EIU: Biomass Gasification, Renewable Energy Center

Heating the Midwest with Renewable Biomass

April 26, 2012

Eau Claire, WI.

eastern is committed to the philosophy of creating a greener, pedestrian-friendly campus.

- current coal-fired boiler system was installed in 1925 and has outlived its useful economic life
- current location conflicts with EIU's core vision to be academically oriented and pedestrian friendly with lots of green space
- frequent system failures and an immense amount of deferred maintenance forced plant replacement into a 'mission critical' status

current steam plant

multiple views

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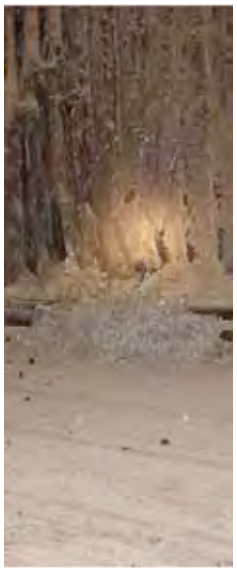

deferred maintenance

$16 million :: from corrosion to outdated technology to equipment failure

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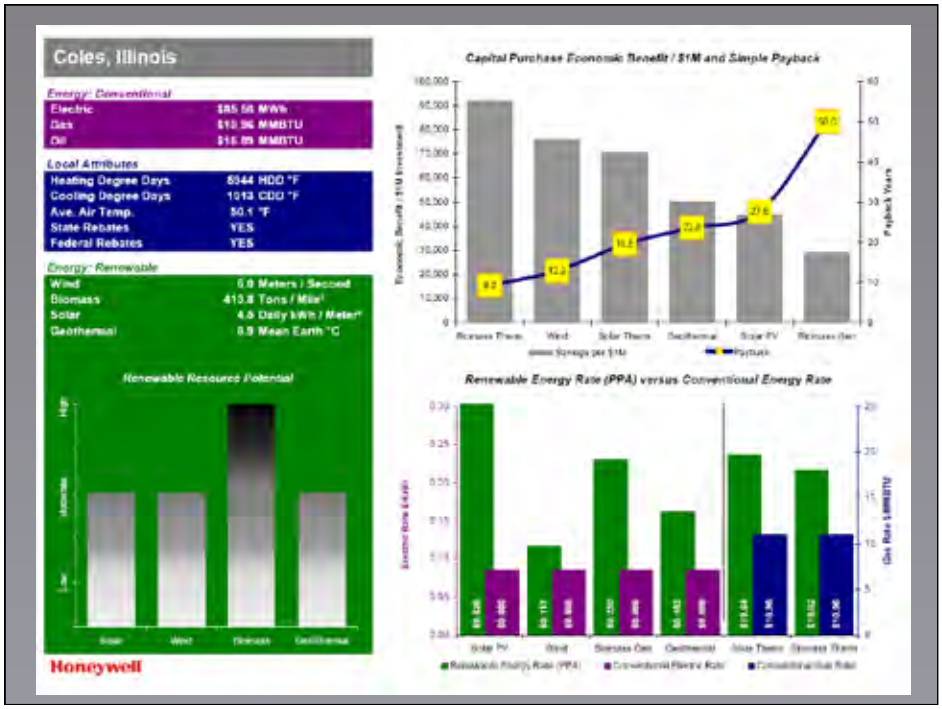

