DTE Energy

DTE Energy: Energy Storage Demonstration Projects

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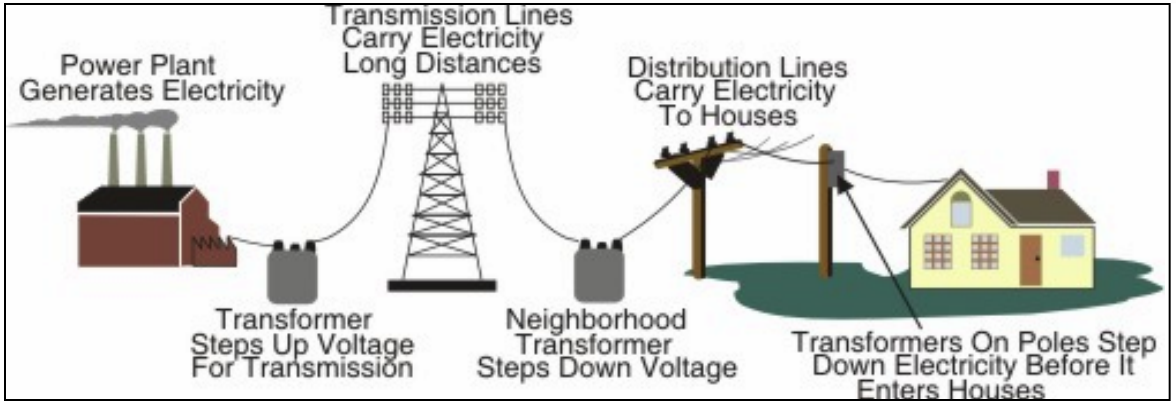
Agenda

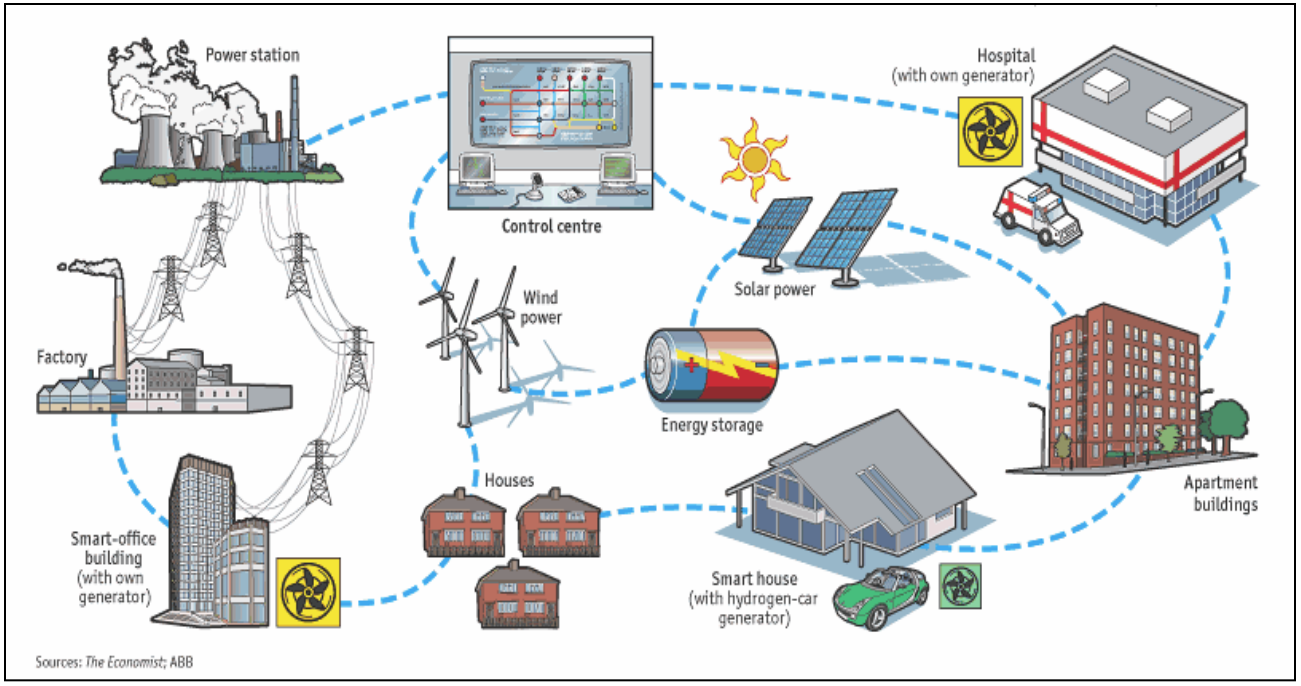
- Distributed Generation Applications at DTE Energy
- Energy Storage Applications
- PV and Energy Storage
- Community Energy Storage Project
  - 25 kW – 50 kWh
  - Secondary use of EV batteries

