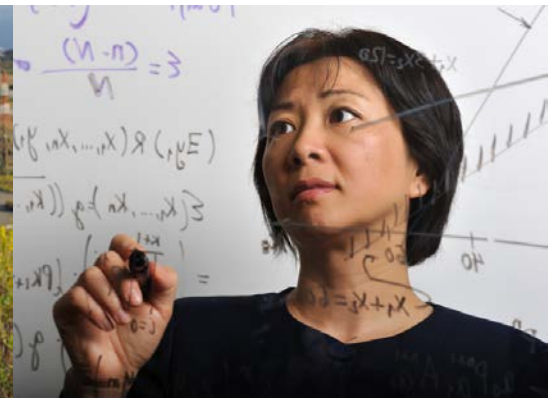


## AACC SEED Webinar:

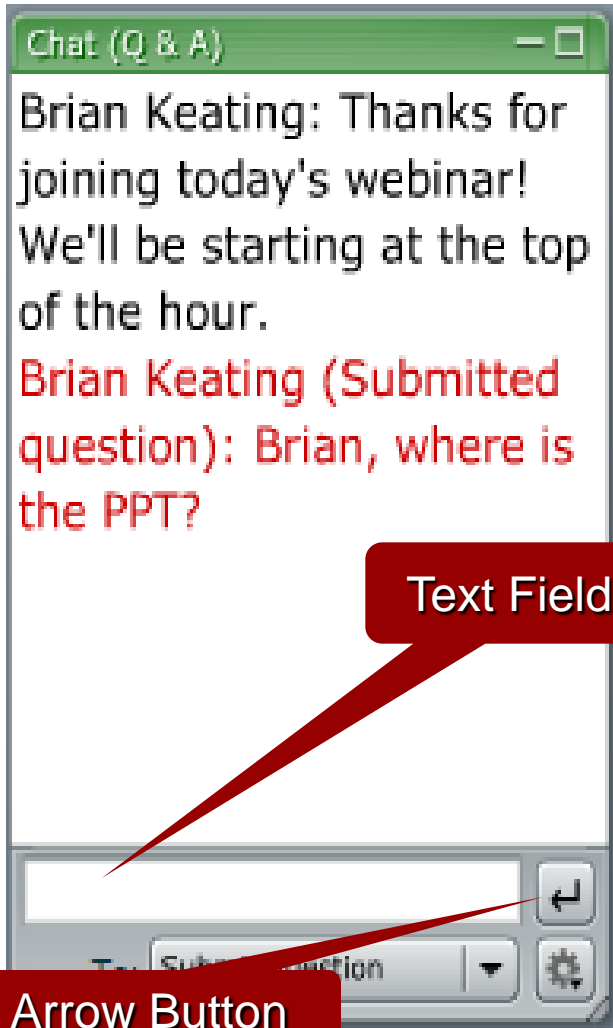
# *Alternative Fuel Vehicles: New Technology, Refined Workforce Programs*

November 2011



ecoAmerica  
start with people

# Submitting Questions



- To submit a question or comment, type the question in the **text field** and click the **arrow button**.
- Please enter the name of the person to whom the question is directed.
- Your name, the text "**Submitted Question**," and your question will appear in red on your screen, indicating successful submission.
- Questions are directly transmitted to presenters—no other participants will see your questions.

# Practice: Attendance

In the chat room, please type:

- your name,
- the name of your organization,
- your location, and
- the number of people attending with you today.





***A coordinated national strategy to support  
community colleges in building the green and  
sustainable economy***

***Supported by the Kresge Foundation***

**Dr. Mark Quarto**, Technical Consultant, Automotive Research & Design, LLC

**Jeff Minter**, Instructor, Madison Area Technical College

**Greg Newhouse**, Associate Dean, San Diego Miramar College

- **Roughly 250+ colleges across U.S. offer auto service technician programs**
- **With policy (e.g. Obama's emission standards, state plug-in EV requirements) driving demand...**
- **And industry investment increasing (billions of dollars in battery and clean vehicle technology)...**
- **Workforce implications already are significant**

