



Creating Sustainable Campuses

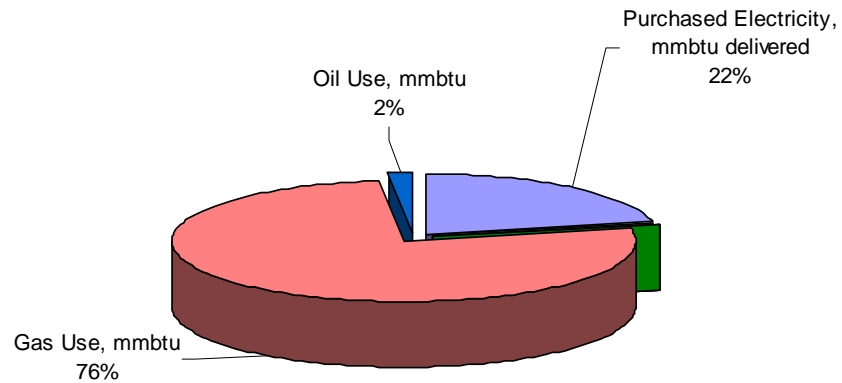
The Morris Model

Managing carbon with hybrid energy systems



Carbon Footprint 2004 12,000 tons

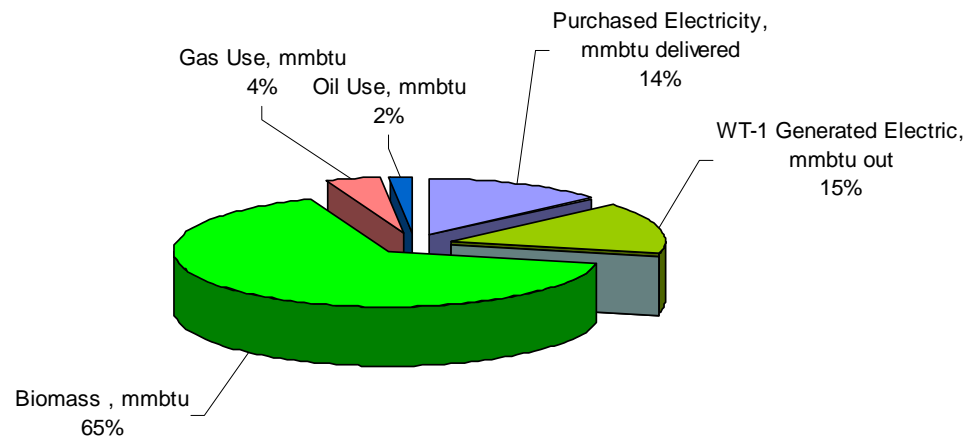
2004 UM Morris Campus Energy Source Breakdown





Carbon Foot Print 2009 4,000 tons

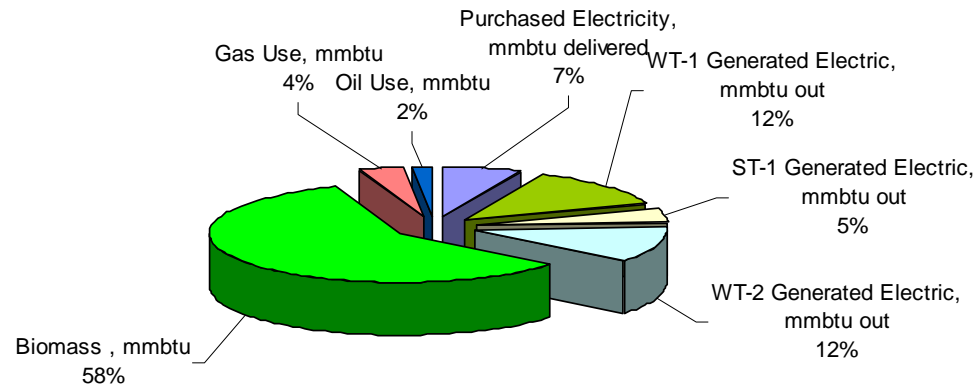
2008 UM Morris Campus Energy Source Breakdown





