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University of Missouri



District Energy Goes to Class at Mizzou!



Today's lecture...

- *Brief view of MU's District Energy System*
- *Downfall of classic utility communication*
- *How to interact with your academic community*
- *What's happening at Mizzou*
- *The success of our students, future energy leaders*
- *Academic interaction value to the district energy operation*

MU Energy Management

A campus energy enterprise!

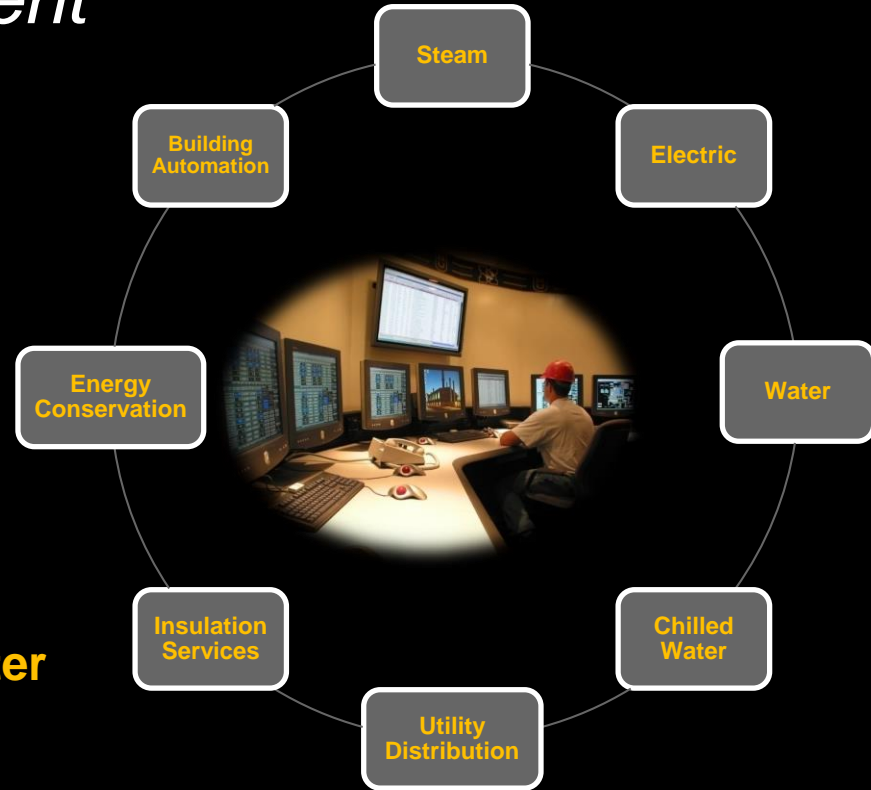
Production Capacities:

66 MW CHP Generation

1.1 Million lb/hr Steam

32,000 Tons Chilled Water

4 Million gal/day Drinking Water



MU Energy Management is a...

District Energy System

Co-generation Facility

Building Automation Company

Tri-generation Facility

Power Plant

Micro Grid

Energy Conservation Company

District Cooling System

Combined Cooling-Heat and Power System

Public Drinking Water System

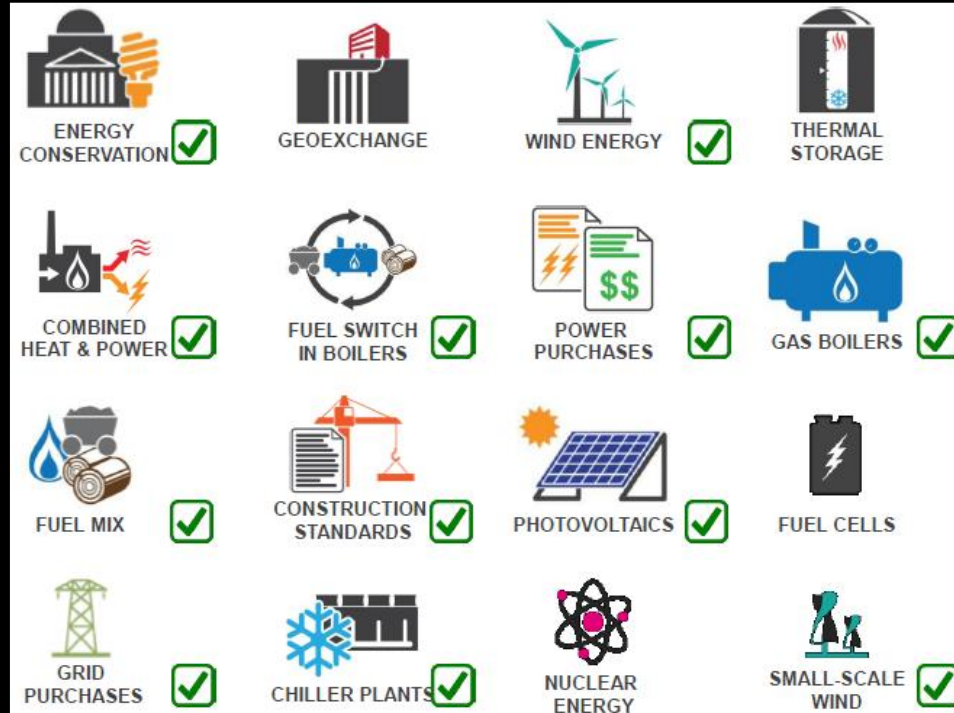
Smart Grid

Providing the MU campus with reliable, cost effective, and sustainable utility services!

