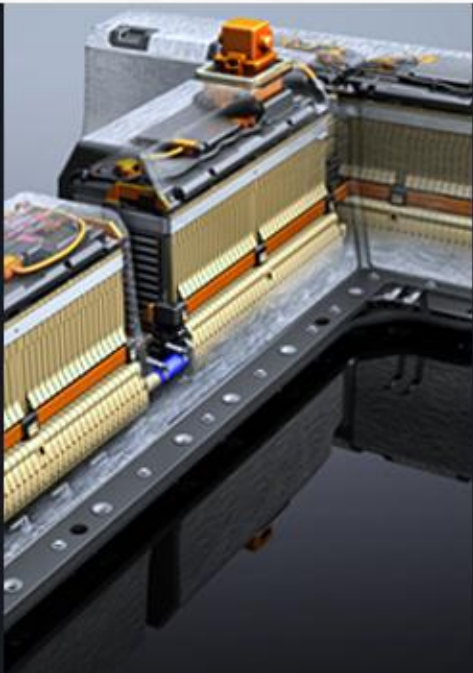




THE FUTURE OF AUTOMOTIVE SKILLS, OPPORTUNITY AND ALLIANCES

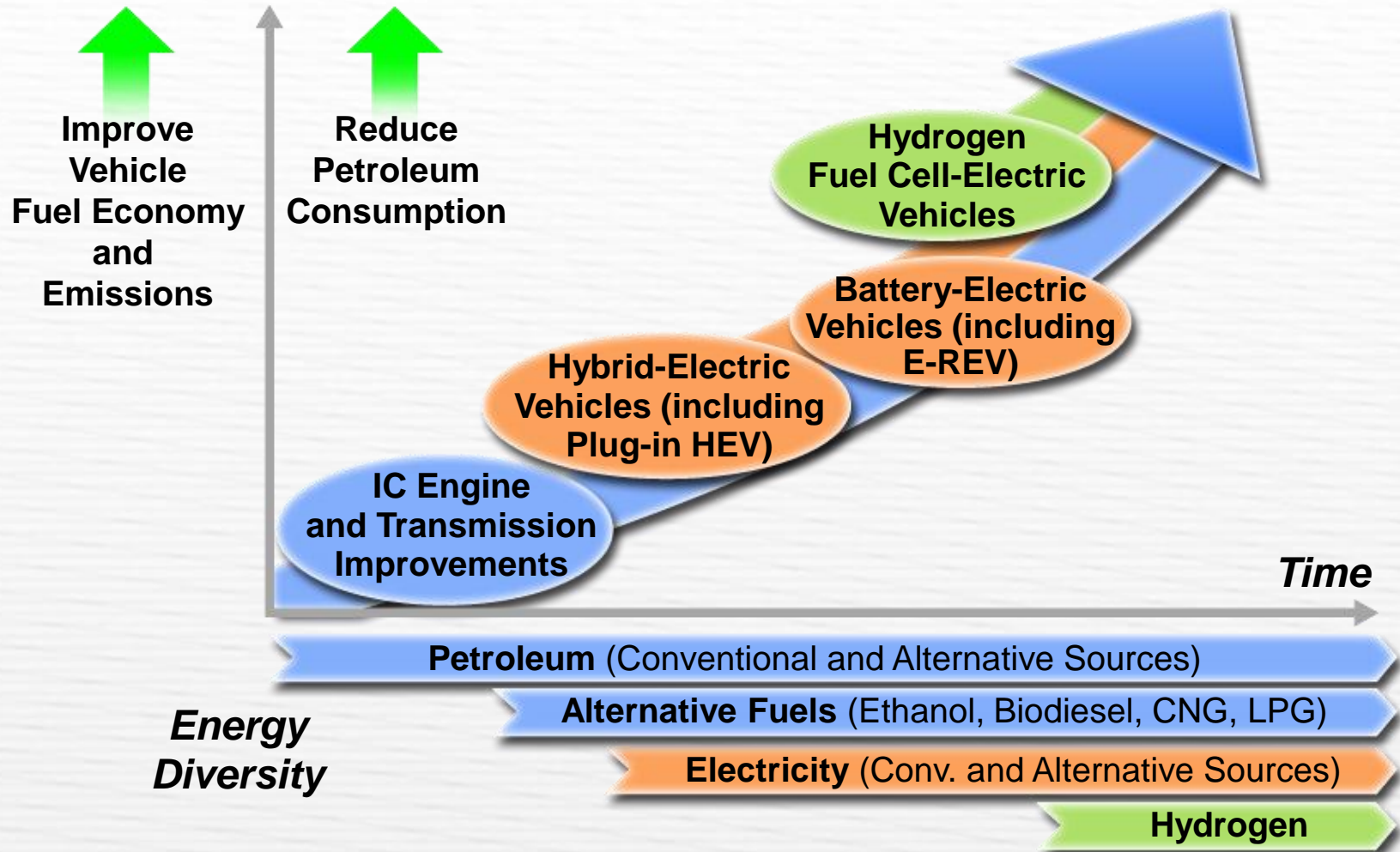
Randall S. Champagne

GM Advance Battery System Engineer





GM Advanced Propulsion Technology Strategy





TODAY – DISRUPTIONAL REINVENTION





OLD DNA

NEW DNA

Mechanically Driven



Electrically Driven

**Energized by
Petroleum**



**Energized by
Electricity and Hydrogen**

**Powered by
Internal Combustion**



**Powered by
Electric Motors**

**Controlled
Mechanically**



**Controlled
Electronically**


Stand-alone



“Connected”



Creating a New Propulsion Category

<p>HEV</p> <p>Hybrid Electric Vehicle</p>	<p>Electric Vehicle</p>  <p>With Extended-Range</p>	<p>BEV</p> <p>Battery Electric Vehicle</p>
<p>Petroleum</p>	<p>Electricity + Petroleum</p>	<p>Electricity: Limited Range</p>