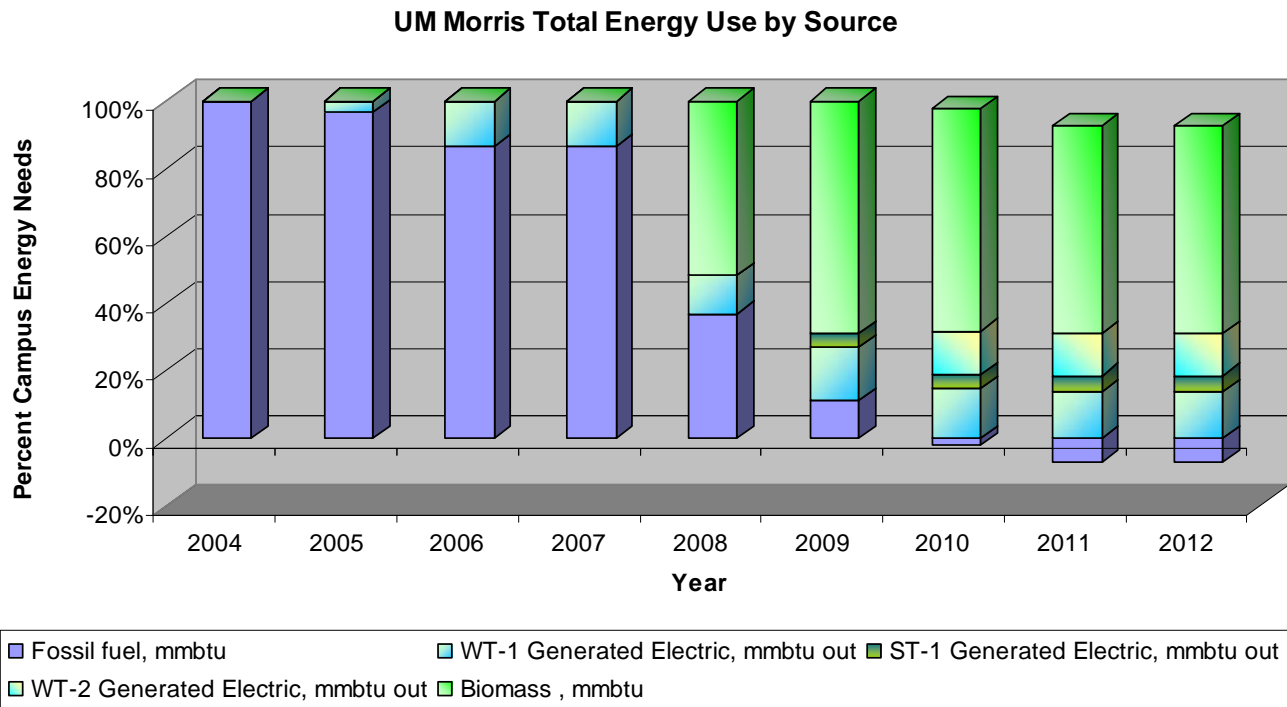
Carbon Foot Print 2010 Less than 2,000 tons

