Breakfast Slide Show
Electric cars are nothing new. This electric car was made in Detroit in 1914.
A consortium of the leading technical universities and colleges in Indiana will establish a program to educate and train the workforce needed to design, manufacture and maintain advanced electric vehicles and the associated infrastructure.

The Indiana Advanced Electric Vehicle Training and Education Consortium (I-AEVtec) will develop and offer Certificates as well as Associate degrees for training vehicle technicians, BS and MS degree programs for design and manufacturing engineers in the electric vehicle industry and a Certificate program in electric vehicle safety for emergency responders.

Funded by US Dept of Energy at $6.2M
Purdue Electric Vehicle

• Electric Vehicle Initiative - Consortium of Indiana technical universities/colleges
  (Indiana Advanced Electric Vehicle Training & Education Consortium I-AEVtec)

Workforce Development
• Work With Industry to Develop Degree/Certificate Programs in Technology & Engineering
  (Design, Manufacture, Maintenance, Emergency Response - electric vehicles and Smart Grid (BS/MS)

Education
• Produce Web Courses on Batteries, Fuel Cells, Electric Motors/Controls, Hybrid Engines, Smart Grid Technology & Promote Consumer Acceptance
• Establish the SmartEnergyHub - EV, PHEV, FCV and SMART GRID Technologies
• Develop Educational Modules for Secondary Schools

Economic Development
• Develop Active Industry & Government Partnerships (electric vehicles/Smart Grid)
• Manage Power Peaks/Spikes & Work on Innovative Methods to Keep Price of Electric Power Attractive to Industry
• Develop an Electric Vehicle Grand Prix go-kart race to inspire students to commit to a career in electric vehicle technology

www.evgrandprix.org
Electro-Mechanical Systems

- Stations for 4 teams
- Full electrical diagnostics
- 4 go-kart components
- Future – small dynamometer

Recent email from a current Purdue student

“Also, you might be intrigued to know that I just received a job offer at Tesla Motors out in Los Angeles working on chassis design and power train of their upcoming Model-S EV. During my interviews I had a lot to say about the things we have been learning in this class and they were pretty impressed with what we are doing.”
Course Rigor

- Power calculations included:
  - Drag coefficients
  - Vehicle weight
  - Rolling resistance
  - Incline or decline grades
  - Desired acceleration and vehicle top speed

- Electronics and battery systems developed to meet power needs

\[
P_{\text{total}} = \left( \frac{1}{h_{\text{total}}} \right) P_{\text{aero}} + P_{\text{roll}} + P_{\text{grade}} + P_{\text{acceleration}}
\]  
(1)

\[
P_{\text{aero}} = \frac{1}{2} C_d \rho \text{Air} A_{\text{frontal}} (V + V_w)^2 V
\]  
(2)

\[
P_{\text{roll}} = C_{\text{roll}} m_{\text{vehicle}} g V + C_{1\text{roll}} m_{\text{vehicle}} g V^3
\]  
(3)

\[
P_{\text{grade}} = m_{\text{vehicle}} g V \sin \theta
\]  
(4)

\[
P_{\text{acceleration}} = C_{\text{inertia}} a_{\text{required}} m_{\text{vehicle}} V
\]  
(5)

where:
- \(P_{\text{total}}\) = total required power (W)
- \(P_{\text{aero}}\) = power required to overcome aerodynamic loss (W)
- \(P_{\text{roll}}\) = power required to overcome rolling resistance (W)
- \(P_{\text{grade}}\) = power required to climb a grade (W)
- \(P_{\text{acceleration}}\) = power required to achieve desired acceleration (W)
- \(A_{\text{frontal}}\) = frontal area (m²)
- \(a\) = vehicle acceleration (m/s²)
- \(C_d\) = Coefficient of drag
- \(C_{\text{roll}}\) = Coefficient of rolling resistance
- \(C_{\text{inertia}}\) = Coefficient of inertia (accounts for mass inertia of rotating parts of the vehicle such as flywheel, shafts, etc.)
- \(C_{1\text{roll}}\) = another coefficient of rolling resistance, proportional to the squared vehicle quantity.
- \(g\) = gravitational acceleration (m/s²)
- \(m\) = vehicle mass (kg)
- \(\rho_{\text{air}}\) = air density (kg/m³)
- \(V\) = Vehicle velocity (m/s)
- \(V_w\) = Wind velocity (m/s)
- \(\theta\) = incline (grade) angle
- \(h_{\text{total}}\) = total efficiency (typically about 0.95 for EV)
EV Technology Laboratory

- Laboratory tests and designs were proven in the real world
  - Validation of Calculations
  - Competition
  - Teamwork

- EV Race Tested:
  - Endurance
  - Innovation
  - Design
  - Optimization
  - Outreach

- Students balance performance and energy efficiency in context

- Future Small Vehicle Dynamometer
EV Dyno Laboratory
K-12 Engagement

- Develop educational modules for secondary schools that illustrate electric vehicle technology, that meet Indiana’s curricula requirements that can be used in the classroom.

- Modules on batteries, fuel cells, motors, controls, electric vehicles and environmental impact for general science, chemistry, physics, industrial technology and consumer science.

- These will include materials for secondary school teachers, who may not be familiar with the technology, as well as for students.

- Partner with high school teachers - summer support for secondary school teachers to work at Purdue.

- Purdue University Spring Fest engages with more than 25,000 students, families and local media.

Bauer Community Family Resource Center
Goal: Introduce and Foster STEM
Hands-on Learning Based Activities
Weekly Program (12-15) + Purdue Faculty and Students

Emerging partnership with 4H: 12 module electric vehicle program
150,000 3rd through 12th grade students in Indiana
6 million 3rd-12th grade in the US
Spring Fest 2010

Great day for college students, industry, parents & kids
Inaugural 2010 *Purdue evGrandPrix!*
17 Teams/Karts = 100+100 Students
80 laps = 40 + 40
2000 Fans
70+ TV Stations/400+ Media Sites

Unique go-kart track at Purdue
Educational Event
Strategy & Skill Based
Fastest time
Energy efficiency
Technical design
Community outreach

Timeline
Year 1 – Indiana
Year 2 – Regional
Year 3 – National

Corporate sponsorships
Substantial scholarships
Associated K-12 event
Technology Celebration Week
Indianapolis Motor Speedway

• Inaugural Purdue Collegiate evGrandprix
• Part of Emerging Technology/Alternative Energy Weekend
• 40+ Teams
• International Event (Cal Poly Tech to UK)
• Grand Prix Track Layout - 100 Laps
a competition to design, build, and race the fastest and most energy-efficient battery electric powered go kart.
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