

ELECTRIC VEHICLE SERVICE PERSONNEL TRAINING PROGRAM

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Overview

Timeline

- **Start: December 22, 2009**
- **End: December 21, 2012**
- **Percent complete: < 40%**

Budget

- **Total project funding**
 - **DOE share: \$500,001**
 - **Contractor share: \$133,640**
- **CY09 Funding: \$ 0**
- **CY 10 Funding: \$ 184,000**
- **CY 11 Funding: \$149,000**
- **CY 12 Funding: \$167,001**

Barriers

- **The investment required to train technicians to repair/maintain technologies is a MARKET BARRIER**
- **(Consumers) tend to be reluctant to purchase vehicles with new technologies that could be difficult to maintain (3.5.2.7)**
- **Early users need to have technical expertise and assistance (readily available (3.5.2.8))**

Partners

- **Project lead**
 - **City College of San Francisco**
- **Interactions/ collaborations**
 - **Chabot College**
 - **Pat's Garage**
 - **Perfect Sky**
 - **San Francisco Municipal Shops**
 - **Other colleges as study progresses**

Objectives and Relevance (1)

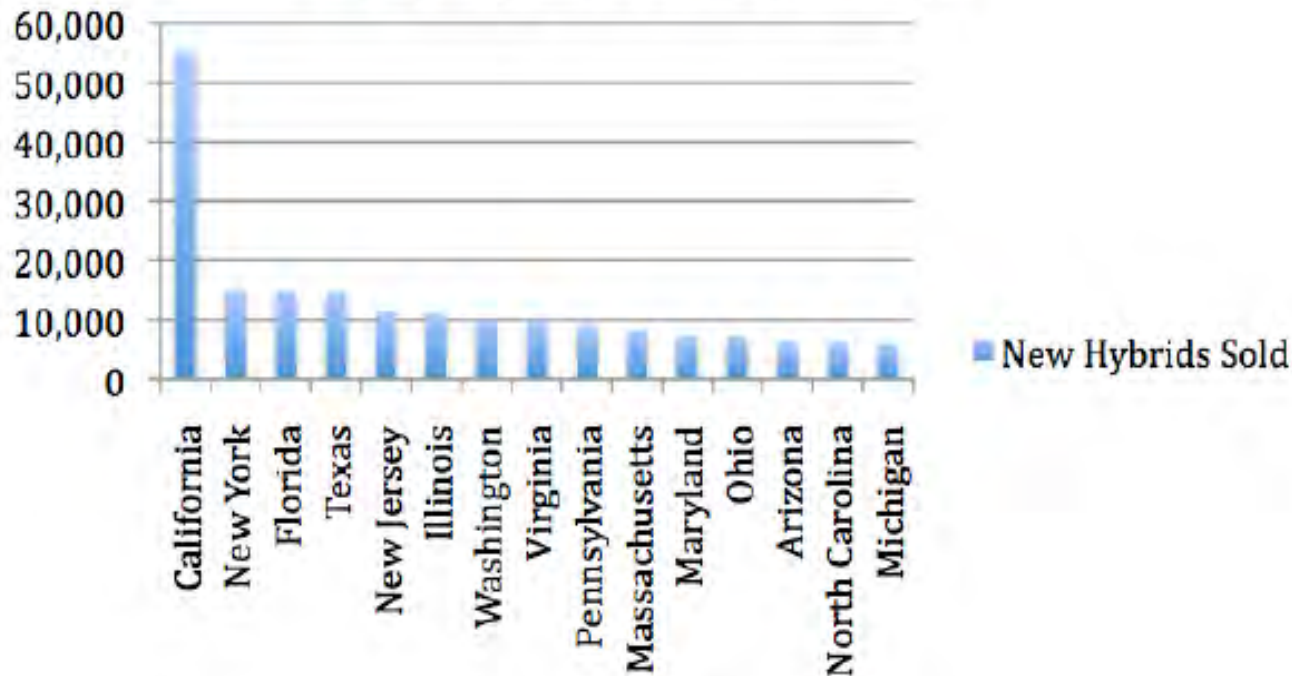
- ▶ **Provide expertise and assistance to consumers and fleet users of hybrids, PHEVs, EVs and FCVs through a trained maintenance workforce**
- ▶ **Educate the new generation of auto technicians to become familiar with “more electric” vehicles**
- ▶ **This expertise**
 - **simplifies maintenance accessibility**
 - **lowers cost of maintenance**
 - **assures vehicles operate with optimal environmental performance**
 - **provides beneficial workforce impacts**