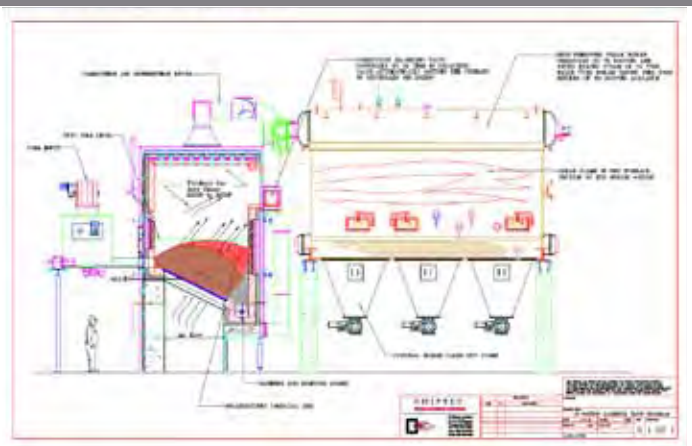

how a gasifier works

process flow diagram

biomass gasification

- fuel – 2 1/2" softwood/hardwood chips – 27,000 green TPY
- alternate 'virgin' biomass fuel opportunities (miscanthus, conditioned corn stover, etc.)
- 2 stage process – one system
  - pyrolysis: *the chemical decomposition of organic material by heating in the absence (or limited availability) of oxygen*
  - thermal oxidation: combustion in boiler
- reduced emissions
- automated fuel feed and boiler controls
- proven technology
  - Commercially installed last 20 years: 175 installations worldwide in hospitals, schools industrial applications (900 HP installation at veneer mill in Marion, Wisconsin; co-gen at Middlebury College, Burlington, VT.))
- green energy

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some interesting tidbits

- Our energy issues are due to human 'population' : 7B now and doubling every 40 years.
- If all were vegetarians, earth could support ~10B based on food
- Things that will most likely do us in are lack of modern sanitation and modern medicine (natural enemies)
- If we used all the corn we grow to make ethanol, would offset ~5% oil- also see second bullet
- It takes up to 126BTU input to produce 100BTU ethanol
- US needs ~100 x 10e15 BTU annually. Based on wood fuel at 3T/A-yr., and 8k BTU/LB, would need 3,125,000 sq. miles of forest. That is a square 1767 miles on a side
- However, as a regional solution, woody biomass makes the most sense

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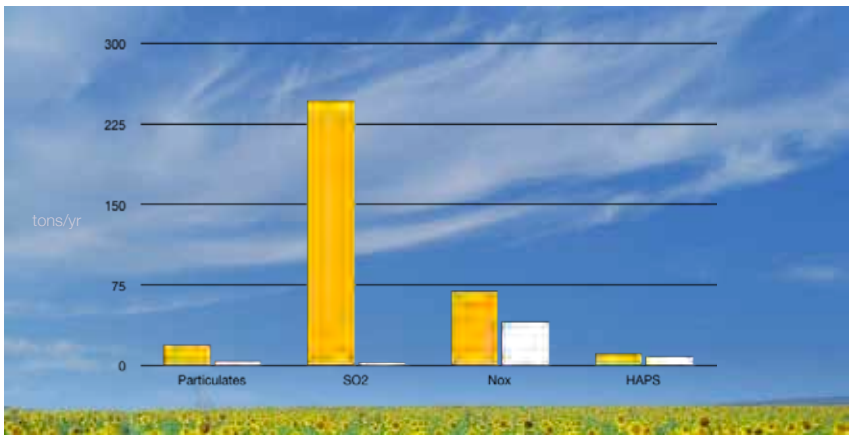

Currently Allowed (tons/yr)
Expected from new plant (tons/yr)

air emissions compared

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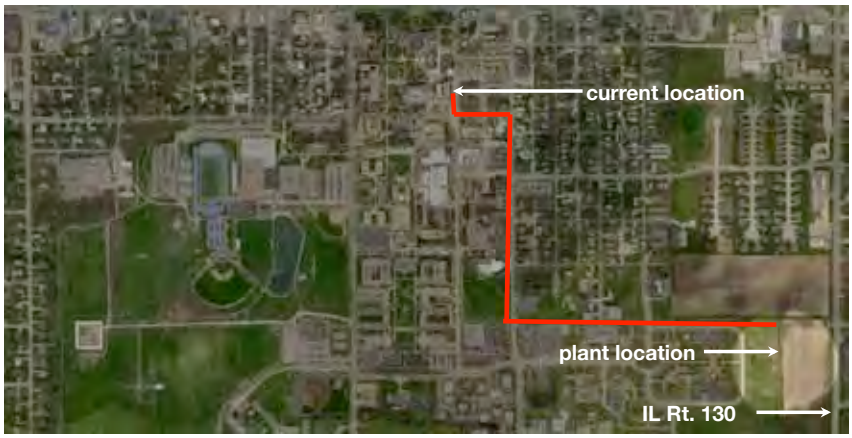

new EIU renewable energy center

location indicated on ariel view of campus

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new EIU renewable energy center

plant site and area

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Summary Timeline

- October 2009 :: Build America Bonds sold; construction mobilized
- November 2009 :: IEPA permit received; official groundbreaking
- December 2010 :: building shell completion
- April 2011:: first fire gas/oil back-up units
- May 2011:: process steam production/ operating staff reassigned
- June 2011:: first fire gasifier plant
- November 2011 :: stack testing completed
- October 2012 :: existing plant decommissioned

