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The three methodologies for assessing the energy savings potential: the experience of France

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The 3 mains methodologies

- 3 complementary approaches can be used for the assessment of the energy savings potential :

1. The international benchmarking at sectoral and end uses levels using adjusted indicators
2. The technico-economic approach using technologies characterisations and penetration, and relying on micro-economic assesments
3. The comparison between a reference scenario and a scenario with measures using technico-economic modelling (eg MEDEE).

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Definition of energy saving potential

- Estimate of the additional energy saving stock realisable for un given period
- Technical potential/ technico-economic potential/ exploitation rate
- Static or dynamic potential
- Adoption of efficient technologies decreases the potential, the R&d increases it as well as the economic growth.

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The benchmark approach

To compare the situation of a country to the best practices already implemented in others countries.

- The benchmark approach is relevant whatever the level of the analysis taken : nation wide, by sector or by end- uses.
- The benchmark is dynamic
- It requires a lot of data and adjustement techniques

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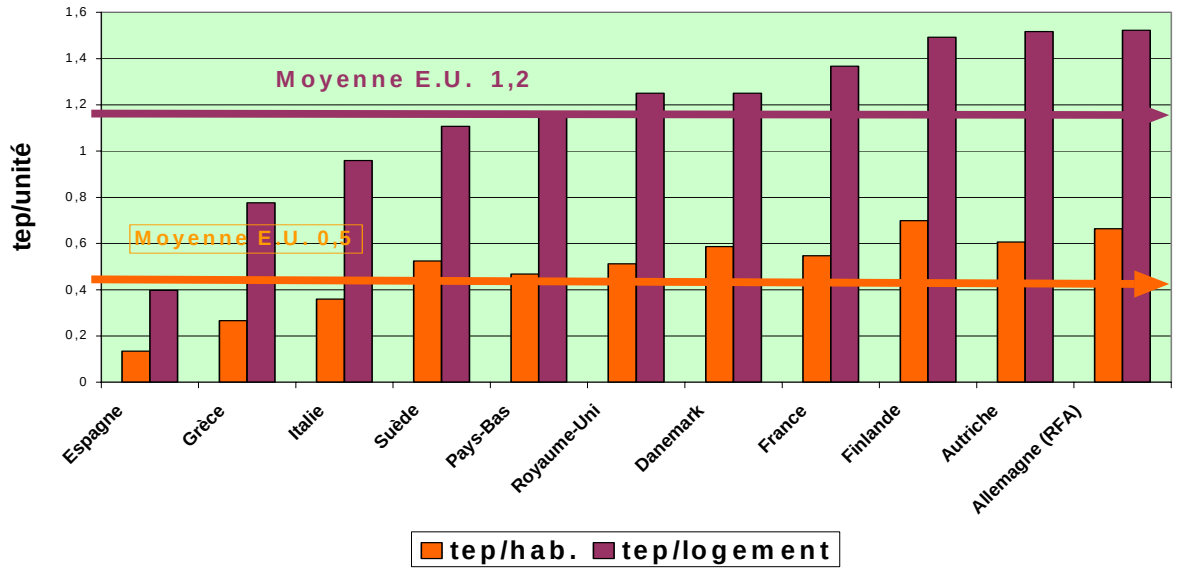
Discrepancies of a factor 4-5 of space heating consumption per capita or dwelling in the E.U.



