

INITIATIVE FOR RENEWABLE ENERGY AND THE ENVIRONMENT



Rod Larkins, Associate Director
December 2, 2009

www.iree.umn.edu

**INSTITUTE ON THE
ENVIRONMENT**

UNIVERSITY OF MINNESOTA
Driven to Discover™

Institute on the Environment

- 2007: Institute on the Environment (IonE) formed at the University of Minnesota
- System-wide – Not part of any one college
- IREE the signature program of the IonE

IonE Mission

The University of Minnesota's Institute on the Environment (IonE) is dedicated to discovering solutions to the earth's most pressing environmental problems through cutting-edge **research**, world-class **leadership development** and innovative **collaboration**.



IREE Mission (est. 2003)

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.



Colleges connected with IREE

- Institute of Technology
- College of Food, Ag and Natural Resource Sciences
- College of Biological Sciences
- Humphrey Institute for Public Affairs
- College of Design
- Carlson School of Management
- 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



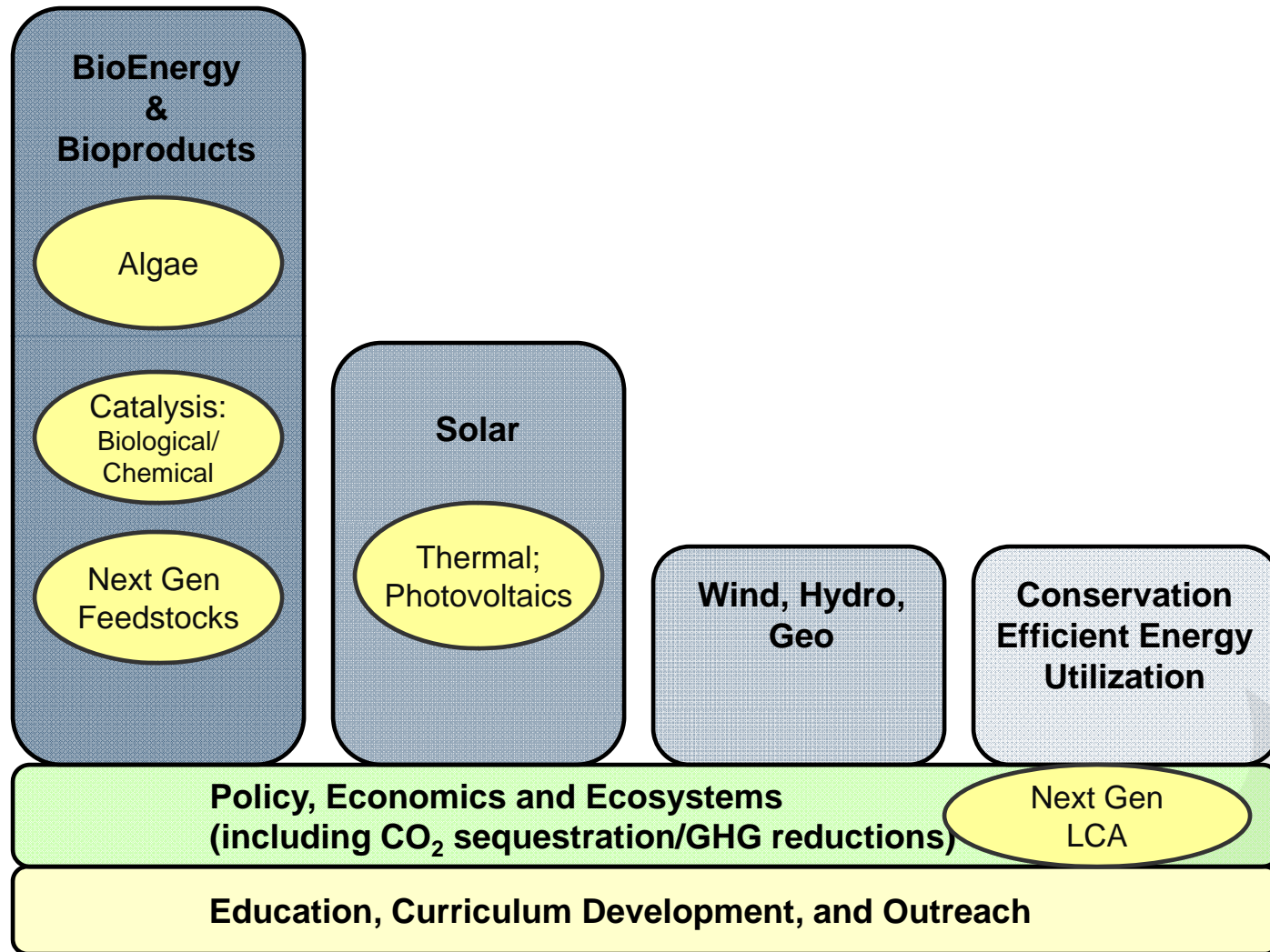
Facts and Figures – Personnel

- ~108 faculty
- ~89 undergraduate students
- ~144 graduate students
- ~30 post-doctoral researchers
- ~34 research associates
- ~22 research scientists
- ~15 visiting scholars

