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Introduction to Thermodynamics

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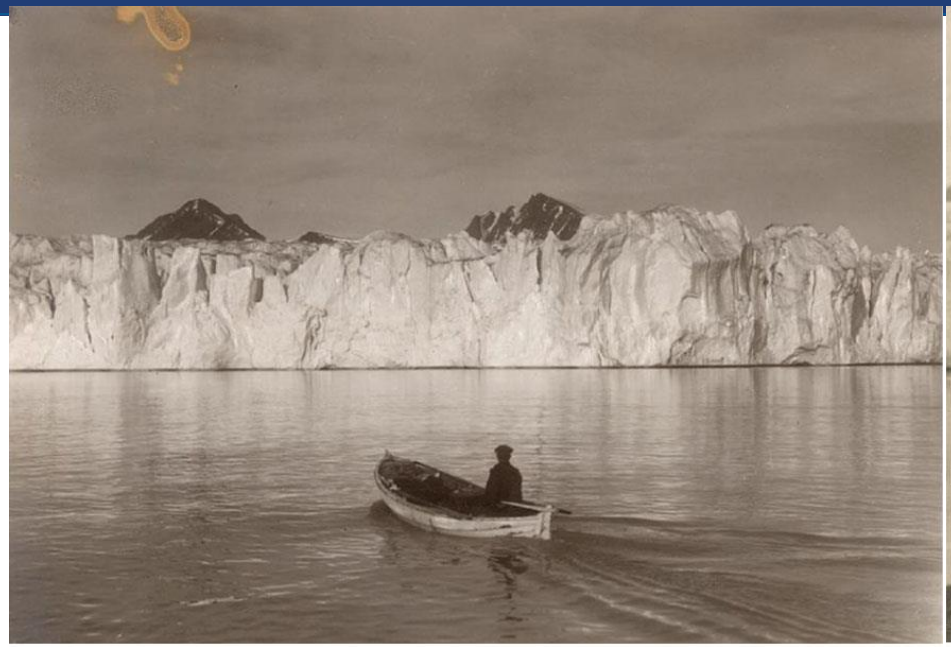
In the beginning…

