EV Workplace Charging

Power Demand … the hidden secret

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Workplace Charging Considerations

- Charging rate required for employees
- First cost of equipment
- Fee or non-fee based
- Impact on building energy/demand

EV Chargers

Electrical Ratings

- AC Level 1 : 120 VAC, 1.9 kW

Typically 1.3 kW

- AC Level 2 : 240 VAC, 19.2 kW

AC Level 2

Typically 6 kW

EV Chargers

Electrical Ratings

- DC Level 1 : 500 VDC, 40 kW
- DC Level 2 : 500 VDC, 100 kW

CHAdeMO

Kia, Nissan, Mitsubishi, Subaru, Toyota

SAE Combo

Audi, BMW, Chrysler, Daimler, Ford, GM, Porsche, Volkswagen

Equipment Costs

Charger	Average Capitol Cost[1]			Recurring Costs
	Payment	Equipment	Installation[2] (transformer)	Networking (maintenance)
AC Level 1	No-fee	$150	$225	$0 ($50)
AC Level 2	No-fee	$725	$375	$0 ($250)
	Fee-based	$2,125	$4,875	$300 - $500 ($250)
DC Level 2	Fee-based	$23,500	$13,125 ($17,500)	$300 - $500 ($1,500)

[1] Agenbroad, J., Holland, B., "Pulling Back the Veil on EV Charging Station Cost", Rocky Mountain Institute, April 2014.

[2] Includes permitting

Operating Costs

Charger (10 kWh's/day)	Recurring Costs	
	Energy (sessions)	Demand[1]
AC Level 1 (1 EV)	$300[2] (250)	$0 $300 /EV/yr
AC Level 2 (5.4 EV's)	$810[3] (1,350)	$792 $297 /EV/yr
DC Level 2 (28.8 EV's)	$4,320[4] (7,200)	$5,016 $324 /EV/yr

[1] AC Level 2: 6 kW, DC Level 2: 32 kW avg., $11/kW, 12 months/year (MI: $22/kW)
[2] 35 mi, 3.5 mi/kWh, $0.12/kWh, $0/kW (residential or non-demand electric rate)
[3] 1.67 hours @ 6 kW, 5.4 times per day 5 days/week, 50 weeks, $0.06/kWh (commercial electric rate)
[4] 0.3125 hours @ 38 kW avg., 28.8 times per day, 5 days/week, 50 weeks, $0.06/kWh (commercial)

