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P3-*People, Prosperity and the Planet-* Award Program: A National Student Design Competition for Sustainability

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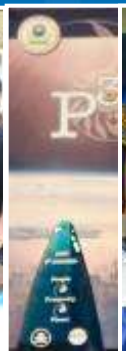

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Mission of EPA

…to protect human health and the environment

- **Establish and enforce** environmental protection standards consistent with national environmental goals
- **Conduct research**
  - on adverse effects of pollution
  - on methods and equipment for controlling it
  - to gather information on pollution and use it to strengthen environmental protection programs and recommend policy
- **Assist others**, through grants, technical assistance and other means, in arresting pollution of the environment

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EPA's P3 Award Program

- Launched in 2004 as two-phase grant competition
- Harness the energy, creativity and enthusiasm of college students
- Infuse students with an awareness of their impact on the economy, society, and the planet
- Contribute to the integration of sustainability principles into curricula

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P3 Project Areas

Open to research proposals addressing sustainability challenges anywhere in the world in the following areas:

- Water
- Energy
- Agriculture
- Built Environment
- Materials and Chemicals

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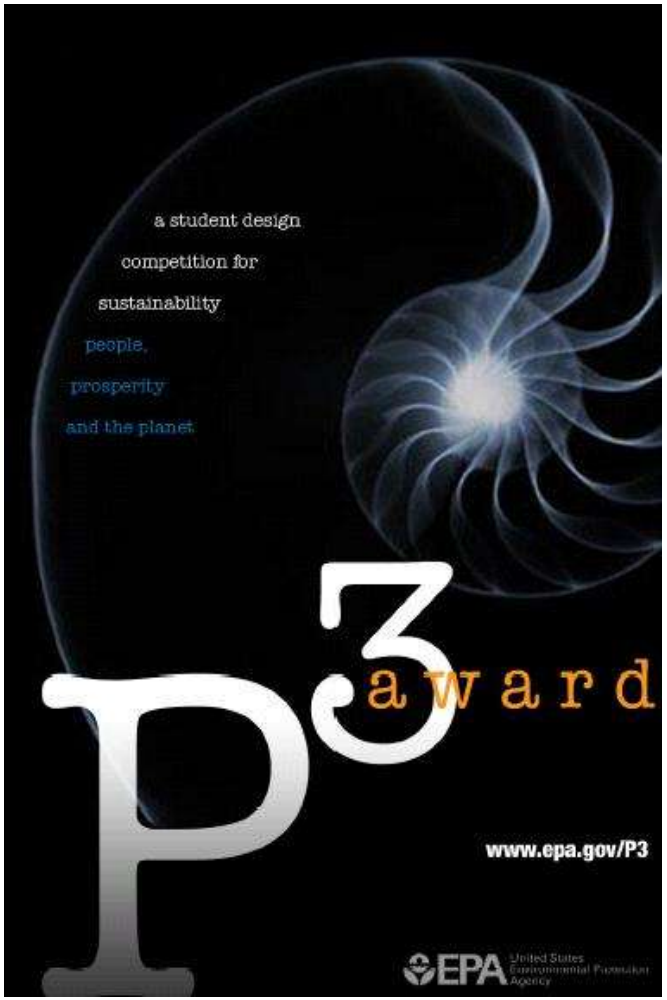
P3 Program Process- Phase I

- Solicitation open Sept-Dec
- Student teams submit proposals for proof-of-concept innovative technology or design
- Proposals are peer reviewed
- Phase I grants awarded - fall following year
- P3 teams submit *Project Report*
  - Phase I accomplishments
  - Phase II proposal
- Students participate in the National Sustainable Design Expo



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National Sustainable Design Expo

- Co-sponsored public event at base of the Capitol on the National Mall
- Opportunity for P3 team members to interact
- Opportunity to expand conversation on sustainability

P3 Program Process- Phase II

- Phase I winners compete for P3 Award and $90,000 grant to develop technology
- Panel of judges convened by AAAS (American Association for the Advancement of Science)
- P3 Awards presented at P3 Award Ceremony

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Aspects of P3 Projects

- P3 teams encouraged to be student-led and interdisciplinary
  - Included representation from engineering departments, chemistry, biology, architecture, industrial design, business, economics, policy, social science, and others
  - Partnerships with industry, non-governmental organizations (NGOs), government, and the scientific community.
- Require integration of sustainability concepts as an educational tool
- Encourage development of small businesses

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P3 Projects: Developed World

- Green Buildings including living roofs, smart windows, improved energy efficiency, solar power
- Real-time feedback of environmental performance
- “Biosphere” cities
- Recycling logistics, infrastructure, and strategies
- Policy analyses
- Sustainability indicators
- Fuel cell advances
- Sustainable energy technologies: wind, solar, bio-methane, biodiesel, biohydrogen
- Bioremediation of agricultural chemicals
- Educational programs on sustainability or energy

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P3 Projects: Developing World

- Water treatment: point-of-use or small, centralized facilities
- Water conservation, extraction or delivery
- Strategies for improved sanitation
- Alternative pest management strategies
- Appropriate construction materials
- Sustainable housing
- Renewable energy: wind, solar
- Planning for growth

