

Saving final or primary energy?

Lessons from a flow approach of the French energy balance. Implications on the value of energy standards for buildings.

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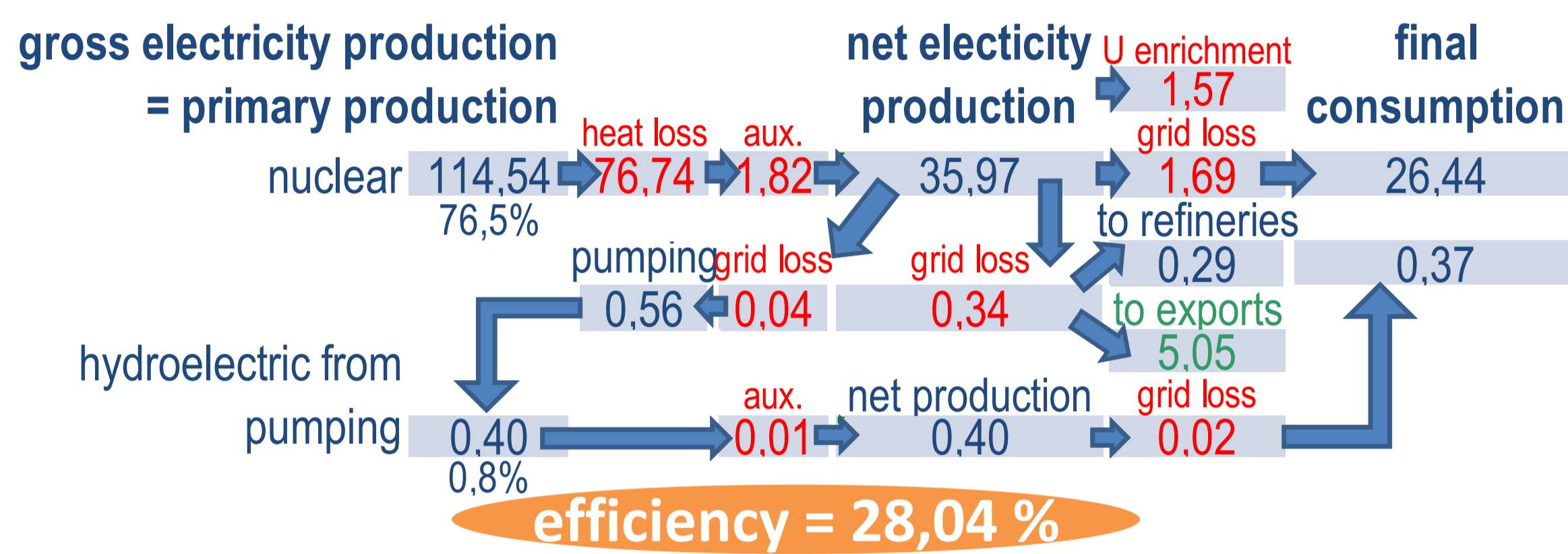
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In the prospect of limiting not only energy consumption but also entropy increase, it is important to understand the way the energy system operates. This work is an attempt to do so by presenting and analyzing an original flow diagram of the French energy balance. It first provides evaluations of the energy efficiency of the national energy system. And then uses them to discuss the conversion factors from final to primary energy that are used in the French heat regulation. It shows that these conversion factors, especially the electricity one, depart from reality. This leads to a misinterpretation of the 2012 energy standard for new buildings.

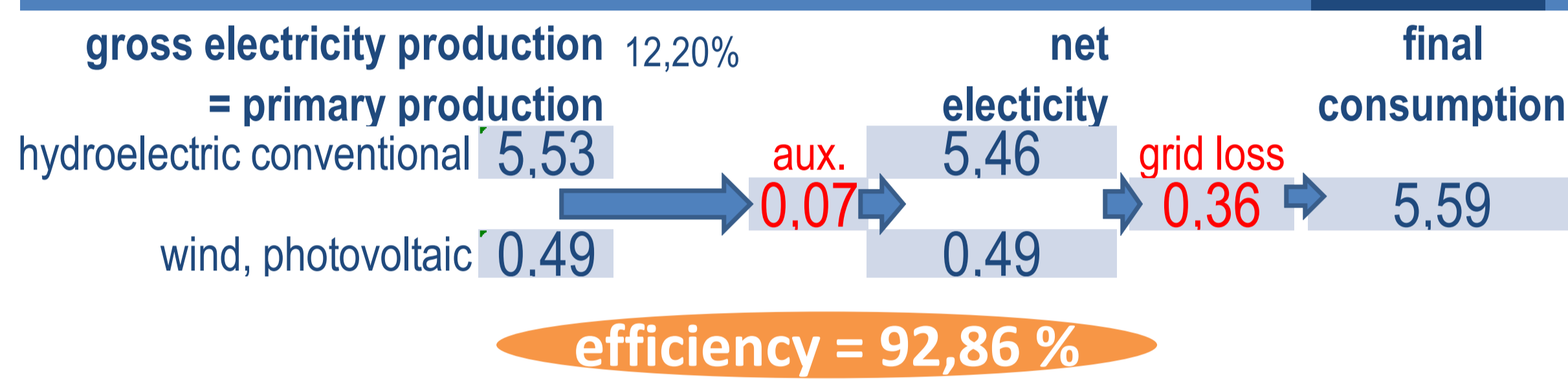
From primary sources to electricity final consumption in France 2008 (Mtoe)