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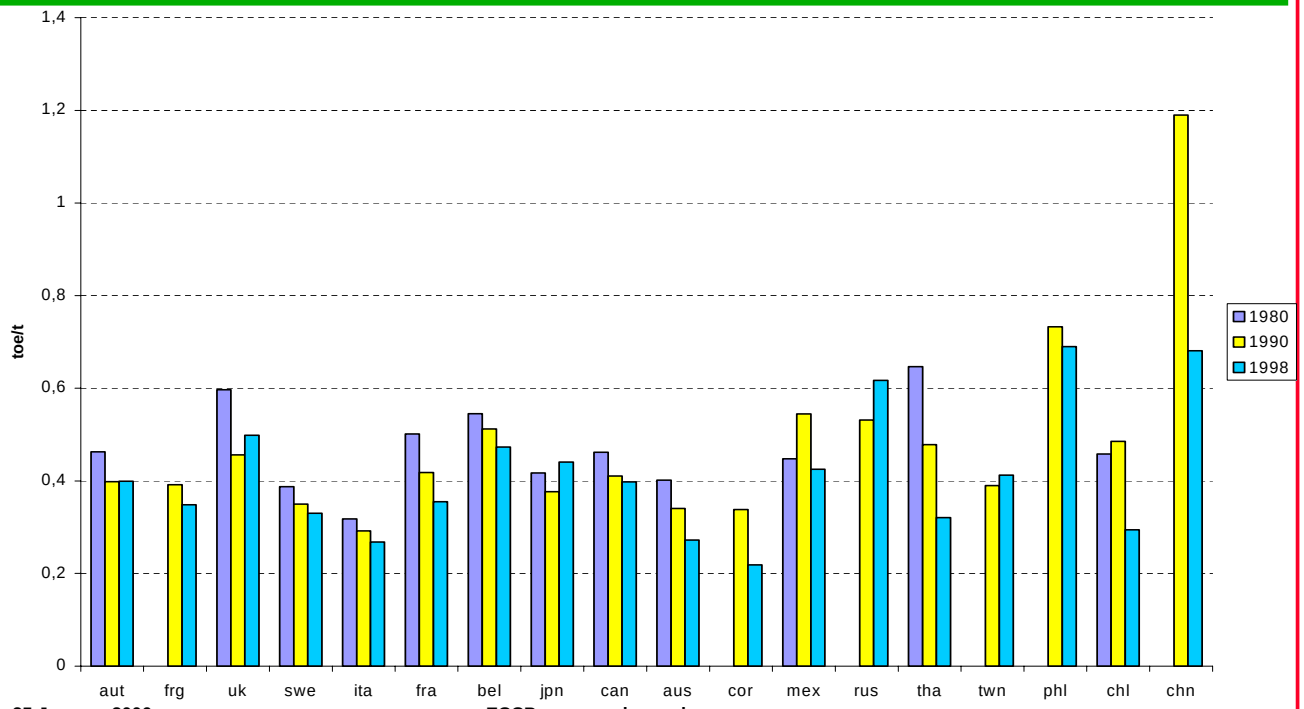
Average Consumption per unit of output Steel



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Factors of the unit consumption dispersions

- Type of process Ł adjustement can be made
- Quality of inputs
- Size of the firms
- Age of energy consuming devices
- type of the process
- The energy management of the firm
- Qualité de l 'output
- The « business » cycle
- Etc.

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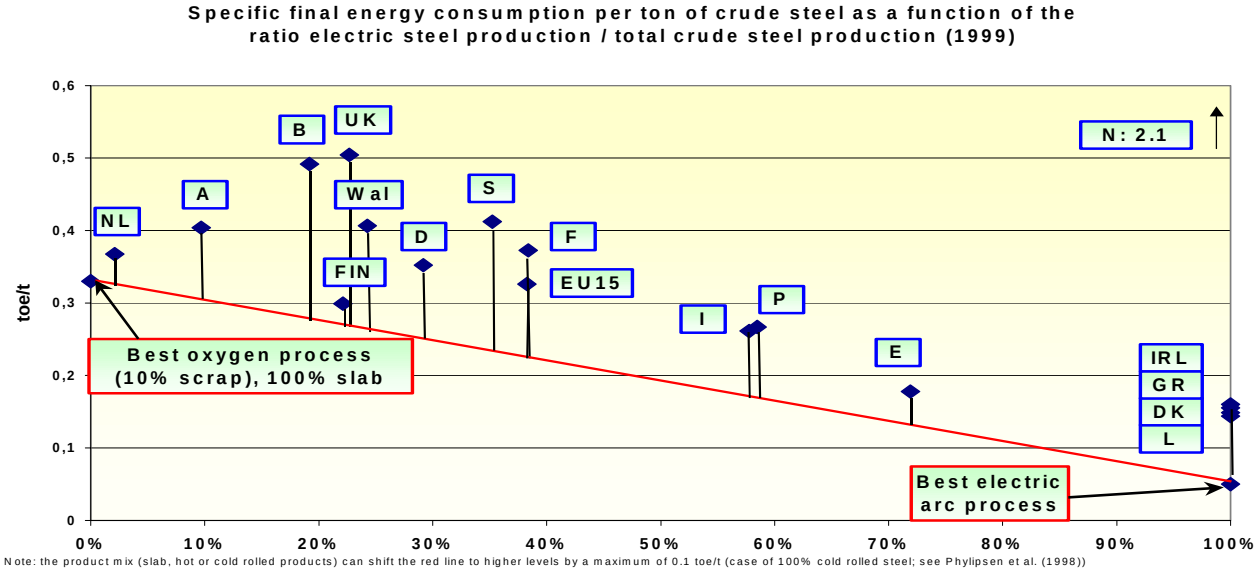
Benchmarck of the specific consumption for steel in Europe



