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# **R&D for Increasing the Potential of the Forest-Based Industries**

**The Marcus Wallenberg Prize Symposium**

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## The Potential – R&D Can Deliver Large Benefits to the Industry

- New breakthrough technologies can
  - Reduce energy consumption, greenhouse gas emissions, water consumption, fiber demand, and input costs
  - Improve sustainability and public image of forest-based sector
  - Provide more economic value from products
- Example: **20% reduction in energy = US\$9 billion a year**
  - Based on US EIA data for 2005 global forest products energy consumption
  - Assumes 50% of reduction in coal, 25% in oil, and 25% in natural gas at US 2007 average costs

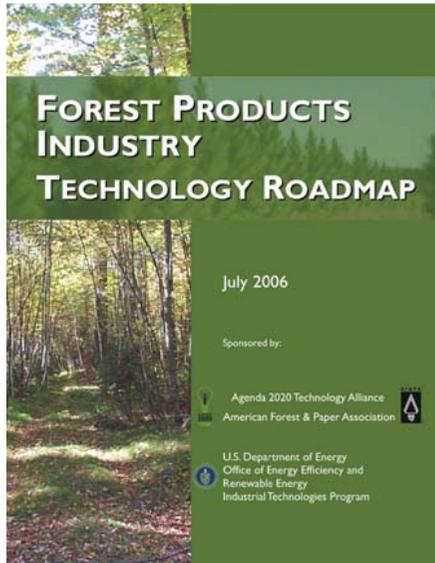
## The Opportunity – Transform the Industry's Products and Processes

- Transformational R&D
  - High potential for benefits
  - Challenging and costly – high risk
  - Well-suited for collaborative programs
  - Access to government funding and support
- Approaches
  - EU: Forest-Based Sector Technology Platform (FTP)
  - US: Agenda 2020 Technology Alliance

# Agenda 2020 Technology Alliance

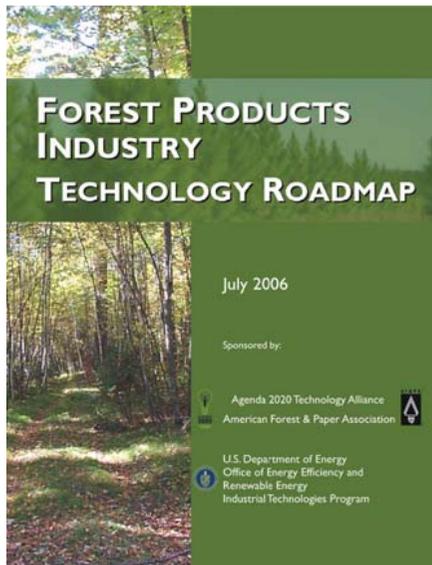
- Agenda 2020
  - Industry-led technology alliance
  - International group of member companies
- Mission
  - Identify priority R&D needs that can help transform the industry – breakthrough, not incremental R&D
  - Facilitate collaborative, pre-competitive R&D programs and government funding

# The Industry's R&D Needs – 2006 Technology Roadmap



- R&D needs in six focus areas
  - Forest productivity
  - Forest biorefinery
  - Breakthrough manufacturing
  - Wood products
  - Environmental
  - Fiber recovery
- Broad recognition in federal agencies, academics, and international communities
- Many successful outcomes
  - Value Prior to Pulping consortium
  - Pine Genome Initiative
  - US DOE-funded projects in conversion of biomass and pulp and paper energy reduction
  - International conferences on forest products nanotechnology
  - Recognition of forest products in US National Nanotechnology Initiative
  - College training programs for manufacturing operations

