IPST Conference on Remaining Competitive in an Evolving Industry
March 9, 2011

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Industrial Technologies Program
Energy Efficiency & Renewable Energy
U.S. Department of Energy
In his State of the Union Address, President Obama emphasized the importance of investing in clean energy innovation.

Ambitious, but achievable proposals will transform America’s energy future through innovation, including generating 80 percent of our energy from clean energy sources by 2035 and investing over $8 billion in research, development and deployment of clean energy programs.
Clean Energy R&D Highlights:

Department of Energy

- Industrial Technologies Program
- Office of Biomass Program
- Advanced Research Projects Agency – Energy (ARPA-E)

U.S. Department of Agriculture

- Focus on biofuel production

DARPA

- Open Manufacturing Industry Day, DARPA-SN-11-18
ITP: Delivering Results For 30 Years

Working with industry, we have successfully developed and moved cutting-edge technologies and energy-saving measures into practice.

- Produced >220 commercialized technologies
- Obtained 215 patents between 1994 and 2009
- Received 51 prestigious R&D 100 awards since 1991
- Reached more than 33,000 industrial plants
- Saved 9.3 quads and reduced emissions by 755 million metric tons of CO₂

Harness Scientific Ingenuity  Spur Innovation  Leverage Resources  Change Corporate Culture
• Employs ~11 million people
• Makes a significant contribution to GDP (~12%)
• Supplies ~52% of U.S. exports, worth ~$66 billion/month
• Spurs job creation and investment
• Every million dollars in energy cost savings has the potential to create many additional jobs.
Existing technologies with an attractive internal rate of return can cut the growth in global energy demand by half or more within 15 years.


More than 10% of U.S. industry’s energy use could be saved by more broadly adopting existing technologies that yield an internal rate of return greater than 10%.

-- McKinsey, 2007

Industries around the globe can cut CO₂ emissions 19 to 31% using proven technologies and practices.

Energy-intensive industries, such as the pulp and paper industry, have potential for significant energy intensity reductions.

<table>
<thead>
<tr>
<th></th>
<th>Chemicals</th>
<th>Petroleum Refining</th>
<th>Pulp &amp; Paper</th>
<th>Steel</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End-use process energy (fuel)</strong> consumption per dollar of shipments and potential intensity reduction</td>
<td>Btu/$ shipped</td>
<td>Btu/$ shipped</td>
<td>Btu/$ shipped</td>
<td>Btu/$ shipped</td>
<td>Btu/$ shipped</td>
</tr>
<tr>
<td>Industry Average</td>
<td>4,860</td>
<td>6,310</td>
<td>13,930</td>
<td>12,480</td>
<td>6,450</td>
</tr>
<tr>
<td>State of the Art Plant</td>
<td>17%</td>
<td>28%</td>
<td>26%</td>
<td>22%</td>
<td>12%</td>
</tr>
<tr>
<td>Practical Minimum</td>
<td>42%</td>
<td>38%</td>
<td>39%</td>
<td>39%</td>
<td>38%</td>
</tr>
<tr>
<td>Theoretical Minimum</td>
<td>84%</td>
<td>71%</td>
<td>43%</td>
<td>53%</td>
<td>62%</td>
</tr>
</tbody>
</table>

- Best operational practices to improve actual operating efficiency
- Use of best available technologies (equipment and processes)
- Capital investment in State of the Art (SOA) equipment and process technologies

New technologies via R&D based on current knowledge

New technologies from future scientific frontiers
R&D Strategy

- Identify strategic issues facing the industry.
- Identify specific technology needs and targets — provide direction to researchers.
- Translate strategic issues into actionable items by the R&D community.

Strategic line of sight between industry and R&D efforts —

- Maintains relevance of R&D.
- Enables DOE to maximize R&D investments.
R&D Focus Areas

**Advanced Water Removal**

*Develop breakthrough approaches to non-evaporative paper web dewatering before entering the thermal drying section*

**High Efficiency Pulping**

*Develop innovative pulping and bleaching technologies that reduce energy intensity*

**Improved Fiber Recycling**

*Increase the quality and quantity of recycled fiber; reduce energy required to re-pulp fiber*

**Wood Processing**

*Reduce energy used for wood drying/curing and emissions control*
Energy Savings Opportunities Drive R&D Objectives

Forest Products Focus Areas:
- Enhanced Raw Materials
- Next Generation Mill Processes
- Fiber Recycling
- Wood Processing

Focus Areas:
- Fiber Pulping
- Fiber Bleaching
- Paper Making
- Chemical Recovery
- Fiber Recycling
- Wood Products

Trillion Btu

100 200 300 400
Summary of Current ITP Forest Products R&D

Forest Products Portfolio

• 3 active projects, all in pilot demonstration phases.