# American Association of Community Colleges

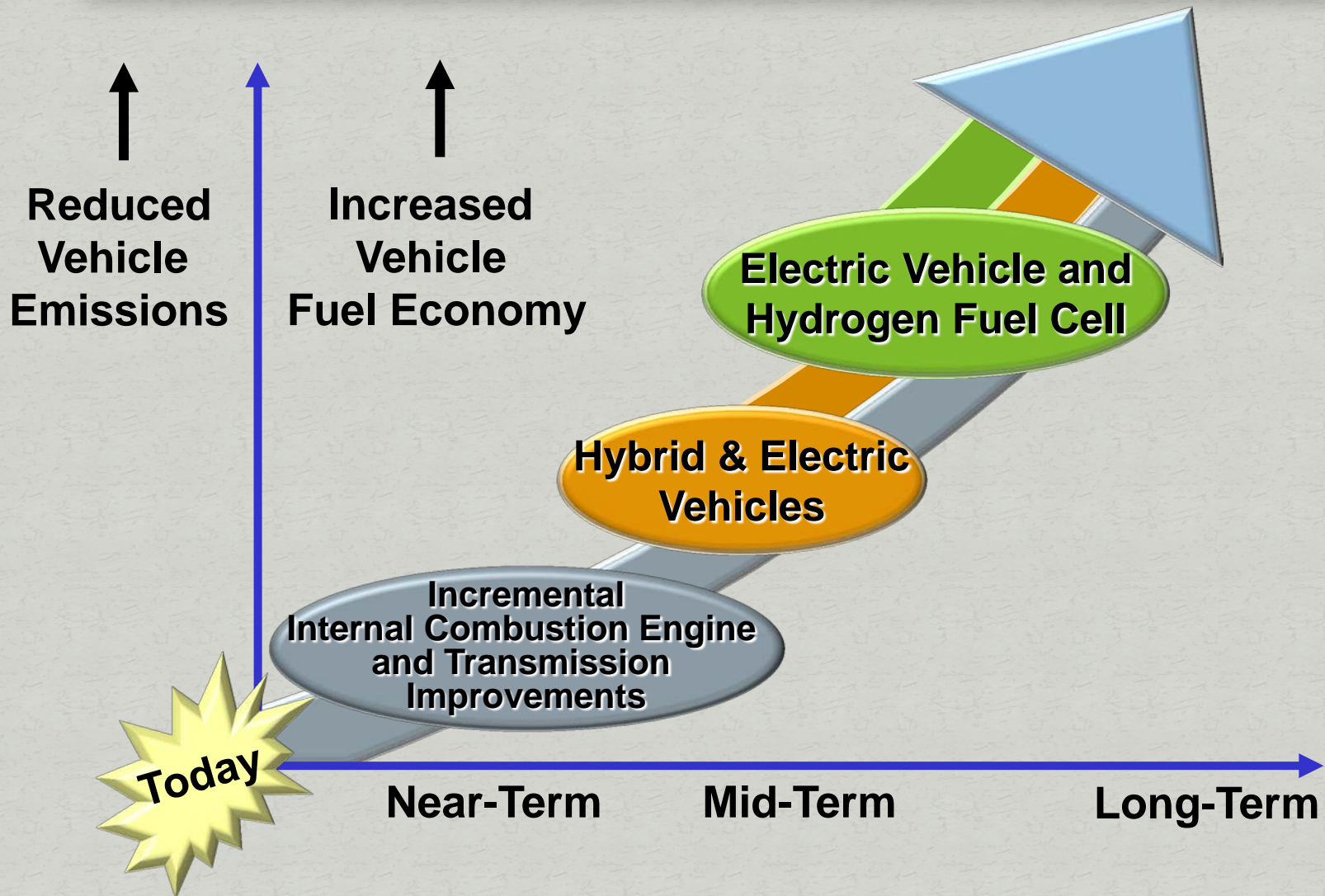
**Presented By:**

**Dr. Mark Quarto**

Automotive Research and Design, LLC

November 30, 2011

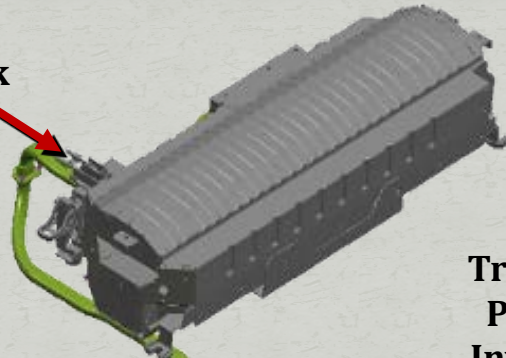
# Automotive Technology Strategy





# Hybrid Electric Vehicle System

288V Nickel Metal  
Hydride Battery Pack  
With Controller



Traction  
Power  
Inverter  
Module

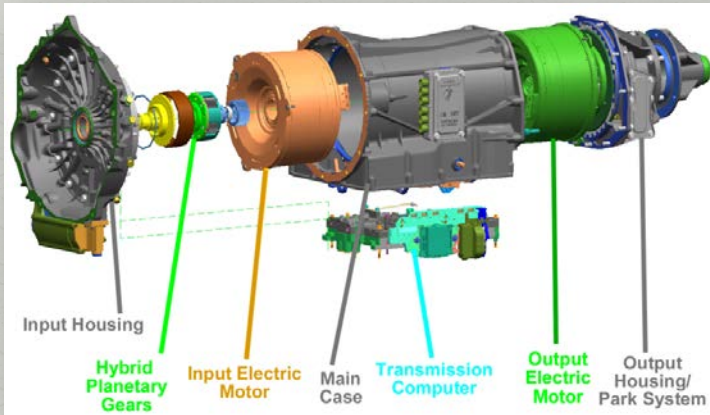
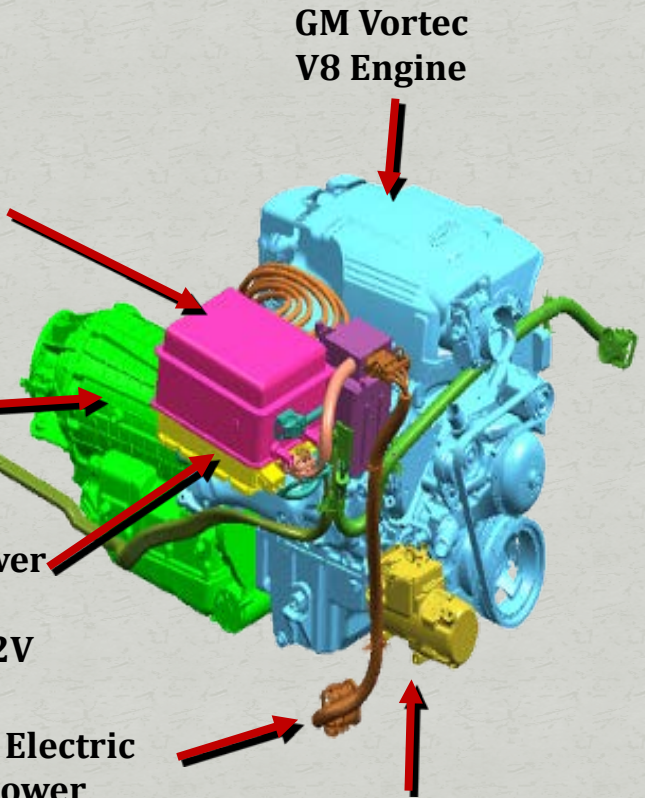
2-Mode Electrically  
Variable Transmission

2 x 60kW Motors

Auxiliary Power  
Module  
288V ↔ 12V

42V Electric  
Power  
Steering

288V Electric  
A/C Compressor



# What Is the Automotive Industry Outlook for Hybrid, Electric, and Fuel Cell (Advanced) Technologies?

- ⇒ The EPA & DOT are requiring automotive manufacturers to acquire a **54.5 mpg** CAFE level by **2025**
- ⇒ Toyota and GM Advanced Technology production portfolios:
  - ✓ Toyota/Lexus – **100%** Hybrid/Electric/Fuel Cell by **2018**
  - ✓ GM – **80%** Hybrid/Electric/Fuel Cell by **2020**
  - ✓ Most other manufacturers following with similar plans

# What Is the Automotive Industry Outlook for Hybrid, Electric, and Fuel Cell (Advanced) Technologies? **continued**

⇒ **Toyota, GM, and Supplier Advanced Technology Investment**

## ✓ **Toyota**

- Major ownership stake in Panasonic Electric Vehicle Energy Battery Systems

## ✓ **General Motors**

- 2009 - Operating Battery Production Plant in Brownstown Twp, MI
- Constructed and Operating an Electric Motor R&D facility in Pontiac, MI and will be producing motors in its Baltimore, MD Facility by 2012

