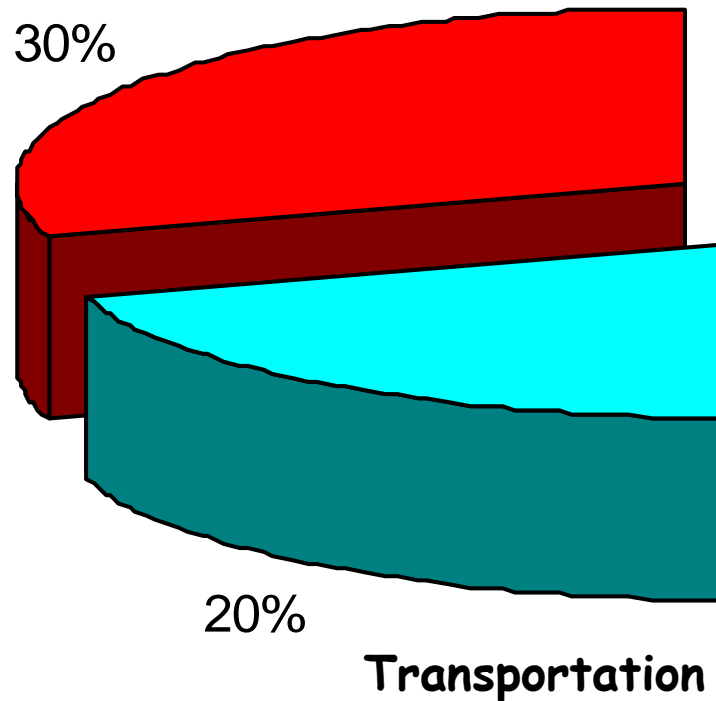


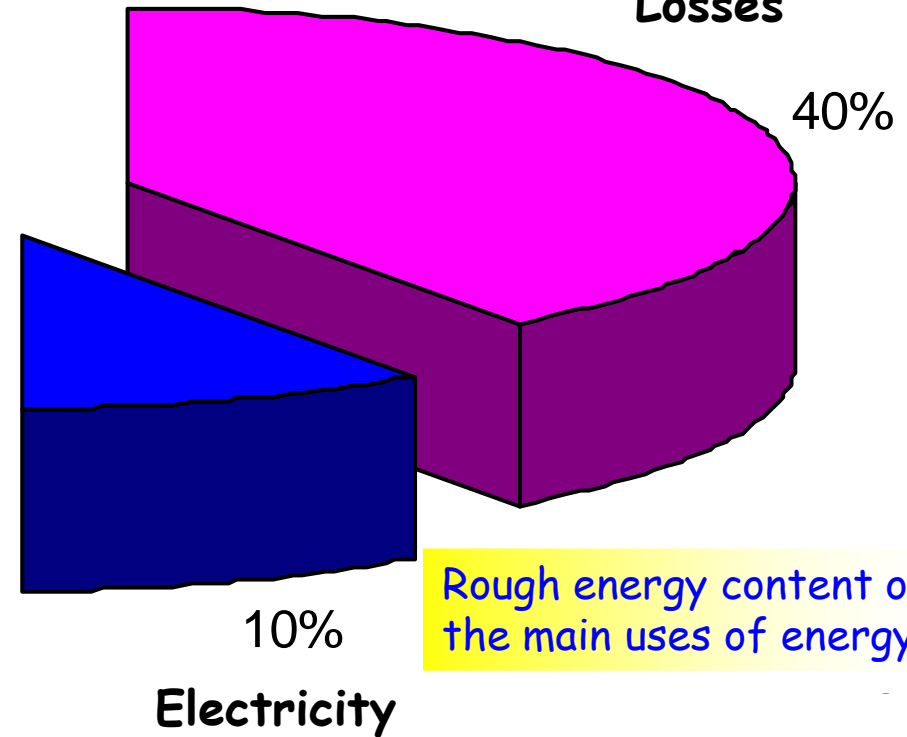
2 main objectives:

- ❑ Decrease GHG emissions
- ❑ Decrease our dependency on fossil fuels

Heat or Cold



Losses



Rough energy content of the main uses of energy

*Basic research (multidisciplinary) is needed. In particular modelisation-simulation and mathématiciticians*

## A few points

### We will need more (clean) electricity

- heat pumps
- Plug in hybrid vehicles
- H<sub>2</sub> for BTL & fuel cells

### For transportation

- 2<sup>nd</sup> generation biofuels (from lignocellulosic biomass) using external energy and H<sub>2</sub>.
- Plug in hybrid vehicles

**Buildings** (lifetime ≈ 100 years). High potential energy saving ⇒ energy efficiency

- Heat pumps, solar water heaters...
- Mass scale improvement of existing buildings (it is better to save 20% on 10,000 households than 100% on a single building)
- Energy management and control

## A few points

### Fossil fuels ( $\approx 80\%$ of the world energy consumption)

- Carbon capture and sequestration
- GTL, CTL, BTL, non conventional oil

### Energy storage (needed at all scales)

- to smooth the energy consumption
- to cope with intermittency of renewable energies
- quick charging is needed for transportation

### Renewables

- ocean energy, biomass (precision agriculture, use the whole plant and not only part of it), thin films for photovoltaic cells, energy storage, etc.

### Nuclear energy

- Go to fast high temperature reactors in the future ( $\times 150$  the usable uranium reserves, 1 kWh of electricity for 1 kWh of heat instead of 2 nowadays).
- Needs research on materials, fuels, fuel cycle, waste...