Objectives and Relevance (2)

- ▶ **Develop Hybrid, PHEV, EV and FCV curriculum and identify training aids for automotive technician programs, independent technicians, and municipal fleet operators.**
- ▶ **Disseminate curriculum locally to identify problems and test portability.**
- ▶ **Disseminate to sample of colleges and employers in Southern California and neighboring states to identify training support and infrastructure needs**
- ▶ **Adapt curriculum for high school/ vocational schools.**

Why California? We Buy Hybrids.

Figure 2: New Hybrid Sales by State, 2009



HybridCars.com, "December 2009 Dashboard: Year-End Tally," in partnership with R.L. Polk & Co., January 20, 2010; www.hybridcars.com/hybrid-sales-dashboard/december-2009-dashboard.html.

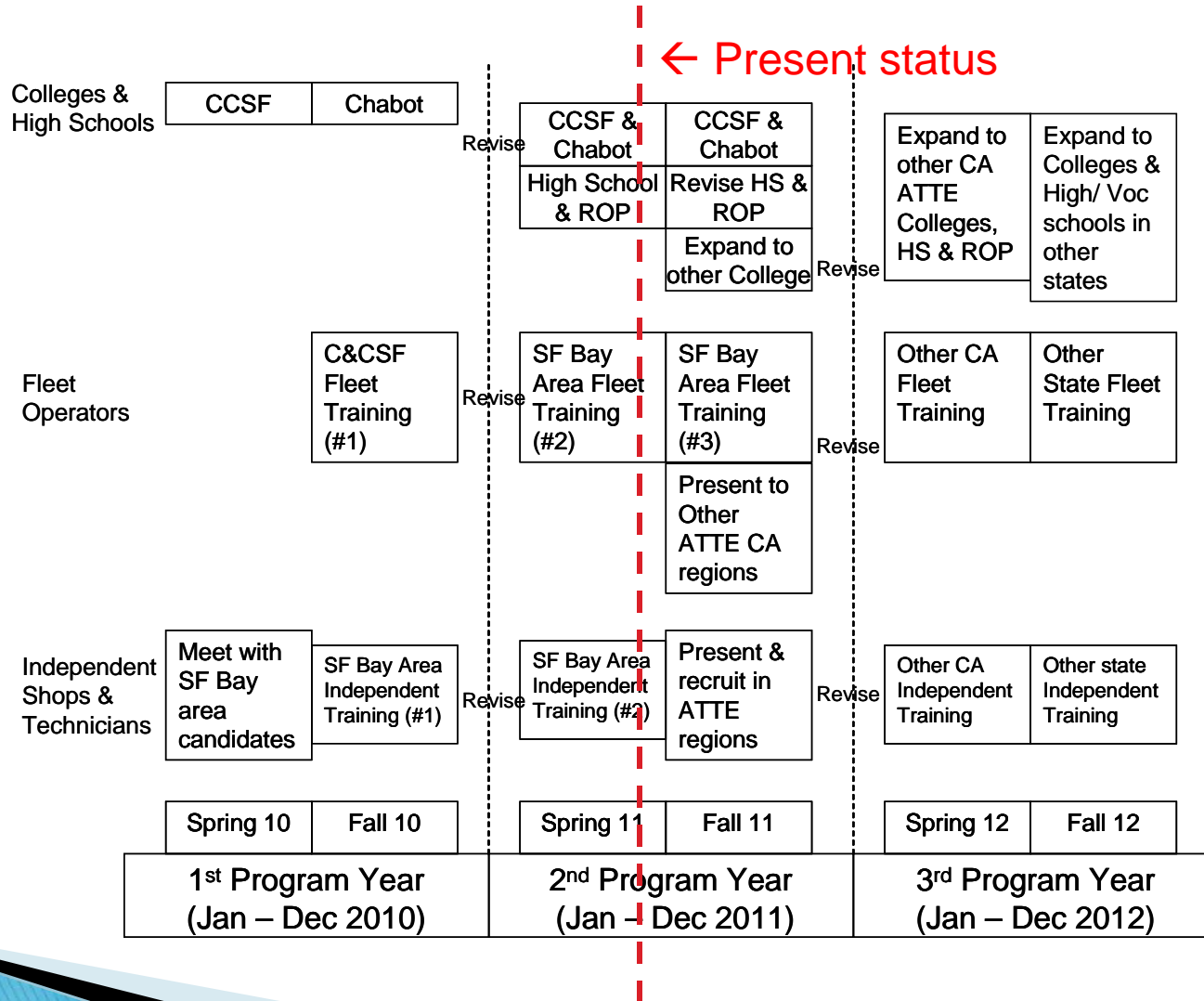
Milestones

Month/Year	Milestone
December 2010	Milestone: <ul style="list-style-type: none">- goal of 2 to 3 classes of college instruction with evolving curriculum at host colleges CCSF and Chabot (4 taught)- 3 classes of fleet operator training provided- 3 classes of training for independent technicians provided
December 2011	Milestone: <ul style="list-style-type: none">- Expand training to High School and/or ROPs- Expand training to 3rd SF Bay Area college, 2nd fleet operator and technicians
December 2012	Milestone: <ul style="list-style-type: none">- Expand training to a Southern California college, secondary school, fleet operator and independent technician group- Expand training to a college, secondary school, fleet operator and independent technician group in Oregon or Washington state.

Approach/ Strategy (1)

- ▶ **The San Francisco Bay area has the second largest fleet of hybrids in the United States. It also has the second greatest density (hybrids per 100,000 population).**
- ▶ **Support and consumer problems are arising here first**