The Evolution of the Electric Utility System

DTE Energy



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



Two way power flow, multiple distributed resources and stakeholders

DG's keeping the lights on during 2011 heat wave

July 22 – 23, 2011
1.5 MW DG

July 23, 2011
2.0 MW DG

Detroit Edison's Renewable Energy Plan includes two pilot solar programs

DTE Energy

SolarCurrents™

Residential & Small Commercial

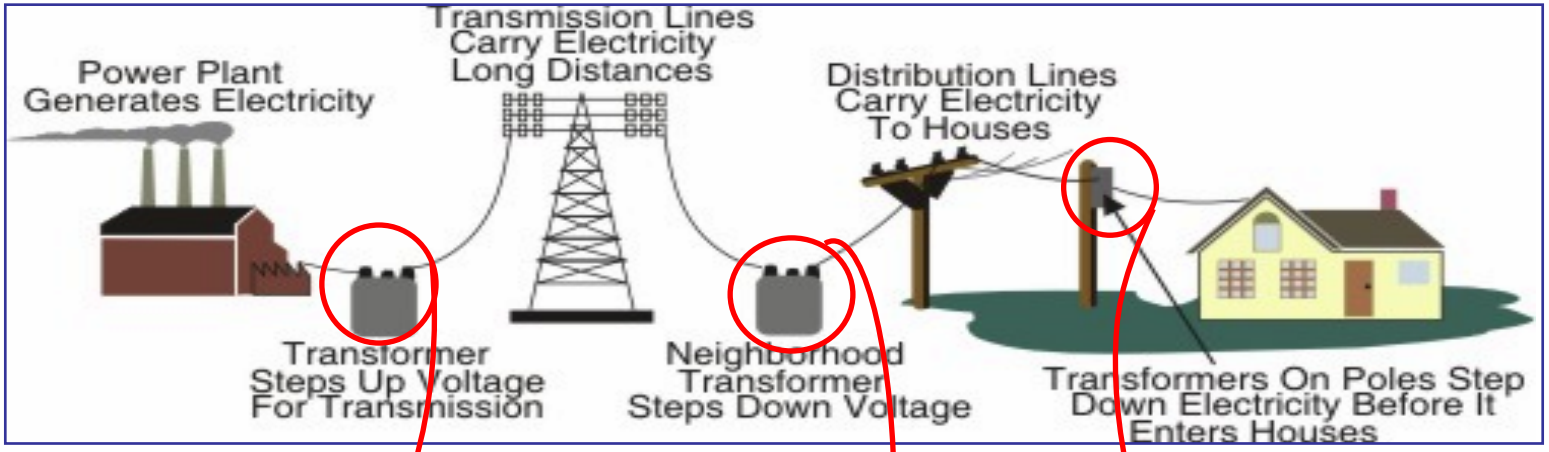
- Approximately 5MW or 1,500 customers through REC contracts
- Customer funds and owns solar photovoltaic system < 20 kW
- Provides financial incentives to make solar more affordable

Commercial & Industrial

- Approximately 15MW of Detroit Edison owned solar assets
- Lease large rooftops , ground-mounted and/or on DTE facilities

Electric Utility Energy Storage Applications

DTE Energy



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

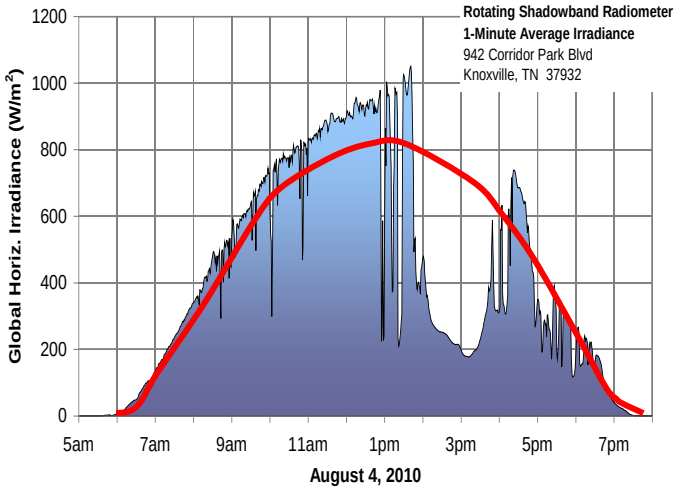
Ludington pumped storage facility stores renewable energy

