An Efficient and Sustainable Use of Biomass for Heat and Power

by

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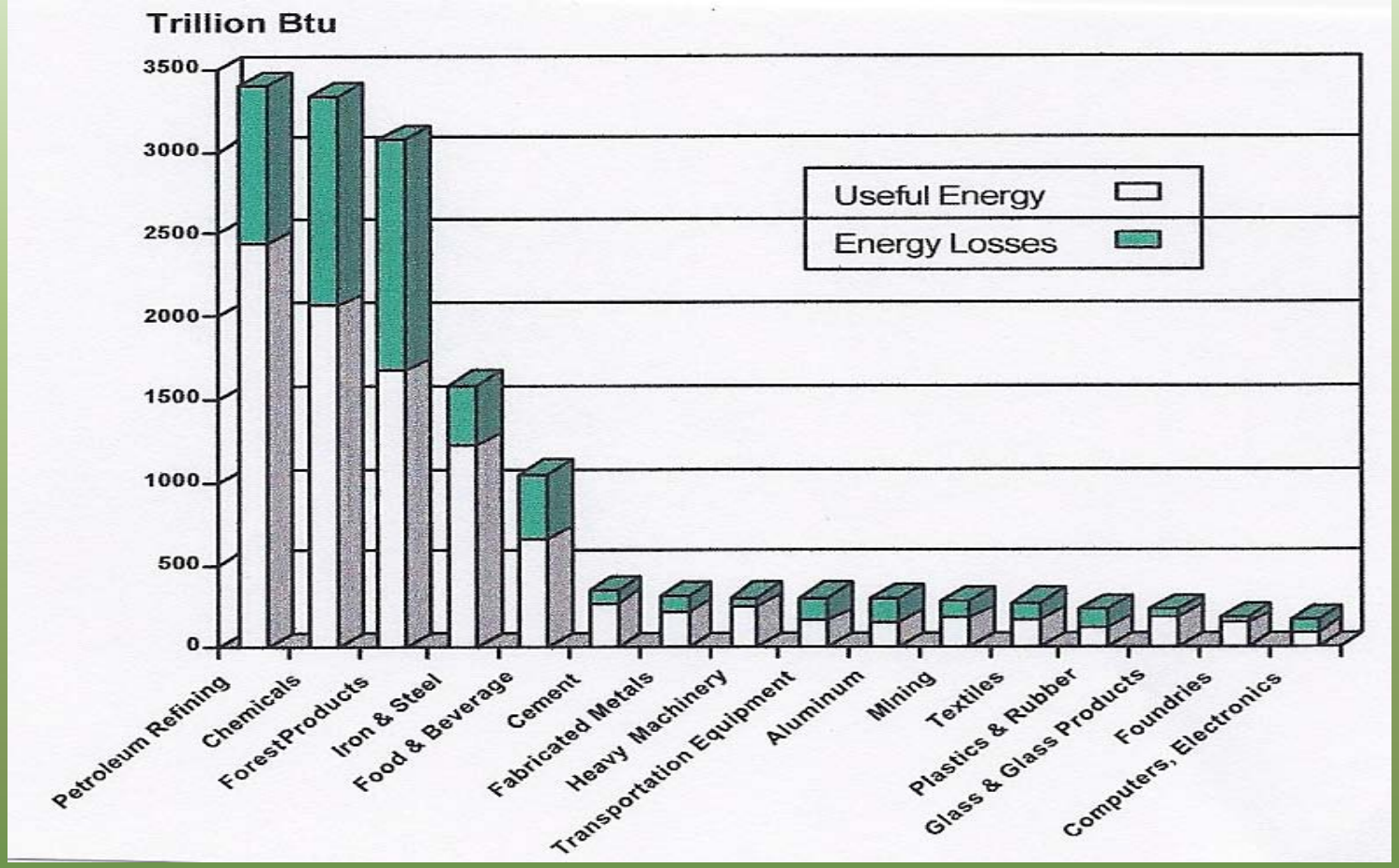
Energy Used and Lost for 16 Industries