Note: the product mix (slab, hot or cold rolled products) can shift the red line to higher levels by a maximum of 0.1 toe/t (case of 100% cold rolled steel; see Phylipsen et al. (1998))

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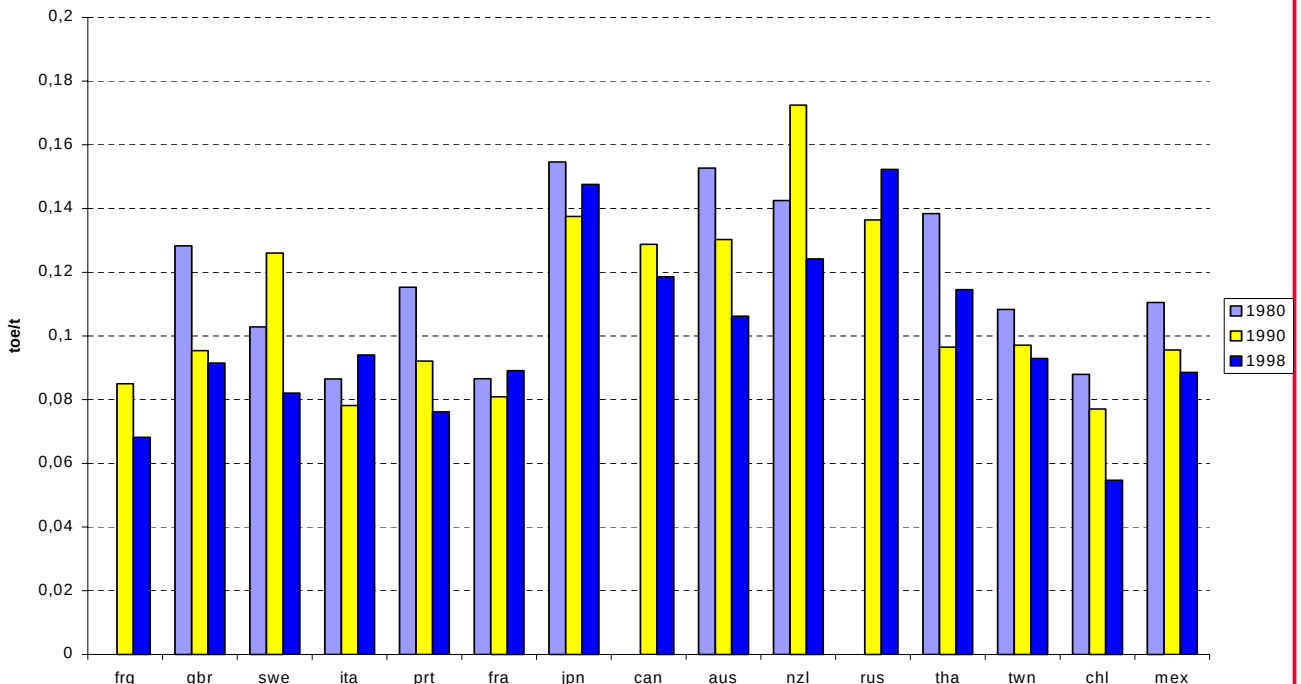
Average Consumption per unit of output Cement