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Educational Benefits

- Collaboration among students
- Valuable “life” experiences to students
  - Apply themselves to “real-world” issues
  - Multidisciplinary team experience
  - International travel
  - Cross-cultural work experience
- Raise awareness of sustainability and the environment on college campuses/local communities
- Publication of research results
- Provides “seed” money for further research and additional funding

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P3 Update

- Nearly 400 Phase I grants
  - 49 states & Puerto Rico
  - 166 schools
  - Over 2000 students

- 49 Phase II grants
  - ~25% of Phase II winners started new companies or NGOs
  - Leveraged P3 funds to gain venture capital & additional grant funds
  - Commercialized new products

UC Davis - 2008 P3 Award Winner - Micromidas Biodegradable Plastic Production From Municipal Wastewater

- **Project**
  - Use municipal sewage to create a biodegradable plastic
- **Return on Investment**:
  - Micromidas Company founded 1year after P3 award
  - now employs 26
  - Negotiated contracts with Waste Water Treatment Plants
  - Several companies interested in the plastic (ie,Nestles, Pepsi)
  - Successfully leveraged $3.6M venture capital funding
  - Selected as one of the ***Top 50 Water Innovation Leaders*** by the Artemis Project
- **Process & Advantages:**
  - Waste is raw material carbon source
  - Natural pond bacteria culled for PHA producing types to digest sludge
  - Sludge converted to fatty acids by microbes which produce intra-cellular PHA
  - PHA is extracted & pelletized

Oberlin – 2005 P3 Award Winner
Lucid Design Group: Building Dashboard

- **Project:**
  - Develop real-time feedback system to see if can motivate people to conserve energy and water
  - Competitions motivated people to conserve: 1 dorm saved $5.1K in 2 weeks
- **Return on Investment**:
  - Developed Building Dashboard
  - Started: the Lucid Design Group
  - Now employs 18
  - Developed a resellers program
  - Leveraged $6M venture capital
  - Dashboard now installed at >100 large institutions
  - Selected as a Category Finalist for the 2010 Adobe MAX Awards
- **Process & Advantages:**
  - Real-time feedback prompts big energy and water savings
  - Turns passive consumers into active managers

University of Virginia - 2007 P3 Award - The Learning Barge Elizabeth River Project

- **Project:**
  - Design & build a floating classroom to teach people about river ecology and sustainable technologies
  - Partnered with Elizabeth River Project and local schools
- **Return on Investment**:
  - P3 Award leveraged industry, institution and private contributions
  - More than 6500 visitors in first season
  - Created 7 jobs
- **Process & Advantages:**
  - >34 UVA students were involved in the construction of the barge
  - World's 1st floating wetlands classroom
  - Lead science coordinators and teachers designed the curricula

Western Washington University – 2007 P3 Award
Biomethane for Transportation

- **Project:**
  - Develop a biogas refining process using dairy cow manure and anaerobic digesters to produce biomethane for vehicular use.
  - Biomethane produces about 95 percent less carbon than a traditional fuel
- **Return on Investment:**
  - Technology demonstrated at pilot scale. P3 Award helped leverage additional awards.
    - Including $.5M DOE Clean Cities Recovery Act Award
    - Start up company being considered.
- **Process & Advantages:**
  - Pilot plant collects manure at local dairy farm which is broken down in an anaerobic digester.
  - Methane and other gases are generated. Contaminants removed by a scrubber.
  - Clean biomethane is collected, compressed and ready to burn in a combustion engine
  - WWU estimates that there is enough farm waste to fuel all vehicles in the region.

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MIT – 2008 P3 Award - Solar Thermal Micro-generators

- **Project:**
  - Provide a renewable energy source to Lesotho using novel solar thermal micro-generators, solar collectors, and “ORC” (Organic Rankine Cycle) engines.
- **Return on Investment:**
  - NGO established to train local town members to operate and maintain the system
  - Additional Awards leveraged
  - Power and hot water system installed for a medical clinic in Lesotho
- **Process & Advantages:**
  - ORC engine converts heat to electricity using solar panels to provide the energy to drive the engine.
  - Generates more than 3 kilowatts of electricity and hundreds of gallons of hot water daily.

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8th Annual Expo
April 20-22, 2012

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Feedback from Participants

"We appreciate the support of the EPA P3 Program, and we believe it has made a tangible difference in how these issues are seen at M.I.T."

- Prof. Jeffrey I. Steinfield, Massachusetts Institute of Technology

"Awarding many small grants for undergraduate research is a great idea. My students learned much working on this project and continue to do so."

- Prof. Kathleen Bower, Eastern Illinois University

"It is exciting and sometimes frustrating to work on a 'real life' project, but always rewarding."

- Phoebe Richbourg, Student on Univ. VA's P3 Award-winning Team, 2007

"… Through these speaking engagements and interactions, the students have also educated and enriched the lives of the practicing engineers in New Hampshire."

- Prof. Jenna Jambeck, University of New Hampshire