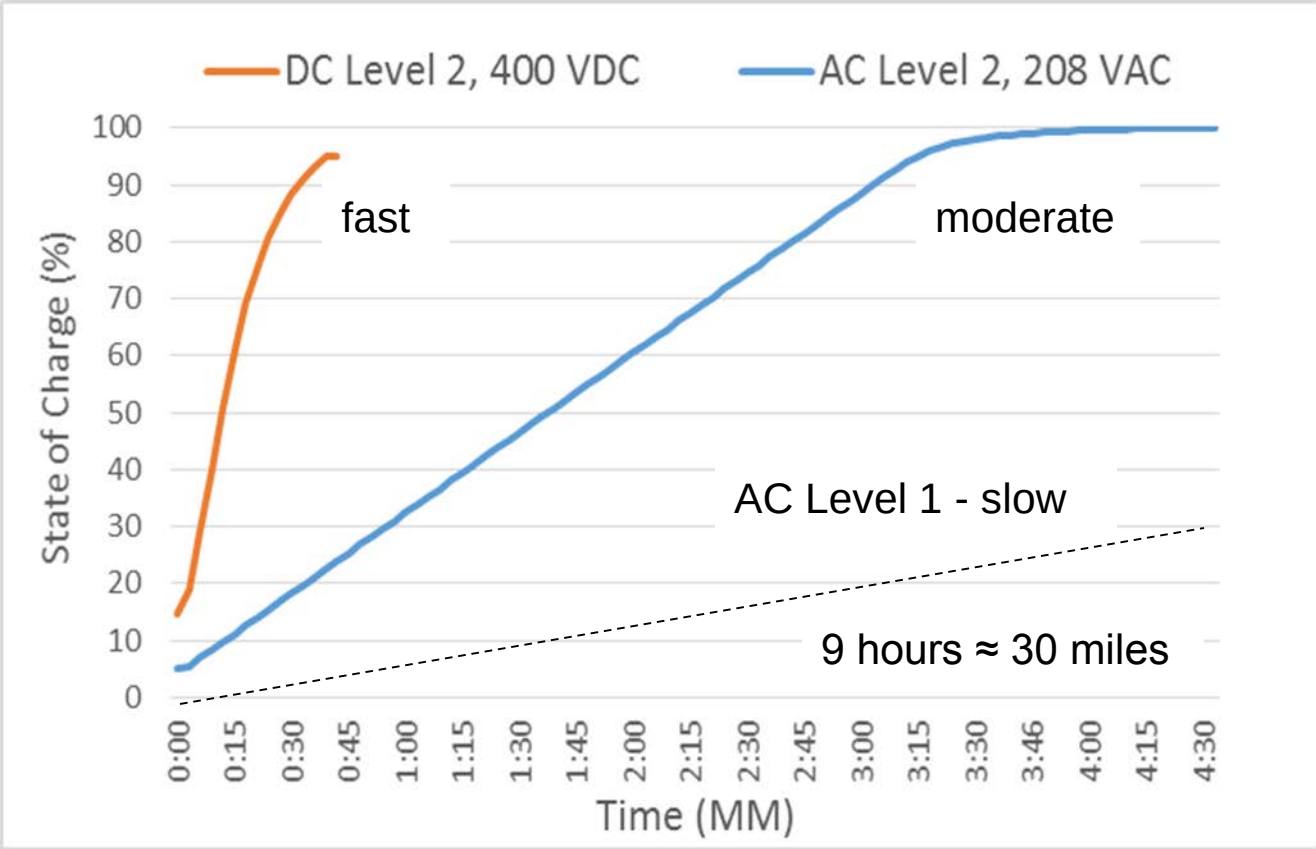
Operating Costs

Charger (10 kWh's/day)	Recurring Costs	
	Energy (sessions)	Demand[1]
AC Level 1 (1 EV)	$300[2] (250)	$0 $300 /EV/yr
AC Level 2 (1 EV)	$150[3] (250)	$792 $942 /EV/yr
DC Level 2 (1 EV)	$150[4] (250)	$2,904 $3,054 /EV/yr

[1] AC Level 2: 6 kW, DC Level 2: 32 kW avg., $11/kW, 12 months/year (MI: $22/kW)
[2] 35 mi, 3.5 mi/kWh, $0.12/kWh, $0/kW (residential or non-demand electric rate)
[3] 1.67 hours @ 6 kW, 1 times per day 5 days/week, 50 weeks, $0.06/kWh (commercial electric rate)
[4] 0.3125 hours @ 22 kW avg., 1 time per day, 5 days/week, 50 weeks, $0.06/kWh (commercial)

Charger Selection

What type of charger is appropriate for workplace charging?