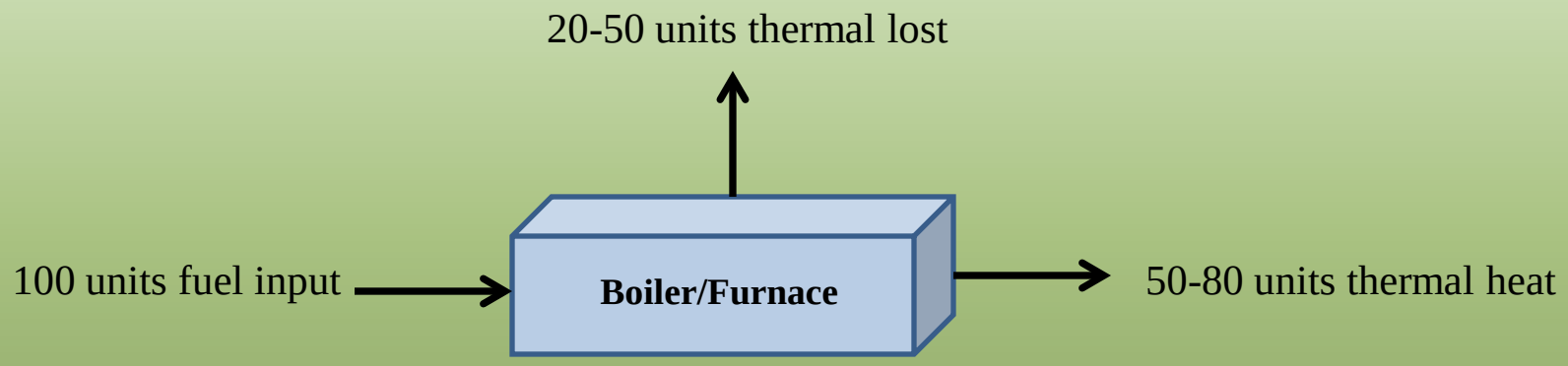
Energy Efficiency Importance

- United States no longer the "land of splendid waste", as described by poet Robert Frost.
- Large quantities of imported oil hurt balance of trade and the value of U.S. currency.
- Energy is a major manufacturing cost and is a contributor to US job loss.
- Emissions (especially CO_2) are inversely proportional to efficiency. A 70% efficient boiler/reactor will generate half of the CO2 of a 35% efficient boiler with any fuel.

Energy Efficient Drivers

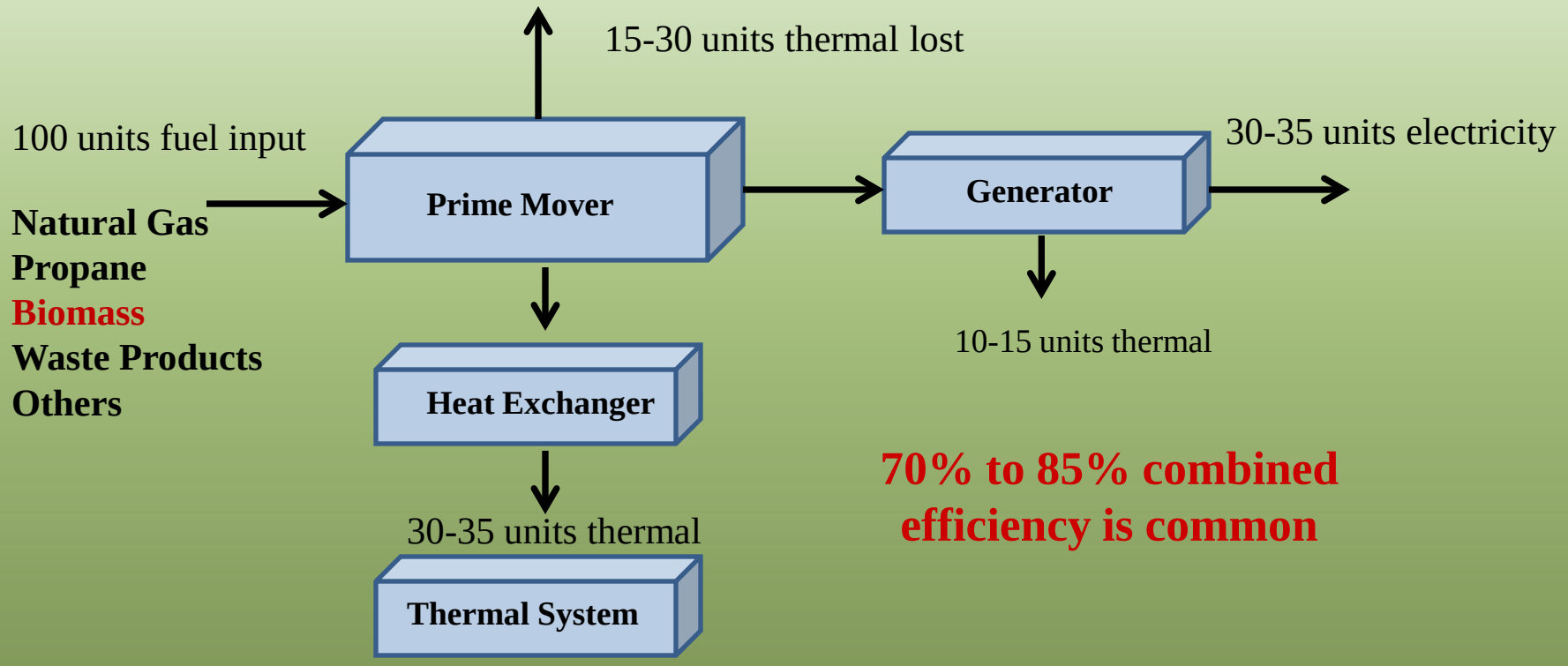
- Furnace Temperature
- Type of Fuel Used, and
- Facility Design