1 MWh = 3.6 GJ = 0.086 toe 1 nuclear gross MWh = 0.26 toe

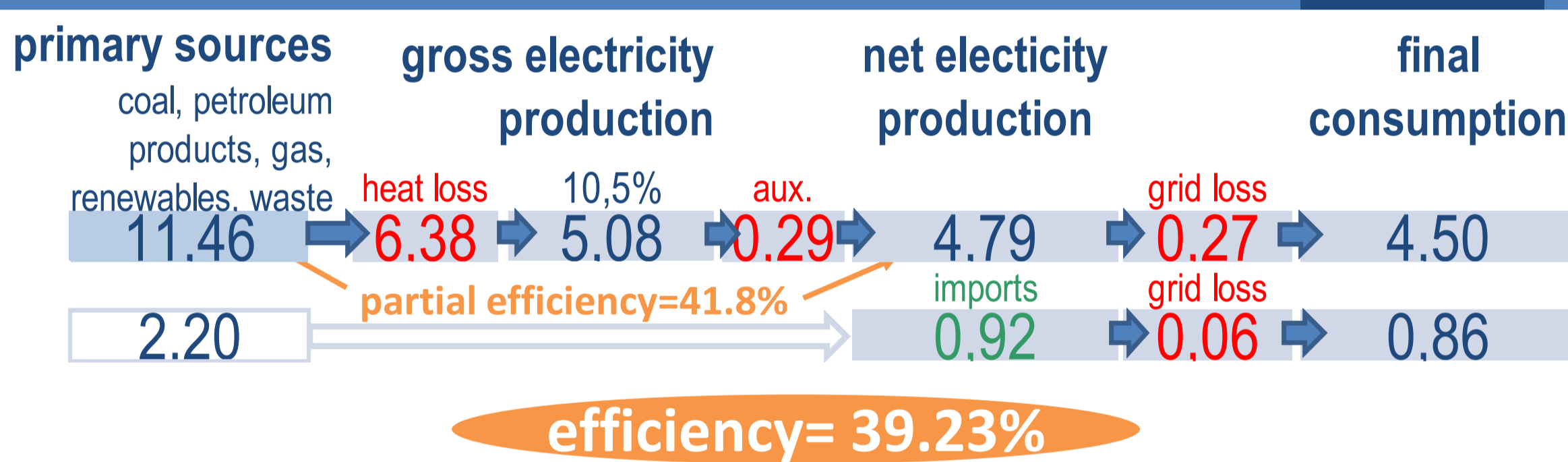
Nuclear 71.0%



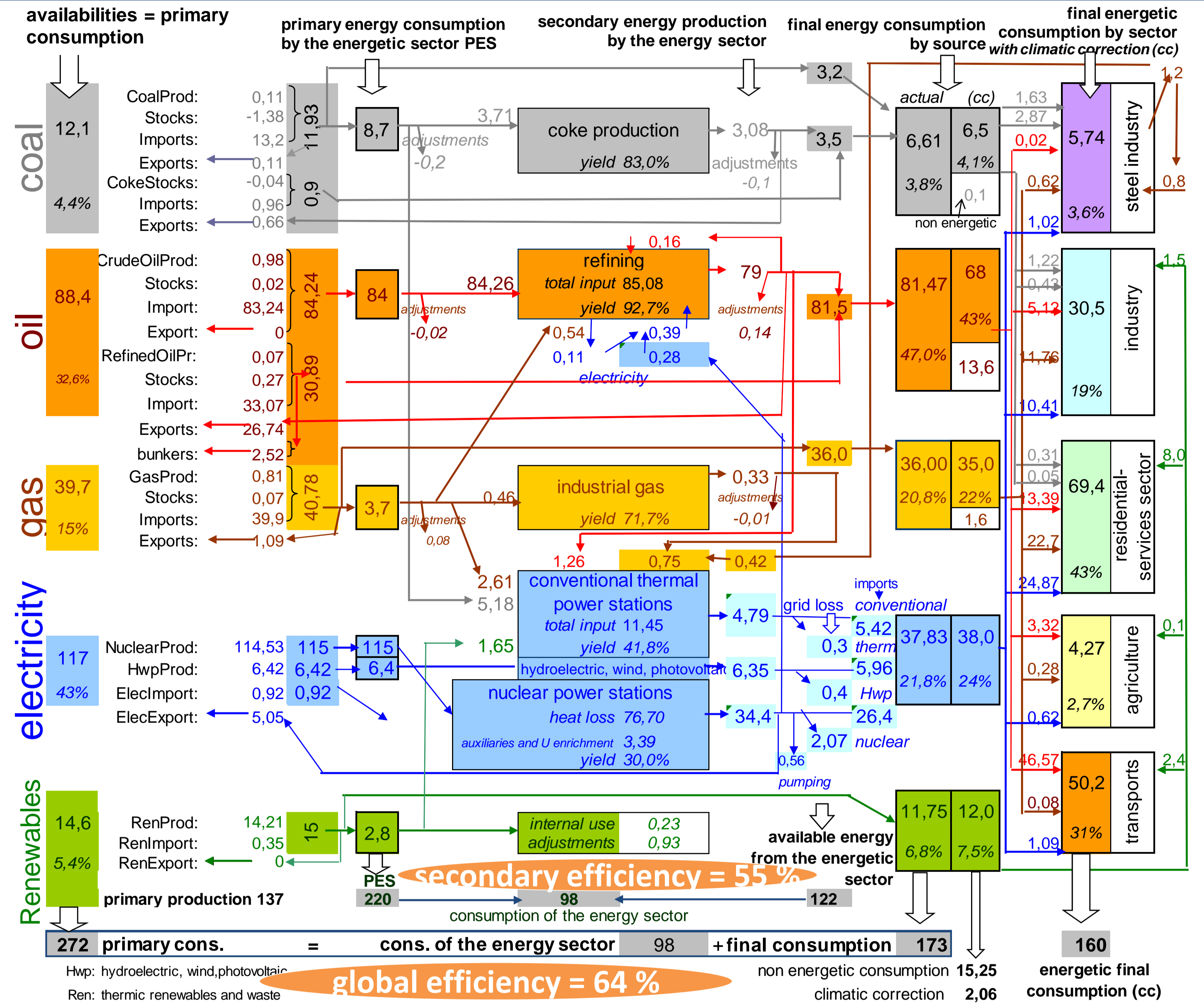
Non thermal renewables 14.8%



Conventional thermal plants 14.2%



2008 energy flows in France (Mtoe)



2005 thermal regulation

Primary Energy Consumption Limit for new residential buildings (for heating, cooling and hot water)

PEC _{max} (kWh/m ² /year)	H1 cold area	H2 temperate area	H3 mediterranean area
Fuels	130	110	80
Electricity	250	190	130

Conventional coefficients from Final to Primary Energy

	Efficiency	Conversion factor
Fuels	100%	1
Electricity	38,8%	2,58

Same implicit threshold for Useful Energy

UEC _{max} (KWh/m ² /year)	H1 area	H2	H3
Fuels	91	77	56
Electricity	97	74	50

* with an average yield of 70% for the boilers

The 2009 Grenelle 1 Law toward the 2012 thermal regulation

▪ A single Primary Energy Consumption Limit for all new buildings (for heating, cooling, hot water, lighting, ventilation, pumps) and all energy sources except wood:

50 kWh/m²/year

▪ There is a controversy against this value qualified by some people of « weapon of the crime » against electricity.

▪ The law also says it has to be modulated according to the location and use of the building and for energies which present a good CO₂ balance,

▪ and that the conversion factor from final to primary energy has to be examined.

The proposals of the Parliamentary Office (december 2009)

- Modulation of the 50 kWh/m²/year limit according to location between -10% and +30% (40 to 65 kWh) for 6 areas, corresponding to the BBC-Effenergie label