A thin space…

Deforestation

What happened in 100 years



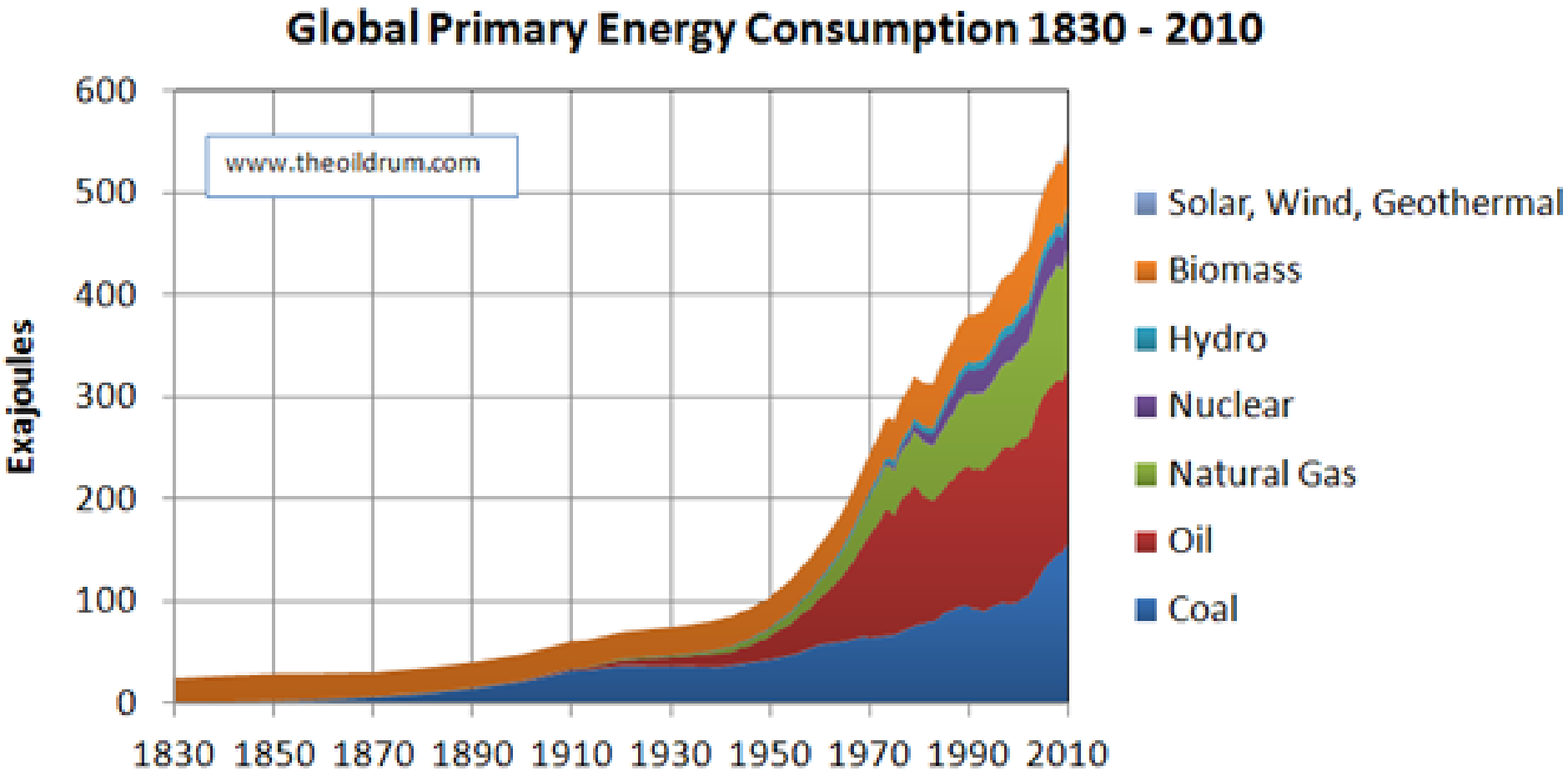
Industrial processes

Vehicle Emissions

As a result:

