

RESEARCH & OUTREACH TO CHANGE THE WORLD

*“IREE and CERTS – A Partnership
for a Sustainable Energy Future”*

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Mission

To promote statewide economic development, sustainable, healthy, and diverse ecosystems, and national energy security through development of bio-based and other renewable resources and processes.



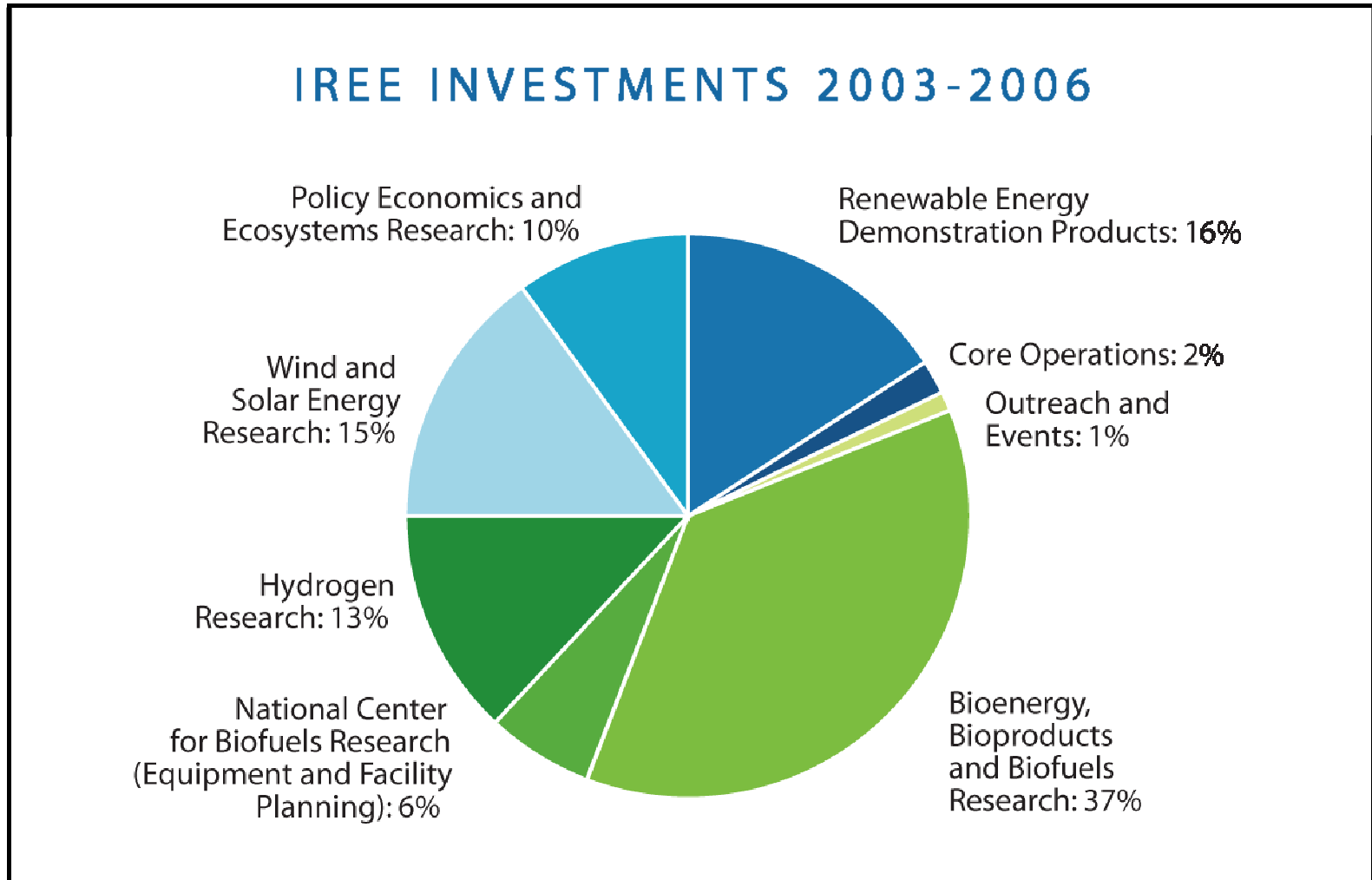
History

- Established in 2003
- Minnesota legislature – directed \$20M from Xcel's RDF and CIP to the University of Minnesota for renewable energy research and demonstration
- 115 projects funded – Statewide
- 275 faculty members, research scientists and students
- 130+ external partners
- \$14M+ leveraged