EV Workplace Charging

Power Demand … the hidden secret

- Impact on Building Electrical Demand

- Demand Limiting Strategies

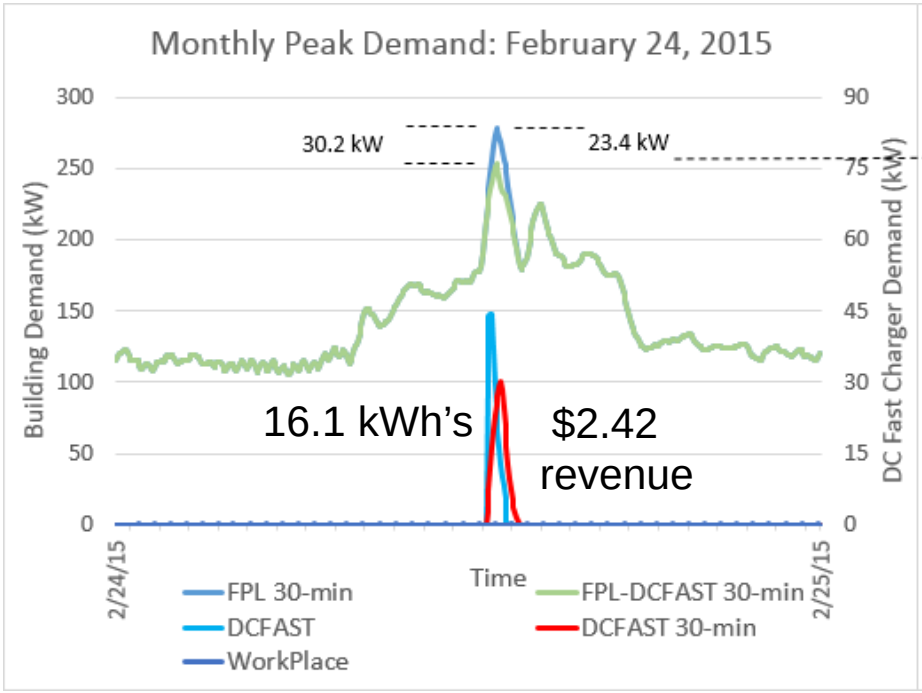
Illustrated by case study

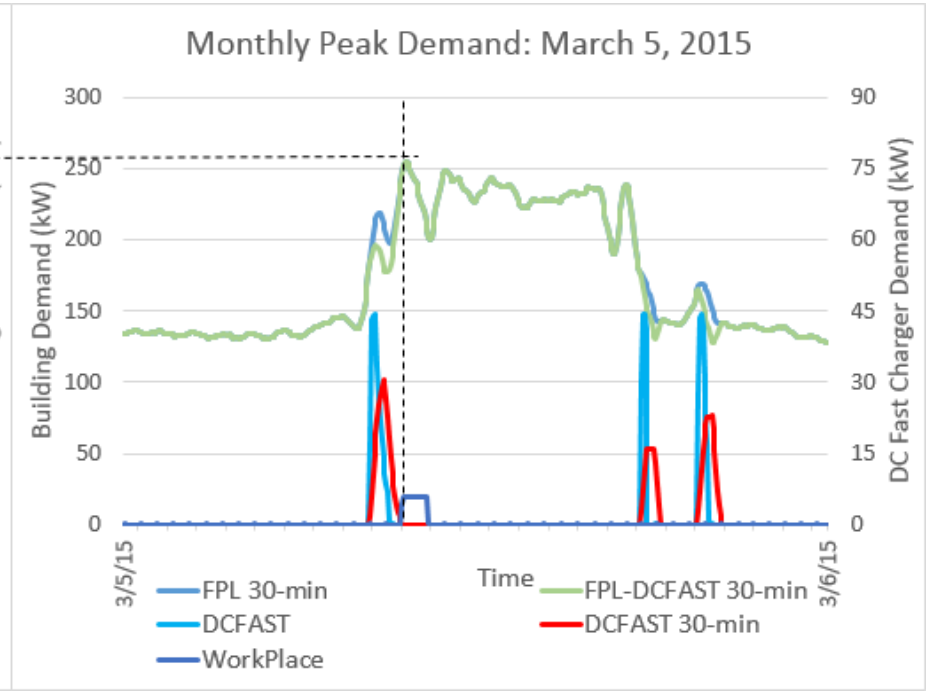
FSEC Building Information

- 70,000 ft^2
- 200 tons chiller capacity
- 90 employees

- 2 workplace chargers (12 kW)
- 2 public Level 2 (12 kW)
- 1 public DC Fast charger (45 kW)
- 5 ½ PEV's (5 Leaf, 1 Volt)

