue
• Can use new or used PEV batteries
CES Communication Architecture

- CES
- CES
- CES
- CES

MISO

DTE Energy Merchant Operation Center

Internet (VPN)

ICCP, Web Services

Distributed Resources-SOC Circuit Model (DEW)

Internet (SSL)

Internet (SSL)

Internet (SSL)

A123 Systems Energy Storage & PV

Detroit Edison System Operations Center (EMS)

ICCP

Internet (SSL)

Distribution Substation

Internet (SSL)

Internet (SSL)

Internet (SSL)

ICCP, Web Services

Detroit Edison System Operations Center (EMS)

Internet (SSL)

Internet (SSL)

Internet (SSL)

Internet (SSL)

DTE Energy Merchant Operation Center

Internet (SSL)

Internet (SSL)

Internet (SSL)

Internet (SSL)
Modular architecture for rapid battery prototyping and deployment
Utility – Aggregator Business Model

- MISO
- DTE Energy Merchant Operation Center
- Detroit Edison System Operations Center (EMS)
- DR-SOC Aggregator Role
- Distribution Circuit
  - PV System & Energy Storage
  - PEV
  - PEV
  - PEV

Networking:
- ICCP, Web Services
- Internet (VPN)
- Internet (SSL)
- SCADA
- Distribution Substation & Circuit Data
Secondary use of EV batteries

• Used EV batteries applications
  – Utility applications
  – Residential applications
  – Commercial applications
  – Large MW size warehouse

• What is the value of used EV battery systems vs new
Conclusion

- DTE Energy has a long history of deploying distributed generation
- Energy storage has multiple value streams
- Plug-in vehicle Li-ion batteries show promise for grid applications