

312 HEATING PRODUCTION



JEFF ZUMWALT
LALIT AGARWAL

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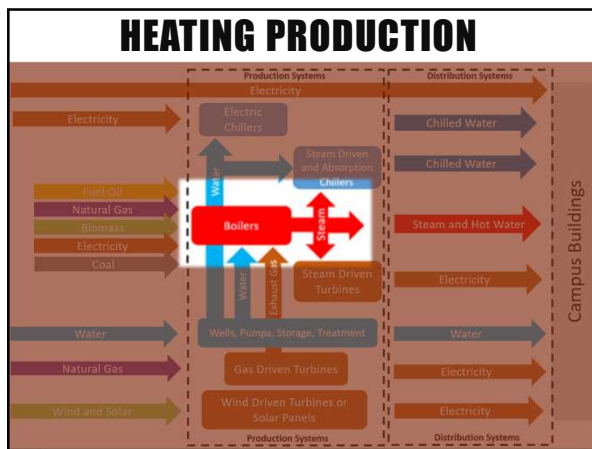
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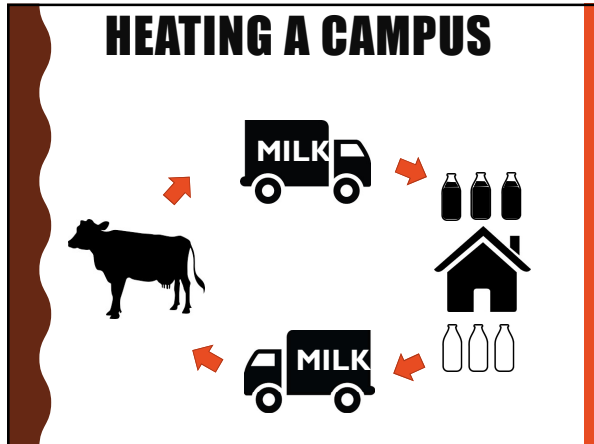
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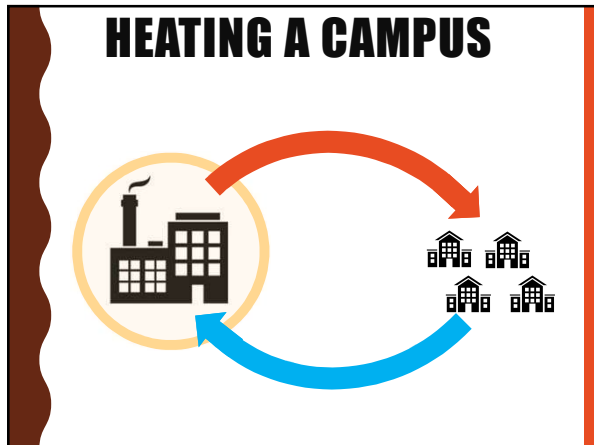
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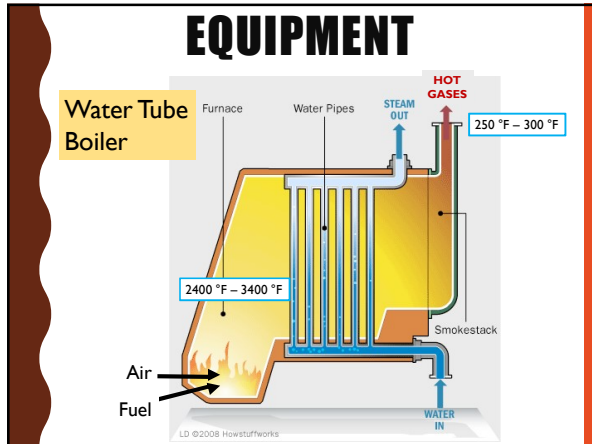


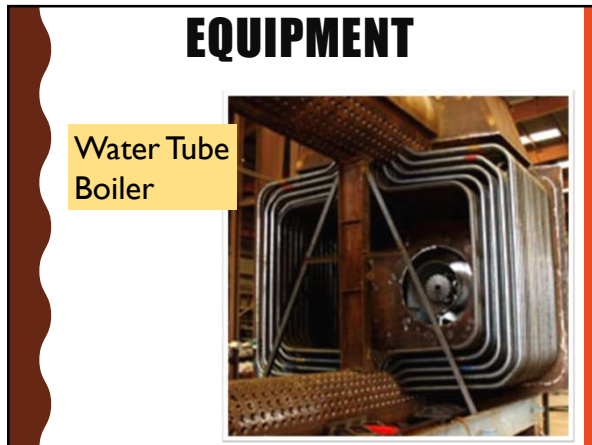


OVERVIEW



- Equipment
- Central Boilers
- Distributed Boilers
- Steam
- Hot Water
- Fuels
- Costs