MU's Diverse Energy Portfolio



Yes, we do that!



Renewable Energy for Mizzou



***Biomass Combined Heat & Power
Grid Wind Energy
On-Campus Wind Energy
On-Campus Solar PV
On-Campus Solar Thermal***



***Over 34% of MU's
energy comes from
renewables!***

Sustainability Success!

Through 2016:

- **Total renewable energy portfolio – 34%**
- **Greenhouse gas emissions reduced by (2008 Base) – 51%**
- **Coal use being reduced by (2008 Base) – 73%**
- **Wind Power percentage of campus electric – 13%**



We provide our campus with reliable and cost effective utilities. We've embraced sustainability with a diverse renewable energy portfolio!



Why is this not good enough?

Why don't they love us?

What else can they want?

Past Utility Expectations...

As long as we keep the pipes full and the wires energized, they'll leave us alone!

Except,

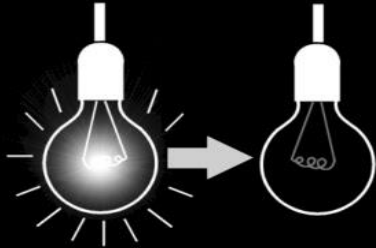
*When the bill comes!
When the utilities trip off!
If still you use fossil fuels!*



Typical Customer Communications

When the bill comes!

- Why is this bill so high?
- Utilities are too expensive!
- What in the heck is demand?



Or when the lights go off!

- Why is the power off?
- How quickly will it be back on?
- You can NEVER shut off utilities to “MY” research?

Paradigm Shift...

- Change the conversation by interacting with your campus community
- Help them to see the value of the district energy system from their perspective
- Don't assume they know all the great things you're doing
- Develop long-term collaborations and partnerships with academics
- Engage your students and help them learn about energy



Interact with Academics!

- Further your schools academic & research missions
- Provide energy related consultation for researchers
- Partner on research grant opportunities
- Provide custom tours coordinated with instructor's courses
- Invite deans, chairs, professors to a presentation and tour
- Meet/participate in campus organizations and committees
- Partner with professors to use utility system information in their courses
- Offer guest lectures on energy related topics for the class room
- Provide presentations and tours for campus academic conferences
- Tour visiting professors who've come to collaborate with your campus



Interact with your Students!

- Tour student classes, clubs, and organizations
- Supplement your staff with student interns, seek input from professors to obtain good candidates. Challenge them with learning opportunities
- Meet with student organizations and clubs interested in energy, seek their input
- Share how utilities are provided with students: website, videos, social media
- Provide technical guidance for class activities and senior “Capstone” projects

Meet with your customers!

- Meet regularly with your key utility customers
 - Seek to understand their utility needs and expectations
 - Share usage data and suggestions on how to economize
 - Explain your rates and how they are determined
 - Provide access to billing and utility use data
 - Give them forecast data to help them budget
 - Provide them tours of the utility systems to help them learn how utilities are produced and delivered
 - Show how their utilities are metered
 - Engage them in your planning process for scheduled outages

What has Mizzou's District Energy Done?

Over the past 10 or more years we've tried, implemented or expanded most the items shown on the previous slides!

We've earned the support and encouragement from our administrative leadership who champions the goal of furthering the academic mission where possible.

Some examples of our success...



Academic Collaboration

CHP Thermodynamic Studies

2016 Optimizing Power Generation Costs



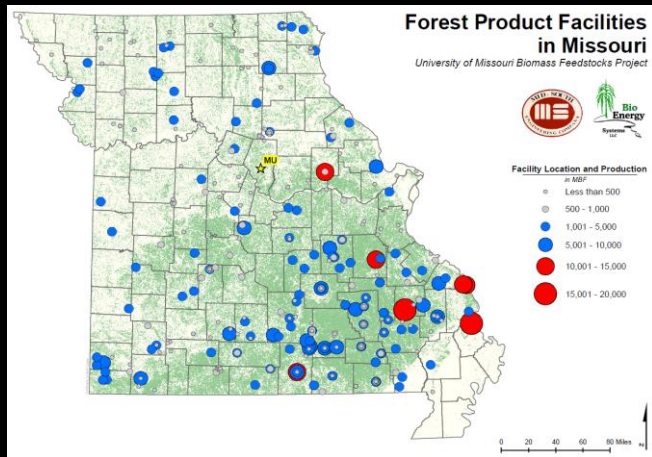
Which provides the lowest cost incremental MW: GT Inlet Cooling or HRSG Duct Burner with cogeneration?