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eastern illinois university energy project

- Various energy conservation measures installed under the Public University Energy Conservation Act as written (<20-year payback) — $23M
- CHP enhancements to include base plant (above) plus backpressure steam turbine driven co-generation and a 20,000 watt solar array for internal electrical production — $57M
- Contract **GUARANTEED savings** in utility costs over 20 years — $144M

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Eastern Illinois University energy conservation measures

- Air conditioning delivery upgrades
- New windows for Residence Halls
- New 69KV Switchyard
- Lighting Upgrades
- Building Envelope Sealing
- Retro-commissioning
- Water Retrofits
- Occupancy Sensors
- Low Voltage Transformer Replacement
- Insulate Condensate Lines

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savings

- 6,174,794 kwh
- 13,845,553 gallons of water
- 54 millions lbs of steam

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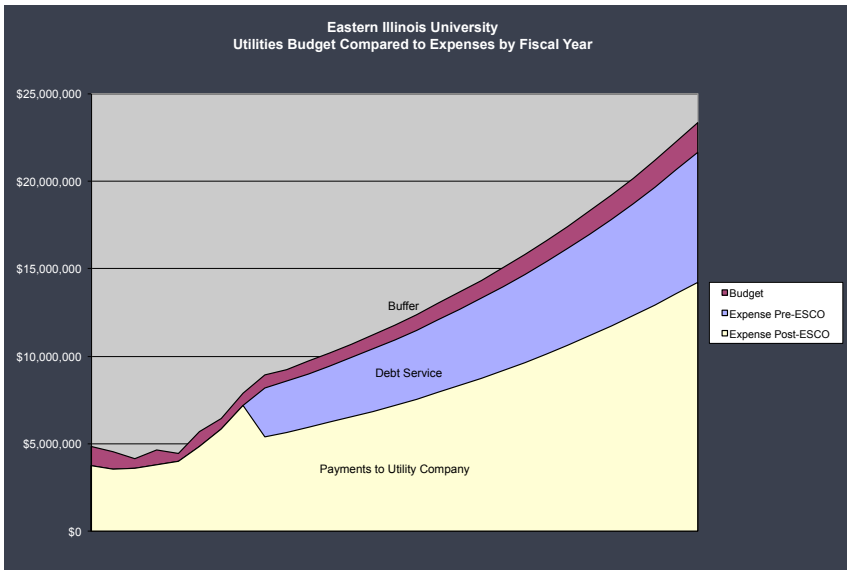