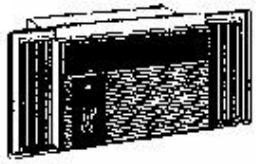
Contrails

Global energy use

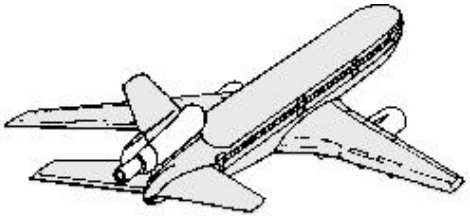


Applications of Thermodynamics

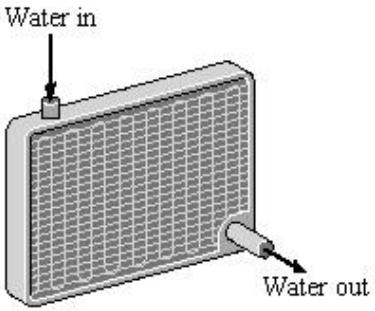
The human body



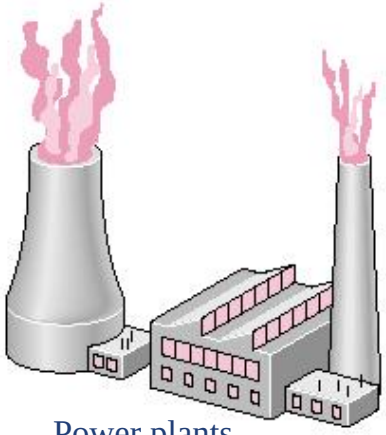
Air-conditioning systems



Airplanes



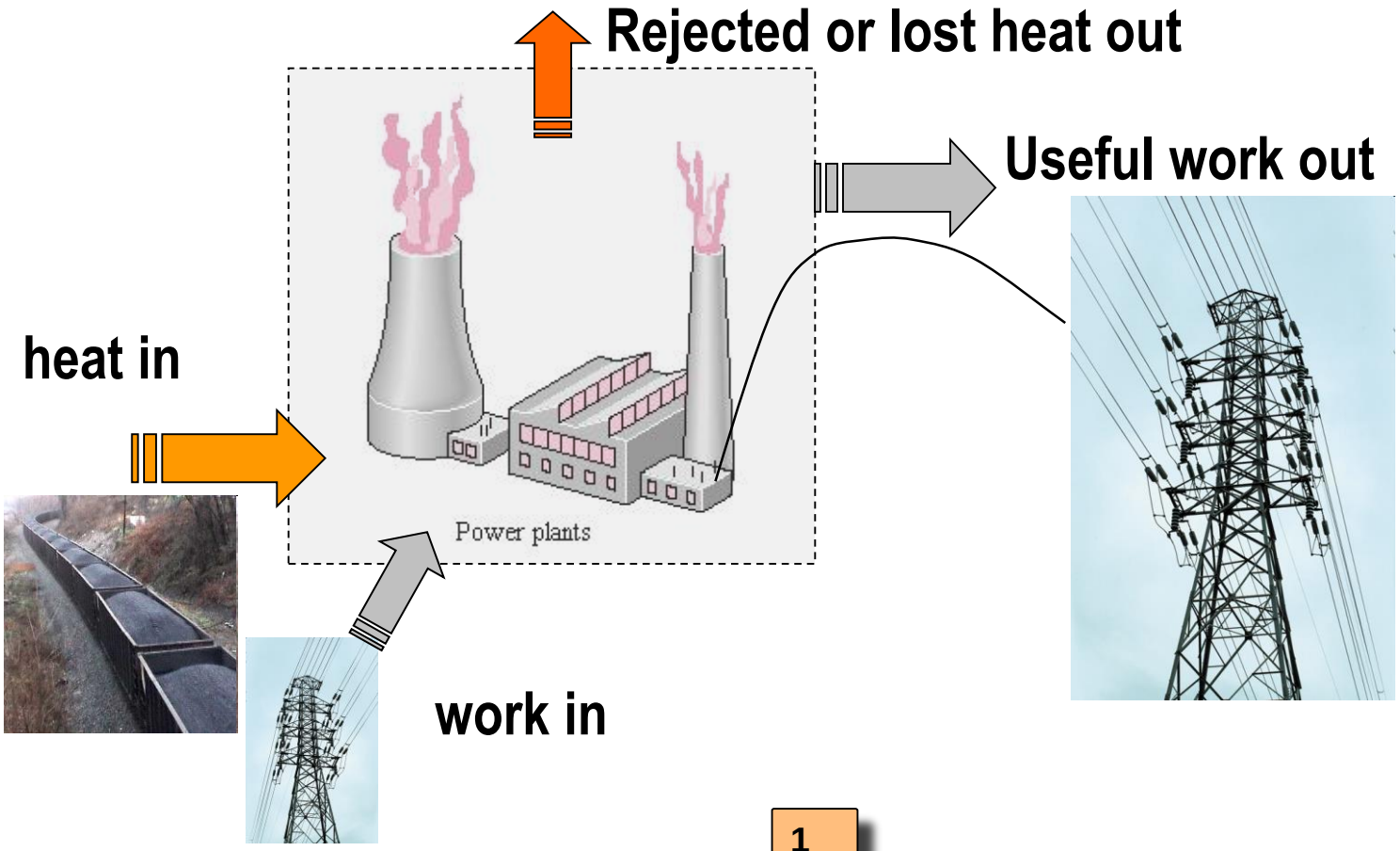
Car radiators



Power plants

Refrigeration systems

Thermal efficiency



Thermal Efficiency

