

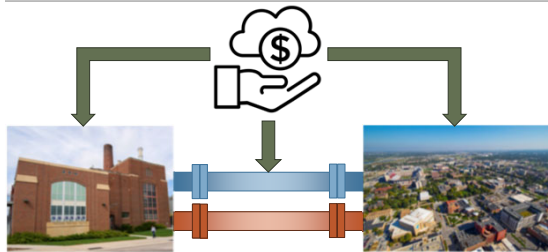
Site to Source

A Guide to Comprehensive Campus Energy Management

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1

Energy Management



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Energy Management

Energy Management Objectives

- Conserve resources
- Reduce emissions
- Reduce costs



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Funding

How to begin the Energy Management journey?



4

Utility Rate Structure

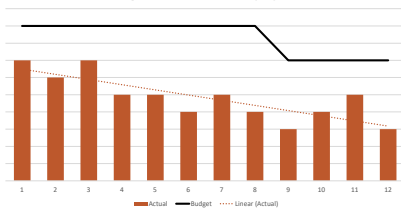
Green Fee
or
Rate Surcharge



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Energy Budget

Budget Vs Actual Utility Spend



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Public-Private-Partnership (ESCO)

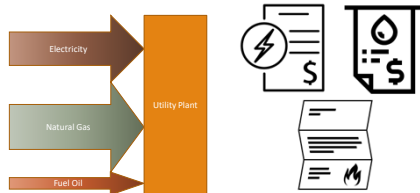
- Upfront Funding
- Payback from utility savings



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Energy Management

Understanding is key to management



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Inheritance Inertia

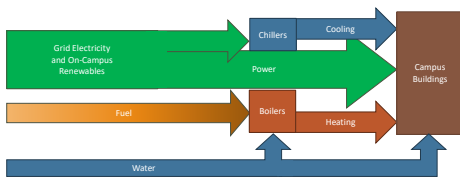


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Central Utility Plant

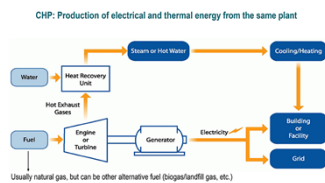
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Central Plant – Conventional



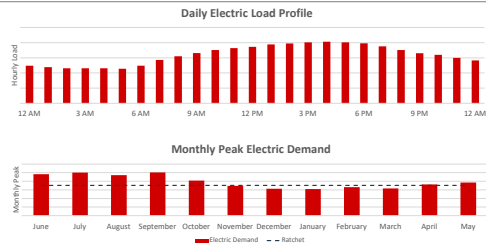
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Central Plant – Combined Heat & Power



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Central Plant – Electricity Use Profiles

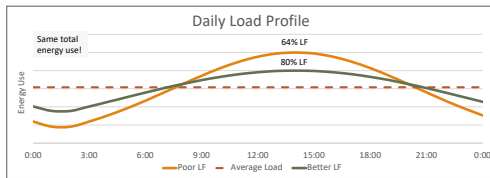


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Central Plant – Energy Use Efficiency

Load Factor (LF)

$$LF = \frac{\text{Total Energy Use [eg, kWh]}}{\text{Peak Energy Use [eg, kW] * Total Amount of Time [Hrs]}}$$



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Central Plant – Reducing Load Factor

Reduce Load Factor, increase efficiency



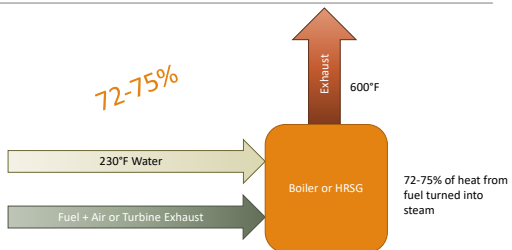
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Central Plant – Heating Production



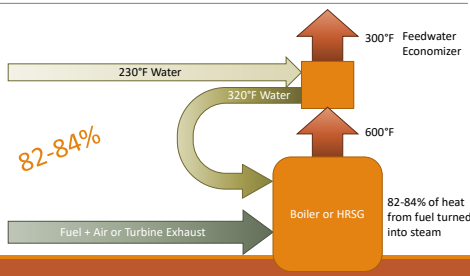
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Central Plant – Boiler Efficiency



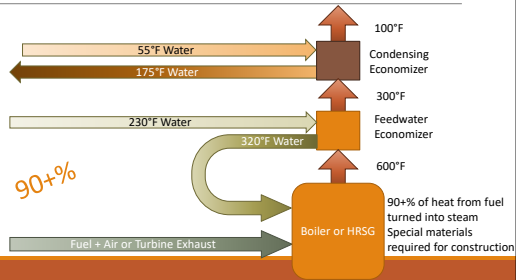
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Central Plant – Boiler Efficiency