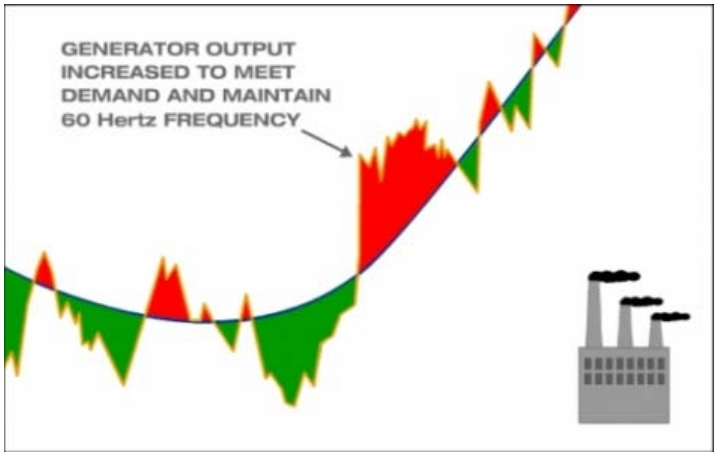
DTE Energy

- 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

DTE Energy

- 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

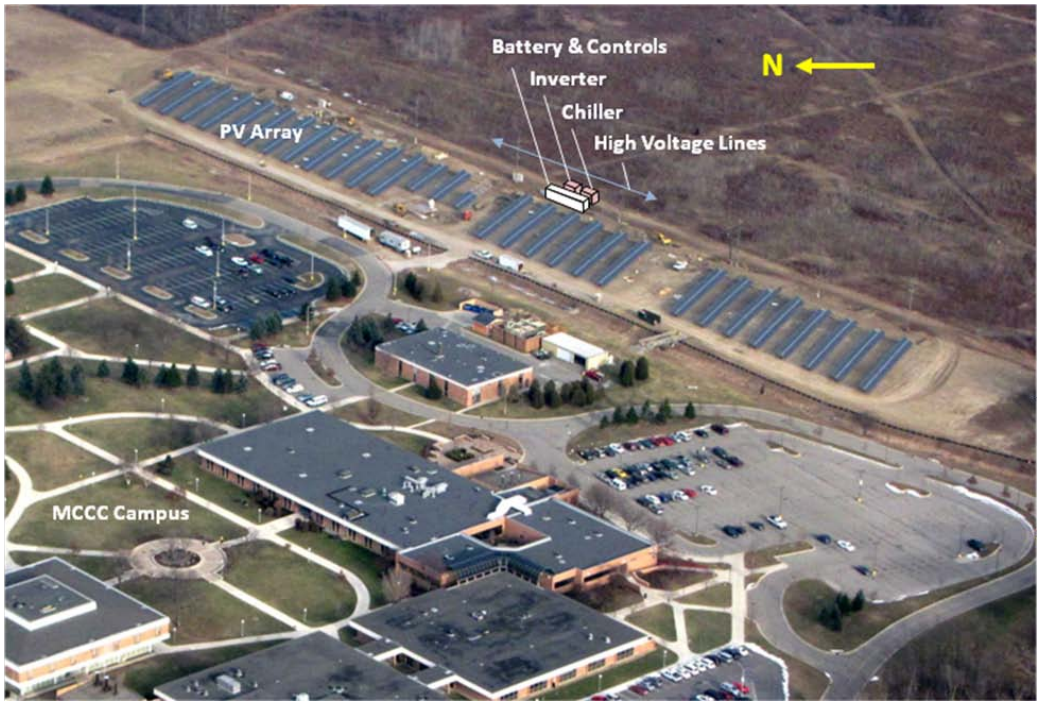
DTE Energy

Location

- Monroe County Community College
- 23 miles Southwest of Detroit

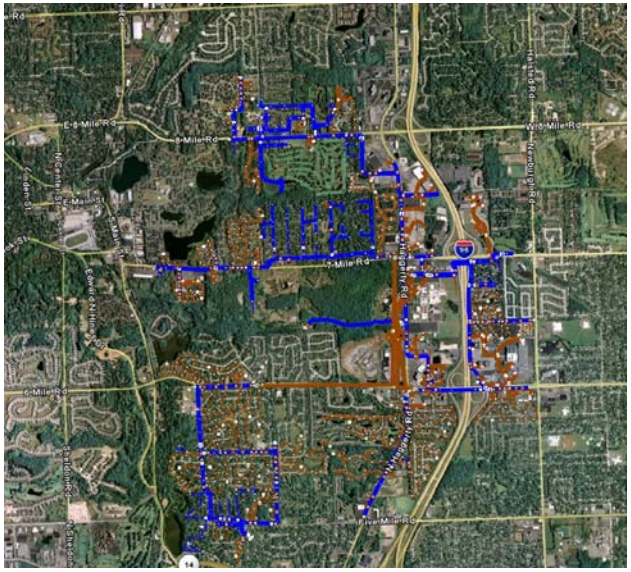
System

- 500kW PV
- 500kW – 30min (250kWh) Storage
- Dynamic 4-Quadrant PCS / Grid Interface
- Installation / Operation Aug 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
- Can use new or used PEV batteries



