

DTE Energy[®]

Managing EV Load Workplace Charging Project Utility Perspective

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DTE Energy is an Integrated Energy Company



Strong, Stable and Growing Utilities

Fully Regulated by Michigan Public Service Commission

~80% of total earnings

Complementary Non-Utility Businesses

~20% of total earnings



DTE Electric

- Electric generation and distribution
- 2.2 million customers



Gas Storage & Pipelines

- Transport and store natural gas
- 4 pipelines, 2 storage sites

Power & Industrial Projects

- Own and operate energy related assets
- 66 sites, 17 states

Energy Trading

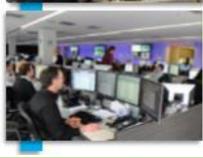
Generates economic value and provide strategic benefits



DTE Gas

- Natural gas transmission, storage and distribution
- 1.2 million customers





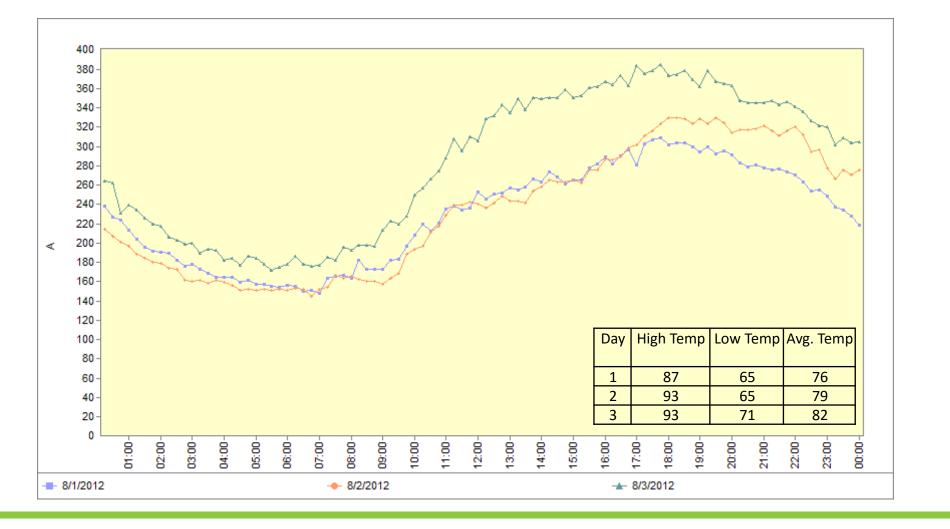
Agenda



- Why manage EV load?
- Local level
- System level
- Renewable variability
- Workplace charging
- Interoperability & standards



Residential Distribution Circuit Load Graph **DTE Energy** Summer 2012 high temperature days



Residential Experimental PEV Rate



- PEV rate approved in August 2010 2,500 limit
- Choice of two Experimental Electric Vehicle Rate options:
 - Option 1- Time of Use Rate
 - Option 2 A Flat Rate (250 customer cap)
- Both options required a separately meter service
- An incentive up to \$2,500 was offered to offset the purchase and installation costs for a Level 2 EVSE



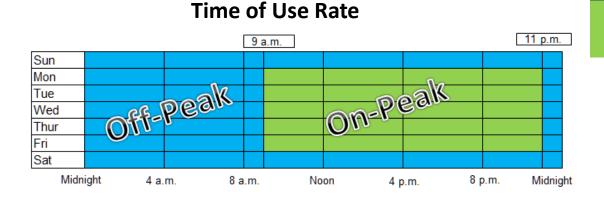
On-Peak: \$0.18195 kWh* Off-Peak: \$0.07695 kWh*

<u>On-Peak</u>: All kWh used between 9am and 11pm Monday- Friday <u>Off-Peak</u>: All other kWh used.