- ▶ **Our approach is to develop a series of related training courses, and then improve course content, equipment requirements and instructor skills. Our three target audiences include:**
 - **Students**
 - **Fleet maintenance**
 - **Independent technicians**
- ▶ **Expanding the program geographically identifies problems with introducing and expanding this type of training.**
- ▶ **Our goal is to expand support for these vehicles thereby lowering the cost of ownership, improving aftermarket support and ensuring vehicles operate in the manner they are designed.**

Approach/ Strategy (2)



Collaboration

City & County of San Francisco Maintenance Shops

- Municipal Fleet support with over 400 Hybrids and EVs to maintain.
- Many now out of warranty.



- Supporting CA Community Colleges
- NATEF Certified auto technician programs to host expansions.

Perfect~Sky

- Hybrid Maintenance Training experts
- College and Industry Experience



- Hymotion conversion center
- Extensive PHEV experience

Technical Accomplishments & Progress (1)

- ▶ **First Hybrid Maintenance and Repair course piloted at CCSF during 09-10 academic year.**
 - **Damaged Prius obtained by donation from insurance company**
 - **Saturday class**
 - **30 students**
 - **Auto electrical course pre-requisite**
 - **Numerous industry (non-traditional student) attendees**
- ▶ **Curriculum-design meeting conducted with Chabot College faculty for both their student program and independent technician program curriculum.**
- ▶ **Both CCSF and Chabot colleges**

Technical Accomplishments & Progress (2)

About the Course

The Hybrid Vehicle Operation and Servicing course provides students with fundamental skills and knowledge to perform service and repair on today's hybrid vehicles. This course will provide students with the knowledge, utilizing the latest technology, equipment, and successful entry-level skills to work on hybrid vehicles. Classes are taught in both theory and practical application, with more than half of the course time spent in the laboratory.