Colleges Associated with IREE

- Institute for Technology
- College of Biological Sciences
- College of Food, Ag and Natural Resource Sciences
- Humphrey Institute for Public Affairs
- College of Design
- Carlson School of Management
- Plus, the U of M Crookston, the U of M Duluth, the U of M Morris, the U of M Rochester and 3 Research and Outreach Centers

Portfolio



Impacts



Over 60 multi-disciplinary research teams



The next generation of renewable energy experts – 150+ students and post-docs



25+ conferences and seminars – bringing together experts from around the world



130+ collaborations with external partners



Leveraged over \$14M in matching funds to support research at the U of M

Impacts: Agriculture



Ethanol and biomass conversion to hydrogen and syngas



Densification of ag residues to bio-oils and syngas through microwave pyrolysis



Wind-to-hydrogen-to-anhydrous ammonia (fertilizer) pilot project



Increased energy yields of soybeans and other forms of biomass through genomics

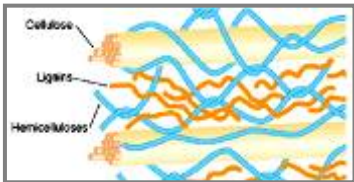


Conversion of livestock waste to bioenergy, bioproducts and hydrogen

Impacts: Forestry



Hybrid poplar research to increase genetic diversity, disease resistance and yield



Developed a novel process for degrading the lignin in woody biomass with enzymes



Airborne LiDAR to explore the biomass potential of north central forests



Paper pulp from non-traditional fiber sources such as switchgrass, poplar and willow



Bio-based, biodegradable products as a replacement for petroleum-based products

Impacts: Transportation



Ground-breaking research of mixed prairie grasses as source for carbon-negative biofuels



Engineered bacteria to create fuel hydrocarbons in hours vs. millions of years for fossil fuels



New engine systems & modifications to improve biofuels' performance & reduce emissions



Produced hydrogen from ethanol, solar energy, algae and other forms of renewable biomass



Initiated plans for a nationally-recognized bio-fuels and products research facility at the U of M

Impacts: Electricity Generation



First large-scale wind turbine at a public university in the U.S. – 50% of UMM's electricity



Nanotech, ink-jet technology and new materials to create high-efficiency, low-cost solar cells



Partnered with industry to develop new materials & lower the cost of solar water heating



Bacteria-powered fuel cells to produce electricity from waste materials



Policy and economic analyses of renewable vs. non-renewable energy sources and systems

Impacts: Environment



Full-Cost Accounting of energy including economic, social and environmental impacts



Roadmap for the upper Midwest to become carbon-neutral over the next 50 years



Assessed CO2 levels and carbon sequestration potential of MN – database for carbon trading