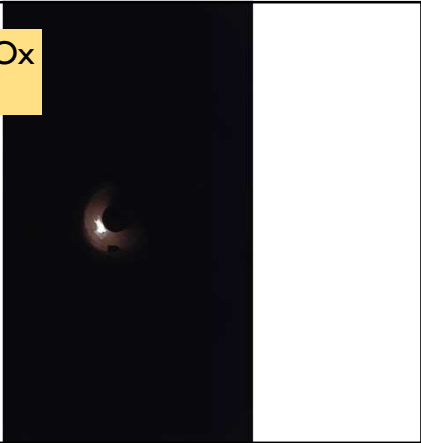


EQUIPMENT

Burner

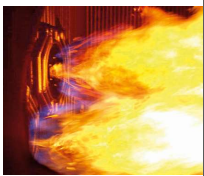


Low NOx
Burner

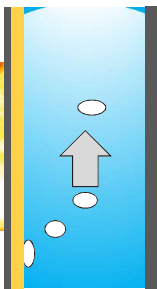


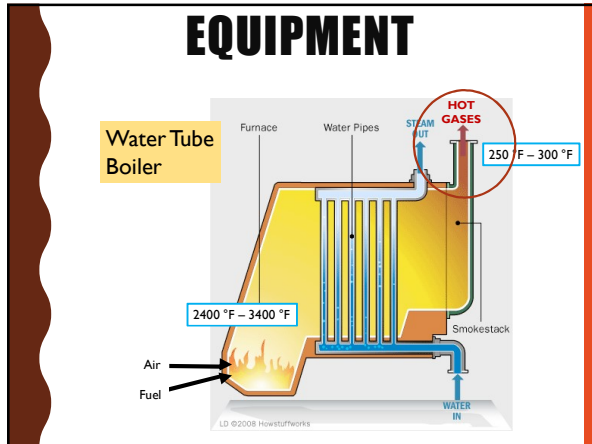
BOILER TUBE

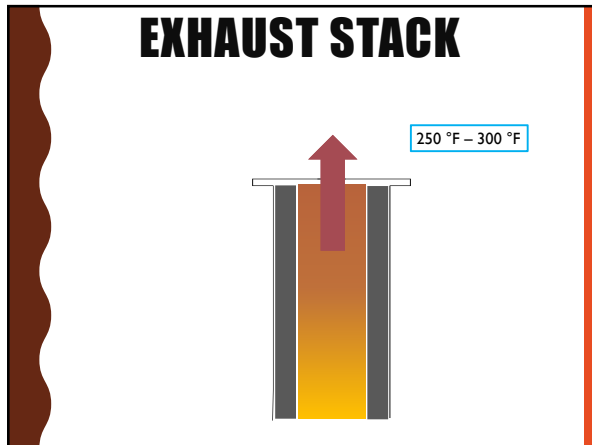
Water
Quality

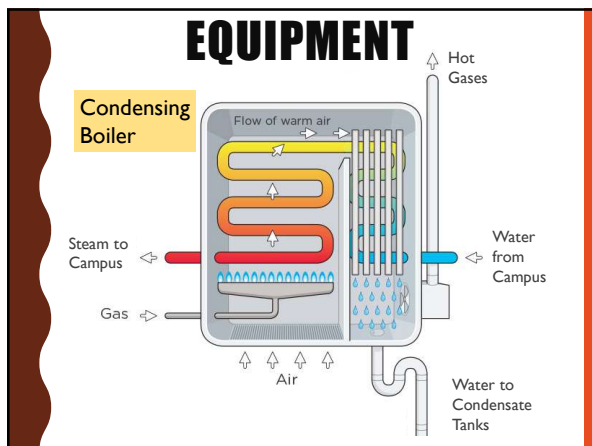


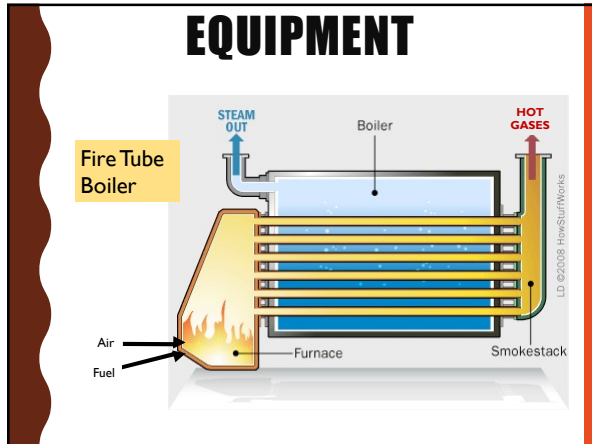
2400 °F – 3400 °F

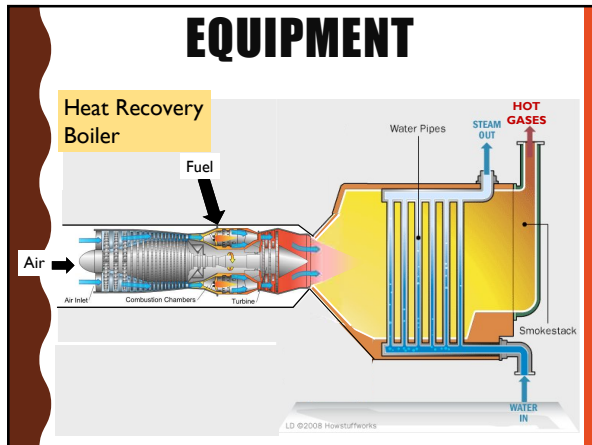


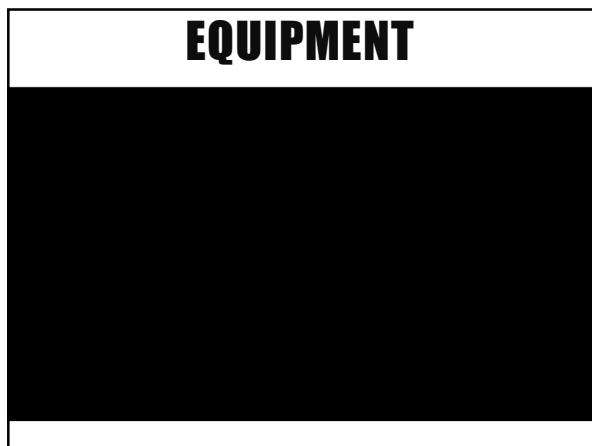




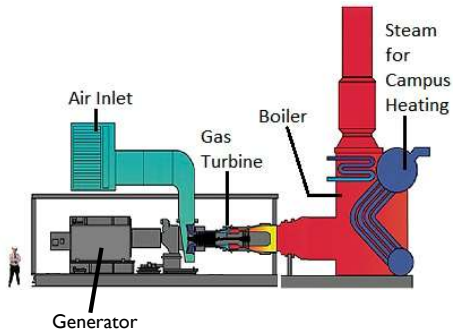








EQUIPMENT




EQUIPMENT - RISKS



EQUIPMENT - RISKS



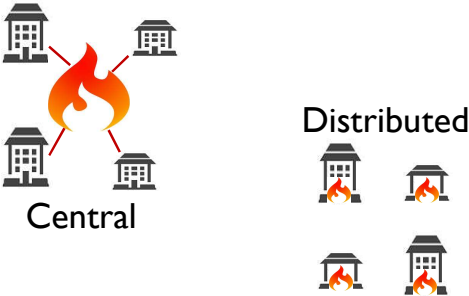
BOILER REGULATIONS



Construction
Repair
Operation

- ASME Boiler and Pressure Vessel Code
- Air Permit
- Operator Licensing
- Insurance Companies

CENTRAL OR DISTRIBUTED



Central

Distributed

CENTRAL

Pros

- Fewer but bigger boilers
- Consolidation of operations/maintenance
- Backup fuel capability
- Can last over 50 years