2010 UM Morris Campus Energy Source Breakdown



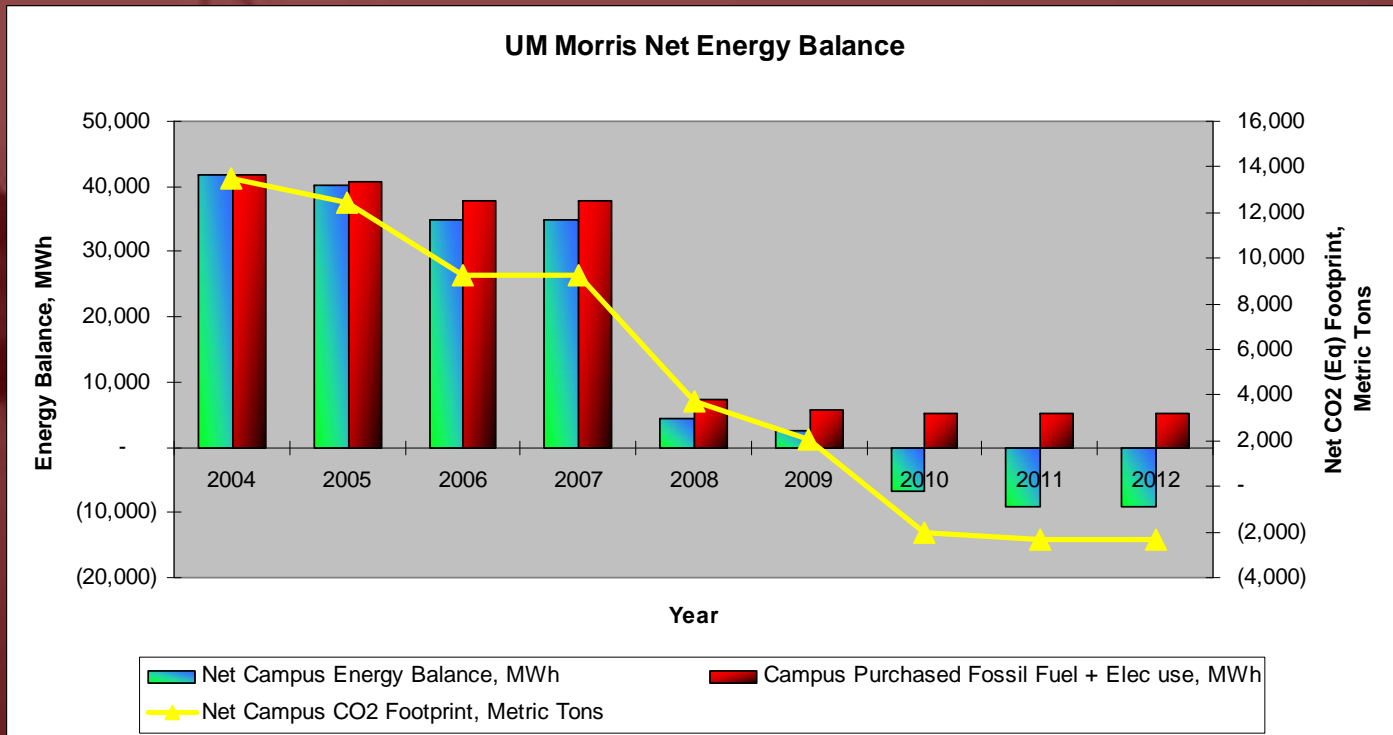


Energy transformation





Carbon negative





Managing Change

- Onsite renewable distributed dispatchable energy generation.
- Integrated combined heat and power plant
- District heating and cooling
- Hybrid energy platforms



The Science of Carbon

- Old carbon vs new carbon
- Carbon markets (Global vs Local)
- Climate change
- Carbon Cycles
- Low Carbon Communities (LCC)



Low Carbon Communities

- Create nearly four times more total jobs than spending the same amount of money within the oil industry.
- Create roughly triple the number of good jobs — paying at least \$16 dollars an hour — as spending the same amount of money within the oil industry.
- Reduce the unemployment rate to 4.4 percent from 5.7 percent (calculated within the framework of U.S. labor market conditions in July 2008).
- Bolster employment especially in construction and manufacturing. The *Green Recovery* program can, at the least, bring back 800,000 construction jobs. *

*Center for American Progress and Political
Economy Research Institute

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Drivers of Change

- Sustainable ecosystems
- Volatile fossil fuel markets
- Energy security
- Economic security
- Carbon Infrastructure



Why Morris? (Green Prairie Alliance)

- ARS research in soils, alternative fuel stocks, and carbon sequestration
- U of MN WCROC agricultural production and hybrid wind to ammonia production
- U of MN Morris thermal gasification of biofuels and environmental studies.