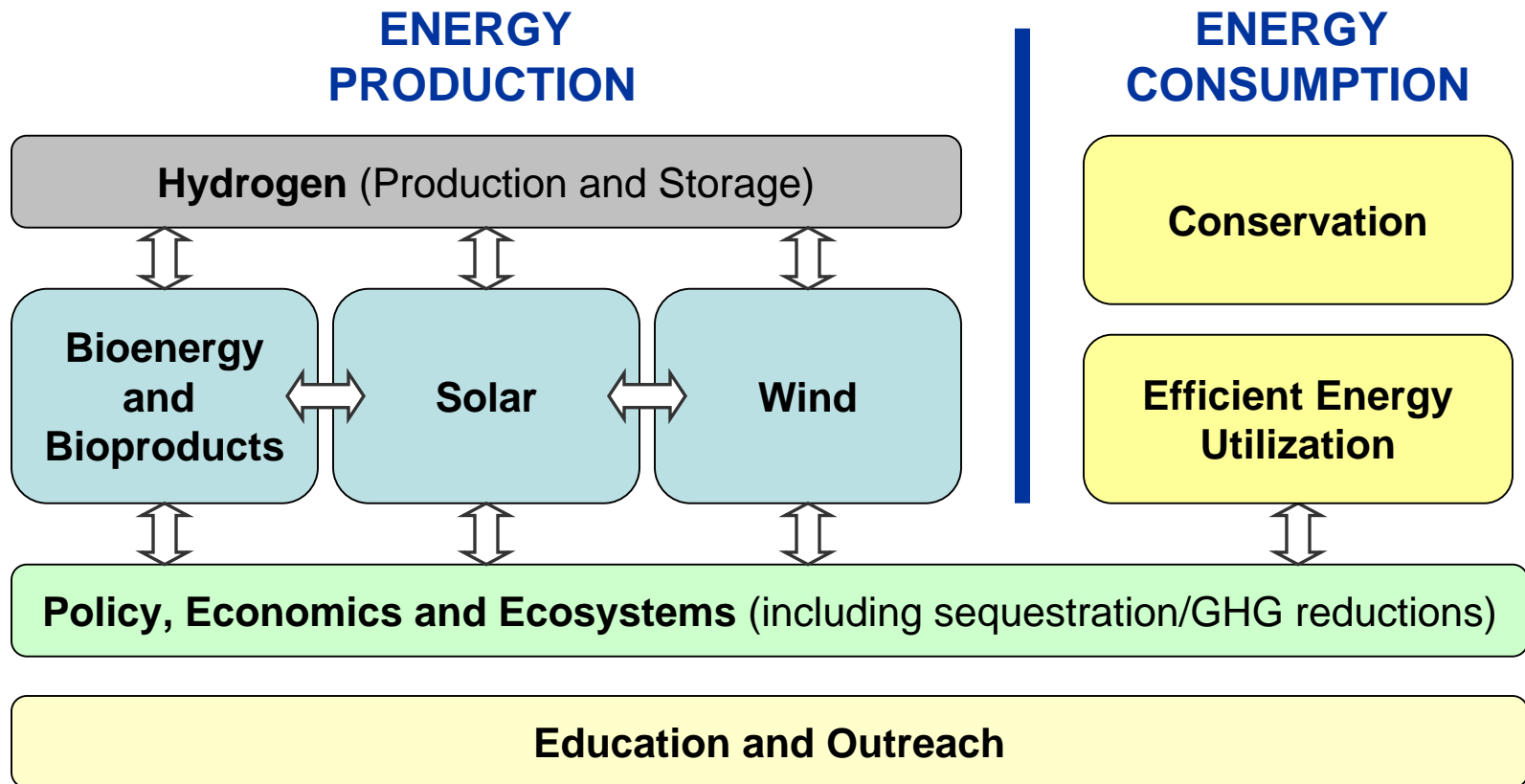
Land management practices to improve soil and water, conserve wildlife habitats & store carbon



