



Electric Vehicle Program



Tuskegee University – (October 2015)
Kevin Schleith - University of Central Florida

DOT - Why EVs?



- **Domestic Policy Goals**

- Mandated reduction of petroleum & greenhouse gases
- Job creation and Economic Growth
- Reduce dependence on foreign oil

- **Global Impact**

- Climate change
- China to balance growth with pollution
- Governments have allocated funding for clean technology

- **Energy Independence**

- Local energy sources reduce price volatility
- Reduce export of dollars, particularly to unstable regions
- Reduce dependence on few key regions

- **Developing Nations**

- Lower-cost conventional vehicles support economic development goals.

Transportation accounts for roughly 15% of energy related CO₂ emissions globally.

Our Mission

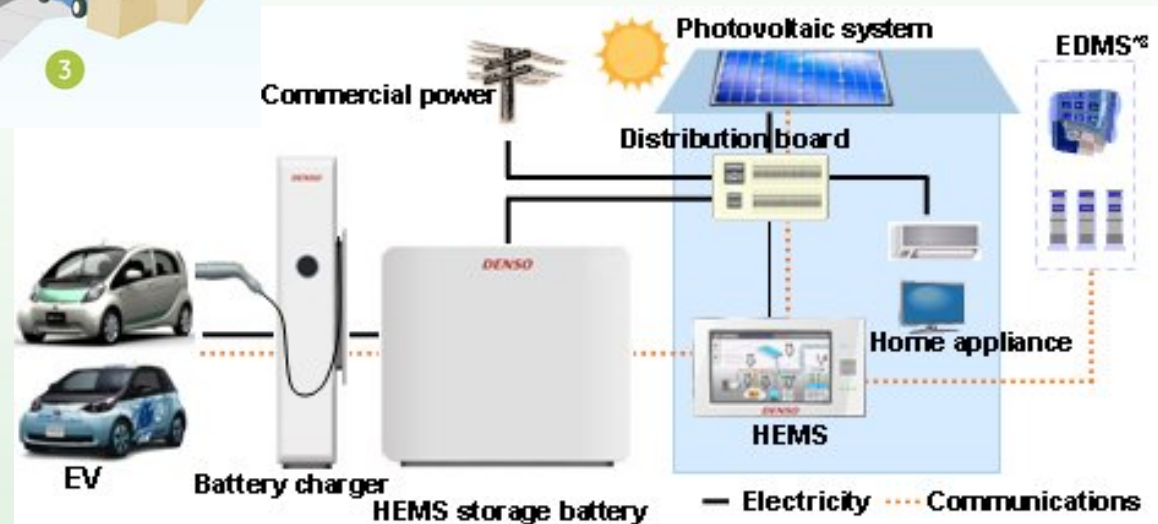
The future will be an integration of electric vehicles and power systems

Fully Integrated Electric Highway Network

Wireless Charging

PV Grid Parity throughout U.S.

Energy Efficient Homes throughout U.S.



Industry Collaboration

- Florida Department of Transportation
- Florida Turnpike Authority
- Alabama Power
- Alabama Department of Transportation
- Nissan North America, Inc.
- Florida Power & Light (FPL)
- Eglin Air Force Base
- GM Powertrain Global Headquarters
- HEVO, Inc

EV's Then and Now



Henry Ford's wife drove and preferred an EV!