# What Is the Automotive Industry Outlook for Hybrid, Electric, and Fuel Cell (Advanced) Technologies? **continued**

⇒ **Suppliers Have Completed Significant Financial Investment in Advanced Technology Systems:**

- ✓ Delphi, Hitachi, Magna, TKD, Panasonic, Continental, Remy Tyco, Bosch, Aisin, Allison, Eaton, A123, LG Chem, Varta, Bitrode, Lear, GE, Schneider Electric, Ricardo, Zytec, Uniq Mobility, SKF, Siemens, Quantum Technologies, etc.

⇒ **Suppliers have invested hundreds of **billions** of dollars in building Infrastructure for advanced technology powertrain and energy systems**

# What Drives OEM Field Service Philosophies and Methods.....

⇒ Provide only enough technician training information (*not education*), service information, and system diagnostics to execute/support the following:

- ✓ **Regulatory or Marketing Warranty Requirements**
- ✓ **Reduce/Eliminate Warranty Part and Labor Investments**

# Current Conditions & Hurdles in Introducing Hybrid, Electric and Fuel Cell Advanced Technologies to the Retail Market

## ⇒ Legacy Knowledge

- applying traditional vehicle knowledge and experiences to advanced technology systems knowledge

## ⇒ Technology Transfer

- applying/utilizing traditional vehicle systems technologies to advanced technology systems