Volt Build-Up





Electrifying the Chevrolet Volt

Electrical

Interior

Powertrain

Thermal

Chassis





Electrifying the Chevrolet Volt

Electrical

Interior



HMI



High-Voltage Distribution



HV Battery



HV Cables-DC

Power Electronics

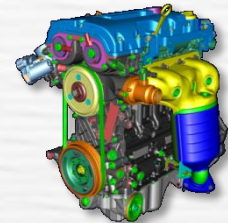


Electric Drive Unit

Powertrain



HV Cables-AC



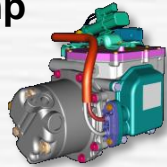
Engine



Thermal



Electric Water Pump



Electric A/C



Electric Power Steering



Regenerative Brake System

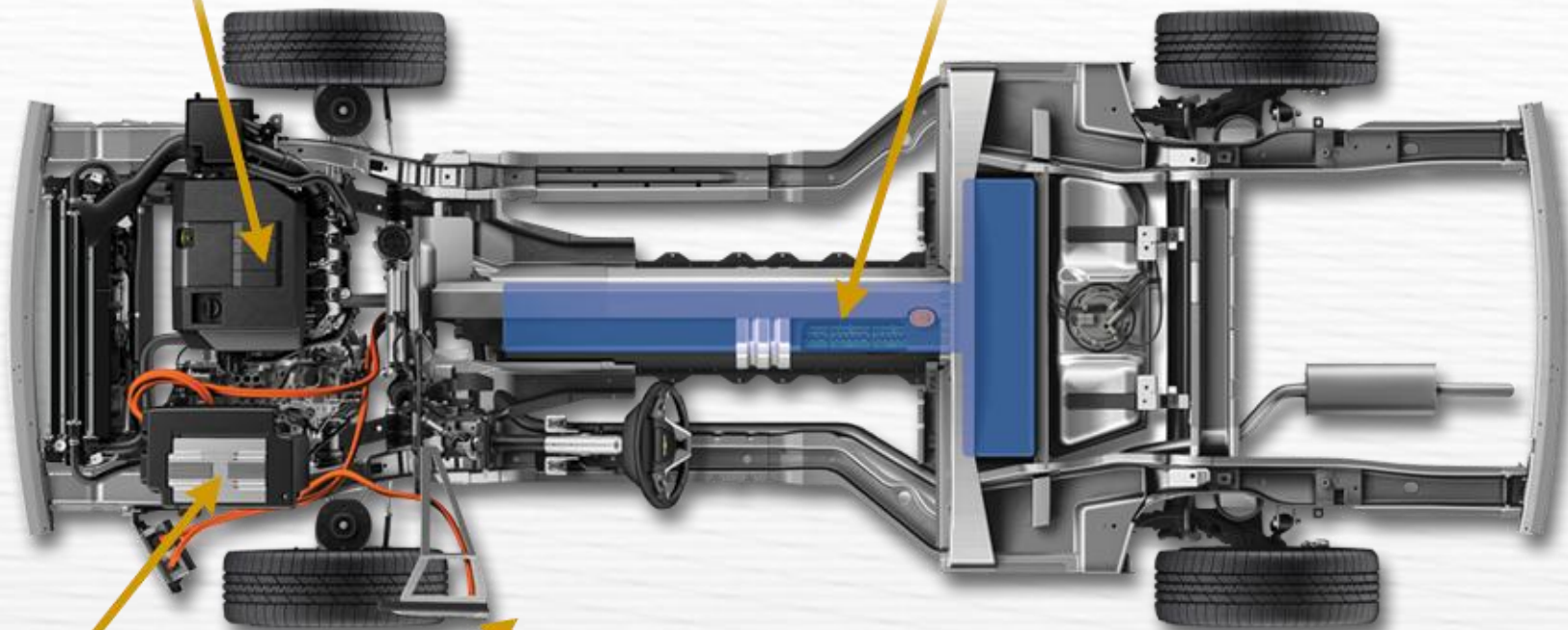
Chassis



VOLT

Engine

Lithium-Ion Battery



Electric Drive Unit

Charge Port

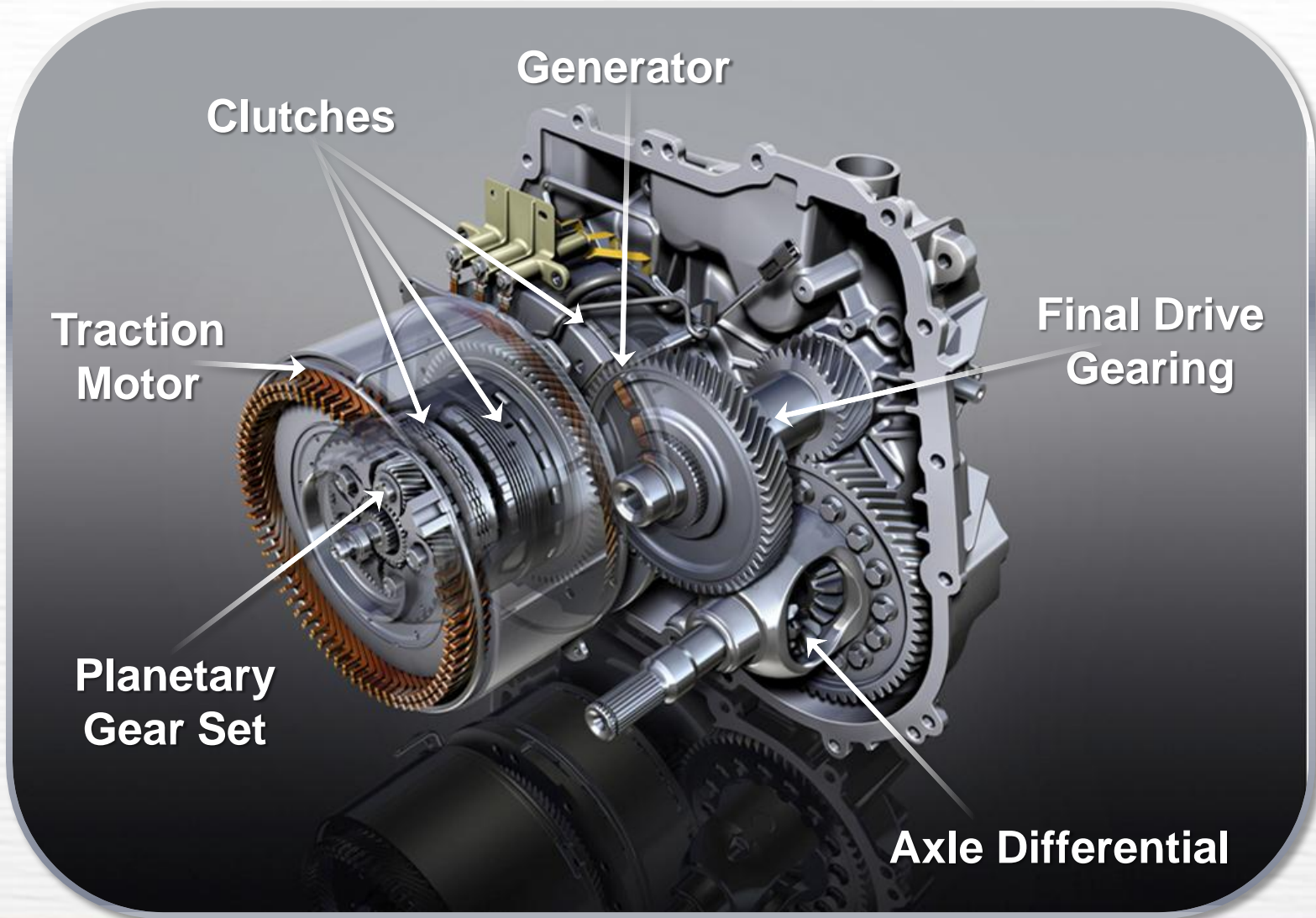


Volt Battery





Voltec Electric Drive





A Connected Customer Experience

MY VOLT

VEHICLES | PRICING & OFFERS | EXPERIENCE CHEVY | OWNERS

OWNER CENTER | OUR VALUED PARTNERS | MYVOLT.COM

Powered by **OnStar**

PLUG IN. TAKE CHARGE.