$$\eta_{th} = \frac{\text{net useful energy out}}{\text{energy supplied}}$$

1

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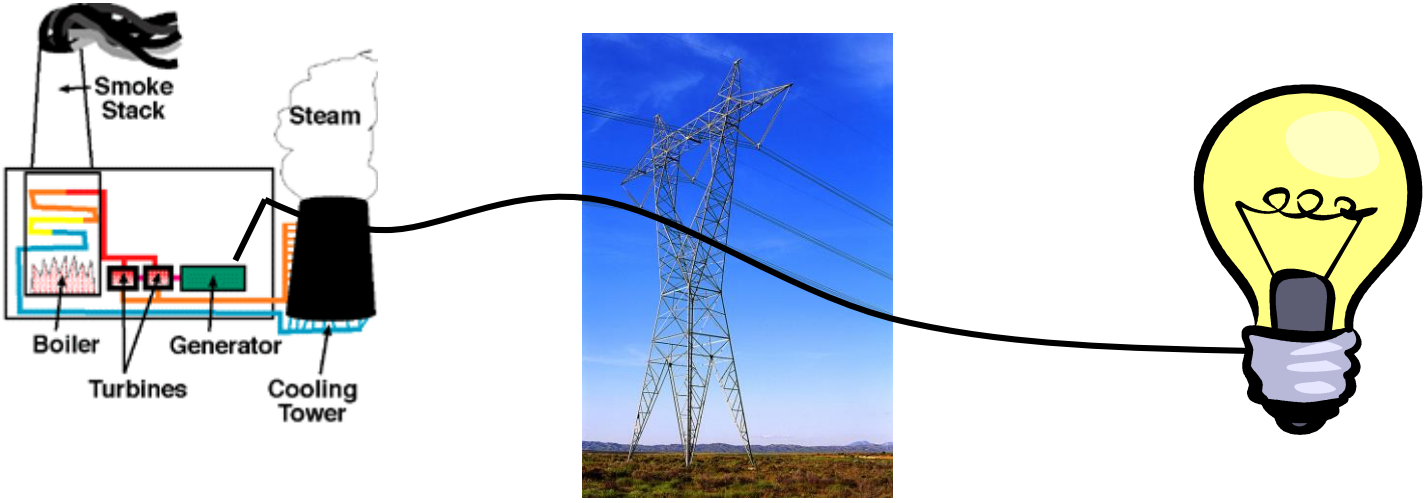
Typical system efficiencies

Device	Efficiency
Electric generator	70-99%
Electric motor	50-95%
Gas furnace	70-95%
Wind Turbine	30-40%
Oil/Coal/Gas Power plant	30-40%
Nuclear power plant	30-35%
Internal combustion engine	20-30%
Fluorescent lamp	20%
Incandescent lamp	5%
Solar cell	5-28%

