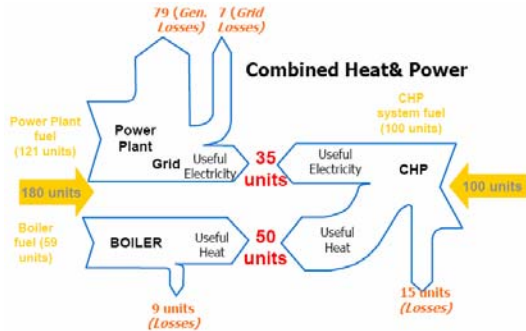
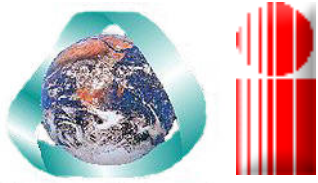




What is Combined Heat & Power?

- Combined Heat and Power (CHP) is the sequential generation of electricity and heat from the same heat input

Benefits:

- Increase the efficiency for electric & thermal generation
- Reduce greenhouse gases & air pollution

New York City Steam District Heating



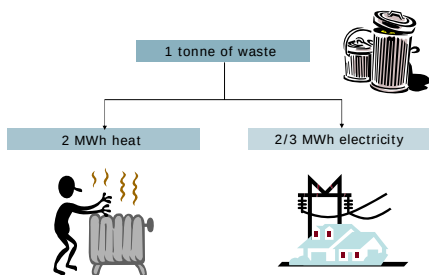
- Largest steam district heating in the western world
 - 105 miles pipe
- Capacity
 - 13 million lbs steam/hr
 - 693 MW electricity
- Delivers 27 billion lbs steam/yr
- 1,800 customers

St. Paul Hot Water District Heating



- Largest hot water district heating in North America
- Capacity
 - 65 MW thermal
 - 25 MW electricity
- Waste wood, coal, natural gas
 - 280,000 waste wood/yr

Energy Recovery from Waste



Waste-to-Energy in the U.S.

- 89 Waste-to-Energy Plants generating about 2,493 MW and 2.5 million lbs steam/hr
 - 61 generate electricity: 2,221 MW
 - 21 co-generate electricity and heat
 - 272 MW
 - 1.63 million lbs steam/hr
 - 7 generate heat: 930,000 lbs steam/hr

Why CHP from Waste-to-Energy Plants?

- Some cities are densely populated and have cold winters, e.g. northeastern cities
- Existing U.S. technology for cogeneration
- Available municipal solid waste as fuel, that is a cheap source of energy

Future Work

- Select a U.S. WTE plant located in a northeastern city
- Establish the technical and economic feasibility of applying District Heating & Cooling (DHC)
- Include a Life-Cycle Assessment of the DHC system