Welcome to MyVolt.com, the Chevrolet Volt owner site powered by OnStar³. Click the icons below to see how you can plug into your Volt online to access an unprecedented level of real-time data along with remote vehicle commands and critical vehicle diagnostics.

Sign up or **LOG IN**

EFFICIENCY
Get real-time efficiency data on your Chevrolet Volt in three useful views—the last 7 days, the last 30 days and lifetime. Plus, more detailed reports on everything from overall gas consumption to total kW-hr usage are only a click away.

STATUS
Charging Efficiency Mileage Data Lock Door Unlock Remote Start Home & Lock

COMMANDS

LAST 30-DAY COMMAND
Check the status of your last Volt command here, including the exact time it was received.

EXPLORE THE VOLT

Chevrolet Volt Overview
A quick overview of the technology powering the Chevrolet Volt.

More:
First Responders and the Volt | Volt: Around Town and Beyond

ONSTAR MYLINK™
The OnStar MyLink mobile app gives you unparalleled portable access to your Chevrolet Volt. Click below to learn more.

VOLTAGE
get plugged in **VOLTAGE**
Join the VoltAge community and connect with other electric vehicle enthusiasts. Keep up with the latest news, blogs and preproduction testing videos, as well as hear from the experts. You'll also find plenty of photos and a complete listing of Volt events.

JOIN THE COMMUNITY

FACEBOOK

TWITTER

eNAV
When you're not sure where you're going, OnStar Turn-By-Turn Navigation with eNAV can get you there. With eNAV, you can send a destination directly to your Chevrolet Volt from MapQuest.com, without ever having to print anything out.

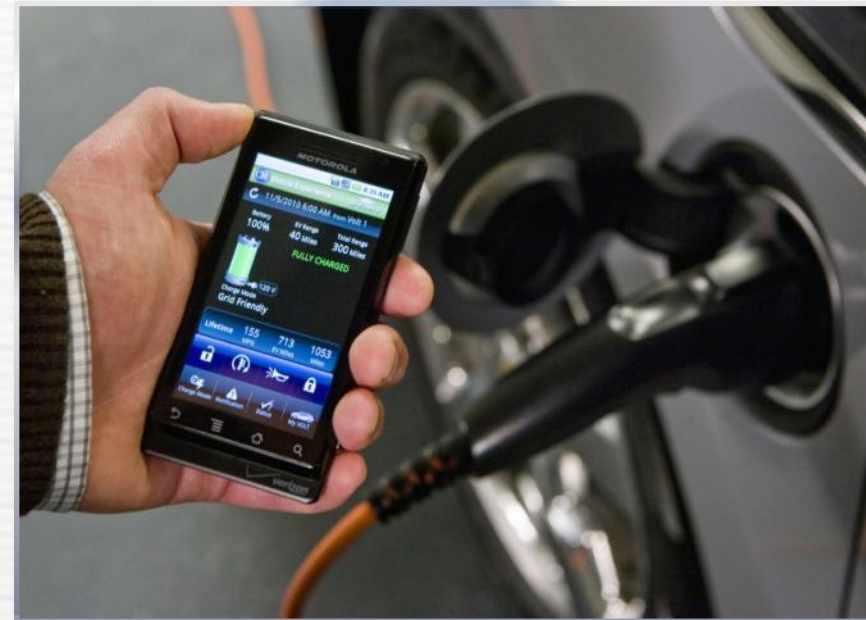
LEARN MORE ABOUT eNAV

Latest News

Chevrolet Volt's 240V Home Charging Unit Priced at \$490
October 06, 2010
DETROIT - Chevrolet has an agreement with a supplier to offer Chevrolet Volt owners one of the most affordable 240V home charging units on the market.