Overall efficiency



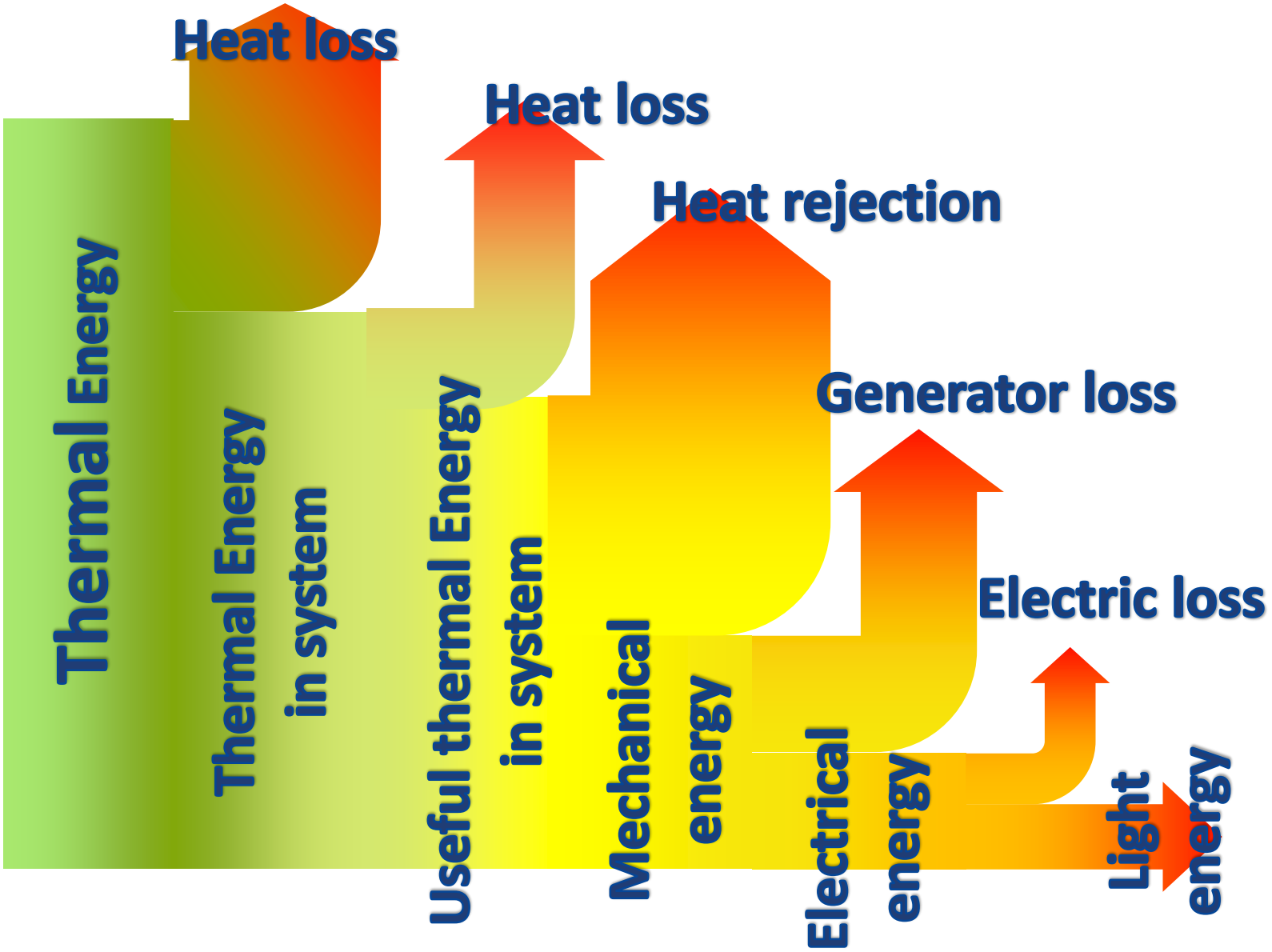
35% **90%** **5%**

2

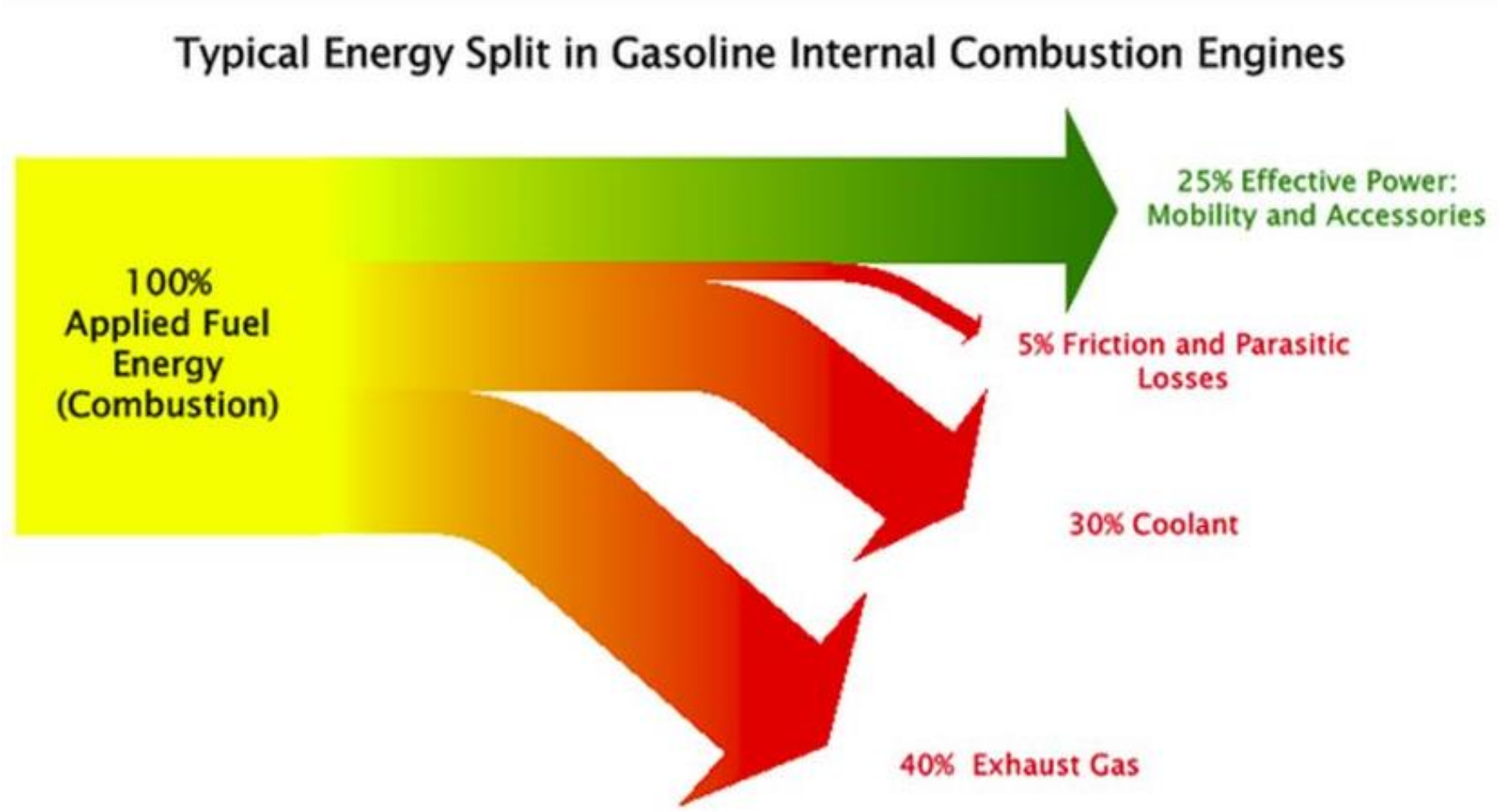
Overall efficiency = 0.35 x 0.9 x 0.05 = 0.016

OR 1.6%

Energy use


Heat loss
Heat loss
Heat rejection
Generator loss
Electric loss
Thermal Energy
Thermal Energy in system
Useful thermal Energy in system
Mechanical energy
Electrical energy
Light energy