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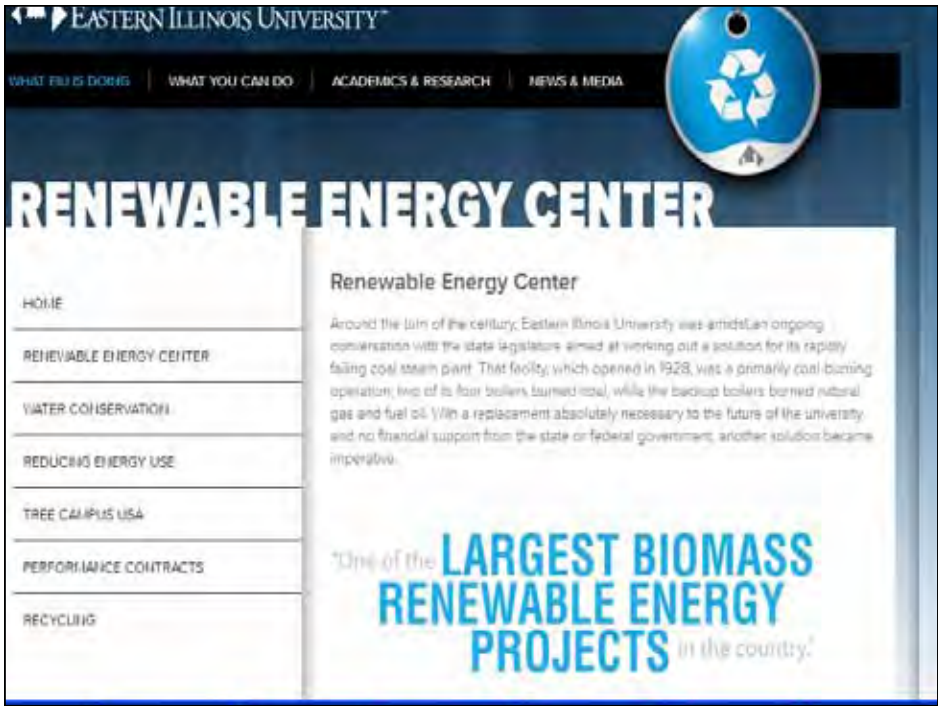
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WHAT EIU IS DOING
WHAT YOU CAN DO
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NEWS & MEDIA
RENEWABLE ENERGY CENTER
HOME
RENEWABLE ENERGY CENTER
WATER CONSERVATION
REDUCING ENERGY USE
TREE CAMPUS USA
PERFORMANCE CONTRACTS
RECYCLING
Renewable Energy Center
Around the turn of the century, Eastern Illinois University was embroiled in ongoing conversation with the state legislature aimed at working out a solution for its rapidly failing coal steam plant. That facility, which opened in 1928, was a primarily coal burning operation; two of its four boilers burned coal, while the backup boilers burned natural gas and fuel oil. With a replacement absolutely necessary to the future of the university and no financial support from the state or federal government, another solution became imperative.
"One of the LARGEST BIOMASS RENEWABLE ENERGY PROJECTS in the country."


ACADEMICS
HOME
ACADEMICS
RESEARCH
EIU - Tree Campus USA
Tree Campus USA is a national program recognizing college and university campuses that effectively manage their trees and develop connectivity with the community beyond campus borders to foster
Planned Projects and Coursework
Examples of integrative research projects that will support faculty and student scholarship in a variety of departments and disciplines include:
• The study of synthesis gas to be converted into pure hydrogen or liquid fuel as a source of renewable energy
• The impact of "biochar" (a gasification byproduct) on the carbon capture and ecological systems
• Economic, geographic, geological, historical, political and sociological issues related to biomass or other clean energy sources
The Departments of Biological Sciences, Chemistry, Economics, Geology Geography, Physics, and Technology have identified research projects focused on the study and uses of biomass. Once demonstrations of the research-scale gasification reactor begin, at least 100 students each semester will have the opportunity to learn the fundamentals of the gasification process.

Academic Challenge

To integrate students learning with the opportunities brought with the Renewable Energy Center.

Center for Clean Energy Research and Education (CENCERE)

Create and provide opportunities for faculty, students and staff to be engaged in study of clean energy across the whole campus.

Laboratory Biomass Gasification System

(Made Possible by Charleston Area Charitable Foundation)

The Related Academic Offerings

- BS-Applied Engineering and Technology (AET) with Alternative Energy and Sustainability concentration- fall 2011/12
- Interdisciplinary Minor in Environmental Sustainability - fall 2012/13
- MS- Sustainable Energy—36 hours energy science, technology management, policy and econ, research, communications, and sustainability practicum– fall 2012/13