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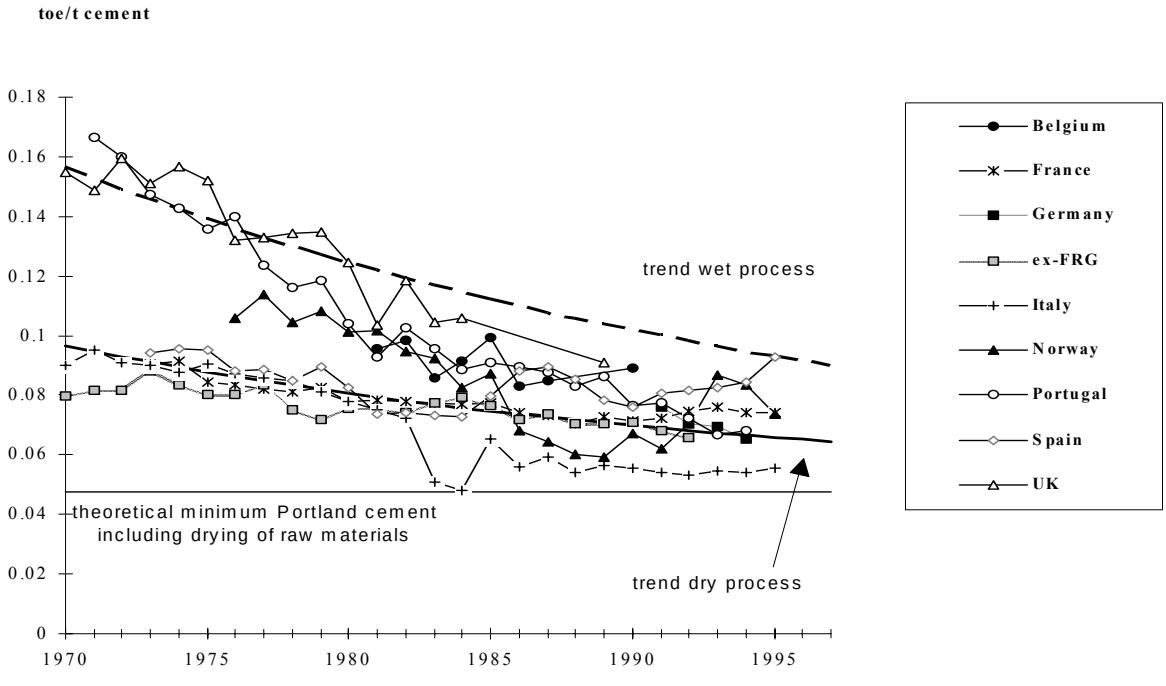
Convergence of the specific energy consumption in the cement industry



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Assessment of an overall potential for France : use of a final energy intensity adjusted to the French caracteristics

Adjustements have been made on :

- *Economic structure (GDP per main sectors)*
- *Industrial structures*
- *climate , « fuel mix « et dwelling size*
- *Modal shares in transport*
- *International air traffic*
- *car « fuel mix »*

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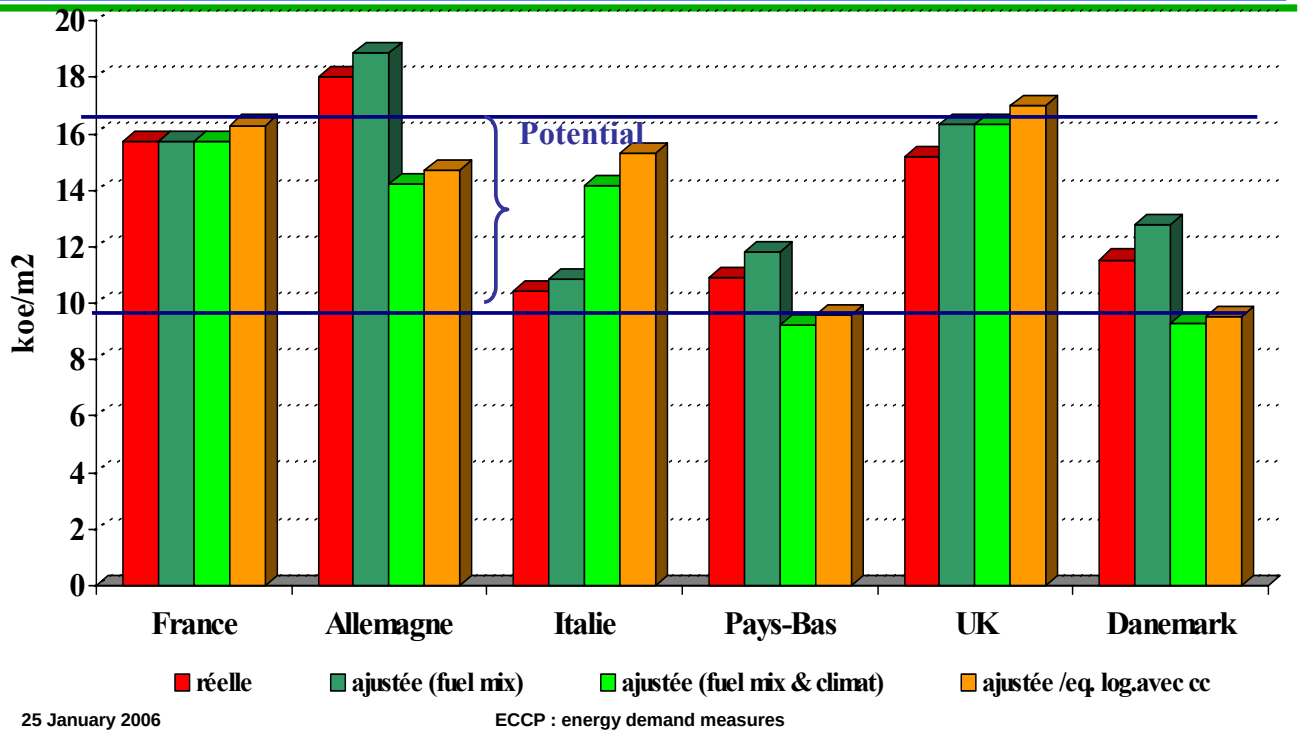
Evaluation of potential for space heating in France using an adjusted indicator of unit consumption