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Central Plant – Boiler Efficiency



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Hot Water

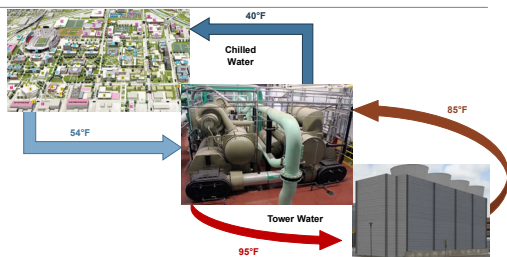
- Advantages:
- Highly efficient condensing boilers
 - No steam trap or vent losses
 - Minimal insulation loss
 - Fits well with renewables

- Disadvantages:
- More pumping energy
 - Carries less heat



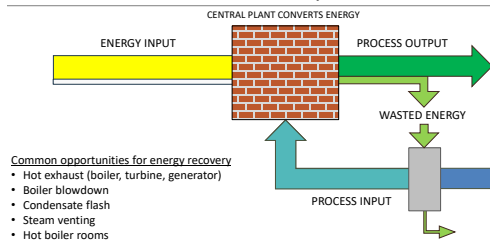
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Chilled Water



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Central Plant – Efficiency

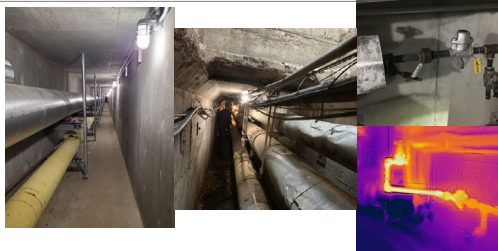


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Distribution System

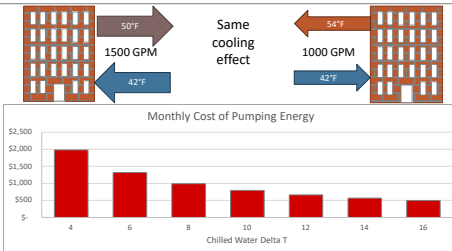
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Steam Distribution



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Chilled Water Distribution



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Electrical Distribution



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Campus Utility Metering

Can't manage what you
don't measure

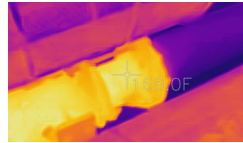
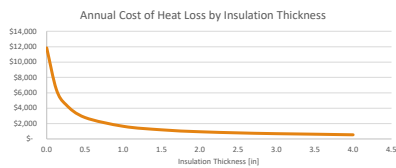


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Building Systems (Consumption)

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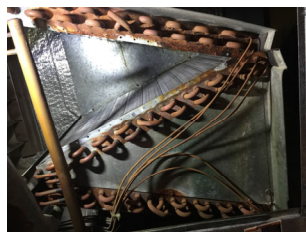
Insulation



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Coil Efficiency

Keep coils clean



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LED



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Building Automation System (BAS)

Consolidate Control of
HVAC equipment

- Control
- Monitoring
- Analytics



32

HVAC Scheduling

Turn it off when it is
not needed



33

Economizing

Use natural conditions
when favorable



34

Temperature and ventilation setback

Reduce temperature
and ventilation when
possible

Occupancy Sensors



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Simultaneous Heating and Cooling



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Load Shedding

Rolling load reduction

Pre-cooling



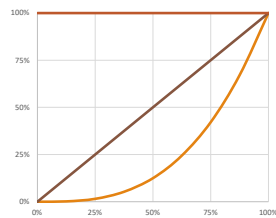
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Demand based operation

Light Dimmers

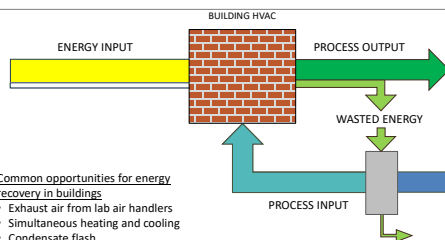
Variable Frequency Drive

Demand Controlled Ventilation



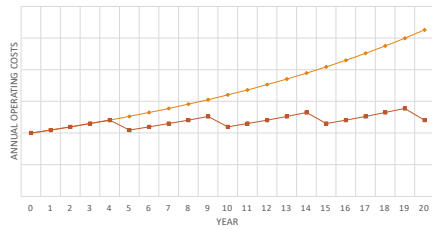
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Energy Recovery



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Recommissioning and RetroCommissioning



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Automated Fault Detection and Diagnosis



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