ENERGY, ENTROPY, EXERGY AND SPACE HEATING SYSTEMS

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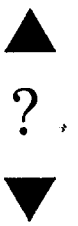
Energy is often claimed **to be consumed** for heating, cooling, and lighting building interiors.



The first law of thermodynamics states that the total amount of **energy is conserved**.

It is necessary to articulate **what is consumed** by building environmental control systems.

We discuss the following.

- What is consumed by a hypothetical space heating system?

  ☛ **Exergy**, not energy

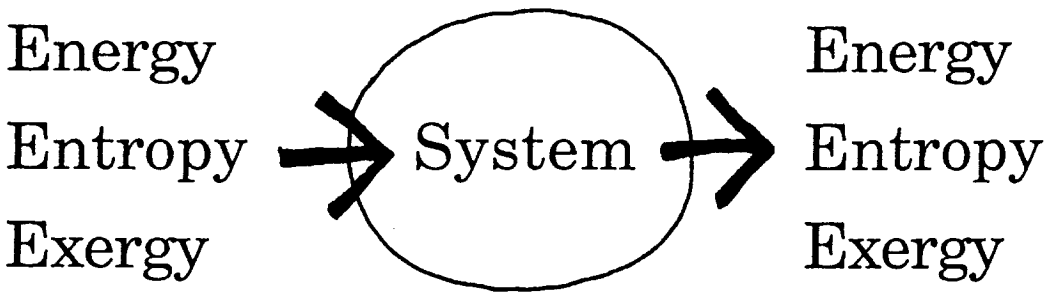
- How does the system work?