NEARLY 450 RESEARCHERS TOTAL



IREE's Portfolio – Moving Forward



Striking a Research Balance

- The University is responsible for doing basic science (game changing, bleeding edge)
- Basic research requires significant time to become commercial
- IREE's Mission Statement leads with "Promote Economic Development"
- IREE points researchers towards gating problems in renewable energy
- IREE develops a balance between near term and long term programs



Critical Issues Surrounding Solar & Wind Technologies

1. System Efficiencies
2. Systems Cost
 - a. Components
 - b. Installation
3. Reliability/Repair Cost
4. Grid Integration
5. Periodicity



An Industry/Academe Consortium for Achieving 20% wind by 2030 through Research & Workforce Training

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

Institutions of Higher Learning

- University of Minnesota, Twin Cities (UM)
- University of Minnesota, Morris (UMM)
- Syracuse University (SU)

Technical College

- Dakota County Technical College (DCTC)

Industrial Partners

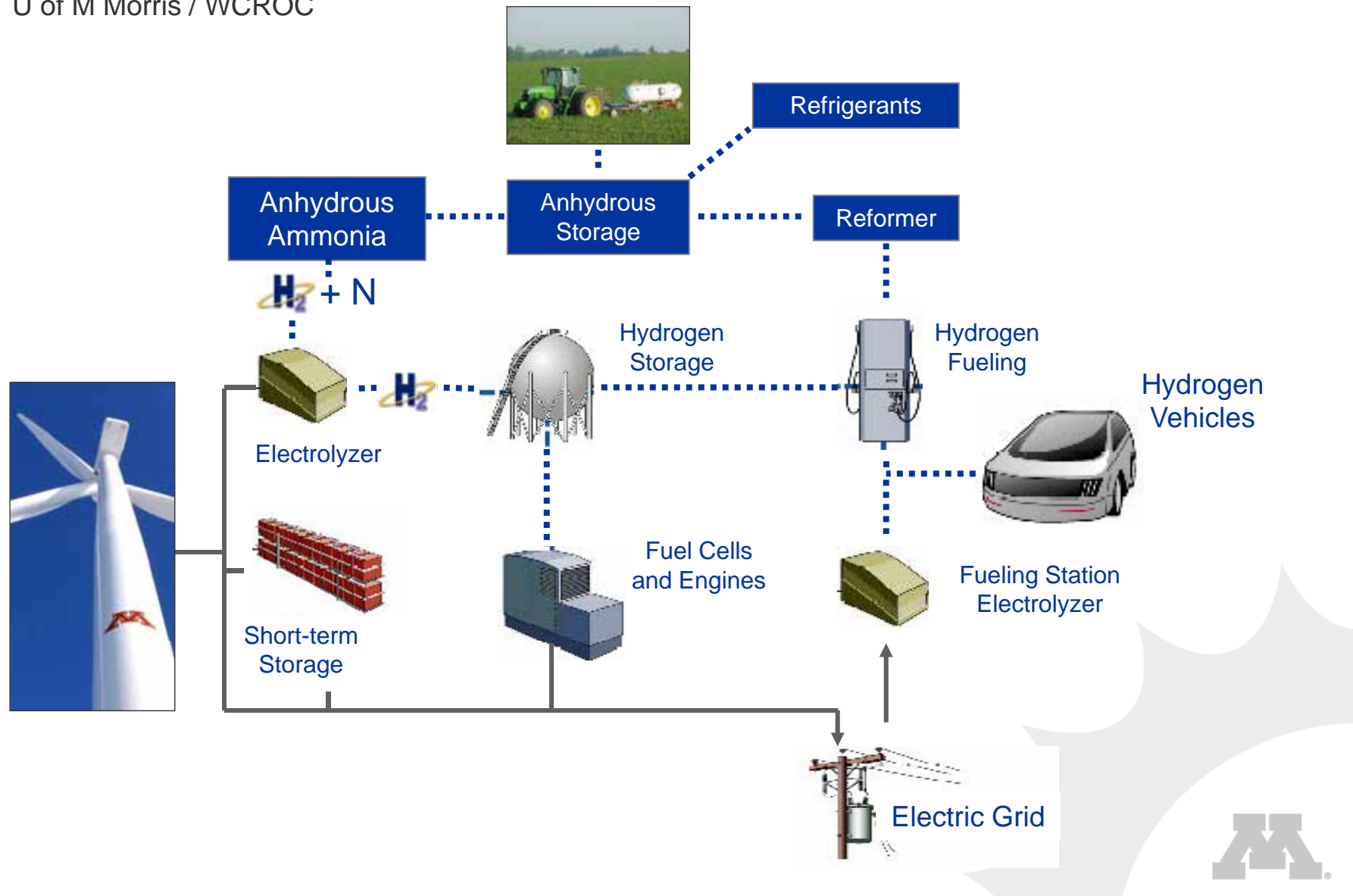


2.3MW Siemens turbine dedicated to research and workforce training at UMORE Park



Wind-to-Hydrogen

U of M Morris / WCROC

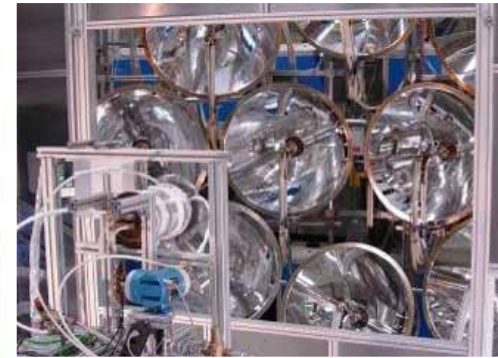


Thermochemical Fuels: Solar at Night

Project lead: [Jane Davidson](#), Mechanical Engineering

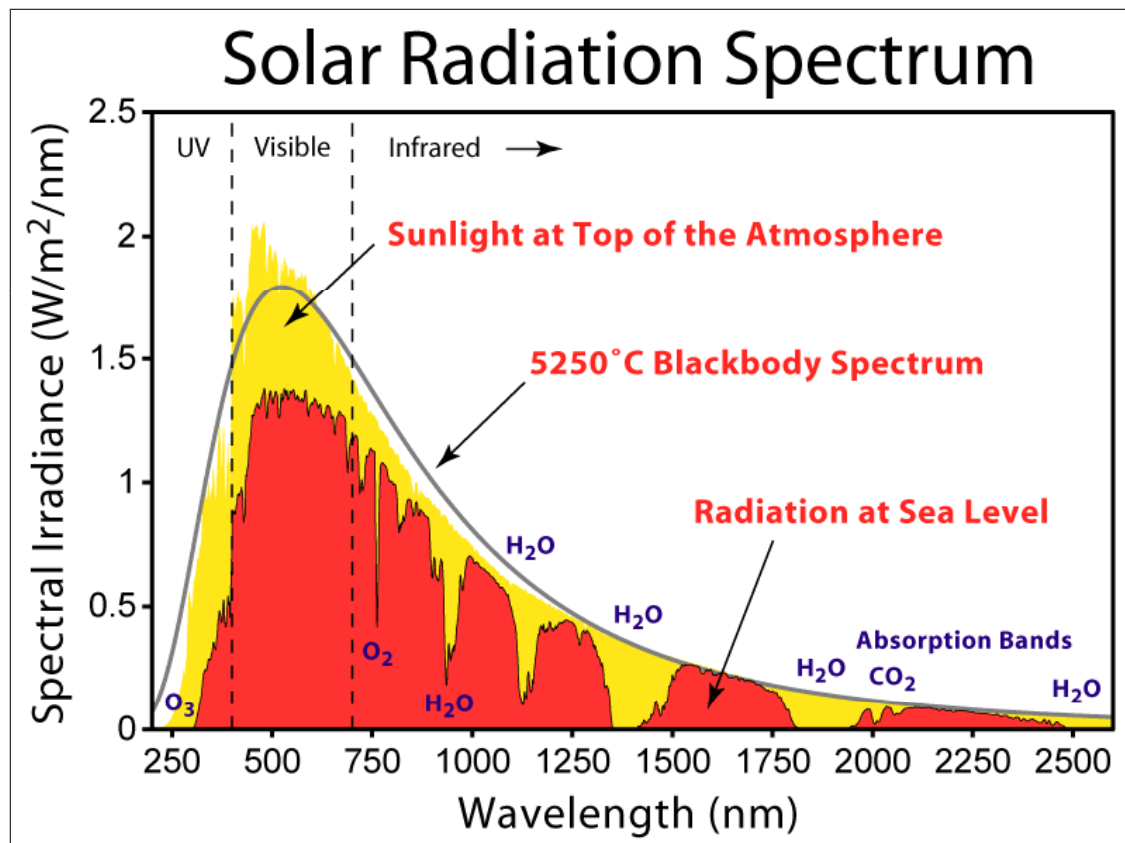
11 MW-electric/ 55 MW-thermal (Sevilla, Spain)