Building Demand Impact Example





Charger Impact on Utility Cost

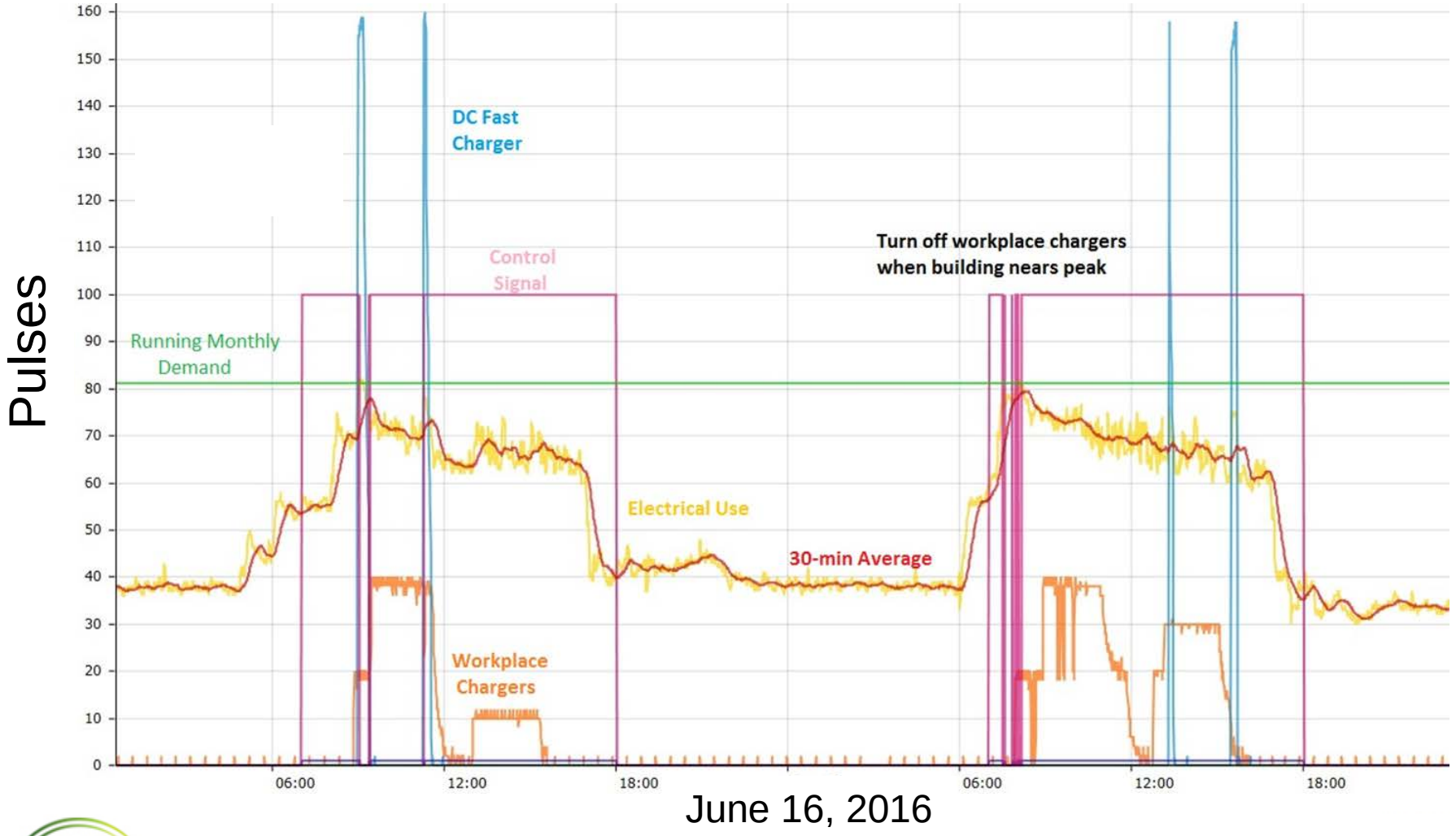
Feb 6. 2015 – Jun 7, 2016

Charger Type	Energy		Demand		Total	Revenue (session)
	kWh	Cost	kW	Cost		
DC Fast	3,129	$ 159	30	$ 316	$ 475	$ 407 220
Public Lev 2	2,368	$ 120	8	$ 85	$ 205	$ 424 194
Employee Lev 2	7,235	$ 367	36	$ 379	$ 746	- - 503
Total	12,732	$ 646	74	$ 780	$ 1,426	$ 831 917

Normal Building Operation:

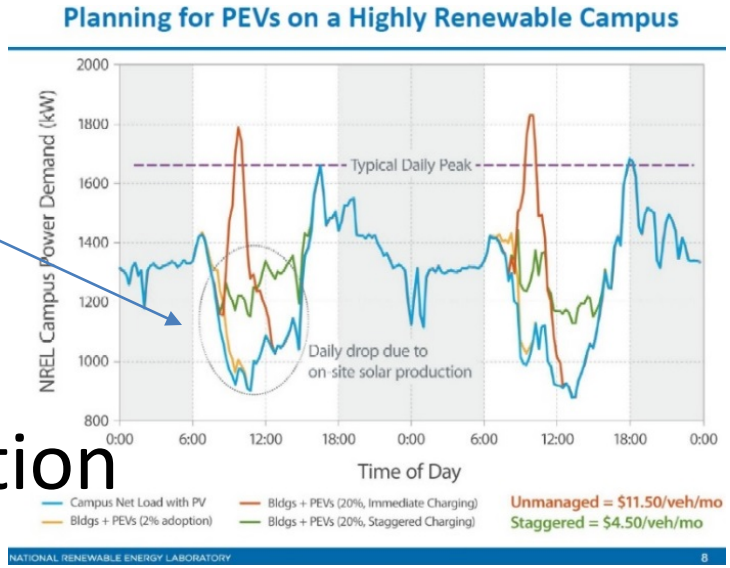
- 370 kW summer peak
- 1,500 MWh/yr
- $10,000/mo. electric