Vehicle Comparison



**Petrol
(ICE)**



**Hybrid
(HEV)**



**Plug-in Hybrid
(PHEV)**



**100% Battery
(EV, GEV, BEV)**

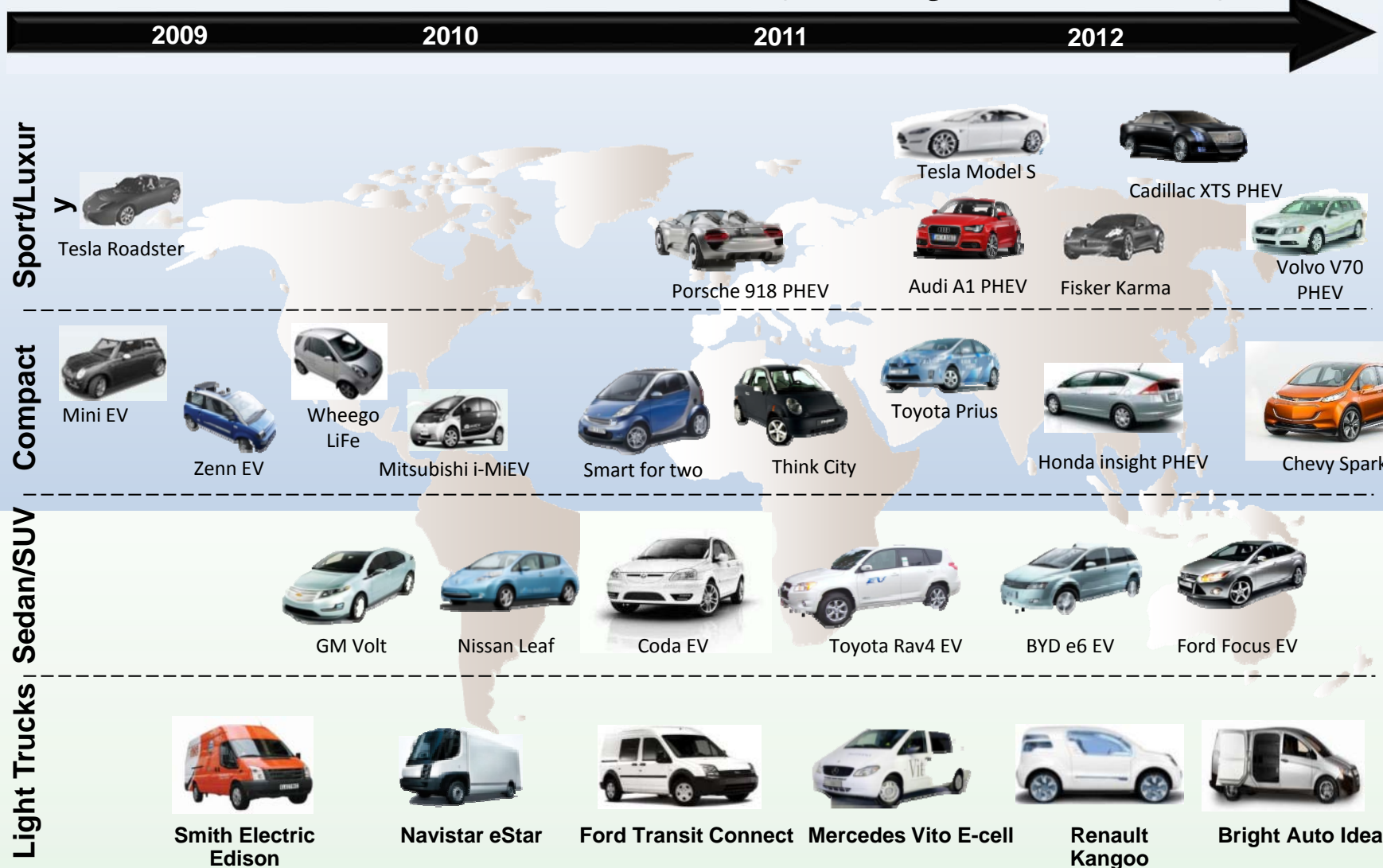
PHEV: Plug-In Hybrid Electric Vehicle
REEV: Range Extended Electric Vehicle
BEV: Battery Electric Vehicle
EV: Electric Vehicle



**Range Extended Electric Vehicles
(coming 2016)**



Electrical Vehicles (not just cars)...