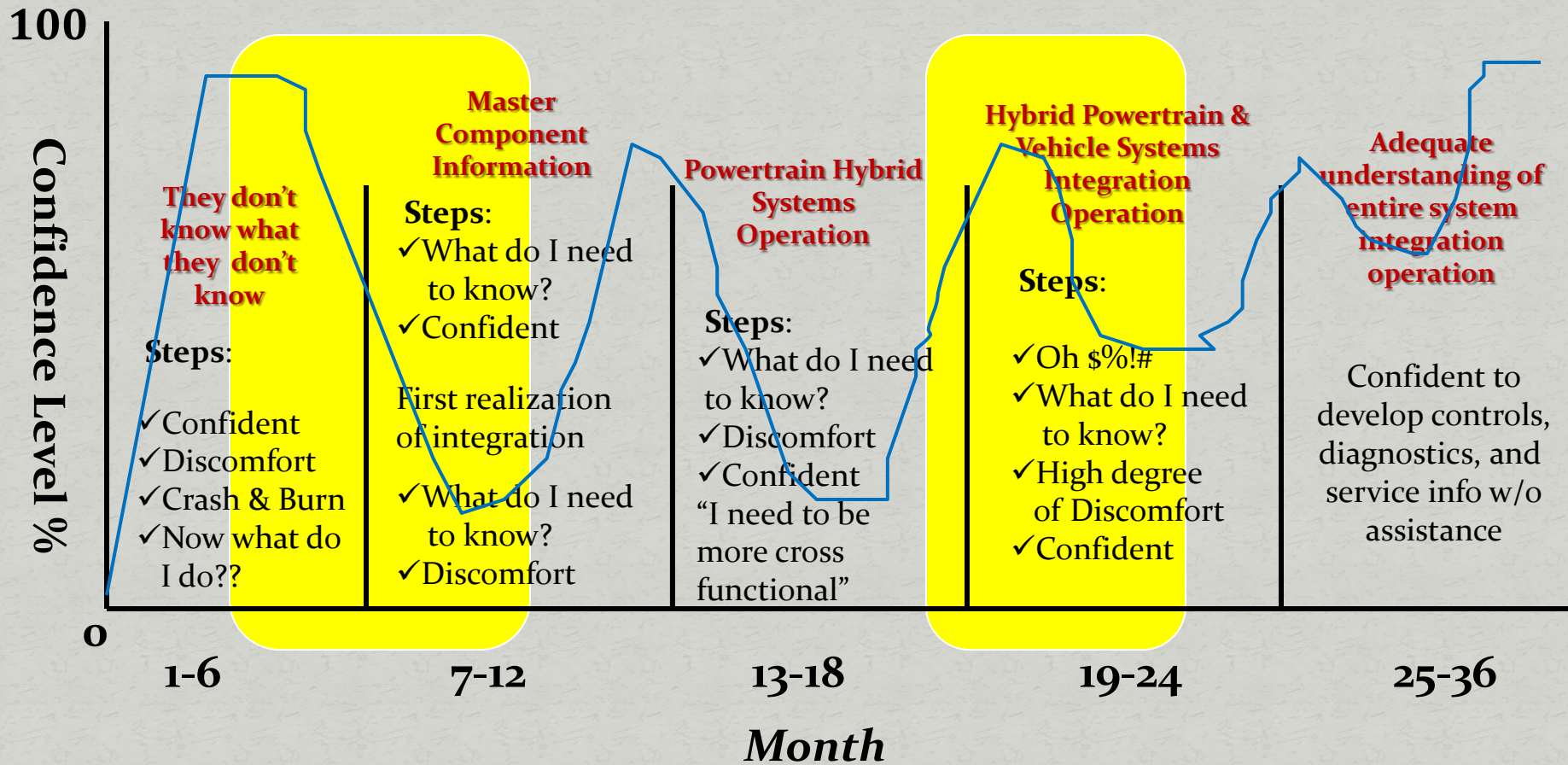
# Learning Time Horizon

*Advanced Technology Learning Time Horizon can be compared to other time honored processes*

## ⇒ **5 Stages of Grief**

- ✓ **Denial**
- ✓ **Anger**
- ✓ **Bargaining**
- ✓ **Depression**
- ✓ **Acceptance**

# Advanced Technology Systems: 5 Steps to Hybrid Knowledge



## 24-36 Month period definition:

*Period to fully learn and understand entirely new systems that are being developed "on the fly" and effectively complete all deliverables without the constant assistance of direct or indirect team members (dependent on technical background and experience)*



# What is the Learning Time Horizon for a Hybrid Electric Vehicle Professional?

⇒ Engineers that transition or are hired to develop a hybrid system....how long does it take for them to learn & become comfortable with the basic technology and system integration?

✓ 12-36 months (pre-existing hybrid knowledge effects time)

⇒ Automotive technicians must also be knowledgeable about the system knowledge and integration

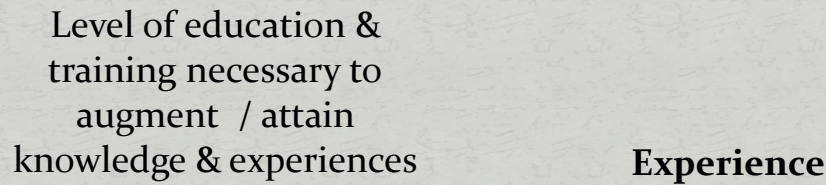
✓ Time horizon will be significant to actually learn technology

✓ Curriculum must permit significant “hands-on” implementation to offset lack of legacy knowledge & technology transfer and accelerate learning rate

# Comparison of Experience vs. The need for technical education & training



**Traditional ICE systems**



**Hybrid and electric vehicle systems**



**Fuel Cell hybrid systems**

# Workforce Development and Curriculum Development Opportunities

*Basic Electric  
Propulsion System  
Building Blocks  
that remain **Constant**  
(irrespective of  
Energy Source)*

AC Induction  
Electric Machine(s)

Permanent Magnet  
Electric Machine(s)

Power Inverter  
&  
Control System

dc-dc  
Converter System

Rechargeable  
Energy Storage  
System (NiMH, Li Ion)

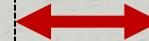
Propulsion  
Control  
System

*Energy Sources  
are **Variable***

Hybrid  
Internal  
Combustion  
Engine

Fuel Cell  
Engine

Hybrid  
Diesel Engine



# Opportunities for Related Technology Categorized as “**Non-Automotive**” Workforce and Education Development

## *Engineering, Engineering Technology, Electronics, Mechanical and Materials Sciences Disciplines*

- √ **Electric Motors & Generators**
- √ **Power Inverters**
- √ **dc-dc Converter (Switching Power Supplies)**
- √ **Power Generation and Control Systems (Wind, Solar, Hydro, Nuclear)**
- √ **Electrochemical (battery and/or fuel cell systems)**
- √ **Energy Storage Systems (battery and chemical/hydrogen)**
- √ **Power Wire and Cable Systems**
- √ **Regenerative/Electric Braking Systems**
- √ **Electric Steering Systems**