Chevrolet Starts Market Launch of Volt with Customer Advisory Board
September 28, 2010
DETROIT - Chevrolet has hand-picked 15 advanced technology enthusiasts and electric vehicle advocates to be the first consumers to experience the Volt every day under real-world conditions during a three-month vehicle and charging evaluation program starting in late October.

Chevrolet Volt Batteries Could Enable Renewable Energy Solutions
September 21, 2010
TROY, Mich. - General Motors and ABB Group will work together to develop pilot projects for re-using the batteries from the Chevrolet Volt electric vehicle, examining whether the batteries may be a source for renewable energy that could improve the effectiveness of wind and solar





TODAY'S OPPORTUNITY

**Changing the World of
Transportation**



INVESTING IN MICHIGAN'S GREEN ECONOMY

Detroit-Hamtramck	\$336M – Volt Assembly Plant
Flint Engine South	\$202M – Engines
Brownstown Township	\$43M – Battery Assembly Facility
Bay City	\$37M – Cam Shafts and Connecting Rods
Grand Blanc	\$30M – Tooling
Warren	\$27M – Battery Systems Lab
Flint Tool & Die	\$23M – Stamping
Flint Metal	\$2M – Stamping

**\$700
MILLION**

Bay City

Flint

Grand Blanc

Warren

Hamtramck

Brownstown

Township





Electrification Has Changed GM



“Beginning in 2011, General Motors will add 1,000 engineers and researchers...
...over the next two years to significantly expand its vehicle electrification expertise to lead in the development of electric vehicles from hybrids to electric vehicles with extended-range capability, like the 2011 Chevrolet Volt.”

– *Dan Akerson, GM Chairman and CEO*

- New skill sets
- New academic curricula
- New ENTHUSIAM for one of the biggest global growth industries



Today's Jobs

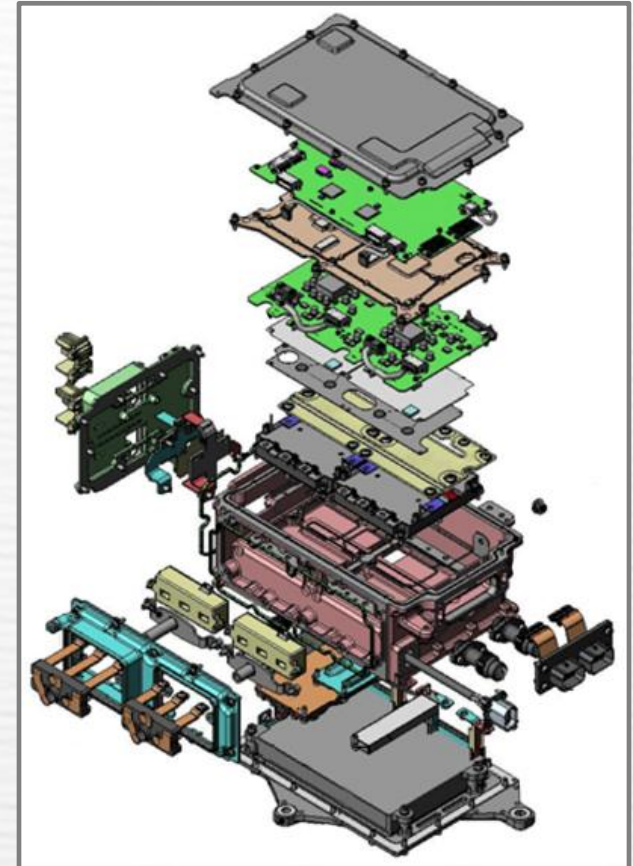
Engineers who understand aerodynamics and efficiency