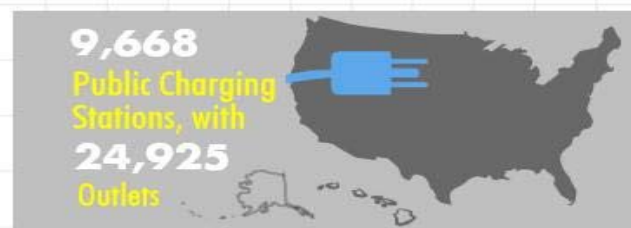
Best for 2015

80 -90 mile range on full charge or
110-120 miles per gallon equivalent



The Market is Growing

Electric Drive Market Snapshot: May 2015



@ElectricDrive

www.electricdrive.org/sales

May 2015

One Million Global Plug-Ins Milestone Reached (September 2015)

Top selling models (rounded to Aug '15, 70% of sales)

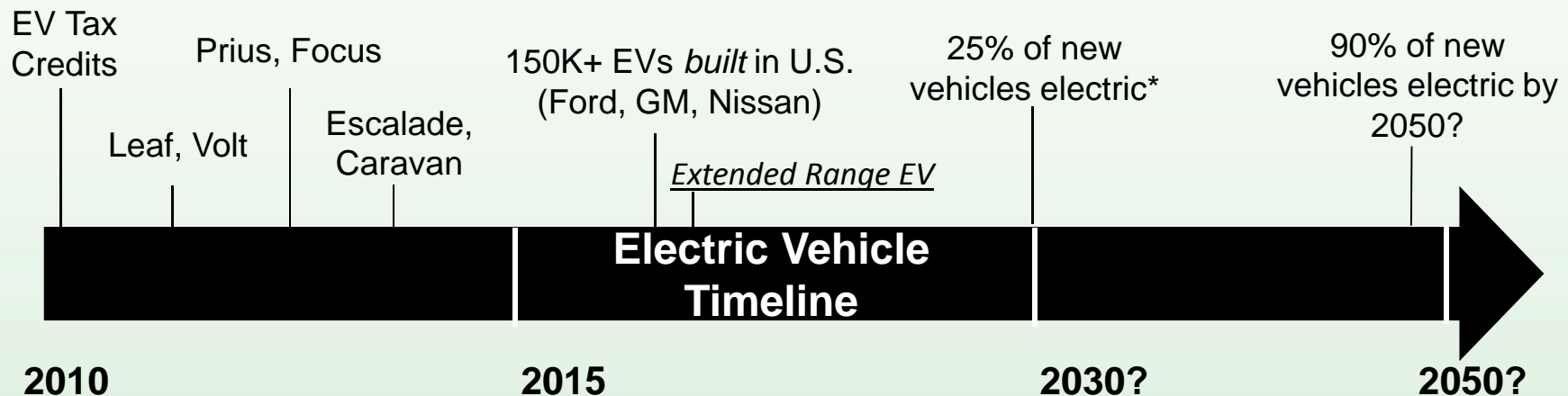
1. Nissan Leaf	Almost 200,000
2. Chevy Volt	Almost 100,000
3. Tesla Model S	About 85,000
4. Toyota PHV	About 74,000
5. Mitsu Outlander PHV	Over 70,000
6. Mitsubishi i-MIEV	About 50,000 (incl. minivans, trucks in Japan)
7. BYD Qin	38,930
8. BMW i3	~30,612
9. Renault Zoe	30,437
10. Ford Fusion Energi	24,104

Top countries (93.2 percent of sales)

1. United States	363,265 passenger cars since 2008
2. China	157,354 cars since 2011 (plus over 65,000 HD vehicles)
3. Japan	121,000-plus passenger cars and vans since 2009
4. Norway	65,958 passenger and vans since 2003
5. Netherlands	61,025 passenger and vans
6. France	over 59,000 passenger and vans since 2010
7. UK	39,616 passenger cars
8. Germany	38,154 passenger cars
9. Canada	14,429 passenger cars since 2011
10. Sweden	12,786 passenger cars