# The Industry's R&D Needs – 2006 Technology Roadmap Needs Updating

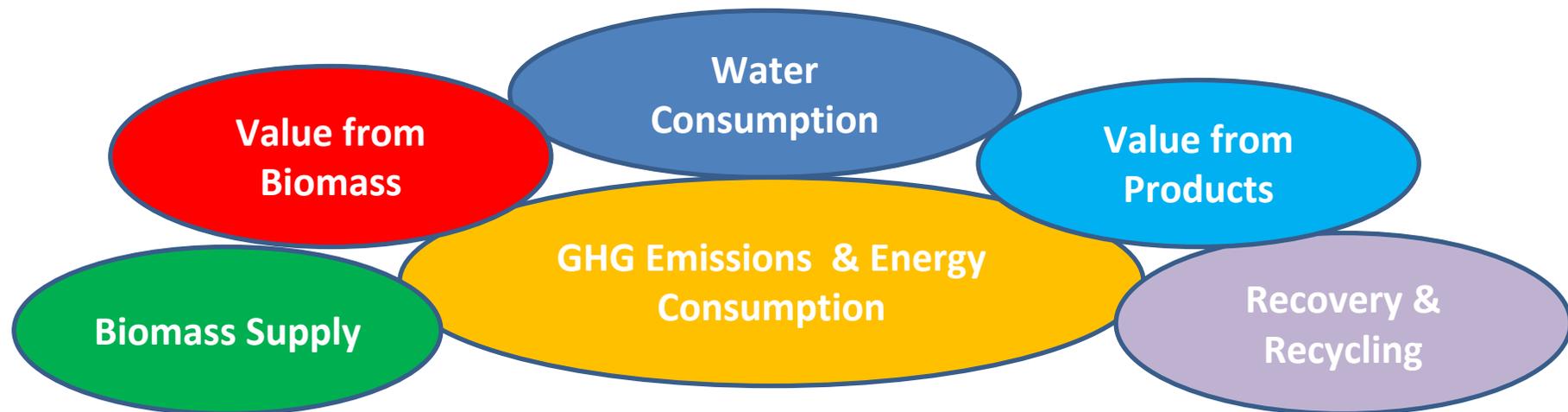
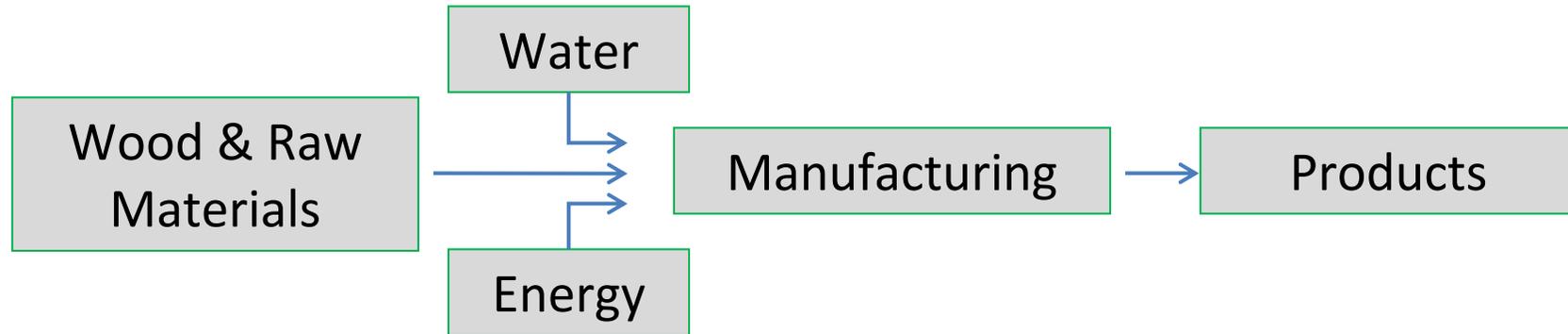


- Emphasis has changed since 2006
  - Climate change, GHG emissions
  - Emphasis on sustainability
  - Concerns about wood supply
  - Uncertainties of energy and water availability
  - Rising input costs
  
- Launched new roadmap process in 2008

## The Process – 2009 Technology Roadmap

- Open process
- Partnership between Agenda 2020 and IPST at Georgia Tech
- Strategic Issues Workshop – December 2008
  - Business-focused, 45 participants
  - Defined priority issues facing the industry
- Technology Roadmap Workshop – April 2009
  - Technology-focused, 90 participants
  - Targeted the priority issues
  - Roadmap report to be issued soon

# Forest Products Technology Agenda – Six Focus Areas in 2009 Roadmap



## Reduce carbon emissions and energy consumption at mills and plants substantially

- Eliminate CO<sub>2</sub> emissions from fossil fuels
  - Use renewable sources for non-steam thermal demand – biomass-derived fuels to replace fossil energy
- Reduce energy demand in manufacturing
  - Deliver a drier sheet to dryer section
  - Reduce energy required to wash pulp and concentrate black liquor by 50%