DTE Community Energy Storage

Key Parameters	Value
Power (active and reactive)	25 kVA/25 kW
Energy	50 kWh
Voltage	120/240 V AC
Battery – A123 Prismatic	Li-Ion Prismatic
Round trip efficiency	> 85%

Local Benefits:

Backup Power

Voltage correction

Renewable Integration

Circuit Benefits:

Load Leveling at substation

Power Factor Correction

Ancillary services

Specifications for CES are “OPEN SOURCE” .
EPRI hosted open webcasts to solicit industry wide input.
www.aeptechcenter.com/ces

CES External Features
25 kW – 50 kWh

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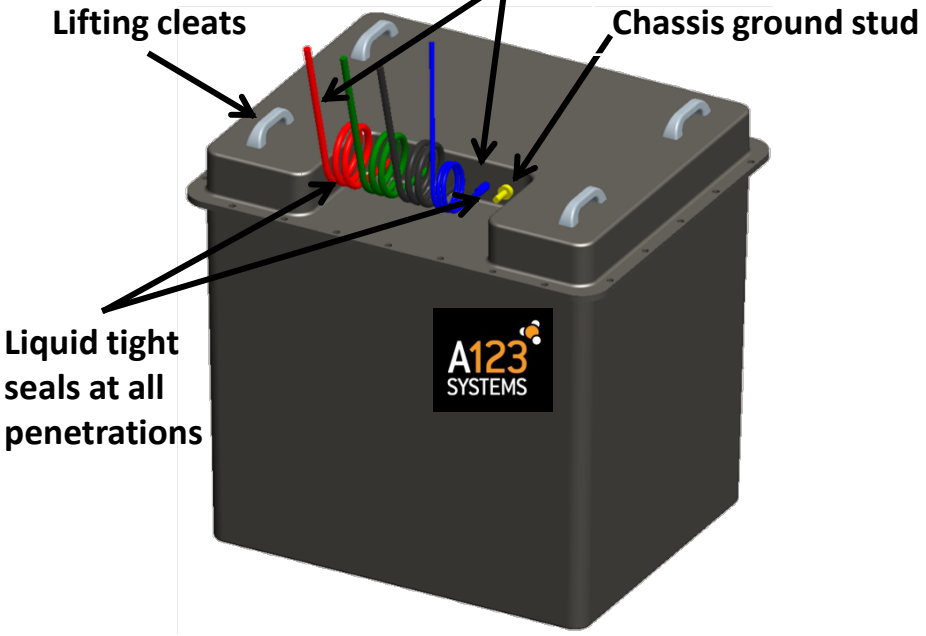
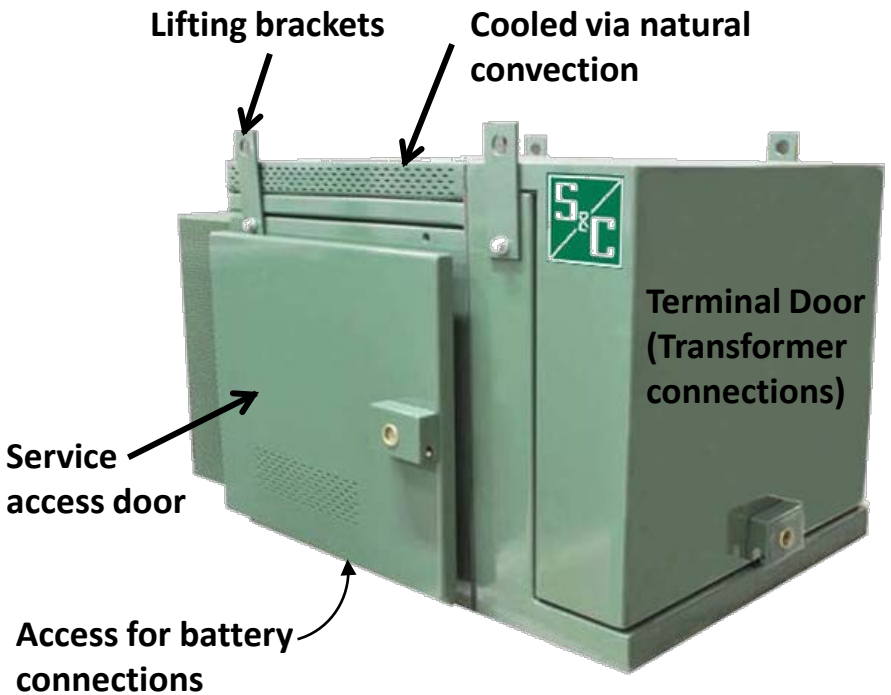
Battery System