EV Transformation



EV Charging Stations



Map

EV Charging Apps



AAA Adds EV Charging Station Locations to Mapping Tools

Operational / Environmental Metrics

- If 10,000 vehicle owners switched from gas-powered passenger cars to EVs, over 33,000 metric tons of CO₂ emissions could be avoided annually.
- EV owner will save about 75% of the annual fuel by switching from gas to electric



Benefits

Consumer Fuel Savings

350k EVs today = \$290 M

4 M EVs in 10 years = \$3.3 B

Convert 50% Gov. fleet = \$248 M

Annual Societal Benefits (4 M EVs)

Urban Air Pollution = \$1.5 Billion

Human Health = 43,900 (DALY)

Employment = 136,000 jobs

U.S. GDP = \$16.6 Billion

Business Profit = \$10 Billion

Additional Income = \$5.8 Billion

DALY – disability-adjusted life year

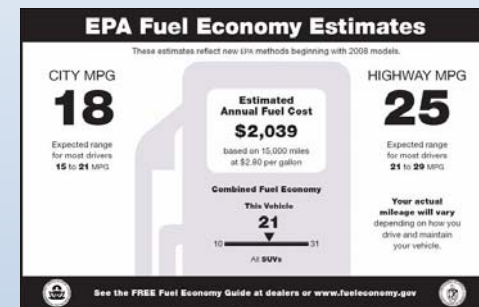


Key Drivers for EV Growth

1. Government Incentives

Clean Air Regulations

Mandate for Higher Fuel Efficiencies



2. Auto Manufacturer EV Pipeline



3. The Energy Conscious Consumer



Key Drivers

Auto Manufacturer Incentives - \$8B loans for Advanced Vehicle Technologies

- \$5.9B to Ford (factories in Ohio, Illinois, Kentucky, Michigan, Missouri, Ohio)
- \$1.6B to Nissan (factory in Tennessee)
- \$465M to Tesla (factory in California)

Fuel Efficient Vehicles Tax Incentives for Consumers

- Tax credit for EV's, up to \$7,500
- Tax credit for charging stations up to \$2,000 for consumers and \$50,000 for public charging or 50% of the cost



Auto Manufacturer

30+ Manufacturers – 60+ Different Models



Source: www.electricdrive.org

Electric Vehicles and Power Systems

Chevrolet



Nissan



Tesla/SolarCity



31 days ago by Eric Leveday 00 26



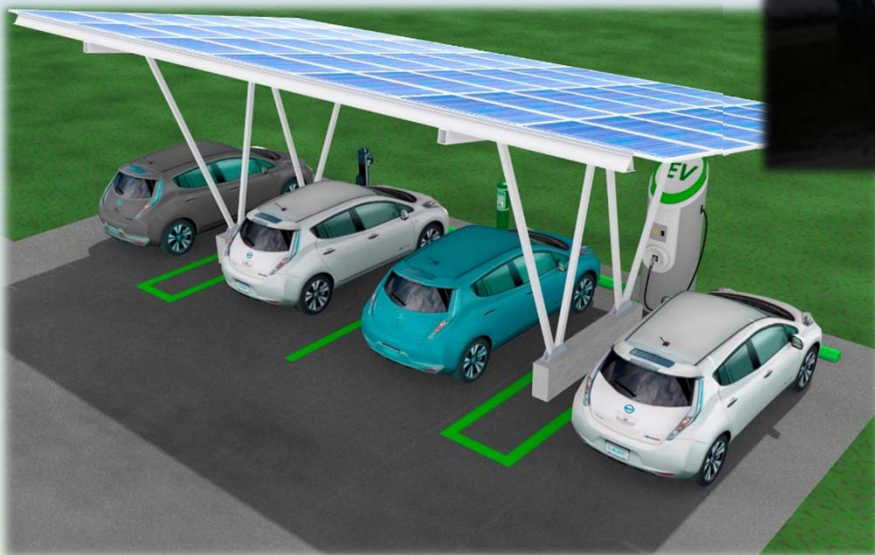
Tesla Model S Consumes Lots of Battery Cells - Like 7,000-Plus Per Vehicle

