



Hospital



University



Correctional facility



Nursing home

April 10, 2018

CHP

Combined Heat and Power

Summit

Eastern Missouri

CHP for Mizzou

Reliability

Resiliency

Efficiency

Sustainability



 University of Missouri

2017 System of the Year!

University of Missouri

- Founded in 1839, the 1st public university west of the Mississippi River
- Over 31,000 students from all 50 states and 120 countries
- Member the of the Association of American Universities
- Over 15 Million sqft of facilities including: hospitals and clinics, a research reactor, level 3 biocontainment laboratory, and numerous research buildings

MU's History of Energy Innovation

- Held the first public demonstration of incandescent lighting west of the Mississippi River using a dynamo and lights donated by Thomas Edison
- The 2nd university in the nation to establish an electrical energy department, just behind MIT
- Among the first universities in the nation to electrify its campus with CHP, building its first central plant in 1892

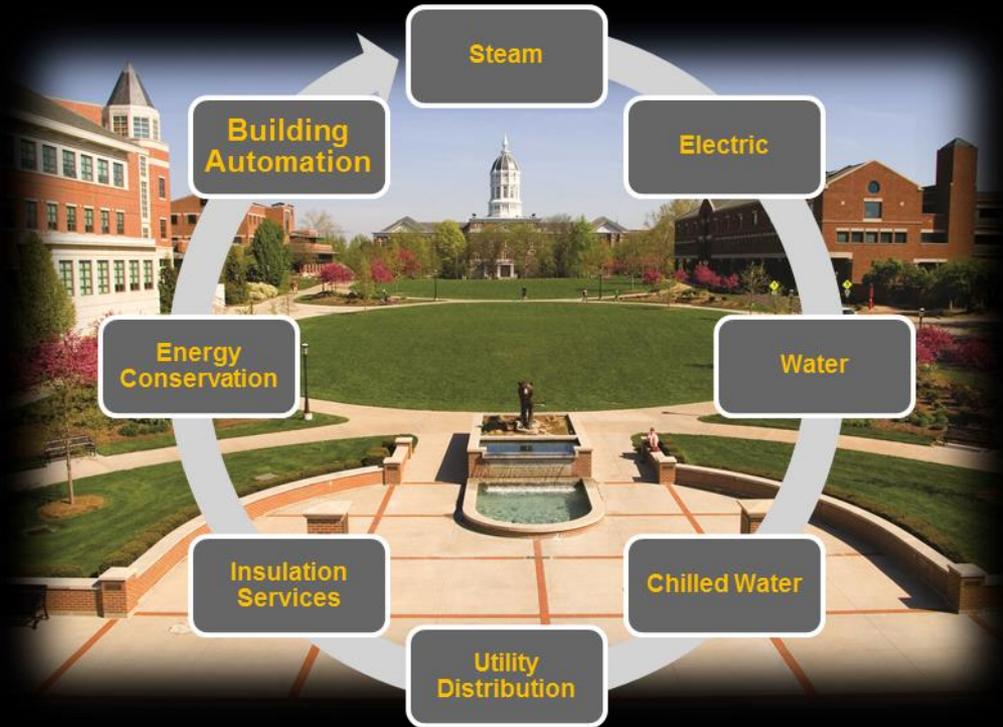
MU Energy Management

a campus utility enterprise

Reliable!

Cost Efficient!

Sustainable!



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!

 ENERGY CONSERVATION ✓	 GEOEXCHANGE	 WIND ENERGY ✓	 THERMAL STORAGE
 COMBINED HEAT & POWER ✓	 FUEL SWITCH IN BOILERS ✓	 POWER PURCHASES ✓	 GAS BOILERS ✓
 FUEL MIX ✓	 CONSTRUCTION STANDARDS ✓	 PHOTOVOLTAICS ✓	 FUEL CELLS
 GRID PURCHASES ✓	 CHILLER PLANTS ✓	 NUCLEAR ENERGY	 SMALL-SCALE WIND ✓

Comprehensive Utility Micro-grid

- **66 MW electric generation capacity**
- **40 MW 69KV transmission connection**
- **1,100,000 lb/hr steam capacity**
- **32,000 Tons chilled water capacity**
- **4 Million gal/day drinking water capacity**
- **110 miles of under-ground utilities**
- **Fully metered and automated**