Course Content

Alternative Fuels and the Environment
 Hybrid Vehicles
 Safety Procedures
 Diagnostic Technologies
 and Con-


ATEC9901
Hybrid Vehicle
Operation and Servicing



Student Outcomes

- contrast how a hybrid vehicle operates when compared to conventional vehicles;
- identify and relate system integration of hybrid vehicle components and systems;
- demonstrate proper safety procedures when working on and around hybrid vehicles;
- identify, discuss, and measure how hybrid high voltage systems operate; compare and contrast AC and DC electrical systems;
- explain in detail how hybrid electric systems operate, including electrical generators and controls;
- analyze how regenerative braking works;
- explain how hybrid transmission operate;
- explain how hybrid cooling and air conditioning systems operate;
- explain normal, and special, and maintenance;
- explain how to use scan tool data, read and stored diagnostic trouble codes for hybrid vehicle systems;
- explain how to use service information to perform step-by-step diagnosis.

Technical Accomplishments & Progress (3)

- ▶ **The second course at CCSF was taught during 10-11 academic year; two courses at Chabot have been provided during this same year.**
 - ▶ **Both programs added an “Alternative Fuel” component to Hybrid and EV content due to student interest**
 - ▶ **We are seeking to move colleges from older technology vehicles and lead-acid battery conversions to more contemporary systems.**
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Technical Accomplishments & Progress (4)



**1970s Technology: City Car
(College of Marin)**

**1990s Technology: Kewet
(City College of San Francisco)**



Technical Accomplishments & Progress (5)



**Hybrid Class and Components:
City College of San Francisco**



Technical Accomplishments & Progress

(6)

- ▶ **Curriculum-design meetings held with City & County of SF maintenance shop (site for municipal and private fleet training).**
- ▶ **Three training sessions conducted with municipal fleet C&CSF journeyman technicians; safety focus (summer 2010)**
- ▶ **Three evening events held for technicians (June, November and December 2010)**
- ▶ **First year Milestones met; on track for meeting or exceeding second year Milestones. Support will be provided to a Portland OR college this year– one year ahead of schedule.**

Progress and What We're Learned (1)

- ▶ **Equipment– the first barrier**
 - colleges rarely have funds to obtain a hybrid vehicle; donations are essential (vehicles and parts)
 - a single vehicle is not adequate to keep a class of 20 – 25 students fully engaged
 - need diagnostic software (eg, TechStream ®)
- ▶ **Training Aids**
 - Shop vehicles have problems keeping batteries charged
 - considered, but haven't tried other EVs (bikes and scooters)
- ▶ **Faculty Skills**
 - Need to support faculty training
 - Outside speakers / experts help immensely
- ▶ **Secondary Schools (High Schools and ROPs)**
 - time constrained
 - a new course doesn't fit their schedules
 - periodic classes to supplement existing instruction preferred

Progress and What We're Learned (2)