A few days ago, Tesla Motors and Panasonic released this joint announcement:

Current Research Activities

FSEC Charging Station

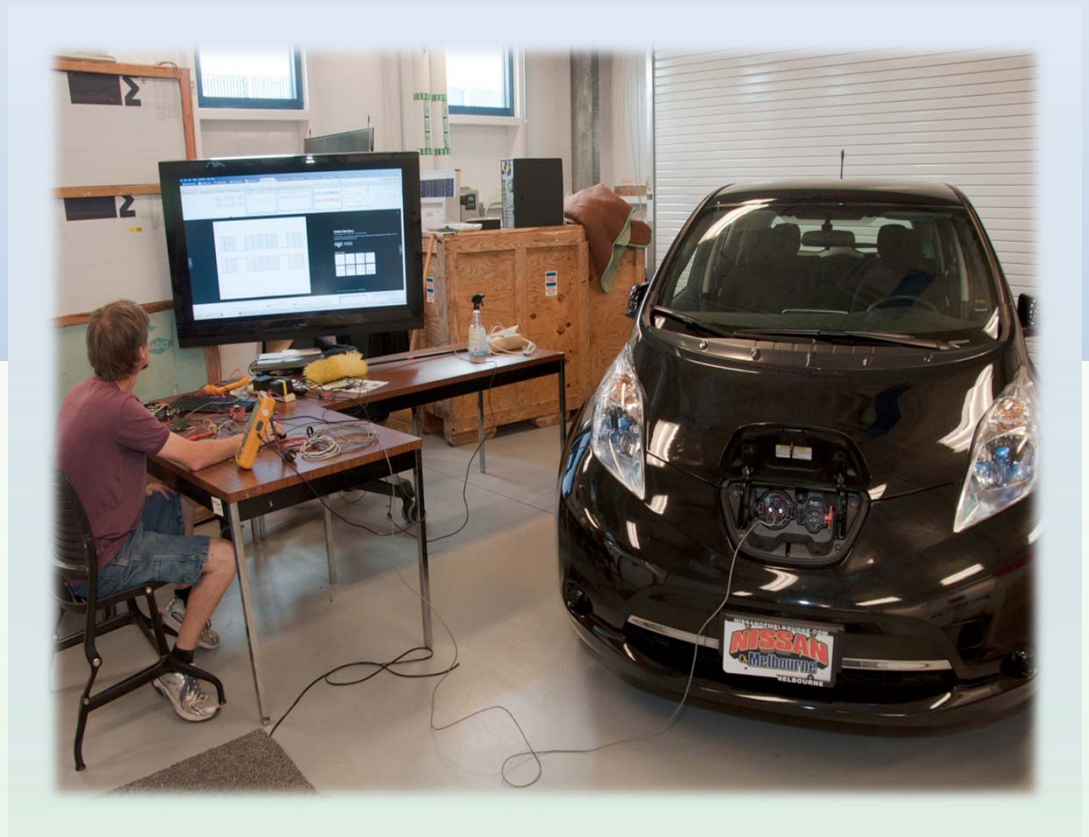
- Charging Technologies
- Electric Grid Integration Workplace Charging Stations
- Environmental Effects
- Transportation Planning