Energy use and losses

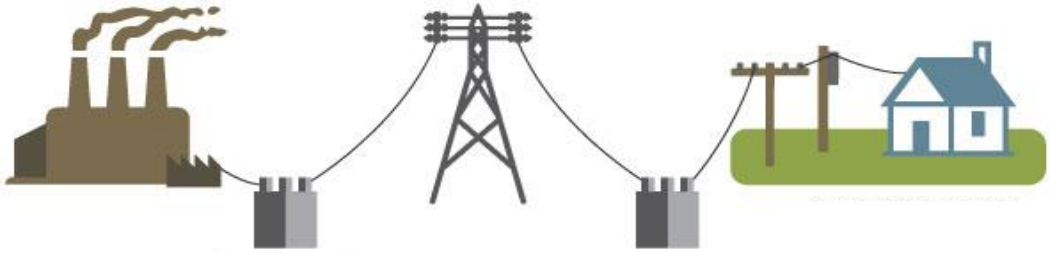


A little of extra thought

90%

20%

$0.9 \times 0.2 = 18\%$



35%

90%

70%

$0.35 \times 0.9 \times 0.7 = 22\%$

A Definition of Thermodynamics …

The study of the relations describing work transfer and heat transfer between a system and its surroundings and the associated changes in the properties of the system