## Reduce fresh water intake in manufacturing at least 50%

- Drastically reduce the amount of fresh water used in pulping and papermaking
  - Remove non-process elements (NPE) from chips prior to pulping
  - Reduce fresh water used in pulp washing
- Develop technologies for reuse of effluent in plants after treatment
  - Separate dilute contaminants (both inorganic and organic) from reusable water

## Increase the supply of high-quality fiber and low-cost biomass

- Improve tree properties
  - Genomics of major species
  - Improved methods to multiply high value trees
- Develop efficient harvest supply chain
  - Systems for efficient harvest, processing & delivery of quality feedstocks for various conversion processes
  - Systems for growing and harvesting small-diameter, short-rotation woody crops
- Produce more wood
  - Increase production of usable woody biomass

## Get value from woody biomass in new ways

- Develop thermochemical conversion processes that scale to feedstock availability
- Make products with higher value than current mix
  - Chemicals, advanced fuels, and polymers from sugars and lignin and cellulose
- Redesign processes
  - Transform pulp mills into flexible biorefineries with low-lignin feedstock, more efficient recovery cycle, and simplified pulping/bleaching
  - Employ purpose grown woody crops

## Increase value of products by developing new features

- Achieve 20-50% improvement in performance/weight ratio of paper and packaging without compromise in performance criteria
- Develop new bio-based composites and nanomaterials
  - Functional interfaces between inorganics and wood-based materials
  - Value-driven applications of wood-based nanomaterials
- Develop new types of biomass-based packaging
  - Bio-based coatings and fiber treatments that permit displacing non-renewable polymers in packaging

## Improve recovery and recycling of waste wood and fiber products

- Enable recycled fibers to have equivalent runnability to virgin fibers
  - Machine design, water systems, fiber modification, nanotechnology
- Improve sorting of recovered wood and fiber
  - Document destruction processes that maintain fiber integrity
- Recover urban waste wood for energy
- Use non-fiber components more efficiently
  - Separate filler from recycling wastes and reuse the recovered filler

## Completing the 2009 Technology Roadmap

- Incorporate:
  - Solid wood products recent roadmapping
  - International roadmaps and programs
- Issue final report before end of 2009 and distribute broadly
- Communicate roadmap priorities to industry, federal agencies, and research institutions

# EU FTP Strategic Research Agenda Aligns Well with the New Agenda 2020 Roadmap

EU FTP Strategic Research Agenda	New Agenda 2020 Roadmap
<p><b>Innovative products</b></p> <ul style="list-style-type: none"> <li>• Paper and packaging</li> <li>• Building products</li> <li>• Next generation of composites</li> <li>• Biofuels</li> <li>• Pulp, energy and chemicals from wood</li> </ul>	<ul style="list-style-type: none"> <li>• Increasing value from products</li> <li>• Getting value from biomass</li> </ul>
<p><b>Intelligent and efficient mfg processes</b></p> <ul style="list-style-type: none"> <li>• Reduced energy consumption</li> <li>• Fewer inputs, more performance</li> <li>• New technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Reducing carbon emissions &amp; energy</li> <li>• Reducing fresh water consumption</li> <li>• Increasing value from products</li> </ul>
<p><b>Availability and use of forest biomass</b></p> <ul style="list-style-type: none"> <li>• “Tailor-made” wood supply</li> <li>• Recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Supply of woody biomass</li> <li>• Getting value from biomass</li> <li>• Recovery and recycling</li> </ul>
<p><b>Multifunctional demands on forests</b></p>	<ul style="list-style-type: none"> <li>• Supply of woody biomass</li> </ul>

## Where Do We Go Next?

- Build industry consensus for highest priorities and most urgent R&D needs
- Form collaborations to pursue R&D priorities
  - Universities, research institutions, and national labs
  - Links beyond the forest products industry, such as chemical industry
  - International interactions
- Seek support and funding from government agencies and industry (producers and suppliers)

## The Potential for R&D to Transform the Industry

- Transforming the industry's products and processes with breakthrough R&D has high potential for long-term benefits to society and the industry
- Industry, academia and government have high interest in the 2009 Technology Roadmap and are excited about moving forward
- Developing new breakthrough technologies is a great opportunity to work together and deliver value to the industry

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