Reliable and Resilient

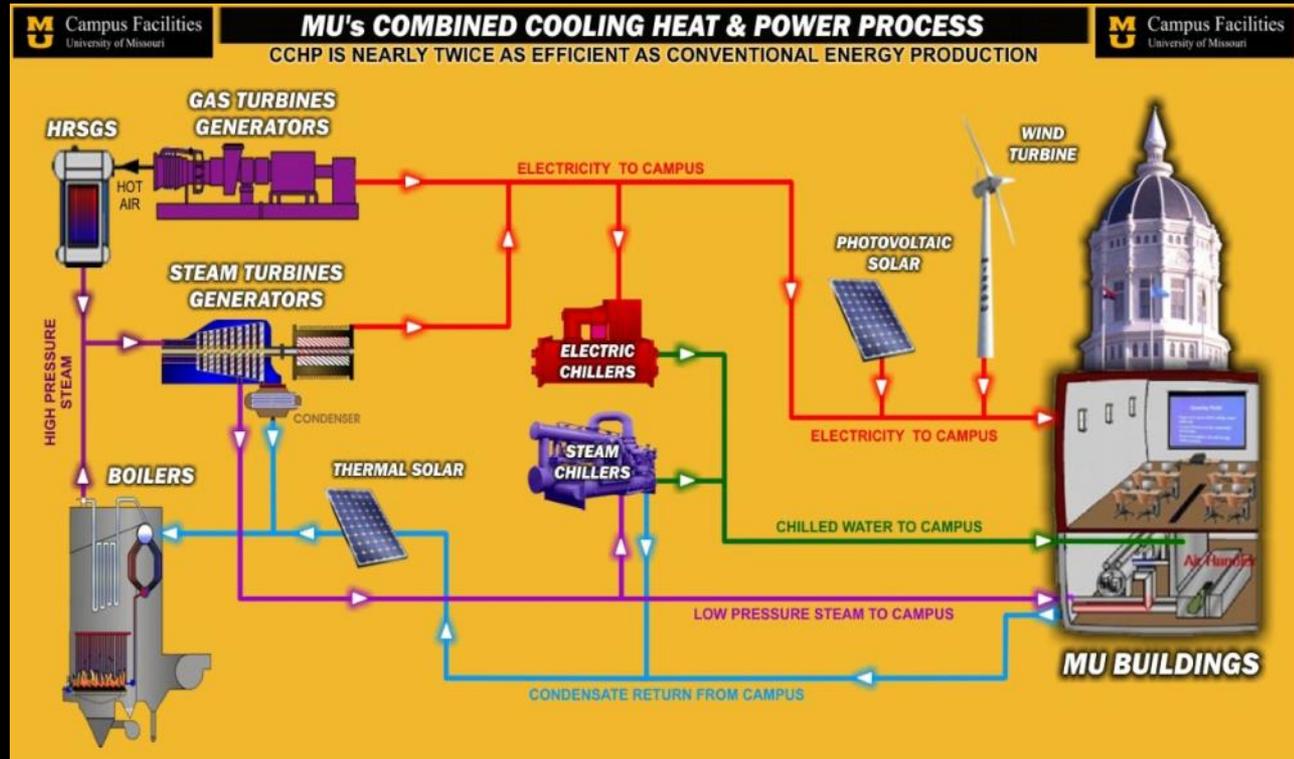
- Full on-site generation
- N+1 operational availability practice
- 40 MW 69kV electric grid tie
- Black start capability
- Multi-fueled energy plant
- Underground distribution and looping
- Proactive maintenance practices
- Over 99.9993% utility availability