The Green Prairie Alliance: Bio-mass/Bio-energy Research Triangle



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Strategic Resources



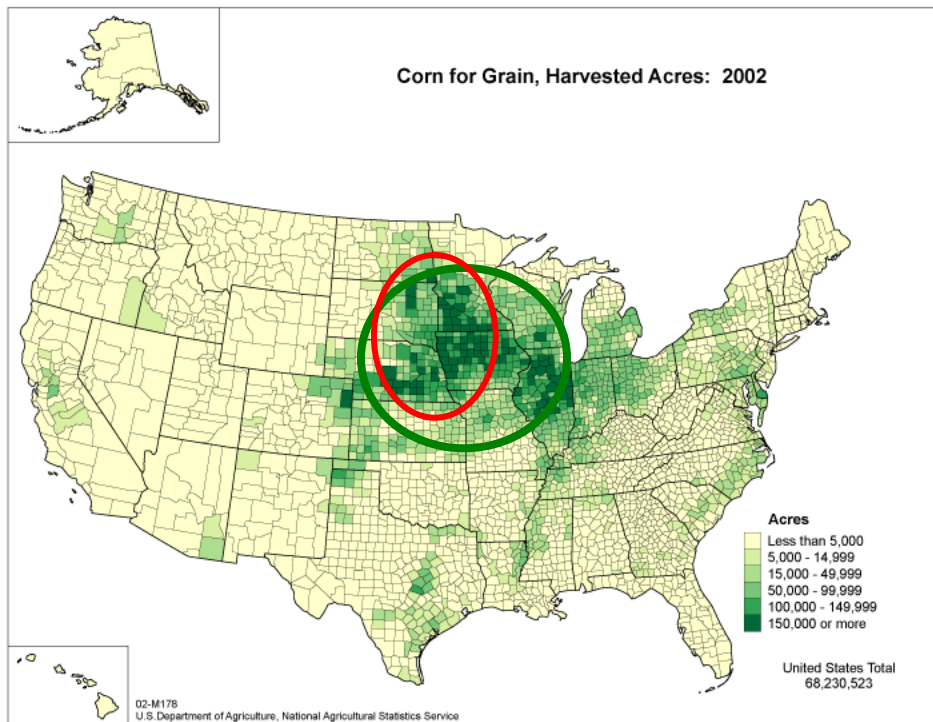
Soil, Moisture, &
Sun

Excellent Wind
Resource

&

20,000MW

Stranded Wind



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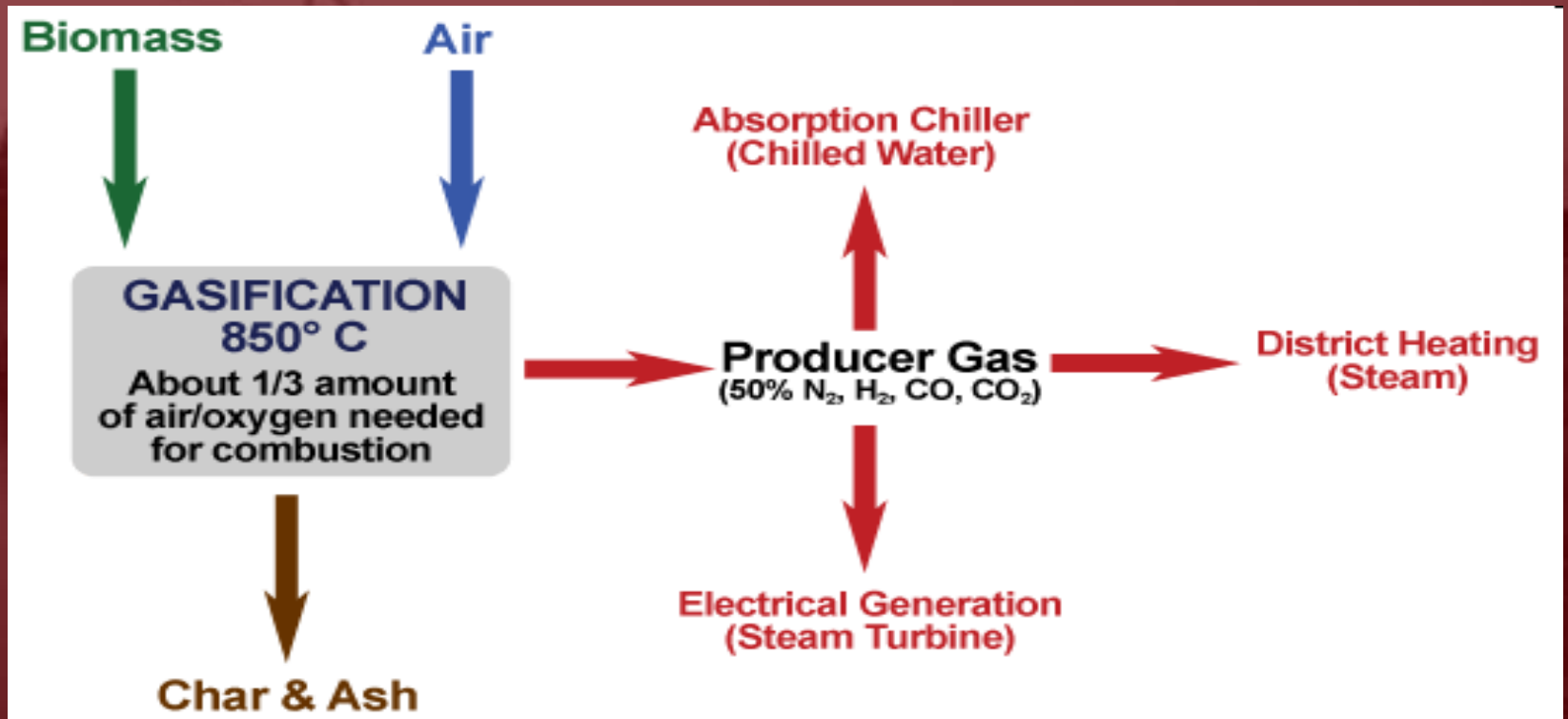
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Bio fuels (New Carbon)