# www.go2hev.com

**Automotive Research and Design, LLC**  
*Madison Area Technical College Partner*

**Phone: 586.718.9469**  
**Email: [training@go2hev.com](mailto:training@go2hev.com)**

# Hybrid & Electric Vehicle Training

Jeff Minter, MATC

[JDMinter@matcmadison.edu](mailto:JDMinter@matcmadison.edu)



**MADISON**  
**AREA | TECHNICAL**  
**COLLEGE**

- ⚡ Traits of a high quality Automotive Program
- ⚡ Our implementation of hybrid vehicle training
- ⚡ Challenges we encountered
- ⚡ Our solutions to the challenges

# Traits of a High Quality Program

- ⚡ Instructors with Industry Experience
  - ⚡ Training on the theory behind the system operation
  - ⚡ Hands-on training to support the theory
  - ⚡ “Live” lab work for the students
- ⚡ All of these **MUST** carry over to Hybrid and Electric Vehicle Training!!!



- ⚡ Emergency Responder Training on Hybrid & Electric Vehicles
  - Developed in January of 2008
  - Partnership between Automotive and Fire Science Departments
  - First Class in March of 2008
  - Over 2000 Emergency Responders have been through our class

# Our Implementation Cont.

## ⚡ Technician Training

- Introduction to Hybrid and Electric Vehicle Course
  - *Designed in Spring of 2009*
  - *First Class offered June 2009*
- Expanded offerings Spring of 2011
  - *Possible through a grant from the Economic Development Administration*
  - *Focused on retraining experienced technicians*
- Adding a hybrid specific class to our Automotive programs  
Fall of 2012

# Challenges to Implementation

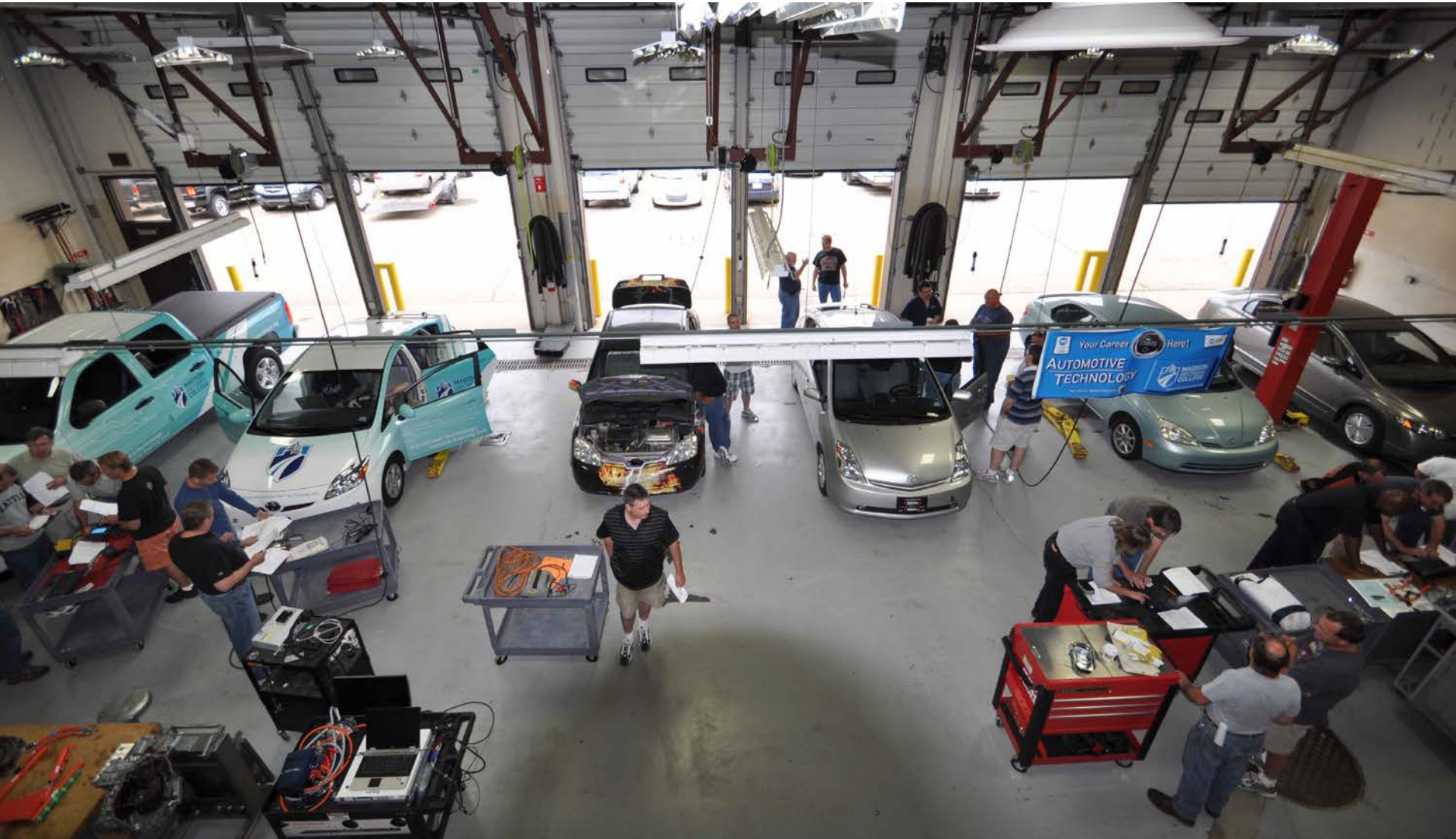
- ⚡ Depth and accuracy of training available for instructors
- ⚡ Availability of hybrid vehicles and components for training purposes
- ⚡ Need for additional test equipment