- Option to install Combined Heat & Power

Cons

- Requires pipe distribution
- Complex systems

DISTRIBUTED

Pros

- Multiple small boilers
- Less complex systems

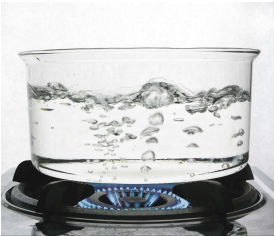

Cons

- Less reliable
- Limited backup fuel options
- Limited Combined Heat & Power options

CENTRAL OR DISTRIBUTED

<u>Central</u>	<u>Distributed</u>
←	→
←	→
←	→
←	→
←	→
←	→
←	→
←	→


STEAM OR HOT WATER



STEAM OR HOT WATER

Steam has "two phase flow" - mix of gas and liquid

Hot Water is liquid only

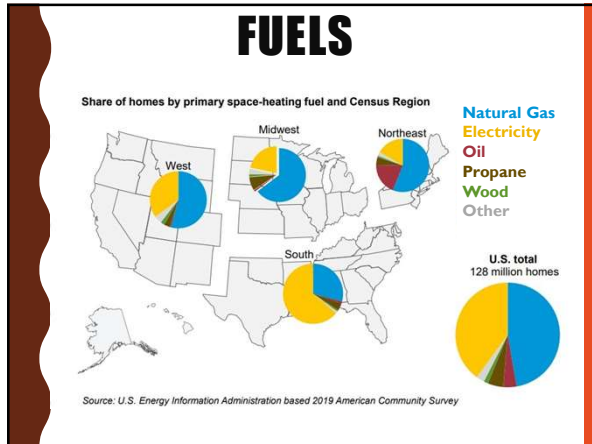


WATER HAMMER



STEAM OR HOT WATER

<u>Steam</u>		<u>Hot Water</u>
←	Efficiency	→
←	Safety	→
←	Maintenance	→
←	Complexity	→
←	Reliability	→
←	Fuel Flexibility	→
←	Process Steam	→
←	Electricity Generation	→



HEATING COSTS

	Kentucky	New Mexico
Fuel	48%	55%
Labor & Maintenance	29%	34%
Chemicals	6%	2%
Electricity	4%	5%
Water	3%	1%
Other	10%	3%



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