  ☛ **Exergy-entropy process**

Key Concepts

Entropy : A measure that indicates the **dispersion** of energy and matter

Exergy : A measure of **dispersion potential** of energy and matter

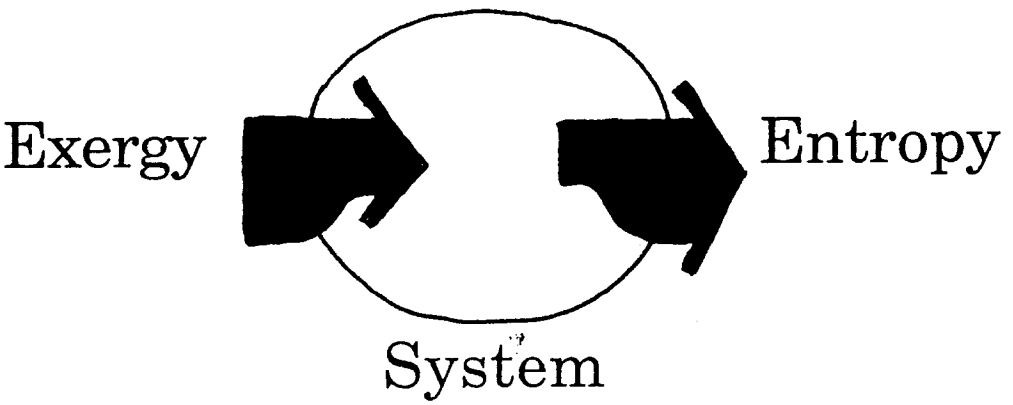


Energy : Input = Stored + Output

Entropy: Input + **Generated** = Stored + Output

Exergy: Input - **Consumed** = Stored + Output

A Working System



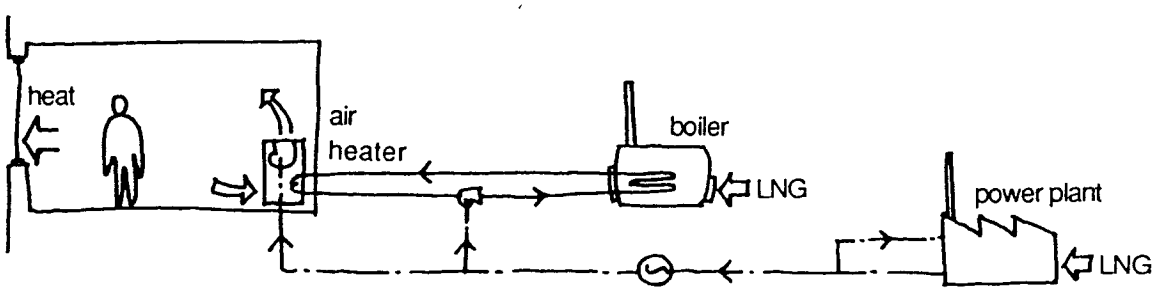
1. Feed on exergy,

2. Consume exergy,

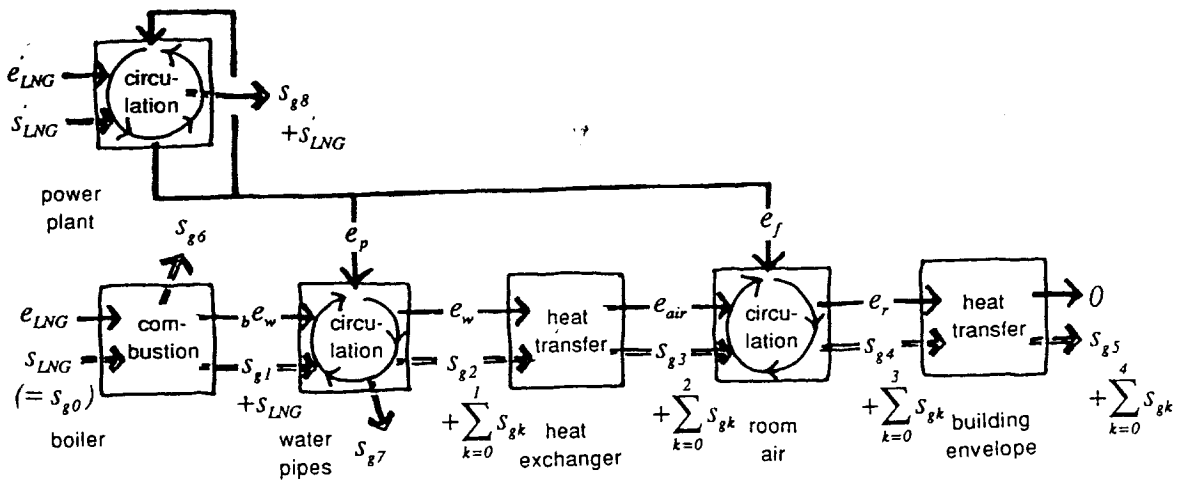
3. Generate entropy,

4. Dispose of the generated entropy.

A Space Heating System



Exergy-Entropy Process

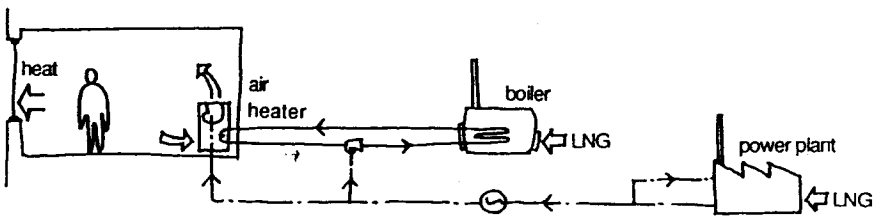


$$e_{LNG} + \dot{e}_{LNG} - \sum_{k=1}^{8} s_{gk} \cdot T_o = 0$$

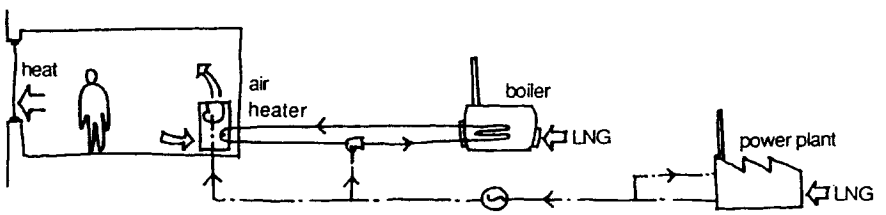
$$s_{dump} = s_{LNG} + \dot{s}_{LNG} + \sum_{k=1}^{8} s_{gk}$$

A case study

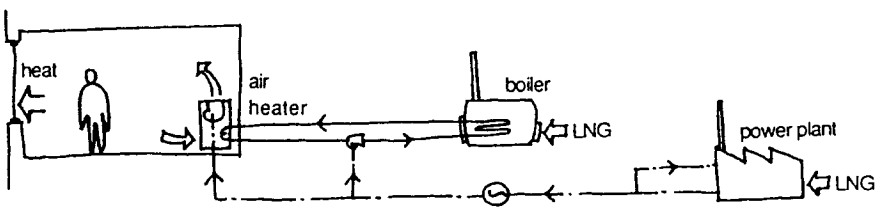
Case 1



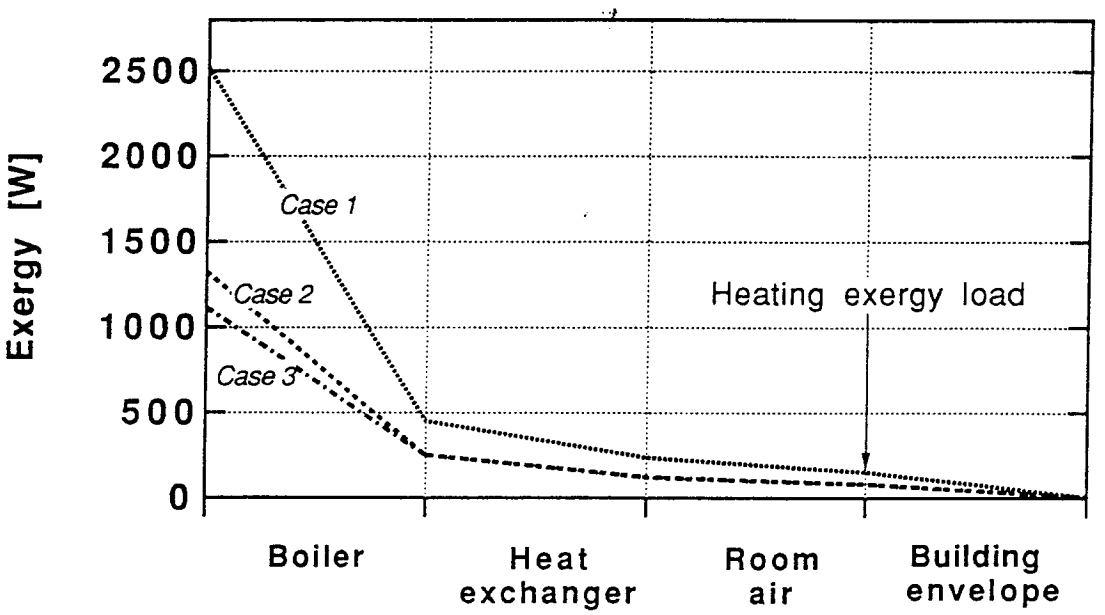
Case 2



Case 3



Exergy Cosumption



CONCLUSIONS

1. Exergy and entropy balance equations are developed for a hypothetical space heating system. They show explicitly the mechanism of the system.

2. The process of the system is to feed on exergy, to consume exergy while at the same time to generate entropy, and to discard the generated entropy.

3. Numerical examples show that it is vitally important to reduce the heating exergy load, which is 6 to 7 % of the primary supply of chemical exergy to the whole system.