- Modulation on height ground + 10 kWh above 400 m, + 20 kWh above 800 m
- Modulation according to the size (S) of the building on 40% of the total, for example with a coefficient of 0,6 + 80 / (100 + S)
- For non residential buildings: simulated limit of 50 kWh applied only on permanently occupied areas, but active management of energy to obtain an effective global performance
- No modulation according to CO₂ balance of energy sources, but a maximum CO₂ emission of 5kg/m²/year (except for renewables), with the previous modulations
- No change of the conversion factor from final to primary electricity which represents a physical reality (as calculated below) but its value should be reexamined periodically.

	Electricity	Nuclear	Photovoltaic Hydraulic, Wind	from Fuels	Average
% in electric consumption		80%	10%	10%	100%
Efficiency		33%	100%	53%	37%
Conversion factor		3	1	1,9	2,7

My own proposals: a guideline for accurate conversion factors

A bigger conversion factor from final to primary electricity

Electricity (21,8% of total final consumption)	Nuclear	Photovoltaic Hydraulic, Wind	From Fuels	Average
% in electric consumption	71%	14.8%	14.2%	100%
Efficiency	28.04%	92.86%	39.23%	32.75%
Conversion factor	3,57	1,08	2,55	3.05

Different conversion factors for fuels

Fuels	Coal	Oil	Gas	Biomass, waste
Efficiency	83.0%	92.7%	100%	100%
Conversion factor	1,20	1,08	1	1

No political use of these values; preferably change the consumption limits.