Controllable Workplace Chargers



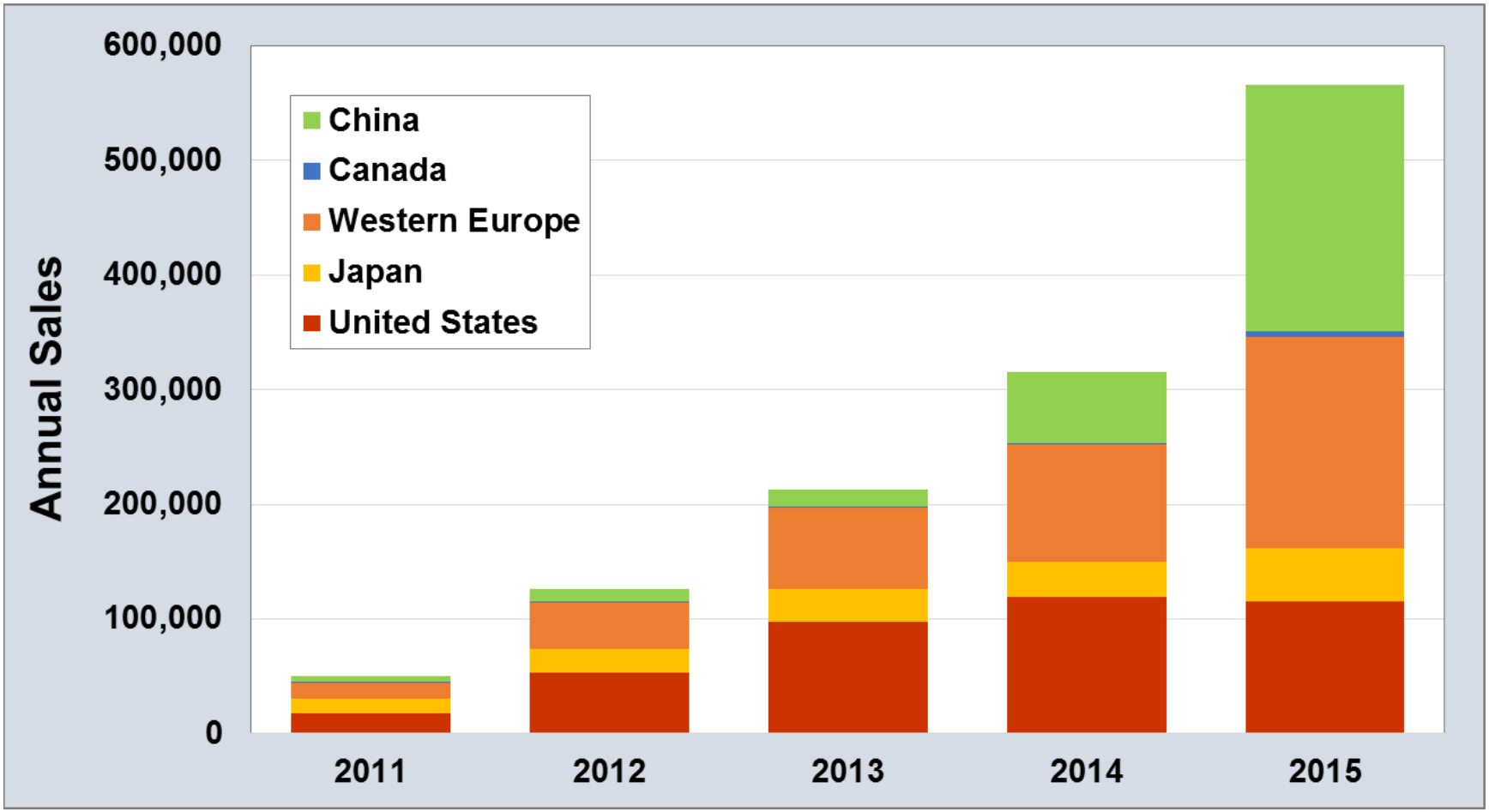
Demand Limiting Strategies

- Scheduling (passive)
- Turn off at peak (active)
- Chiller plant capacity reduction
- Auxilliary power interrupt
- EV as storage medium (V2G)