- 624 heliostats; each 120 m²
- Tower height: 100 m
- Rankine-cycle
- Costs (incl. power block): 35 M€
- $\eta_{\text{solar-to-electricity}} = \begin{cases} 21\% & \text{peak} \\ 16\% & \text{average} \end{cases}$



Laterally Integrated Photovoltaic Systems

Project lead: [Philip Cohen](#), Electrical and Computer Engineering



Biomass Focus

- Production
- Consolidation
- Conversion
- High Value Applications



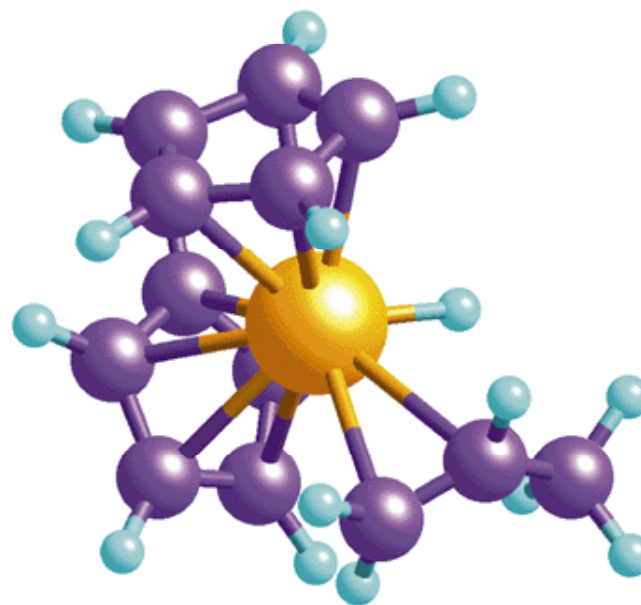
Thermochemical Approaches to Conversion of Biomass in Small-Scale, Distributed Systems

Project leads: [Michael Tsapatsis](#), ChemE; [Roger Ruan](#), BBE



Sustainable Polymers: Tomorrow's Advanced Materials

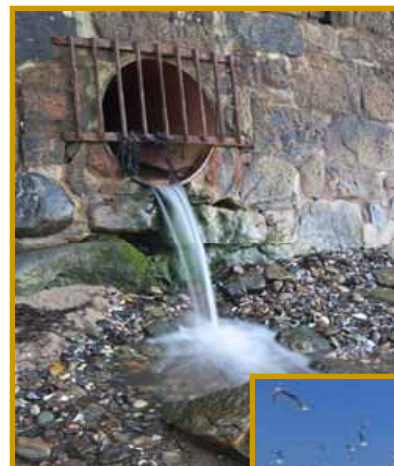
Project lead: [Marc Hillmyer](#), Chemistry



Waste Streams to Energy

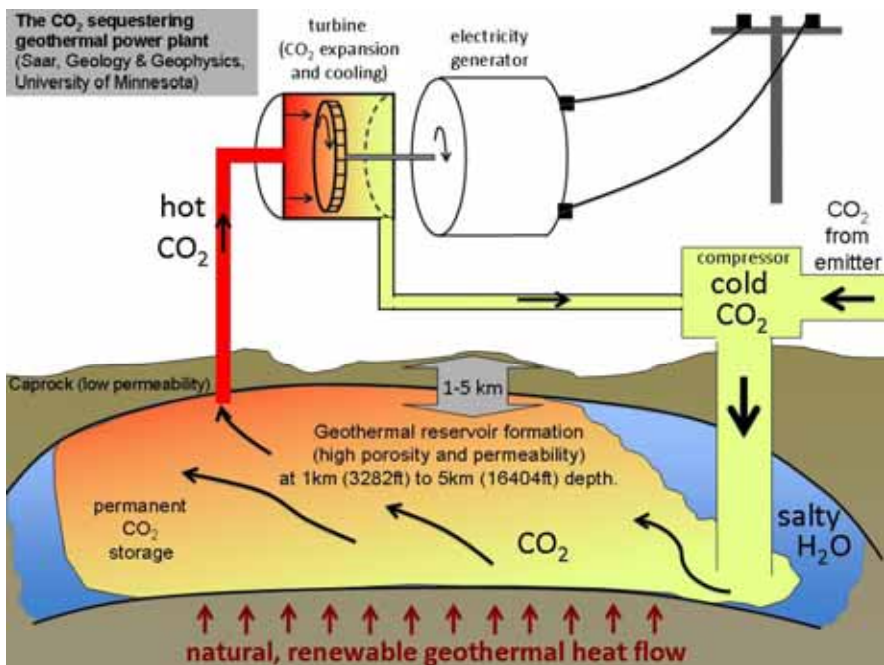
Cleaner Water, Cleaner Air, Improved Land Use