*Prices do not include applicable surcharges and taxes

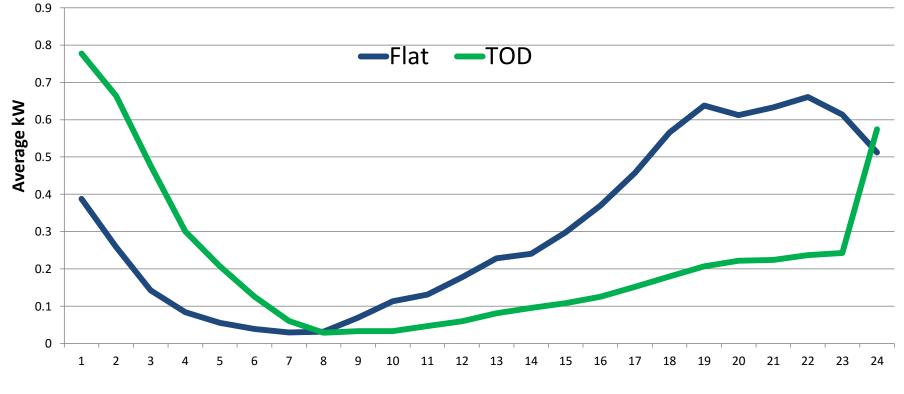
Option 2: Flat Rate Option

\$40 per month + applicable surcharges and taxes.