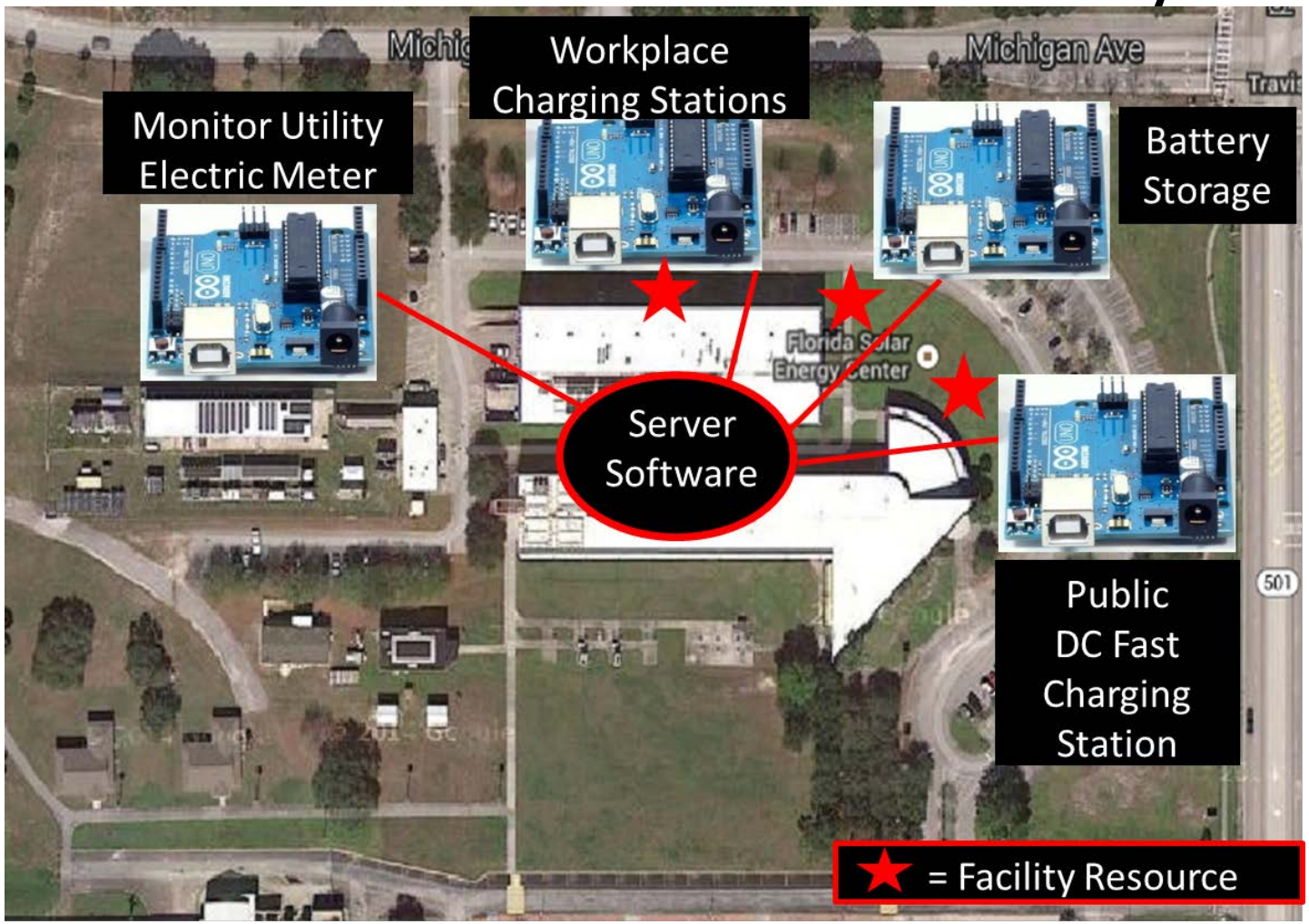
EVs in the Future – World Sales

Plug-in Light Vehicles



Current Research Activities

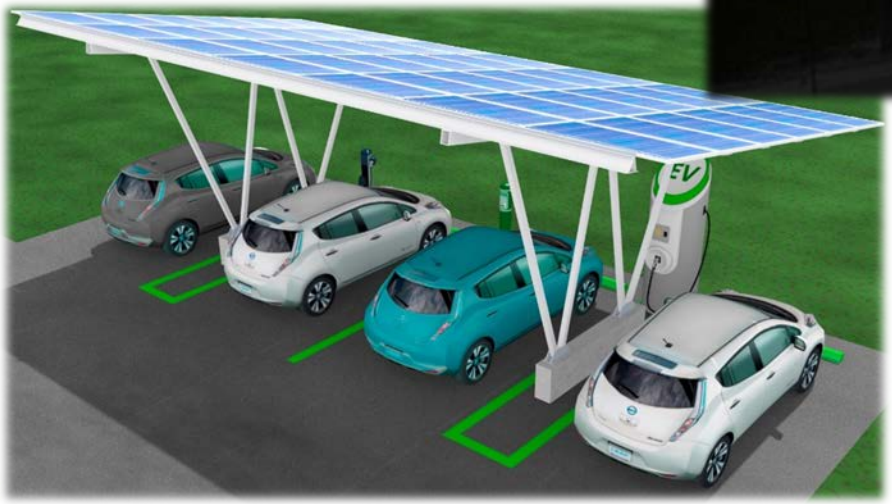
FSEC Facilities Resource Study



Current Research Activities

FSEC Charging Station

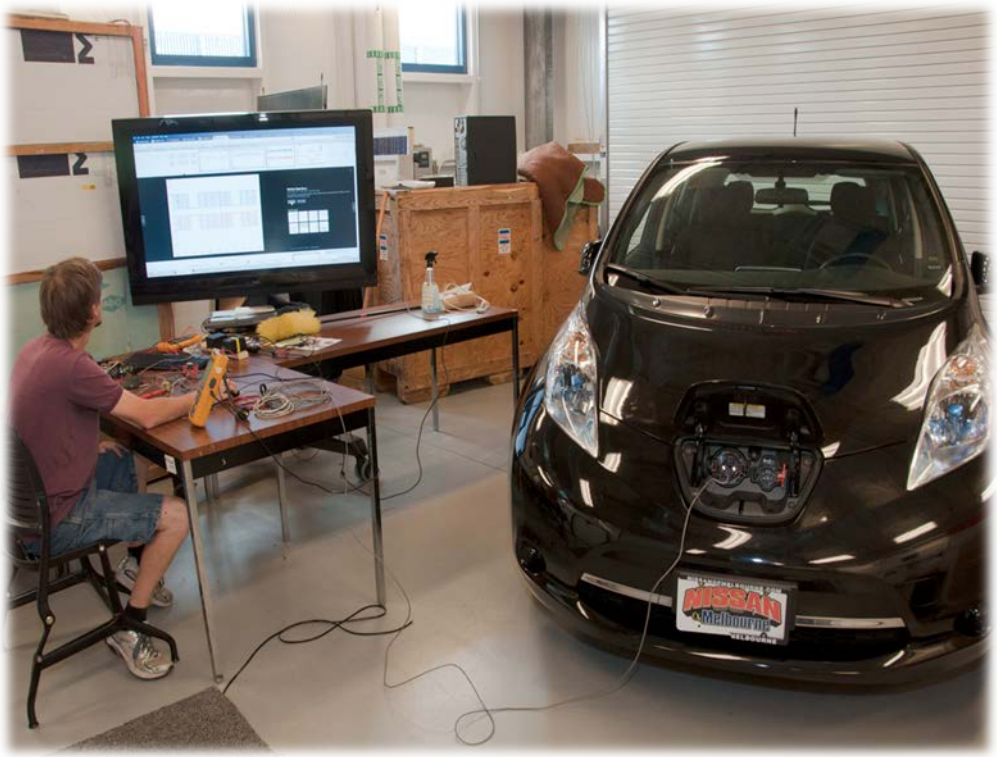
- Charging Technologies
- Electric Grid Integration
- Environmental Effects
- Transportation Planning



Current Research Activities

FSEC EV Laboratory

- Charge vs Discharge
- V2G Applications
- Charging Optimization
- Electrical Demand



Current Research Activities

FSEC EV Laboratory - Wireless Charging

Current Research Activities

Florida Turnpike Charging Station Optimization Study

- Infrastructure requirements
- Queueing models
- Siting

Thank You

For more information:

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