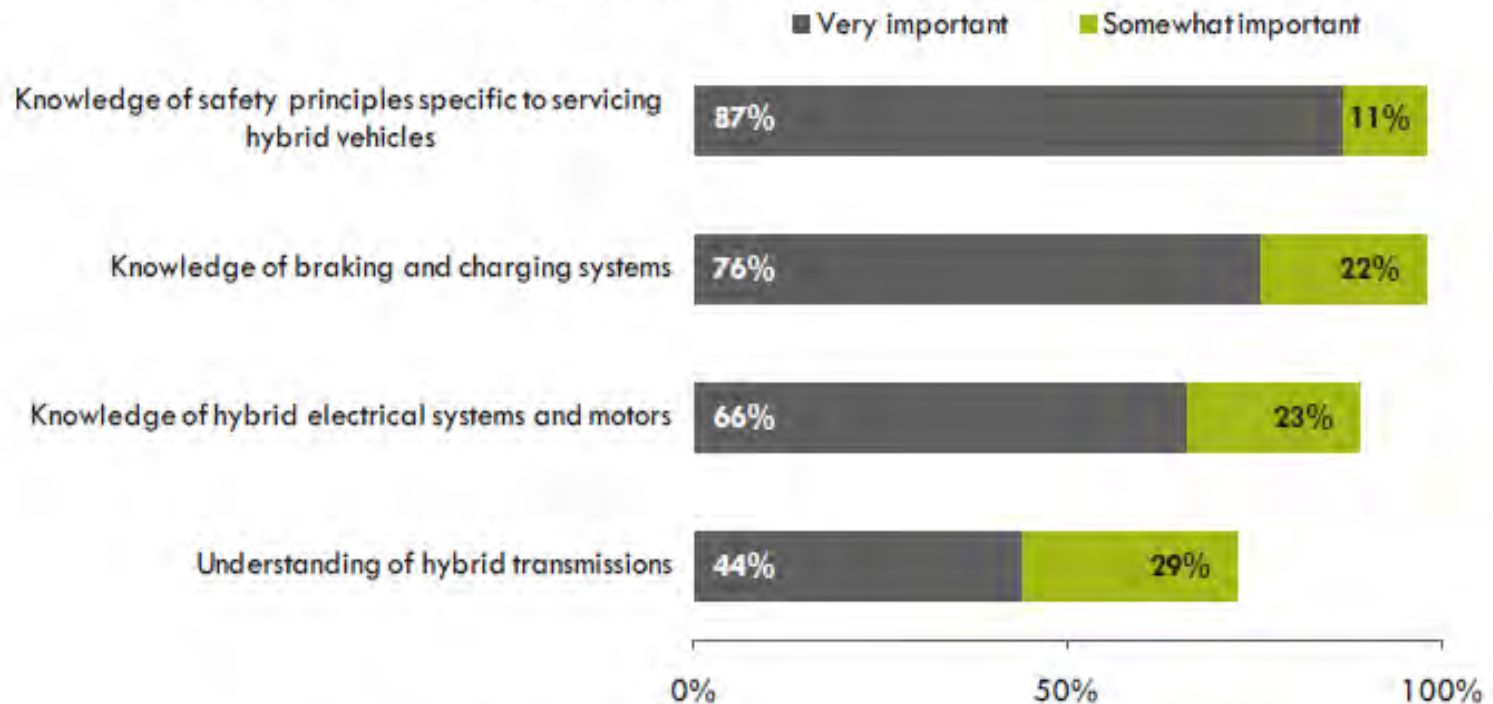
- ▶ From a 3-county survey of auto maintenance repair facilities in the East Bay to assess job prospects and skill requirements:
 - Growing demand for hybrid-skilled technicians
 - Safety is the starting point, followed by how systems operate
 - Individual community college courses are desired more than a full certificate program

Figure 5: Employer Projections for Servicing Hybrid Cars (Next 12 Months)