## ⚡ Instructor Training

- Researched and Attended Numerous Hybrid Vehicle Training Classes
  - *Hands-on Training for the Instructors is Critical*
- Partnered with Automotive Research and Design
  - *Became a Host Location for Train-the-Trainer Events*
- Continual Update Training
  - *Requires a Significant Time and Financial Investment*



# 2011 Train-the-Trainer Event



## ⚡ Hybrid Vehicles/Components

- Purchased our First Hybrid in 2008
  - *Wrecked Repairable Vehicle*
- Received a few vehicles from private donations
  - *Vehicles had significant problems*
- Purchased additional new and used vehicles
- Components were primarily sourced from salvage yards

# Our Solutions Cont...

## ⚡ Need for additional test equipment

- Initial equipment was purchased using capital equipment and departmental funds
  - *Educational discounts are available from most suppliers*
- Additional equipment was purchased using grant funds as available



# Summary of Needs for Successful Implementation

- ⚡ Support from the Administration
- ⚡ Instructor “buy-in”
- ⚡ Instructor training
- ⚡ Additional equipment and vehicles
- ⚡ Financial and time investment
- ⚡ Collaboration between various departments





**ECONOMIC &  
WORKFORCE  
DEVELOPMENT**

*through the*

CALIFORNIA  
COMMUNITY  
COLLEGES

# Alternative Fuel Vehicles: New Technology, Refined Workforce Programs

Greg Newhouse

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ATTE Program Director  
San Diego Miramar College



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# To Address Smog and Greenhouse Gases Transportation Fuels and Vehicles Must Change



Unmanned Aircraft to Study Southern California Smog and its Consequences



Donner Summit air station detects Chinese pollution



# California's Community College System

**A key component is its Economic and Workforce Development Program**

**Within that Program is the Advanced Transportation Technology and Energy Initiative**

**Historically, the ATTE's 7 Community College Centers work with industry, education, labor, and government partners to:**

**develop new technology training programs;**

**integrate advanced technologies into existing curriculum;**

**foster the use of alternative fuels and new energy technologies through education outreach regionally and statewide.**

## ATTE Technical Training Approach

The ATTE approach is a dual one and works to integrate campus and workforce training.

The campus program approach has its focus on partnerships with major manufacturers.

The workforce approach focuses on working with organizations that have a substantial interest in a trained workforce as well as the companies that need such workforce training.

Two examples of with would be our work with the South Coast Air Quality Management District and the Southern California Regional Transit Training Consortium.

