

ASERTTI Fall 2007

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-- Energy Resources, Transportation & Power
Systems, and Environmental Research --

New York State Energy Research and
Development Authority

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NYSERDA

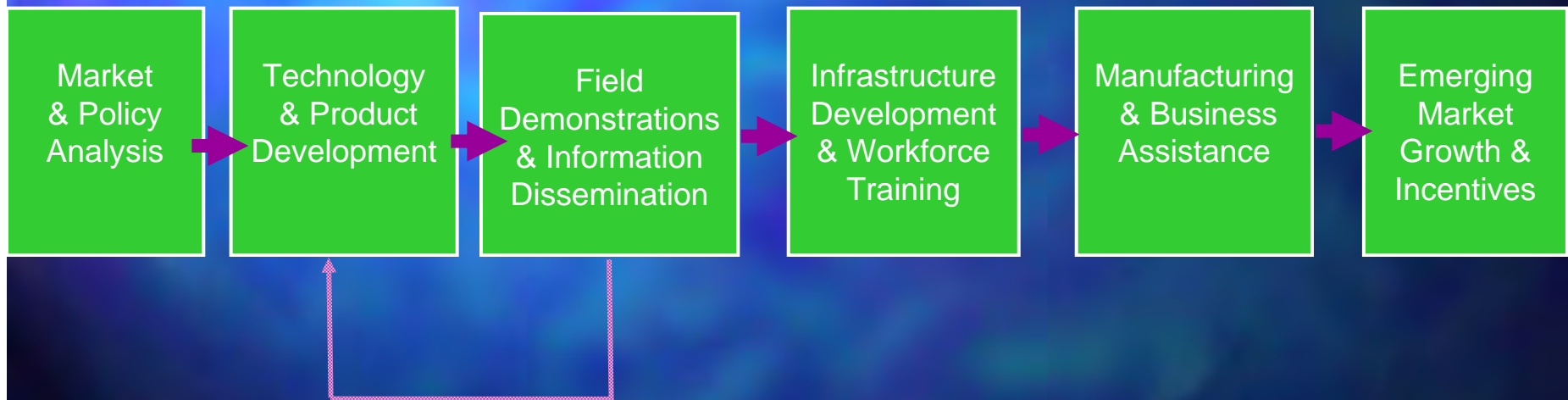
The logo for NYSERDA, featuring the word "NYSERDA" in a bold, white, sans-serif font. To the right of the text is a stylized, orange, swoosh-like graphic that curves around the text, resembling a comet tail or a dynamic motion line.

Program Goals

- Accelerate development and commercial introduction of clean energy technologies
- Support research to better understand and mitigate environmental impacts of energy production and use

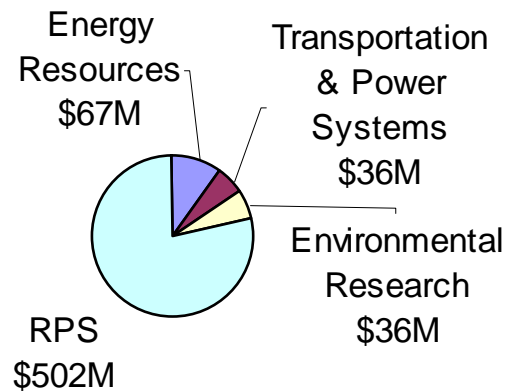
Overarching Strategies to Develop and Advance Clean Energy Technology

-- *INNOVATION in technology, policy & market mechanisms, & business* --



Project Portfolio

ERTER Project Portfolio
\$640 Million - active contracted projects



Program Focus Areas

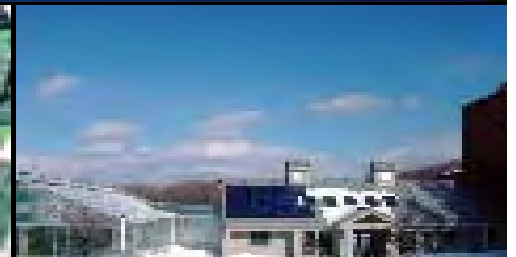
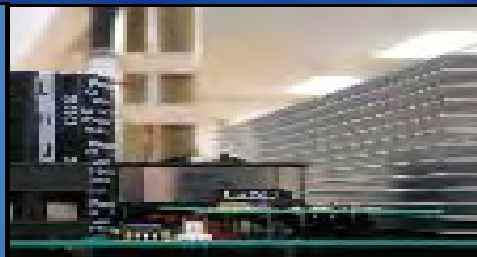
- ❑ Energy Resources
- ❑ Transportation & Power Systems
- ❑ Environmental Research
- ❑ Renewable Portfolio Standard