Residential Charging - Pilot PEV Rate Average Demand - TOU vs Flat Rate

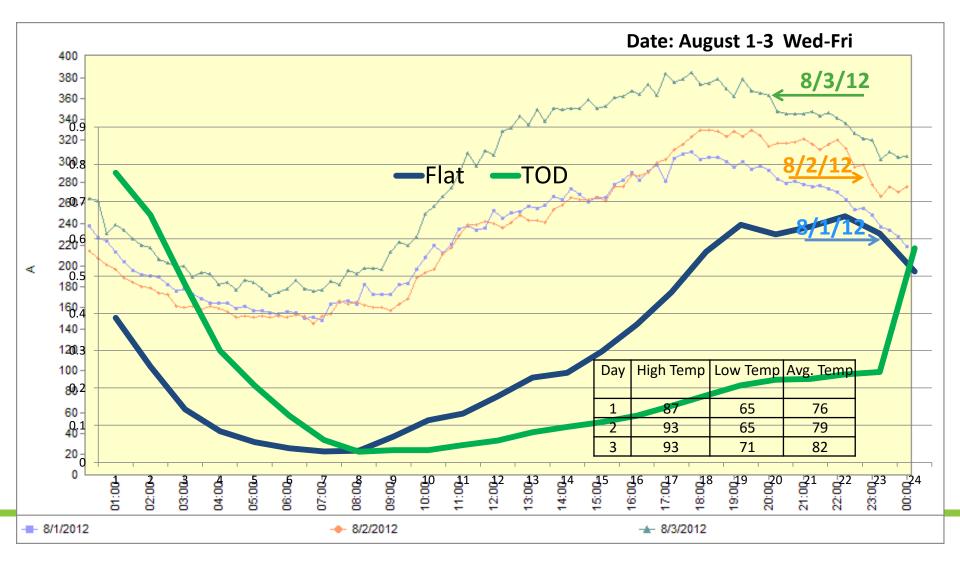




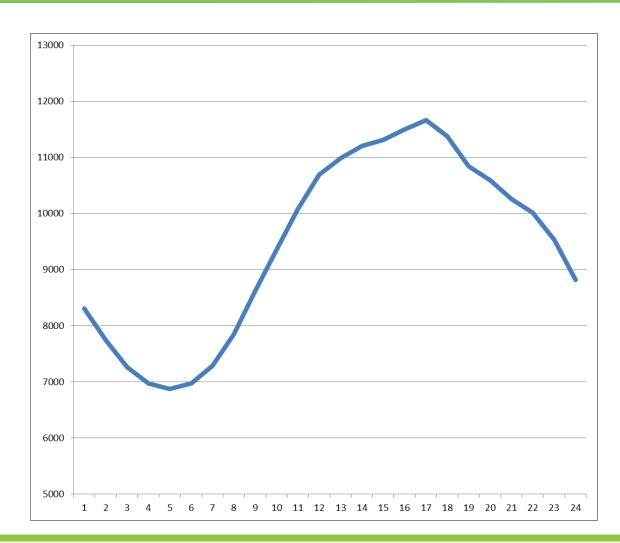
Time of day

Distribution circuit load graphs Summer 2012 high temperature days





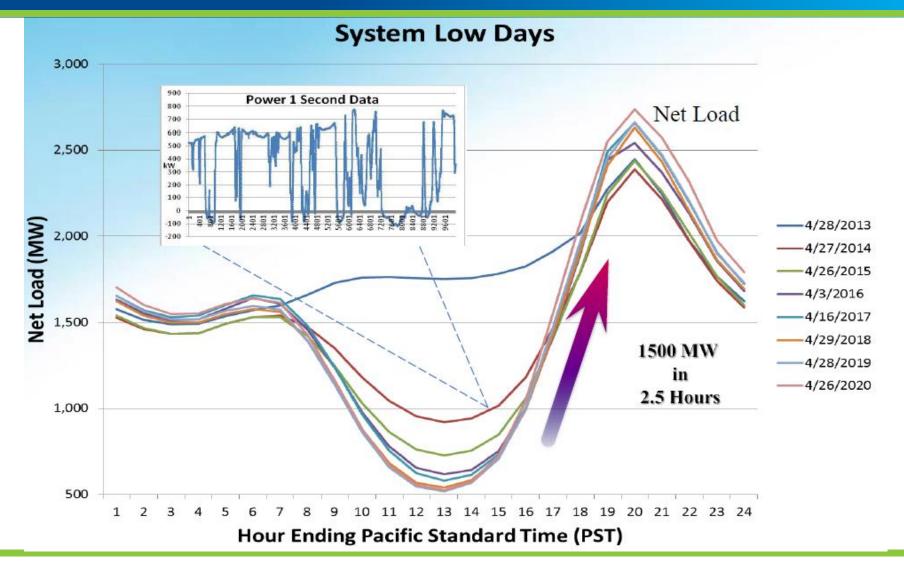
Typical system summer load curve – how to manage morning ramp rate with workplace chargers



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California - SDG&E System Load

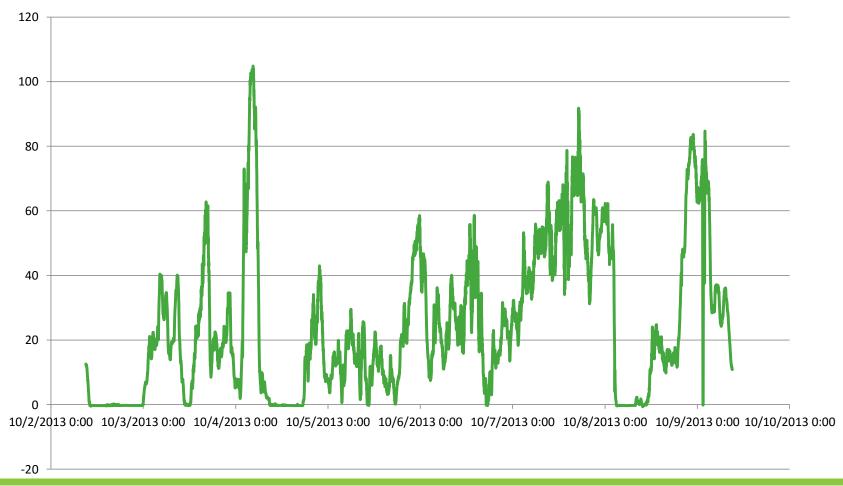




Wind production is variable







Workplace Smart Charging Project - DOE Funded



- Install 24 charging stations in the DTE Energy HQ parking deck
- Utilize DTE's Tropos mesh network to communicate with head end software
- Upgraded existing infrastructure to support increased load from EVSEs
- Utility service was not upgraded – New LED lighting installed

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Delta's "smart grid-capable" Level-2 EVSE

- Bi-directional communications between EVSE and energy service providers
- Revenue-grade metering
- Advanced metering infrastructure (AMI)/Ethernet/power line communications (PLC)/Wi-Fi/cellular/ZigBee interface capable
- Interface capable with in-home displays and home energy management systems
- Utility communication messaging
- Controls including direct load control at fixed percentage of EV load reduction, remote disconnect, etc.