# ATTE Technical Training Approach: South Coast Air Quality Management District

The District is responsible for limiting pollution in the greater Los Angeles area. Transportation-related pollutants are a primary problem.

Historically new regulations, incentives or policies would require new or advanced transportation technology to be acquired and used by fleets.

However the workforce would not have the skills to maintain such vehicles, therefore the programs would be limited in their success.

In addition, new employees were not receiving education on the most recent technologies.

# ATTE Technical Training Approach: South Coast Air Quality Management District

The District and the ATTE program partnered to develop new curricula for electric and natural gas vehicle technology.

The curricula was to be developed by community college faculty and reviewed by industry experts to ensure a high quality product.

The curricula was to be developed in a manner that it could be integrated into community college technical training programs and be delivered in a workforce training manner.

Upon completion the ATTE faculty would deliver a train the trainer program for community college faculty to provide them with appropriate faculty professional development.

# ATTE Technical Training Approach: Southern California Regional Transit Training Consortium

The Consortium is comprised of approximately 11 Transit agencies and 10 Community Colleges throughout Southern California.

Community college faculty and senior level technicians work together to develop technical training programs for advanced vehicle technology – here there is a high level of electrical technical training as well as alternative fuels.

The curricula is developed in a manner that it can be delivered in a workforce training manner.

Upon completion the faculty would deliver a train the trainer program for community college faculty to provide them with the skills needed to become an effective workforce trainer.

# ATTE Technical Training Approach

In each program we stress the need for community college faculty to be the providers of workforce training.

This has a number of key benefits:

- college faculty receive technical education that is useful not only in the area of workforce training, but also within their campus program.
- college faculty have the opportunity to train those in the workforce and in turn bring that learning to students within the program
- colleges typically have new industry partners for their programs.



**Even in Transportation are “Green Jobs” - Hype or Reality...**

**Not everything requires new or different skills – but in some cases the new skills are essential...working on an electric vehicle or hybrid system.**

**Determining training needs – for example workforce training for tow truck drivers does not translate to new community college curricula.**

**If I get training now is there a job? Will there be a job?  
Automotive dealerships versus independent garages.**

**Even if there is a demand, can a college afford the program?**



**ECONOMIC &  
WORKFORCE  
DEVELOPMENT**

*through the*

C A L I F O R N I A  
C O M M U N I T Y  
C O L L E G E S

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**ATTE Program Director**  
**San Diego Miramar College**



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# SEED Announcement: New Transportation Resources at [www.theseedcenter.org](http://www.theseedcenter.org)

Green Sector	Resource Center
	▶ Solar
	▶ Wind
	▶ Green Building
	▶ Energy Efficiency
	▶ Sust. Ag., Food & Land
Topic	<b>NEW</b> ▶ Transportation & Fuels
	<b>NEW</b> ▶ Curricular Materials
	Certifications & Industry Credentials
	Employment Industry Projections
	Innovative Practices & Partnerships
	Skill sets, Competencies & Career Pathways
	Professional Development Resources
	Policy & Funding Sources

**Advanced Biofuels USA - Biofuel Basics**

This section of Advanced Biofuels USA is specifically designed for those who want to learn and teach the biofuels and advanced biofuels. Materials in this section will be useful for educators teaching introductory renewable liquid transportation fuels. Also included in **this section** are slide presentations, narratives, and links to related resources.

**DOE - EERE: Alternative Fuels and Advanced Vehicles Data, Analysis & Trends**

View this **US Department of Energy, Energy Efficiency and Renewable Energy (EERE) resource** for web information and analyses that educators can use to explain trends about alternative fuels, advanced vehicles, and related resources.

# Questions?

# New SEED Resources and Upcoming Opportunities

- **Workforce Development Institute** *FOR FREE (Jan 25 2011): Attend SEED peer-to-peer full day workshop. Limited number of free tickets. Email: [enekrasova@aacc.nche.edu](mailto:enekrasova@aacc.nche.edu)*

- **Next webinar:**

**Free AACC SEED Webinar**  
December 8, 2011 2PM EST

**Community Colleges Leading Rural-Based Green Economy Initiatives**

Register Now

AACC SEED initiative ATEEC EASTERN IOWA COMMUNITY COLLEGES  
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