Over 600 projects
ranging from \$1000
to \$180 million

Energy Resources

Goal: Develop indigenous energy resources and build successful renewable and clean energy businesses in New York

- **Natural gas exploration program**
- **Technology & product development -- bioproducts**
- **Clean energy business assistance**
 - Business start-up - incubators
 - Consultation, business planning, access to capital
 - Manufacturing incentives
- **Market development**
 - PV & small wind incentives
 - Workforce training
 - Local government assistance
 - Secondary education on renewable energy
- **Major New Initiative: cellulose-to-ethanol commercialization**



Highlight: Educating the Next Generation of Consumers

School Power Naturally

- 48 PV systems installed at schools in NYS
- 60 professional lesson plans
- Over 70,000 students have learned about solar power



Transportation & Power Systems

Goal: Enable New York businesses and institutions to develop products and solutions to our energy and environmental problems

- Focused on product development and testing
 - Rail efficiency and performance improvements
 - Vehicle efficiency and environmental performance
 - Transportation infrastructure
 - Environmentally preferred advanced power generation
 - Energy storage
- Major New Initiative: plug-in hybrid-electric vehicles



Highlight: Developing & Commercializing New Technology

Kinetic Hydro

- Developed the first kinetic hydropower turbines to produce grid-connected electricity
- Environmental assessments and field testing underway



Verdant Power In-Stream Hydro East River Demonstration

Environmental Research

Goals: Develop and demonstrate energy-efficient waste management and pollution control technologies and support research to better understand the environmental impacts of energy production and use

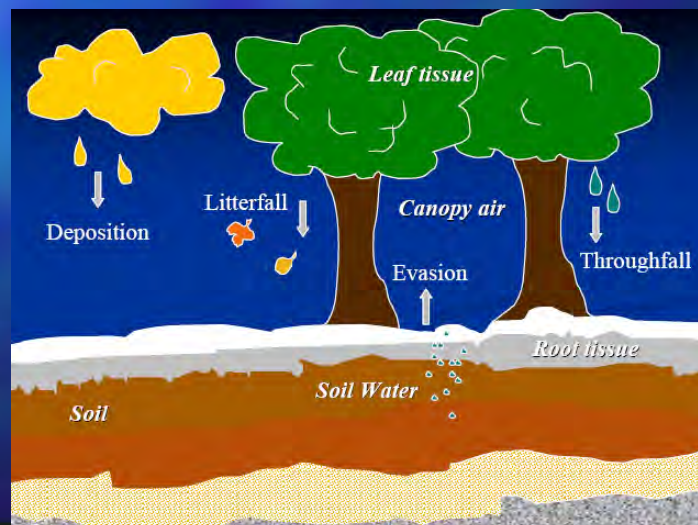
- Municipal water and wastewater
- Agricultural waste management
- Environmental product development
- Energy-related environmental impact assessment in NYS
 - Acid rain, ozone/particles, mercury, climate change
 - Environmental impacts of alternative energy
- Targeted environmental initiatives: clean diesel, wood heat, power gen
- Major New Initiative: climate change research



Highlight: Linking Science and Policy

■ Understanding the Sources, Fate & Transport of Mercury

- Characterized extent of pollution in NYS
- Modeled transport
- Monitored deposition
- Identified hotspots
- Facilitated exchange between scientists and policy makers
- Supported NYS policy action



Renewable Portfolio Standard

Goal: Increase the fraction of renewable energy consumed by retail electric consumers in New York State to 25% by 2013