- Zigbee bi-directional communication
- 0.5% accuracy in operation range
- Zigbee interface to AMI meter / wi-fi
- Display and control through Home Energy Management System (HEMS) user interface
- Smart Energy Profile (SEP) 1.1 (Time synchronization, DRLC, Price information)
- Charging current control through J1772
 interface

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Workplace Charging

DOE Project Task #1:

Workplace Charging EVSE Installations, 24 units

Includes the build and installation of 24 units of the EVSE, for installation and evaluation at DTEs downtown Detroit site

DOE Project Task #2

Monitoring and Network Software Installation.

This includes monitoring and evaluation of the EVSE performance in various scenarios anticipated by power company management, using the smart grid functions of the EVSEs, and network management software installed for this purpose. • 24 units are in operation

- Software Installed:
 - Demand Response
 - Real-time monitoring
 - Charge Profiling
 - Data History



Infrastructure Upgrades





- 50kVA Transformer upgraded to 225 kVA
- Main breaker upgraded to 600 Amp
- 480/208 Volt transformer
- Upgraded existing service panel and added second service panel and bus
- Utility service was not upgraded – New LED lighting installed

EVSE Site





Total of 24 EVSEs Four or five EVSEs around each column

EVSE Site

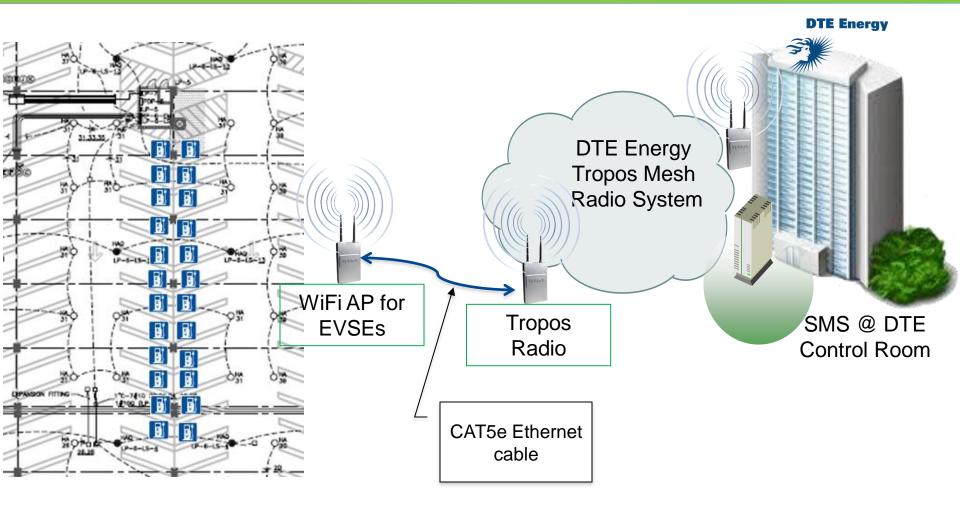




Photo of the 2nd generation EVSE Prototype installed and under field trial at DTE's parking garage in downtown Detroit, MI. Guests viewing charging of Daimler Smart EV at the October 2014 demonstration event.