Typical Thermal Efficiencies



CHP System

Produce the Power On-Site and Recycle the Waste Heat from the Prime Mover

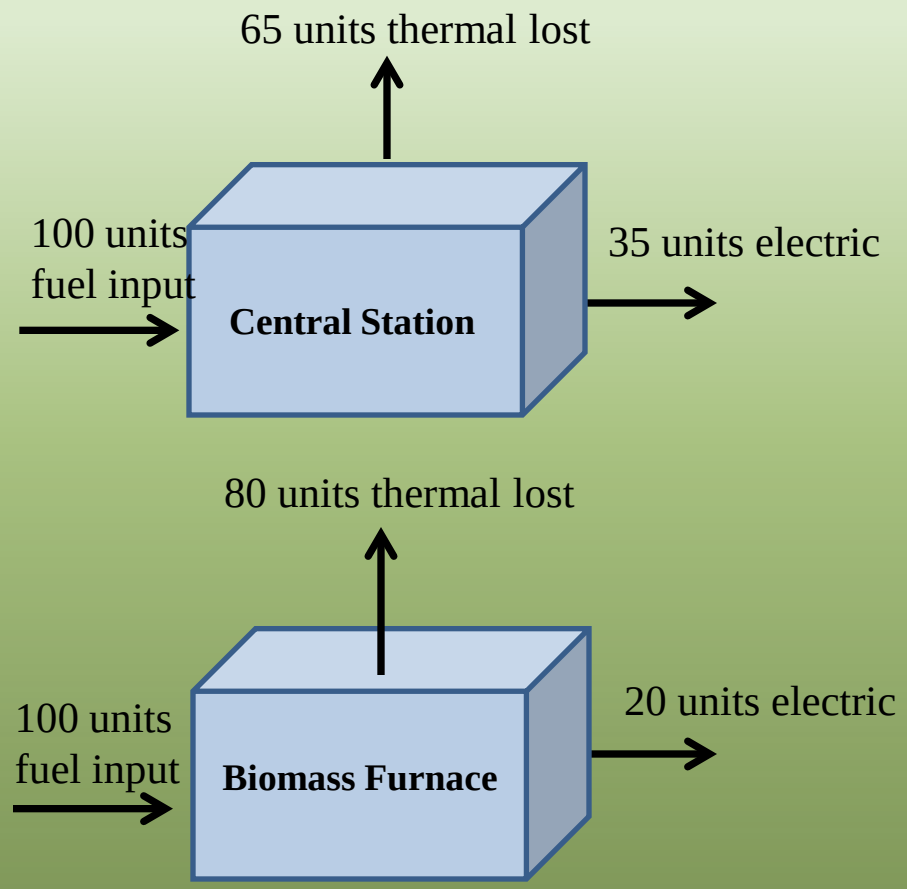


70% to 85% combined efficiency is common

2009 National Energy use

- Utility 38%
- Transportation 27%
- Industry 22%
- Residential 11%
- Other 2%

Conventional Electric Generating Systems



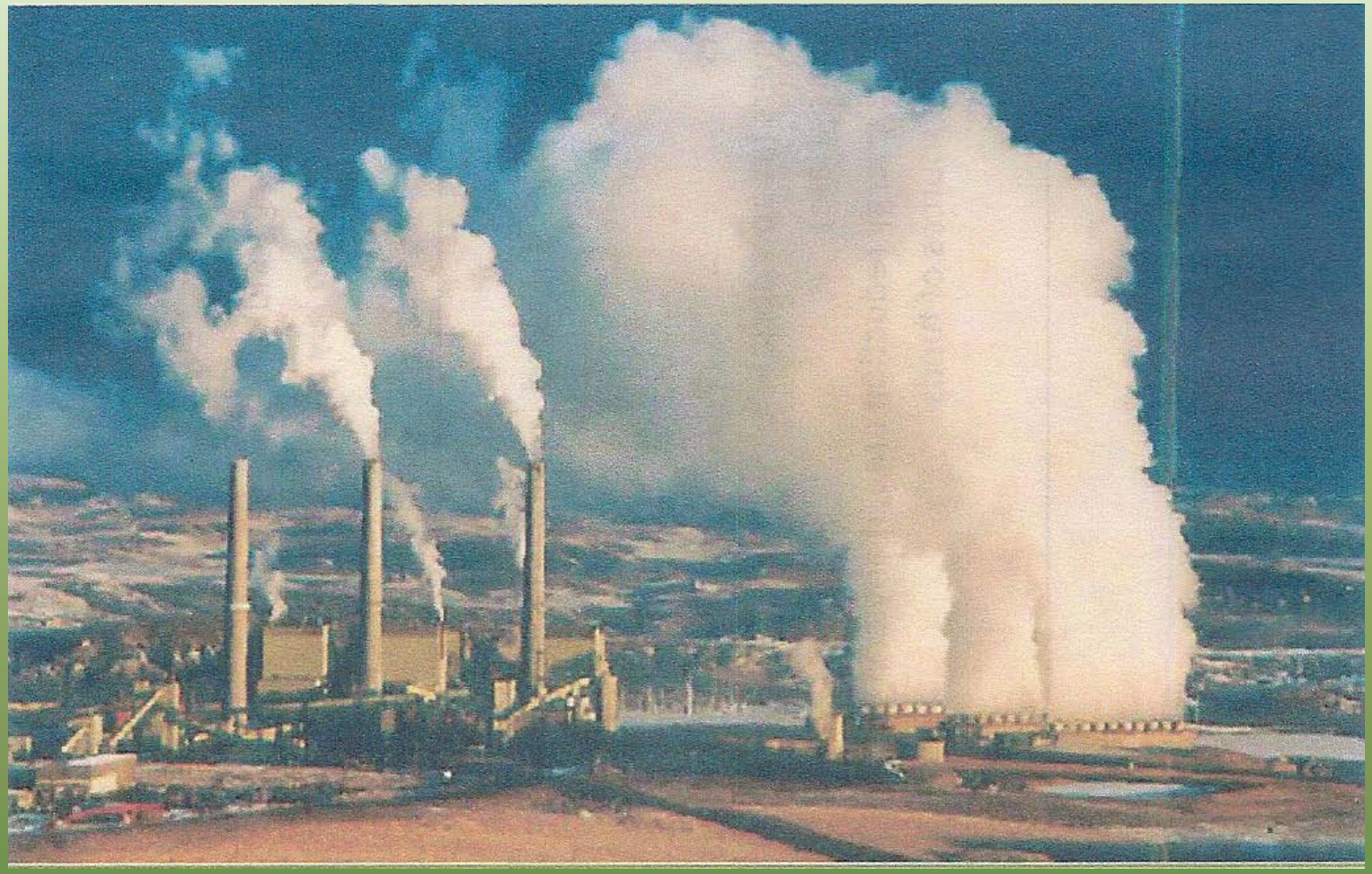
- **Stand alone central power plant economy of scale**
  - **100 units input = 35 units of electric**
  - **Remainder lost as heat**

- **Stand alone generation of electric from biomass**
  - **100 units input = 20 units of electric**
  - **Remainder lost as heat**

Key Questions

- Are you sure the utility thermal efficiency is 35%?
- What happens to the other 65%?
- Why does biomass reduce efficiency?

Photo of a Utility



Effects of Biomass

- Woody biomass contains ~50% moisture which requires energy to be evaporated
- Biomass burns at lower temperatures which generates lower pressures
- Lower pressure turbines have lower efficiency

Critical Definitions

- **Renewability is using materials that CAN be replenished**
- **Sustainability is using materials that ARE replenished**

Conclusions

- **With thermal energy the only proven pathway from renewability to sustainability is CHP.**
- **Nations importing significant energy must drive significant and multiple uses of CHP.**
- **The risk of CHP deployment is low. The technology is commercially available.**
- **National strategy and public support for industrial energy efficiency and CHP is lacking.**
- **There is a need for all of us to educate our state and Federal regulators about the need for industrial energy savings, sustainability and CHP.**
- **CHP deployment could take a lot of industry off the grid; thereby adding to energy reduction and national security.**

Questions?

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