Today's Jobs

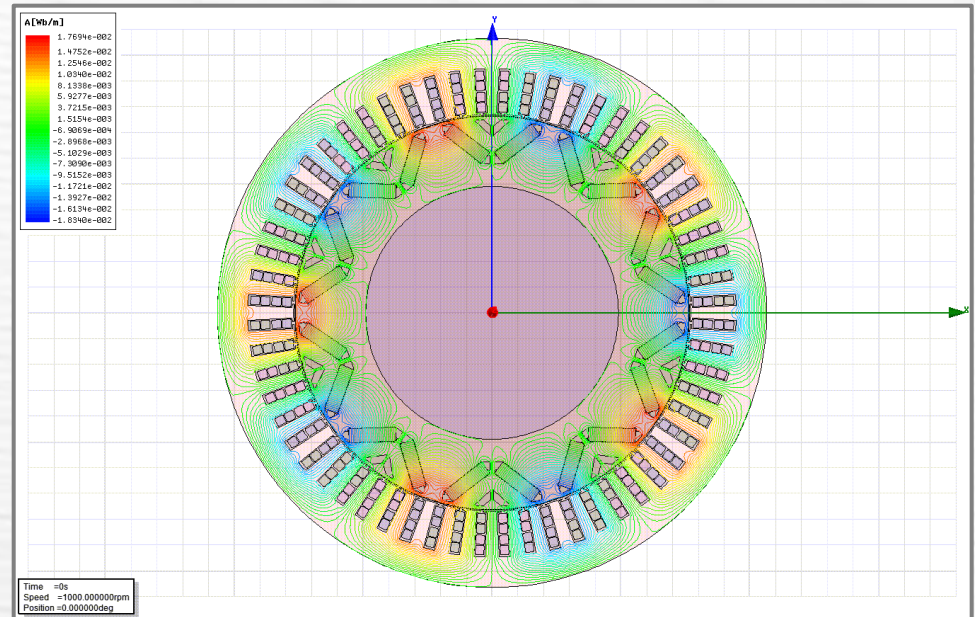
Engineers who understand electronic hardware, software and SYSTEMS





Today's Jobs

Engineers who understand mechanics,
electromagnetics and MECHATRONICS





Today's Jobs

Engineers who understand electro-chemistry and how to apply advanced materials





Today's Jobs

Engineers who can green today's electricity grid, and deliver it to vehicles





Today's Jobs

Materials scientists to develop and create lightweight and environmentally friendly materials





Skills Needed

- Thermal efficiency
- Thermal performance
- Control modeling: Motors, Batteries, Vehicle
- Power electronics
- Electric drive motor development
- Energy modeling
- Battery systems
- Electric drive motors
- Model based systems engineering software and tools
- Math based design engineering
- Electrical distribution systems
- Calibration
- HV safety

The background of the slide is a basketball game in progress. A basketball is suspended in the air near the hoop. In the foreground, a group of players is huddled together, with their hands stacked on top of each other in a team huddle. The scene is set in a gymnasium with a crowd of spectators visible in the background.

TEAMWORK

Will help you obtain skills needed



Michigan Academy for Green Mobility Alliance

Advisory Board Members

Employers

- General Motor
- Ford Motor Company
- Chrysler
- Detroit Diesel
- Eaton Corporation
- Delphi
- Lear Corporation
- Ricardo Inc.
- Compact Power
- Nissan
- Toyota
- Continental Automotive
- ASI
- Denso
- A&D Technology
- A123 Systems

Education/Training Providers

- University of Michigan Dearborn
- University of Michigan Ann Arbor
- Michigan Technological University
- Lawrence Technological University
- Wayne State University
- Kettering University
- University of Detroit Mercy
- Macomb Community College
- Henry Ford Community College
- HEVTC

Government Workforce Development and Non-Profits

- Next Energy
- Alliance Michigan Works!
- Engineering Society of Detroit
- Society of Automotive Engineers (SAE)
- MICHauto
- Michigan Department of Energy, Labor & Economic Development (DELEG Staff)
- Southeast Michigan Community Alliance



Michigan Academy for Green Mobility Alliance

Objectives

- Prepare individuals for emerging technologies in vehicle and vehicle component design, manufacturing, and maintenance
- Accelerated training and re-training targeted due to rapidly change technology
 - Incumbent Engineers
 - Engineering Students
 - Incumbent Technicians
 - Technician Program Students



Q & A