24/7 monitoring and optimization to ensure highly reliable utility service

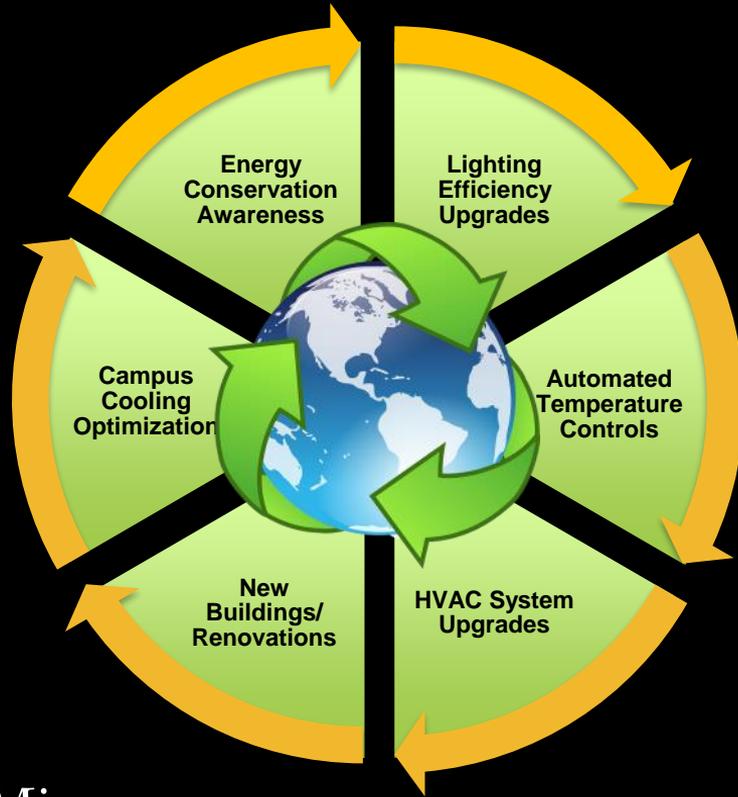
Combined Cooling Heat & Power at Mizzou

MU produces its utilities using highly efficient technologies dispatched with a focus of cost effectiveness!



A 2010 EPA CHP Award Winner!

Energy Optimization and Conservation



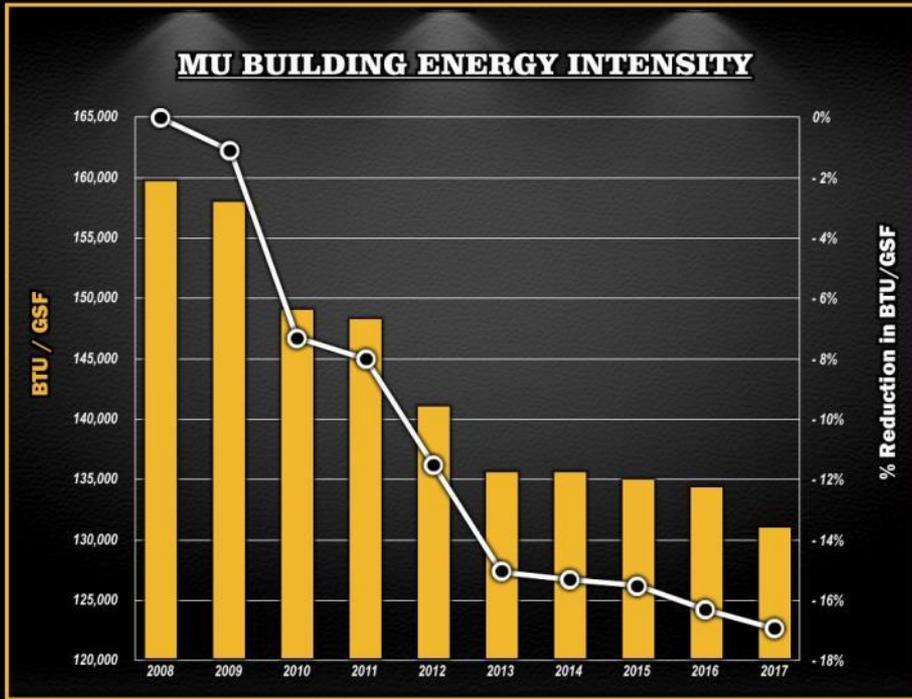
MU's nationally recognized energy conservation efforts began in 1990!

21% Reduction in Energy Use (per GSF)

\$9.5 Million Annual Utility Cost Avoidance

\$85 Million Cumulative Utility Savings

Energy Intensity Continues to Drop



Current Initiatives:

- LED Lighting Conversions
- Improved HVAC Controls
- Automated Fault Detection
- Retro Commissioning
- Waste Heat Recovery

Renewable Energy for Mizzou



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



*Our on-site renewable
technologies are
education resources for
students!*

Energy Sustainability Success!

- **Over 39% total renewable energy portfolio of biomass, wind, and solar**
- **Over 51% reduction in greenhouse gas emissions since 2008**
- **Over a 21% reduction in academic building energy use and a 50% reduction in water use through conservation efforts**
- **EPA's Green Power Partnership recognized MU as a national leader in the development and use of renewable energy**



Value of CHP for Mizzou

- **More reliable and resilient than grid power**
- **More cost efficient than being a rate payer**
- **Environmental stewardship**
- **Excellent resource for energy research and education for students and faculty**



Considering CHP?

- **Begin with understanding your annual thermal load profiles**
- **Evaluate your fuel options and delivery capacities**
- **Consider your options for redundancy**
- **Conduct a feasibility study which includes your interconnection capability with your utility**
- **Learn from others!!!**



Questions?