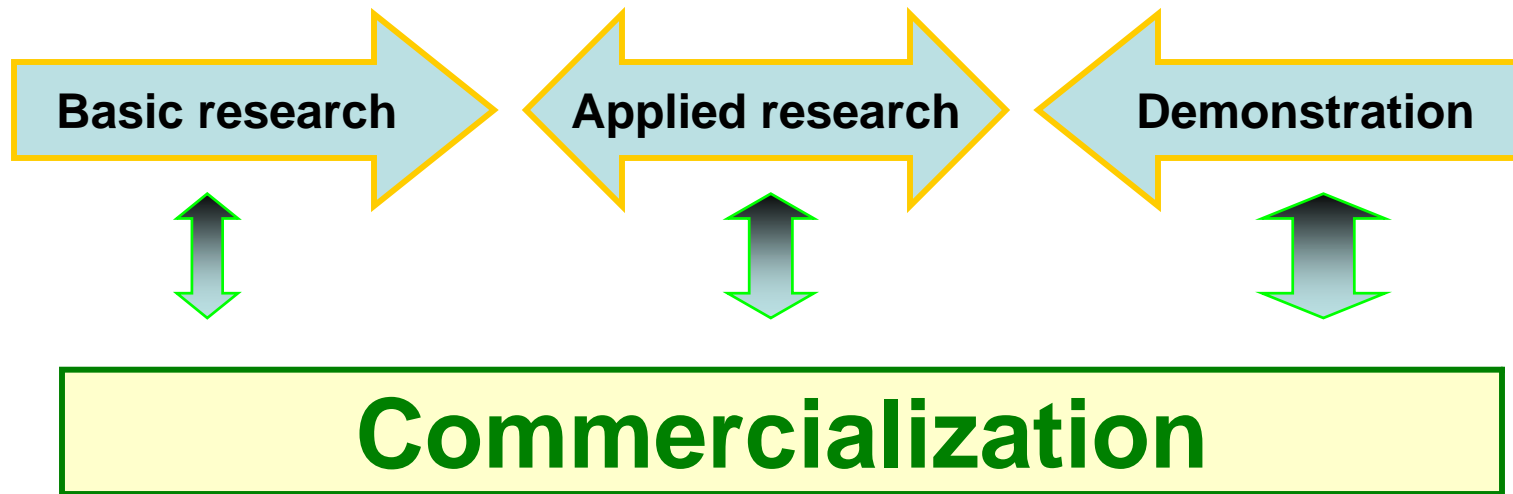
Renewable energy resources as substitute for fossil fuels in producing energy and products

Future Research Opportunities

Focusing on both sides of the equation



The Research Continuum



CERTS Projects in Detail

- 1. Renewable Energy in our Schools*
- 2. Energy Audit at the U of M Crookston*
- 3. Economics of Community Wind Projects*
- 4. Biomass Heating for Central Lakes College and Staples School District*
- 5. SE Project - TBD*

Renewable Energy in our Schools

Goal: Bring Renewable Energy education and implementation to local K-12 schools

Outcomes:

- Computer model using STELLA software
- Starts with current energy usage – shows the costs and impacts of switching to renewables
- Proctor H.S. (near Duluth) – feasibility study and site assessment for 33kW wind turbine - \$20K from MN Power
- Next steps – Increased use in the classroom



Energy Audit at UMC

Goal: Assess current and past energy usage to improve future energy savings

Outcomes:



- \$425K per year on energy
- Study determined baseline for current energy expenditures and assessed potential areas for energy savings
- Recommendations include development of an official campus energy policy and funding for an energy/sustainability coordinator
- May be applied to other facilities in the region

Economics of Community Wind Projects

Goal: Assess the impact of a potential corporate vs. community wind development project in Big Stone County, MN

Outcomes:

- For a 10.5 MW project – community wind has 5 times the local economic impact and 3.4 times the impact on local job creation (at the upper bounds)
- Next steps include assessments of community financing models and required rates of return for investors



Biomass Heating Project

Goal: Explore the possibility of converting from natural gas, electricity and diesel fuel heating to commercial, corn-fired boilers

Description:

- Working with Central Lakes Ag Center, Central Lakes College and Staples School District
- Economic feasibility of using shelled corn as a fuel source (*boiler installed at Central Lakes Ag Center*)
- Analysis of the resultant ash byproduct
- Significant contributions from partners (including Central CERT, U of M Central Region Partnership, Central Lakes College, and Central Lakes Ag Center)
- Potential for replication throughout the Midwest

Lessons Learned

Successful partnerships between the U and CERTS depend on:

1. Timing and Potential Impact
2. Networking / Collaboration
3. Outreach and “In-reach”
4. Leveraging
5. Contacting IREE or CERTS with ideas

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