Combined Heat and Power





Gasification Plant



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Hybrid Renewable Energy Platforms CHP with Renewables

Wind Turbines

Steam Turbines

Gasification /Thermal Conversion

Absorption Chillers

Wind to Hydrogen Platforms



Thermal Conversion of Biofuels

- Morris Biomass Plant:
 - Use up to 8,000 tons of biomass
 - At \$54/ton adds \$400,000 to local economy.
 - Avoids 8,000 tons of CO₂ discharges
 - Chicago Climate Exchange. \$48,000
 - \$80/ton may be realistic for fuel stocks



Opportunities

- Economic development (LCC)
- Environmental impact (GHG)
- Carbon Science
- Agricultural Research
- Public Policy
 - CBED vs RPS vs REP
- Smart grids, distributed energy systems



Vision for the Future

- Distributed Renewable Generation
 - Rethinking energy distribution
 - Using RE to manage carbon
 - Creating local bioenergy ecosystems
 - Creating sustainable communities
 - Value added biofuels products



Sustainable Campus or Community?

- Morris Project
 - 1 million sq ft
 - 2000 people
- How do you transform your community?
 - Follow the money
 - Master Energy Plan
 - Infrastructure
 - Resources
 - Economic insulators
 - Define your community
 - Risk vs reward
 - Stakeholders
 - Local vs Global



Research Drivers

- Energy
 - Hybrid integrated systems with grid intelligence
 - Reduced carbon footprint
- Economy
 - Economic security
 - EU Goal of 50% reduction by 2020
 - Green jobs
 - EU estimate of 10,000 new jobs
- Environment
 - Sustainable inputs/outputs
 - Carbon/hydrogen/Nitrogen solutions
- Food and water
 - Human caused gains or losses

What are the possibilities?





Hybrid Renewable Energy Systems

- Multiple platforms.
- Synergy by integration
- Business plans and energy finance
- Local environment, economy, energy

Practical production systems with research and demonstration platforms

“Destination Renewable Energy Research & Demonstration Systems”



Carbon Markets

- Carbon cap and trade will put value on Carbon
- Carbon/Hydrogen/Nitrogen
 - Value Added
- Global markets
- Biofuels and green electricity are the currency of the carbon markets



National Leadership

- Designing first wind to hydrogen production
- First research turbine at public university
- One of the first ag fuel gasification platforms
- One of the first hybrid renewable energy platforms
- Prototype of future distributed renewable dispatchable community based energy systems.



Back to the future

- Distributed local intelligent energy systems
- System wide changes in efficiency and outputs
- Building renewable infrastructure
- Innovation in sustainable systems
- Hybrid solutions
- Environmental vs renewable to:
- Environmental and renewable!



University of Minnesota, Morris

- Green Prairie Alliance
 - West Central Research and Outreach Center
 - Agricultural Research Station
 - University of Minnesota, Morris
- Public and private partners.
- June 2 & 3 symposium – Sustainable Communities



Value-Added Partnerships

- Department of Energy, U of MN Institute on the Environment, Institute for Renewable Energy and the Environment, MN Corn Growers, Otter Tail Power, Agriculture Utilization and Research Institute, Chippewa Valley Ethanol Cooperative, EERC, West Central Research and Outreach, Central Administration, HGA, Mckinstry, United States Department of Agriculture, Minnesota Pollution Control Agency, Office of Energy Security- Department of Commerce U of MN IT, U of MN Mechanical Engineering, U of MN Carlson Ventures School. Humphrey School of Public Policy, U of MN University Services, State of Minnesota, Office of General Council, Students, Faculty and Staff.
- Citizens of Minnesota