“Our collaboration with the plant gives students valuable experience that can help them in their studies and in their future careers. They also really enjoy working on real world problems that apply our classroom concepts.”
Jacob McFarland, Associate Professor in Mechanical Engineering

Research Interaction – MU Forestry

“The on-site biomass CHP and the knowledge of the plant staff ties well with Forestry’s research and outreach focus of utilizing sustainably sourced woody biomass for energy” Dr. Hank Stelzer, Department Chair Forestry



Missouri
Woody Biomass Harvesting
Best Management Practices
Manual



Missouri Department of Conservation

DOE Industrial Assessment Center

Partnering to help teach energy engineers!

MU's Mechanical Engineering Department was selected last fall to run an IAC by DOE!

Energy Management will participate by:

- Provide Internships for IAC engineering students
- Provide energy related consultation project collaboration
- Participate with class lectures, workshops, and energy plant tours

"The students participating in MU's IAC will get the opportunity to interact and learn from Energy Management's engineers broadening their energy education and preparing them for future careers as energy professionals!"

Dr. Sanjeev Khanna, Professor Mechanical Engineering, Director of the MU IAC



<https://iac.university/>

Energy Strategies Student Advisory Group

Membership from: Sustain Mizzou, Graduate Professional Council, Mizzou Energy Action Coalition, and Missouri Student Association



The mission of the MU Energy Strategies Student Advisory Group is to advise the University of Missouri in advancing its leadership in the production and usage of environmentally, fiscally and socially responsible energy, including providing related educational and research opportunities.

Collaboration with Visiting Professors



Iraq University Delegation

South Korea Students

Bologna Italy University

West Africa Cochran Fellows

Vietnamese Engineering Guests

Nigeria University Delegation

Kenya - University of Eldoret

Current Students – Future Leaders!



Tom Ruddy
CHP



Trey McClure
Electric Distribution



Jake Joos
Energy Controls

We employ 10 to 12 part time engineering students who gain “real life” experiences in district energy!

Mechanical Engineer at Sega Inc.

Designing and retrofitting mechanical systems in power plants across the country

- 2015 University of Missouri Graduate
- BS in Mechanical Engineering, Minor in Energy Engineering
- Worked for MU Energy Management as a student on CHP plant and distribution projects

"I accredit Energy Management with generating my interest in the power industry and providing invaluable hands on experience that has already proven beneficial to my career"

Tim Hezel



District Representative, Nalco Water

Engineering service and chemical sales for institutional division clients. MU CHP plant is a client!

- 2015 University of Missouri Graduate
- BS in Chemical Engineering
- Worked for Nalco as a student on providing service for MU's CHP plant and District Cooling System

“The staff in energy management at Mizzou taught me how to build authentic relationships at work. Ultimately, it was this combination of my education and this experience which led to getting a job offer during my senior year.”

Joshua MacGregor



NALCO Water
An Ecolab Company

Managing Engineer at Mizzou

Provides engineering support for the campus CHP plant and utility distribution system. Serves as Chief (Engineer) Operator for MU's drinking water system

- 2000 University of Missouri Graduate
- BS in Mechanical Engineering
- Licensed Professional Engineer, MO
- Worked for MU Energy Management as a student on the utility distribution system

Tim Gephardt, PE



“Working for Energy Management as an engineering student gave me first-hand insight to an industry I would have not been exposed to otherwise. I’m excited to be part of an organization providing efficient utilities to Mizzou campus community”

Regional Global Practice Manager Burns and McDonnell Co.

Project Manager for power projects in the utility and industrial sectors with an air pollution control specialty

- 1992/1993 University of Missouri Graduate
- BS/MS in Mechanical Engineering
- Licensed Professional Engineer
- Worked with MU Energy Management as a graduate student researching effectiveness of DSI to capture sulfur trioxide

Don Wolf, PE



"I worked closely with Energy Management engineers gaining invaluable power plant experience, which launched my very rewarding 20+ year (and counting) career in the energy industry"

What are benefits from our academic involvement?

- *We're seen more positively by academic community and administration*
- *We've are viewed as greater campus asset*
- *More positive interaction with the campus community and utility customers*
- *Researchers have used the plant's success to seek and receive grants*
- *We're are preparing future energy leaders for our utility industry*
- *We bring a positive image for Mizzou!*
- *Our staff have gained a sense of pride in sharing their knowledge and expertise*
- *Our future energy choices will be made with more collaboration and acceptance*

Questions and Comments



University of Missouri