Current Research Activities

FSEC EV Laboratory

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



Current Research Activities

FSEC EV Laboratory - Wireless Charging



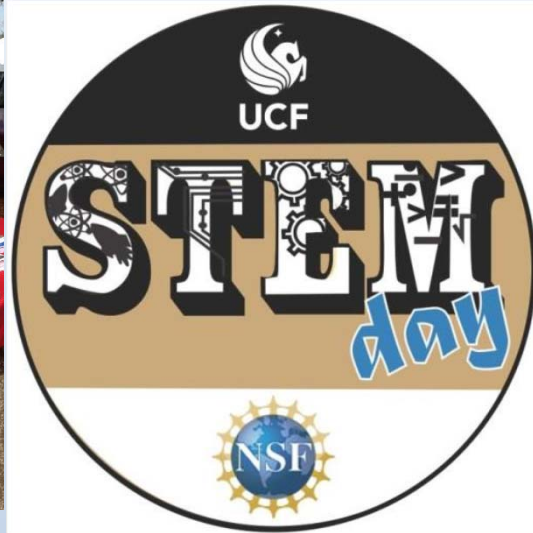
Current Research Activities

Florida Turnpike Charging Station Optimization Study

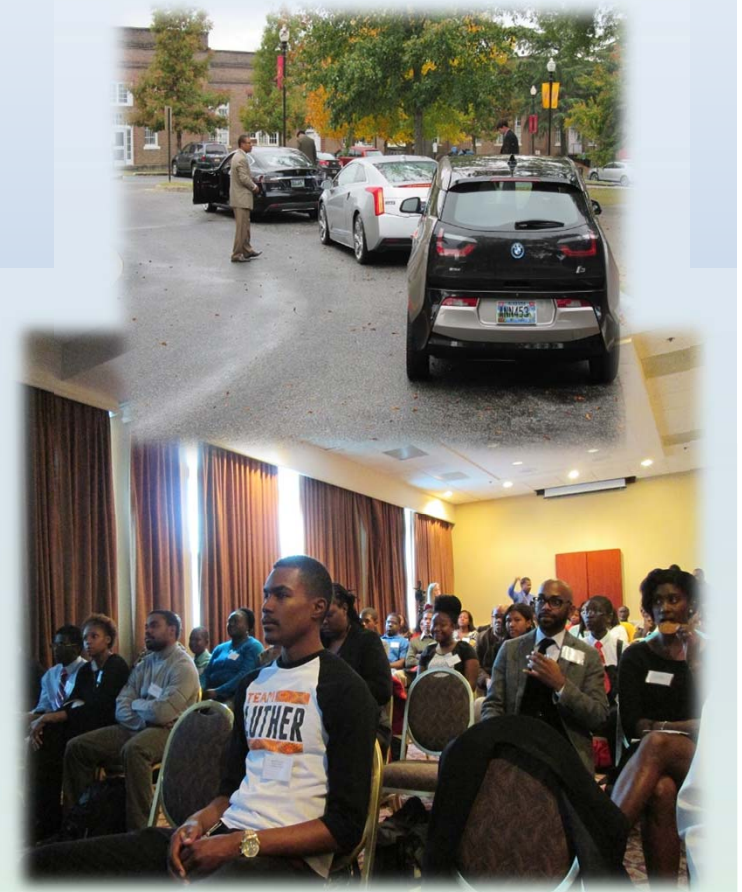
- Infrastructure Requirements
- Capabilities
- Locations



EV's and You



Tuskegee University Electric Vehicle Transportation Center (EVTC) Day



EPRI

ELECTRIC POWER
RESEARCH INSTITUTE



Electric Vehicle Institute

Technical Career Opportunities

(US Auto Industry Employs 716,000)

Chemical engineers	\$97,480
Electrical engineers	\$87,580
Electronics engineers, except computer	\$100,450
Industrial engineers	\$77,160
Materials engineers	\$89,000
Mechanical engineers	\$81,290
Mechanical engineering technicians	\$52,950
Mechanical drafters	\$53,840
Software developers, applications	\$94,680
Commercial and industrial designers	\$67,790

Other Career Opportunities

(US Auto Industry Employs 716,000)

Urban and regional planners	\$63,040
Electrical power-line installers and repairers	\$58,030
Electricians	\$48,250
Retail salespersons ⁽²⁾	\$36,470
Customer service representatives	\$31,400

¹ Occupational Employment Statistics data are available at www.bls.gov/oes.