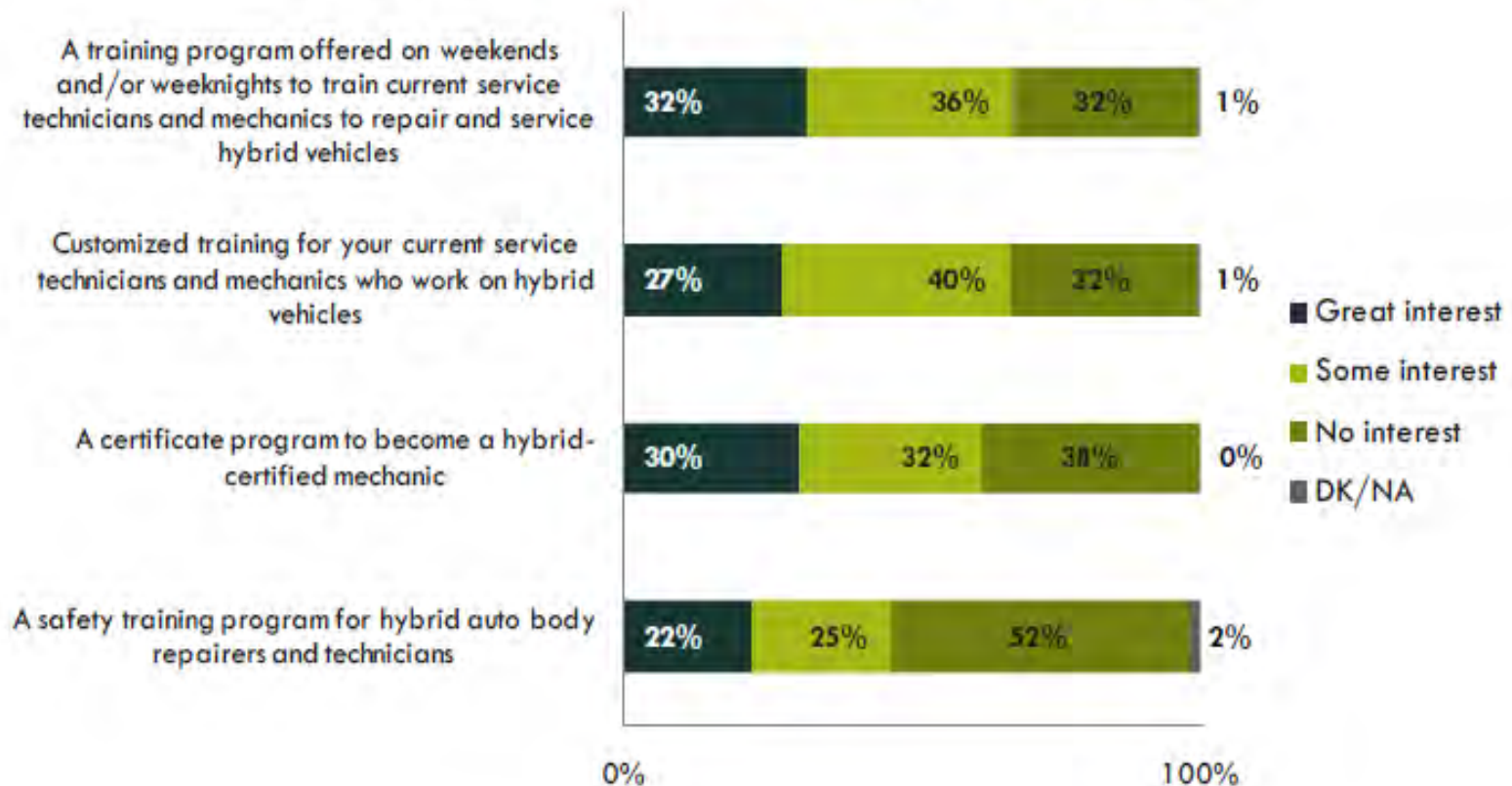
Progress and What We're Learned (3)

Figure 10: Critical Skill Sets for Auto Mechanics and Service Technicians



Progress and What We're Learned (4)

Figure 11: Employer Interest in Community College Programs



Hybrid Vehicles: Maintenance and Repair Occupations, August 2010,
John Carrese, Director, San Francisco Bay Area Center of Excellence, CCSF
funded by Los Medanos and Contra Costa Community Colleges
http://www.coecc.net/Environmental_Scans/hybrid_bay_scan_10.pdf

Proposed Future Work

▶ For the remainder of 2011

- Complete current year courses at CCSF and Chabot. Add a Summer course at CCSF (if campus remains open).
- During the summer, provide a first course to working maintenance personnel at a second municipal Shop (with participation by local taxi and other fleet representatives)
- Update curriculum as new vehicle data becomes available
- Finalize candidate locations for 2011-12 expansion of training. Do to high interest by other colleges in partnering with us, we will asses if we can expand to other sites within the existing budget.

▶ For 2012

- Expand the geographic scope and refine curriculum per Milestones

Summary

- ▶ **The San Francisco Bay Area is one of the leading markets for hybrid and electric vehicles in the United States. Consumer problems need to be addressed here early to assure favorable transition to these new technologies.**
- ▶ **Beyond the factory-trained OEM service network, skills are lacking as regard hybrid and EV servicing. Yet older models are out-of-warranty and are moving out of dealer service networks. (This applies to both individual and fleet operators.)**
- ▶ **Hybrid and EV Maintenance and Repair courses are strongly desired by technicians, shop owners and colleges around the state.**
- ▶ **This project is developing and disseminating skills to students and incumbent technicians so workforce can respond to demonstrated market needs. We are achieving our milestones on schedule.**