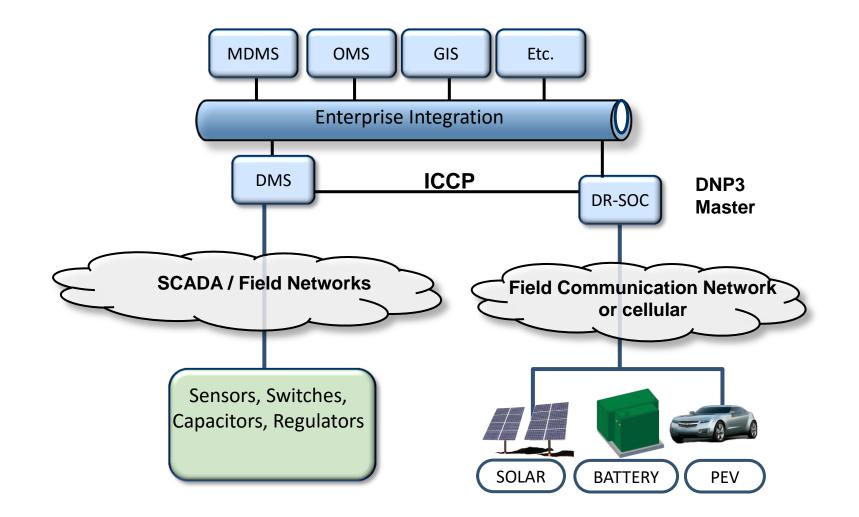
Network Architecture





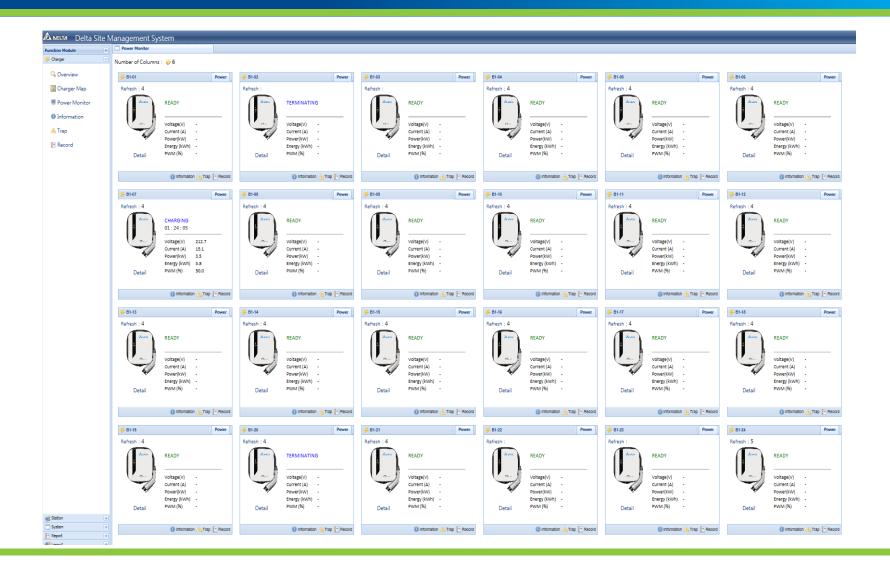
DTE Energy DR-SOC (DERMS)





