AACC SEED Webinar:

Alternative Fuel Vehicles: New Technology, Refined Workforce Programs

November 2011
Submitting Questions

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

Supported by the Kresge Foundation
Speakers

Dr. Mark Quarto, Technical Consultant, Automotive Research & Design, LLC
Jeff Minter, Instructor, Madison Area Technical College
Greg Newhouse, Associate Dean, San Diego Miramar College
Why This Topic

• 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

Increased Vehicle Fuel Economy

Reduced Vehicle Emissions

Near-Term

Incremental Internal Combustion Engine and Transmission Improvements

Mid-Term

Hybrid & Electric Vehicles

Long-Term

Electric Vehicle and Hydrogen Fuel Cell
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
- GM Vortec V8 Engine
- 288V Electric A/C Compressor

Technology and Training Since 1987

www.Go2hEV.com It All Starts Here.
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
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, Zytek, 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.
⇒ 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

Month

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

Level of education & training necessary to augment / attain knowledge & experiences

Hybrid and electric vehicle systems

Level of education & training necessary to augment / attain knowledge & experiences

Fuel Cell hybrid systems

Level of education & training necessary to augment / attain knowledge & experiences
Workforce Development and Curriculum Development Opportunities

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

Energy Sources are Variable

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

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
Automotive Research and Design, LLC

Madison Area Technical College Partner

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Hybrid & Electric Vehicle Training

Jeff Minter, MATC

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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!!!
Our Implementation

✓ 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
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
Our Solutions

✔ 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
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
Alternative Fuel Vehicles: New Technology, Refined Workforce Programs

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ATTE Program Director
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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.
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.
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.
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.
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.
Technical Training Issues

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?
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ATTE Program Director
San Diego Miramar College
SEED Announcement: New Transportation Resources at www.theseedcenter.org
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:**

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