Grand Challenges

• 48 R&D projects across the country split over $13 million in funding as award winners of the Industrial Energy Efficiency Grand Challenge.

• 11 of these are related to forest products; all are in concept definition phases.
  - 5 projects covering the Forest Products Industry with over $1.4 million in funding
  - 6 additional projects that have cross-cutting impact with an additional $1.6 million in funding.
Grand Challenges Projects

<table>
<thead>
<tr>
<th>Applicant</th>
<th>City</th>
<th>State</th>
<th>Project Title</th>
<th>DOE Funding</th>
<th>Non-Federal Cost Share</th>
<th>Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia Tech Research Corporation</td>
<td>Atlanta</td>
<td>GA</td>
<td>Dry Kraft Pulping at Ambient Pressure for Cost Effective Energy Saving and Pollution Deduction</td>
<td>$245,085</td>
<td>$62,760</td>
<td>$307,845</td>
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<tr>
<td>State University of New York, College of Environmental Science and Forestry</td>
<td>Syracuse</td>
<td>NY</td>
<td>New Manufacturing Method for Paper Filler and Fiber Material</td>
<td>$240,035</td>
<td>$114,641</td>
<td>$354,676</td>
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<tr>
<td>North Carolina State University</td>
<td>Raleigh</td>
<td>NC</td>
<td>Crude Glycerol as Cost-Effective Fuel for Combined Heat and Power to Replace Fossil Fuels</td>
<td>$272,754</td>
<td>$68,453</td>
<td>$341,207</td>
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<tr>
<td>Advanced Electron Beams, Inc.</td>
<td>Wilmington</td>
<td>MA</td>
<td>Energy Efficient Removal of Volatile Organic Compounds (VOCs) and Organic Hazardous Air Pollutants (o-HAPs) from Industrial Waste Streams by Direct Electron Oxidation</td>
<td>$294,880</td>
<td>$122,256</td>
<td>$417,136</td>
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<td>Aspen Aerogels, Inc.</td>
<td>Northborough</td>
<td>MA</td>
<td>Aerogel-Based Insulation for High-Temperature Industrial Processes</td>
<td>$299,960</td>
<td>$74,991</td>
<td>$374,951</td>
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<td>Gas Technology Institute</td>
<td>Des Plaines</td>
<td>IL</td>
<td>Advanced Energy and Water Recovery Technology from Low Grade Waste Heat</td>
<td>$300,000</td>
<td>$75,000</td>
<td>$375,000</td>
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<tr>
<td>GE Global Research Center</td>
<td>Niskayuna</td>
<td>NY</td>
<td>Nanostructured Ferritic Alloys: Improving Manufacturing Efficiency and Material Performance for High Temperature Applications</td>
<td>$300,000</td>
<td>$99,909</td>
<td>$399,909</td>
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<tr>
<td>Rive Technology, Inc.</td>
<td>Cambridge</td>
<td>MA</td>
<td>Advanced Nanostructured Molecular Sieves for Energy-Efficient Industrial Separations</td>
<td>$300,000</td>
<td>$461,703</td>
<td>$761,703</td>
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<td>University of California Santa Cruz</td>
<td>Santa Cruz</td>
<td>CA</td>
<td>Next Generation Print-based Manufacturing for Photovoltaics and Solid State Lighting</td>
<td>$277,533</td>
<td>$70,000</td>
<td>$347,533</td>
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<tr>
<td>University of Utah</td>
<td>Salt Lake City</td>
<td>UT</td>
<td>A New Method for Production of Titanium Dioxide Pigment - Eliminating CO2 Emission</td>
<td>$249,576</td>
<td>$62,500</td>
<td>$312,076</td>
</tr>
</tbody>
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How Can I Contact ITP?

- Energy Efficiency and Renewable Energy Information Center:
  1-877-EERE-INF (1-877-337-3463) or eereic@ee.doe.gov

- [http://www.eere.energy.gov/industry/](http://www.eere.energy.gov/industry/)

- Bhima Sastri, ITP Forest Products Technology Manager
  (202) 586-2561
Thank You