- CO₂
- Waste Water
- Animal Waste
- Municipal Waste Streams
- Waste Heat
- Agriculture and Forestry Waste



Combining Geothermal Energy Extraction and CO2 Sequestration to Produce Clean, Renewable, Carbon Negative Electricity

Project lead: [Martin Saar](#), Geology and Geophysics



High-temperature Geothermal – Iceland

Low-temperature Geothermal – Minnesota



Algae-to-Biofuels Research



In Partnership with:

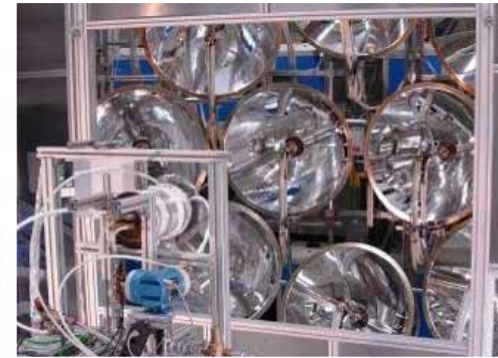


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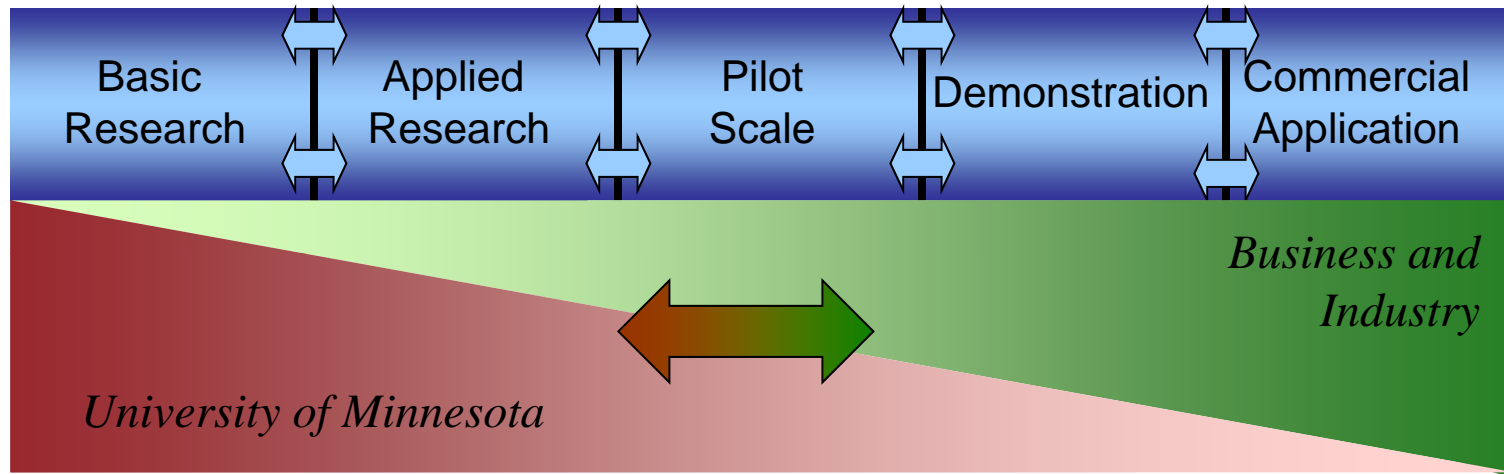
Project lead: [Jane Davidson](#), Mechanical Engineering

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The Research-Development-Commercialization Continuum



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