Site Management System Charger Status





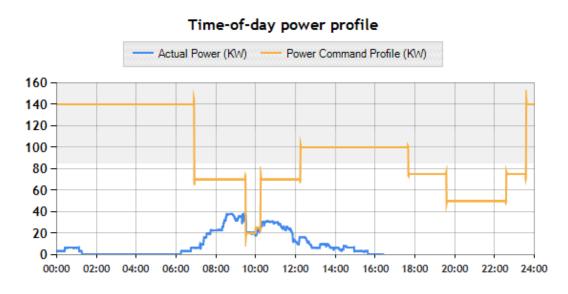
Site Management System Charger Details



🛆 NELTA Delta Site I	Managemen	t System										
Function Module «												
🖐 Charger 📃	Station : All	×	Char	ger : DTE MGN	1 Parking:	B1-01. B1-	01 - (AC Mini)	*				
🔍 Overview	Photo		Scharge Status						Мар			
👿 Charger Map			Refresh	n :				1	,			
🗏 Power Monitor		Anelta		READY								
Information	4											
	1. 1. 1.			Voltage(V)		-						
🛆 Trap				Current (A) Power (kW)								
🗏 Record		EV.orge		Energy (kWh)								
				PWM (%)								
		*										
	Basic Info	•	Recon	d				<u>А</u> Т	rap			
	Basic Info Name:	B1-01	Card ID	d Charge Duration	kWh	Cost	Record Date	Alarm		Description	Lock	Record Date
		B1-01 AC Mini	1		kWh 4.4	Cost \$35.2	Record Date 10/16/2014 18:14			Description	Lock	Record Date
	Name:		Card ID	Charge Duration						Description	Lock	Record Date
	Name: Type:	AC Mini	Card ID 0	Charge Duration 02:29:03 01:50:48	4.4 4.3	\$35.2 \$34.4	10/16/2014 16:14 10/15/2014 16:54			Description	Lock	Record Date
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	Name: Type: Model: Serial No:	AC Mini AC Mini A65142900379AE	Card ID 0	Charge Duration 02:29:03 01:50:48	4.4 4.3	\$35.2 \$34.4	10/16/2014 16:14 10/15/2014 16:54			Description	Lock	Record Date
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	Name: Type: Model: Serial No: Mac Address: IP Address: Subnet Mask:	AC Mini AC Mini A65142900379AE 00:18:23:05:dd:1b 10.150.32.66 255.255.254.0	Card ID 0 0 0 0 0 0	Charge Duration 02:29:03 01:50:48 02:00:03 01:31:21 04:10:15 02:31:52	4.4 4.3 5.3 4.0 9.9 6.8	\$35.2 \$34.4 \$42.4 \$32.0 \$79.2 \$54.4	10/16/2014 16:14 10/15/2014 16:54 10/13/2014 21:26 10/13/2014 18:49 10/13/2014 14:19 10/11/2014 18:58			Description	Look	Record Date
	Name: Type: Model: Serial No: Mac Address: IP Address: Subnet Mask: Gateway:	AC Mini AC Mini A65142900379AE 00:18:23:05:dd:1b 10.150.32.66 255.255.254.0 10.150.32.1	Card ID 0 0 0 0 0 0 0 0	Charge Duration 02:29:03 01:50:48 02:00:03 01:31:21 04:10:15 02:31:52 01:09:40	4.4 4.3 5.3 4.0 9.9 6.8 3.1	\$35.2 \$34.4 \$42.4 \$32.0 \$79.2 \$54.4 \$24.8	10/16/2014 16:14 10/15/2014 16:54 10/13/2014 21:28 10/13/2014 18:49 10/13/2014 14:19 10/11/2014 18:58 10/10/2014 16:29			Description	Lock	Record Date
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	Name: Type: Model: Serial No: Mac Address: IP Address: Subnet Mask: Gateway: Latitude: Longitude:	AC Mini AC Mini A65142900379AE 00:18:23:05:dd:1b 10.150.32.66 255.255.254.0 10.150.32.1 42.334954 -83.060522	Card ID 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Charge Duration 02:29:03 01:50:48 02:00:03 01:31:21 04:10:15 02:31:52 01:09:40 02:54:34	4.4 4.3 5.3 4.0 9.9 6.8 3.1 7.8	\$35.2 \$34.4 \$42.4 \$32.0 \$79.2 \$54.4 \$24.8 \$62.4	10/16/2014 16:14 10/15/2014 16:54 10/13/2014 21:26 10/13/2014 18:49 10/13/2014 14:19 10/11/2014 16:58 10/10/2014 16:29 09/26/2014 18:50			Description	Look	Record Date

