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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

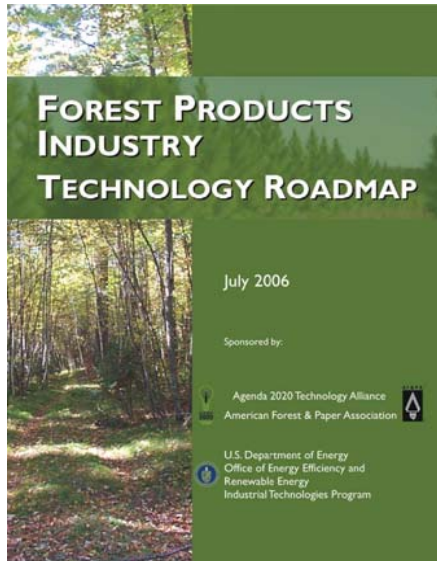
The Opportunity – Transform the Industry's Products and Processes

- 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

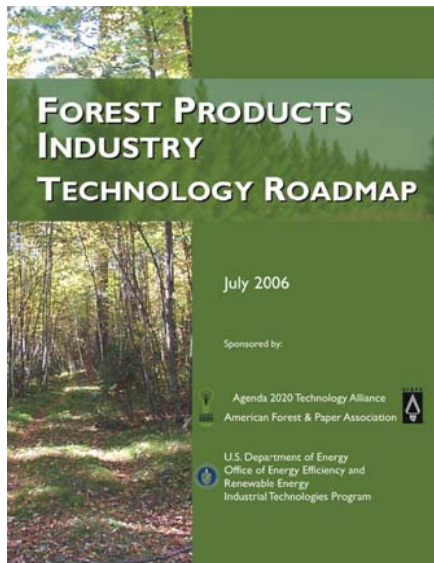
- Agenda 2020
 - Industry-led technology alliance
 - International group of member companies
- Mission
 - Identify priority R&D needs that can help transform the industry – breakthrough, not incremental R&D
 - Facilitate collaborative, pre-competitive R&D programs and government funding

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



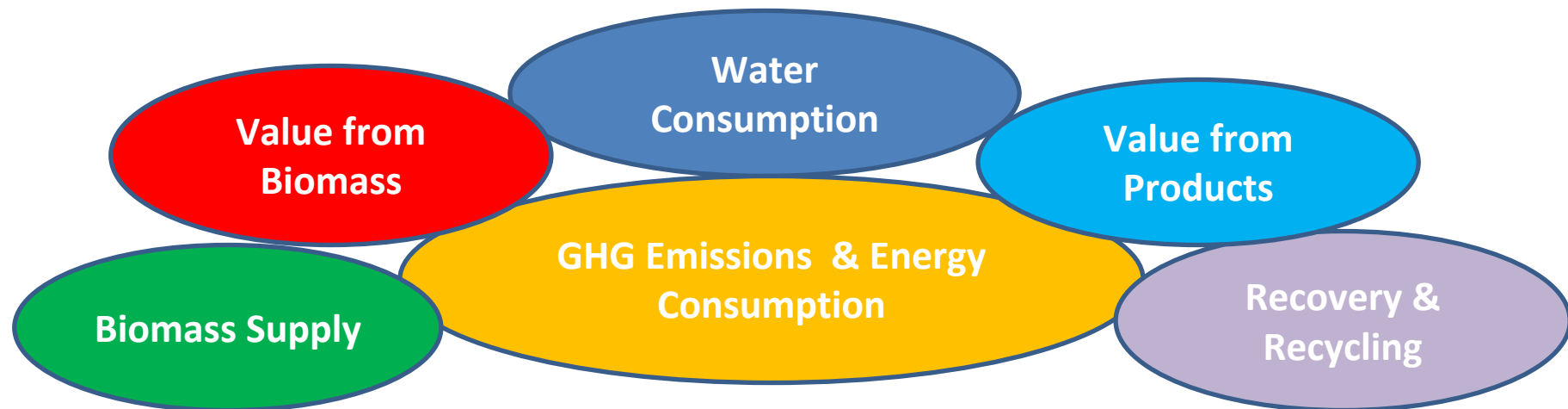
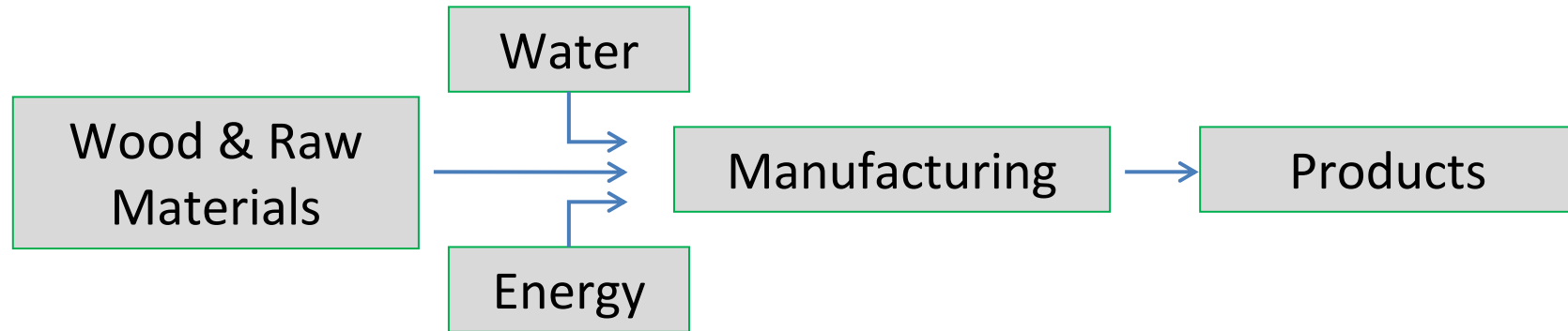
- Emphasis has changed since 2006
 - Climate change, GHG emissions
 - Emphasis on sustainability
 - Concerns about wood supply
 - Uncertainties of energy and water availability
 - Rising input costs

- 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 CO₂ 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>Innovative products</p> <ul style="list-style-type: none"> • Paper and packaging • Building products • Next generation of composites • Biofuels • Pulp, energy and chemicals from wood 	<ul style="list-style-type: none"> • Increasing value from products • Getting value from biomass
<p>Intelligent and efficient mfg processes</p> <ul style="list-style-type: none"> • Reduced energy consumption • Fewer inputs, more performance • New technologies 	<ul style="list-style-type: none"> • Reducing carbon emissions & energy • Reducing fresh water consumption • Increasing value from products
<p>Availability and use of forest biomass</p> <ul style="list-style-type: none"> • “Tailor-made” wood supply • Recycling 	<ul style="list-style-type: none"> • Supply of woody biomass • Getting value from biomass • Recovery and recycling
<p>Multifunctional demands on forests</p>	<ul style="list-style-type: none"> • Supply of woody biomass

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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