- Wholesale grid-tied generating resources {"Main-Tier RPS"}
- Customer-sited, behind-the-meter resources
 - PV, anaerobic digestion, small wind turbines, fuel cell incentives
- Renewable energy credit tracking system
- Major New Initiative: environmental markets



Highlight: Transforming the Renewable Power Industry in NYS

- 837 MW of new renewable capacity under contract; 261 MW in service
- 1,200 MW of new renewable capacity associated with procurement action
- 23 facilities (22 in New York) - 11 hydro/1 biomass/11 wind
- \$720 million in local economic benefits expected



New York State Plug-In Hybrid Program

Richard Drake

Program Manager

Transportation & Power Systems

The NY PHEV Technology Initiative

\$10 million plug-in hybrids program...

*the 600 hybrid vehicles in the State fleet
will be retrofitted to be plug-in hybrids.”*

Governor's Press Release (August 1, 2006)

Commercialization jump start supporting:

Product development

Market development

Guaranteed sales

What is a Plug-In Hybrid?

A Plug-In Hybrid Electric Vehicle (PHEV) is a Hybrid Electric Vehicle (HEV) with additional battery energy that can be charged from the electric grid and used to propel the vehicle for some portion of a trip

- Compared to a HEV, the PHEV can drive under an “all electric” mode for a larger fraction of driving time
- If a current HEV were getting 50 mpg, a PHEV might achieve 90+ mpg (gasoline) because some of the miles are powered with electricity from grid, not gasoline.
- An owner could “fill-up” with gasoline during the day and charge the vehicle at night



Image: J. Romm, A. Frank, *Scientific American*, April 2006



Why PHEVs?

- Possibility of significant GHG reductions over 20 – 30 years with complementary electric sector GHG reduction technologies
 - Large potential petroleum reductions/reduced oil import reductions
 - Electric mode fuel costs are equivalent to about \$0.60 - 0.95/gallon* gasoline
 - PHEVs are especially attractive in urban areas with short, low speed commuting patterns and air quality issues
 - No need for large new energy supply infrastructure investments
 - PHEVs use existing infrastructure (gasoline and electricity)
- Breakeven price estimate based on 6 - 10 cents/kWh range, 90 mpg-equiv. (electric) compared to 25 mpg conventional vehicle

Hybrid-Electric Vehicles in NYS Fleet



Toyota Prius



Honda Accord



Honda Civic

PHEV Technology Initiative

A two stage approach

Stage 1 *Validate the Technology*

Resolve issues such as:

Certification: Safety, Emissions

Verify mpg, driveability, winter operation, etc.

Warranty, Service, etc.

Cost

Stage 2 *Convert State-Owned HEVs*

PHEV Technology Initiative

PON 1088, Awards

3 Models 6 Contracts (4 teams)

Ford Escape 3

Toyota Prius 2

Honda Civic 1

- * Three Battery manufacturers**
- * Two configurations (replace and add) each model (excpt.civic)**
- * Four different KWh battery capacities**
- * Multiple operational modes: blended, all-electric**

Stage 1 Program Status:

- 4 of 6 PHEVs completed safety inspections and delivered to NYSERDA.
- CARB experimental vehicle waivers granted
- Vehicle evaluations underway
 - Vehicles spend 1-2 months @nyserda
 - Then testing at DOE's HEV lab. Argonne
 - Then 4,000 miles of test track Arizona
 - Then CARB testing in Calif.

PHEV Challenges

- High up-front costs for PHEVs
 - Lithium ion battery would likely cost at least \$3000- \$5000 in near to mid-term
 - Currently, after-market conversion kits cost \$10,000 - \$12,000 retail
 - Electric powertrain + internal combustion engine
- Battery durability and performance
- Consumers acceptance
 - Fuel/energy efficient products – will they buy it?
 - Access to garages, some may need to add a charging circuit
 - Availability of off-peak pricing
 - Resale value



Plug-In Hybrids

Beyond the Current Initiative

The goal is to stimulate car companies to provide PHEV options.

Ultimately, success depends on economics:

low life cycle battery cost

Gas prices

Public policy: tax credits, CO2 regulation

OEM endorsement, market share and profit margins