Site Management System Charger Power Profile





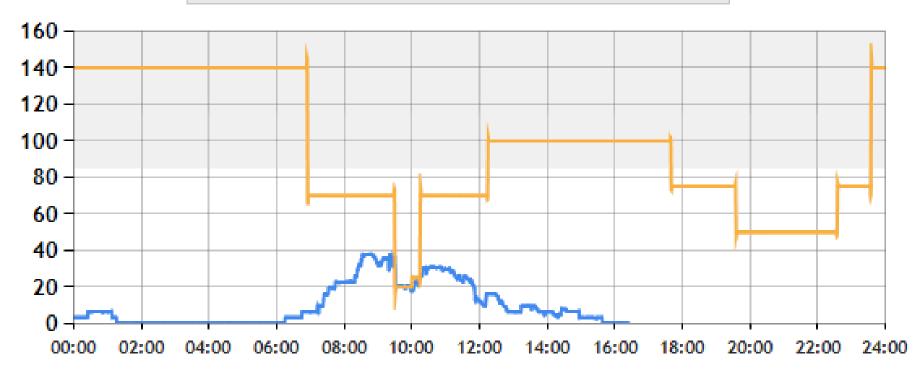
- Power Profile display in 24 hr overview and close up view.
- Orange trace max power setting
- Blue trace real-time power
- Any profile curve can be entered into software
- Control Strategy Based on Power Command Profile, distribute available capacity equally to those EVSEs in charging

Site Management System Charger Power Profile



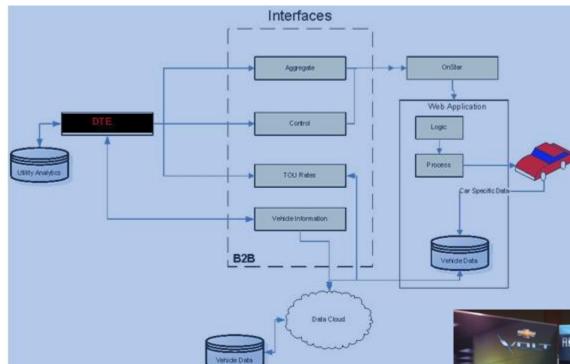
Time-of-day power profile





DTE Energy – OnStar Demonstration





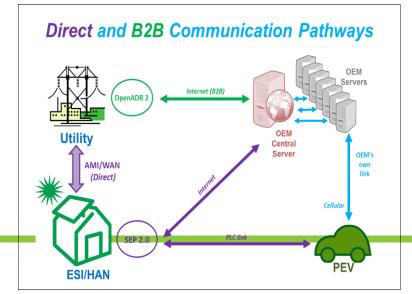
 From DTE HQ, uploaded DTE Energy PEV rate schedule to Volts through OnStar telematics

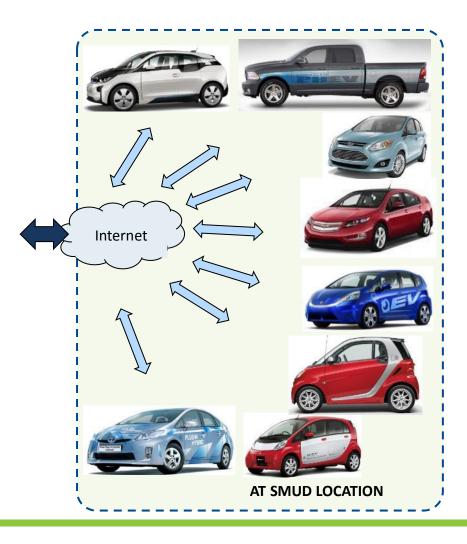


OEM Central Server Proof of Concept EPRI-Utility-Auto Demonstration



- <u>Use Case 1</u> is the B2B internet connection
 - From the Utility Demand Response Management System to the Central Server utilizing the OpenADR 2b protocol.
 - Implements DR Events and TOU Rate Tariff Schedules communicated via the B2B internet connection to the Central Server to the individual OEM servers to the PEVs.







VTO Systems Research Supporting Standards and Interoperability

- Vehicle to Building Integration Pathway
- Systems Research Supporting Standards and Interoperability
- Modeling and Control Software to Support V2G Integration
- Diagnostic Security Modules for Electric Vehicles to Building Integration

Multi-Lab EV Smart Grid Working Group





Thank you!



Vegetatise Management 28 | Protection & Central 36 | Mohile Dispatch 40



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