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new EIU renewable energy center

current photos

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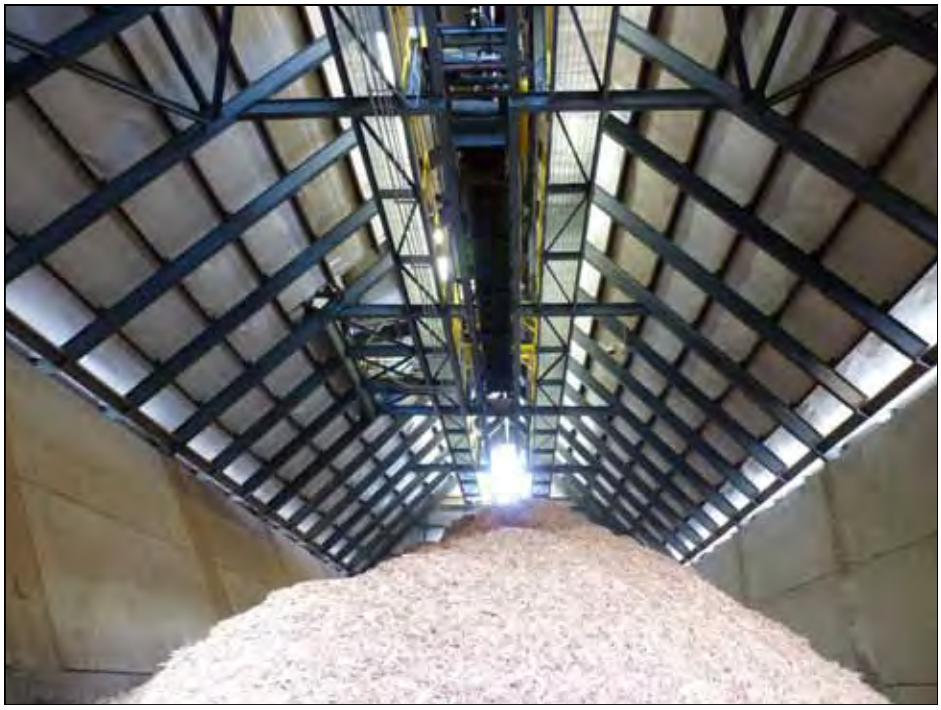


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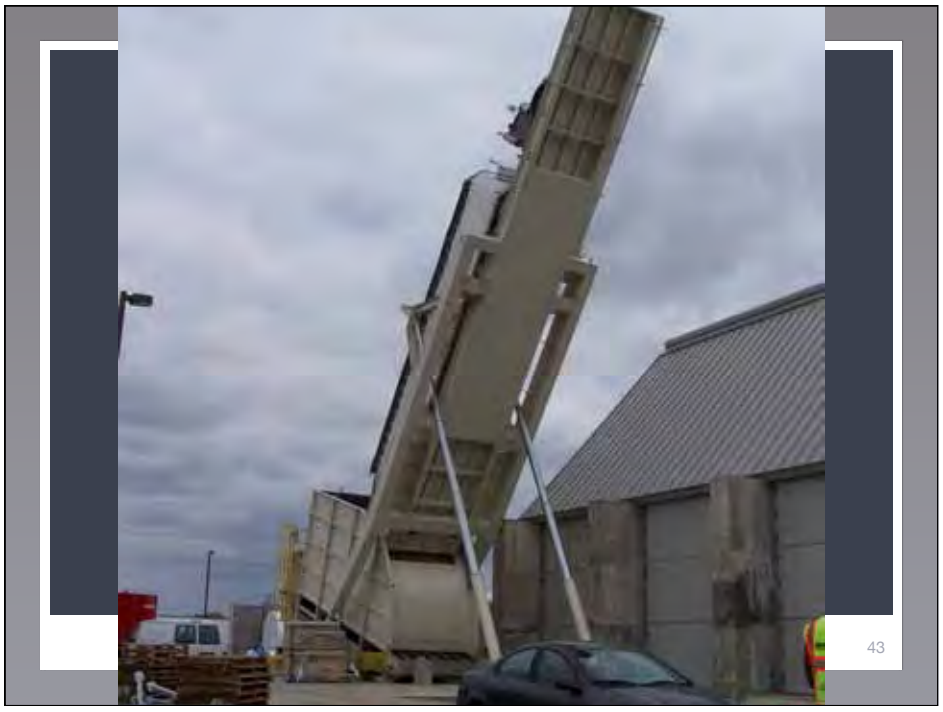
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Thank You!!

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http://www.youtube.com/watch?v=whNOyCCSVGQ