Reading list

- Çengel YA, Turner RH & Cimbala JM, Fundamentals of Thermal-Fluid Sciences, 3e, McGraw-Hill (2008)
- Çengel YA and Boles MA, Thermodynamics - An Engineering Approach, 7e, McGraw-Hill (2011)
- Moran MJ, Shapiro HN, Munson BR & DeWitt DP, Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics & Heat Transfer, Wiley (2003)

The book of property tables, used in this and subsequent courses, is …

- Rogers, G F C & Mayhew, Y R, Thermodynamics and Transport Properties of Fluids, SI Units, Blackwell (5th edition).

This is an *essential* purchase for every student.

How to use the handout

- Blank space left for YOU to fill during classes

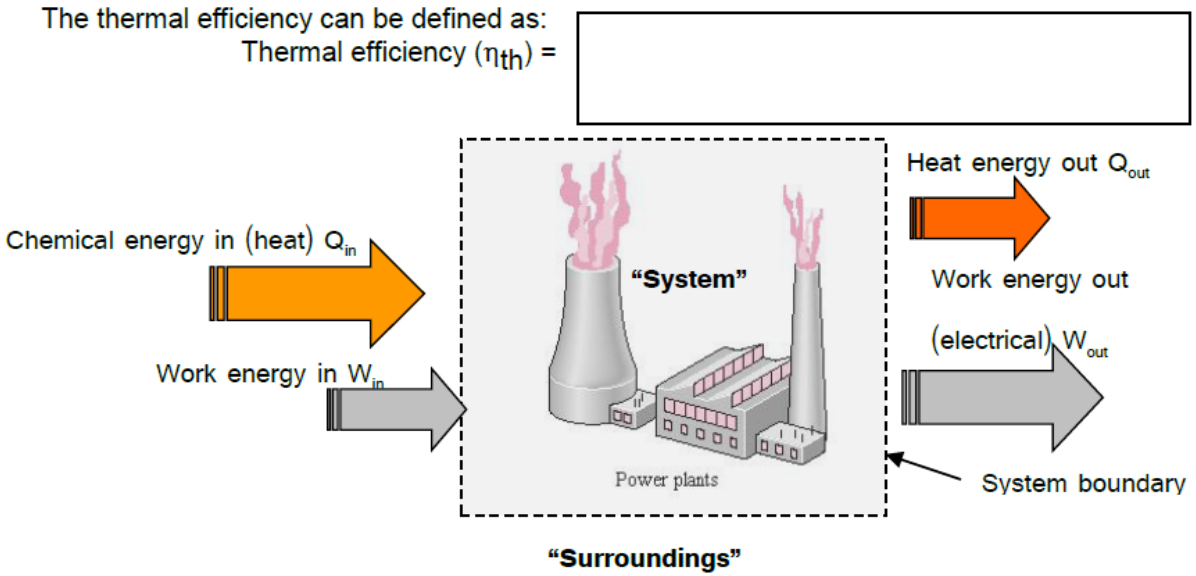


Fig 1.2 System diagram for a conventional power plant

Extra notes

- Handout booklet available on SurreyLearn.
- Self-study (13 topics) on SurreyLearn to enhance your study 

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Several notes

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- Self-study (13 topics) on SurreyLearn to enhance your study
- Full solutions of examples are released on Surreylearn when you see
- Full solutions of tutorial questions are released on Surreylearn but only after the tutorial sessions
- Lectures to be delivered virtually by recorded bite-size videos.
- Face2face tutorials (or by live zoom meeting)
- You are expected to spend at lease 1 hour/week for thermodynamics after class on your self-study
- An quiz-like assessment unit will be released later, weighs 10% of the module.
- Final module mark = 80% final exam + 10% thermo quiz + 10% fluid quiz