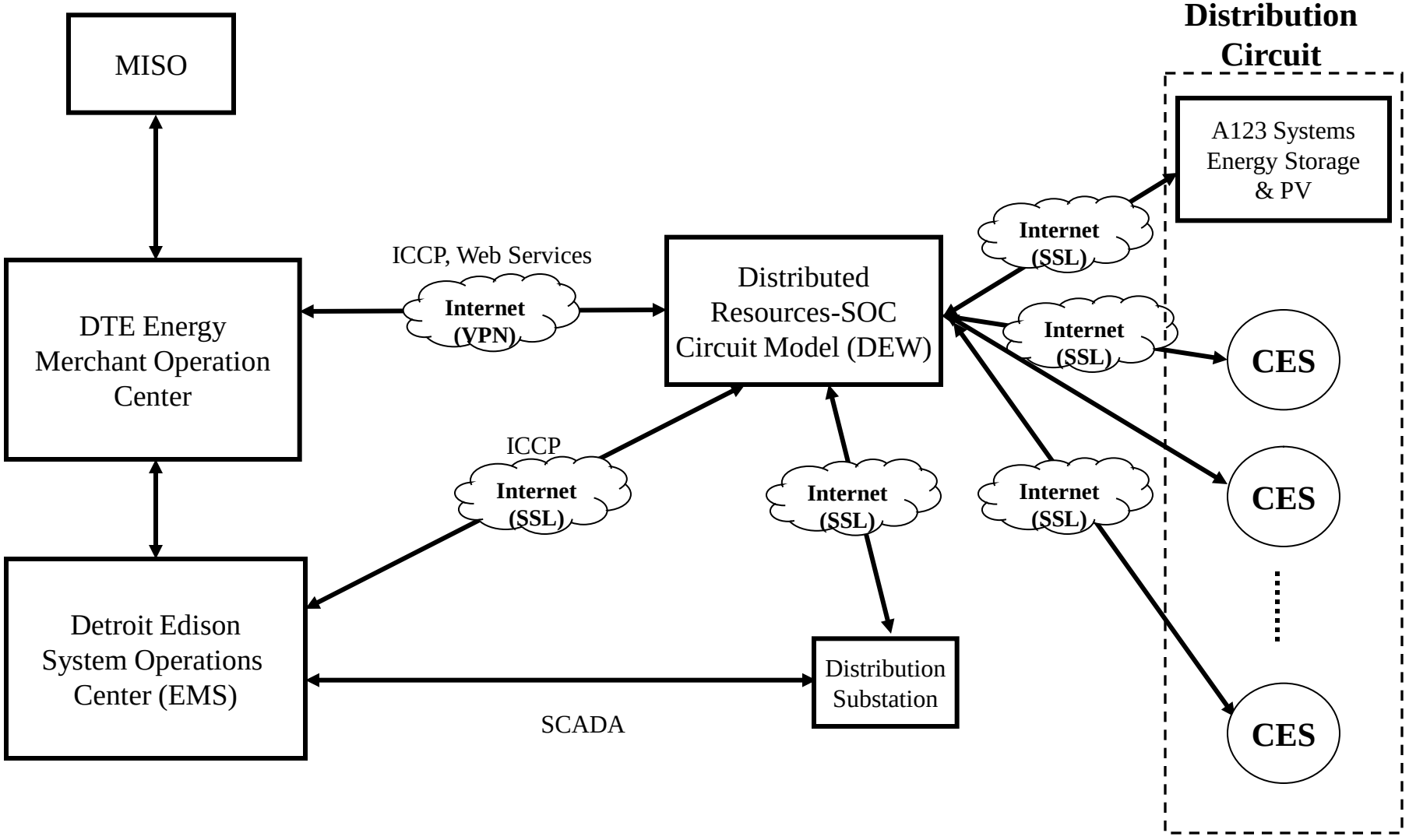
Sealed resin transfer molded cover and base container

Inverter System



Utility Grade NEMA 4 Enclosure
Approx Dims: 33 in x 39 in x 30 in tall

CES Communication Architecture



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