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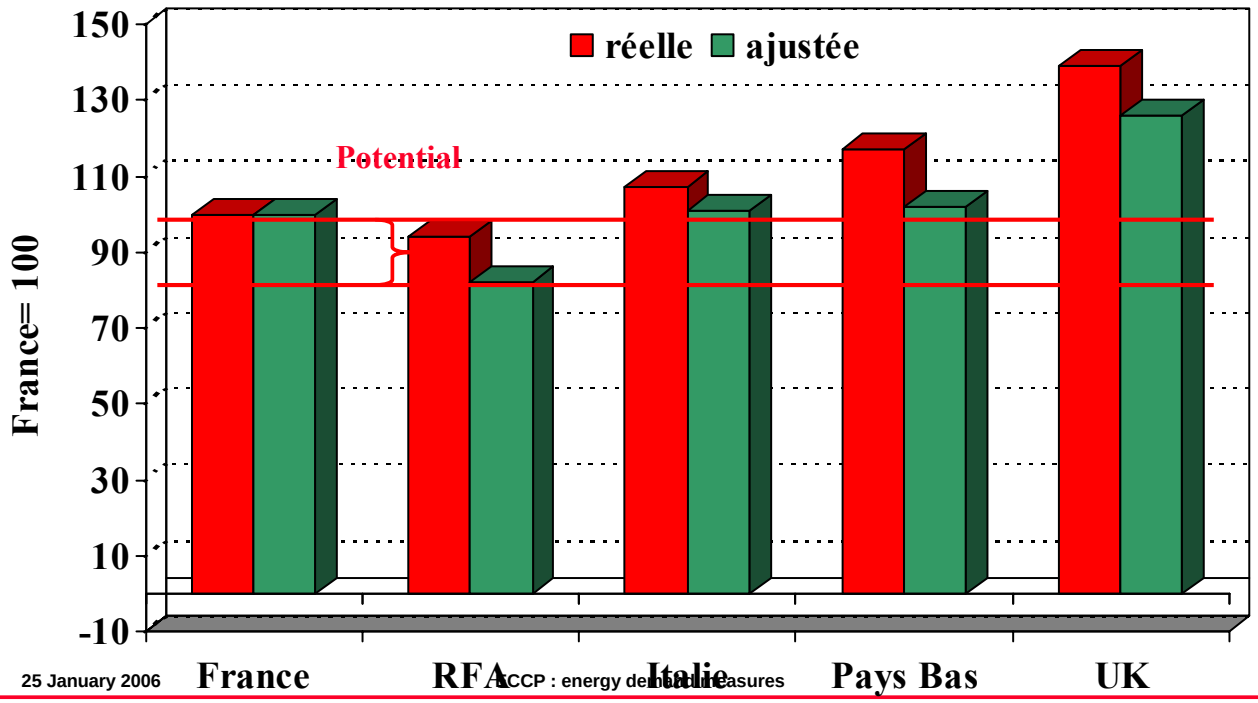
Evaluation of the overall potential: use of final energy intensity adjusted to the characteristics of France *(2000)*



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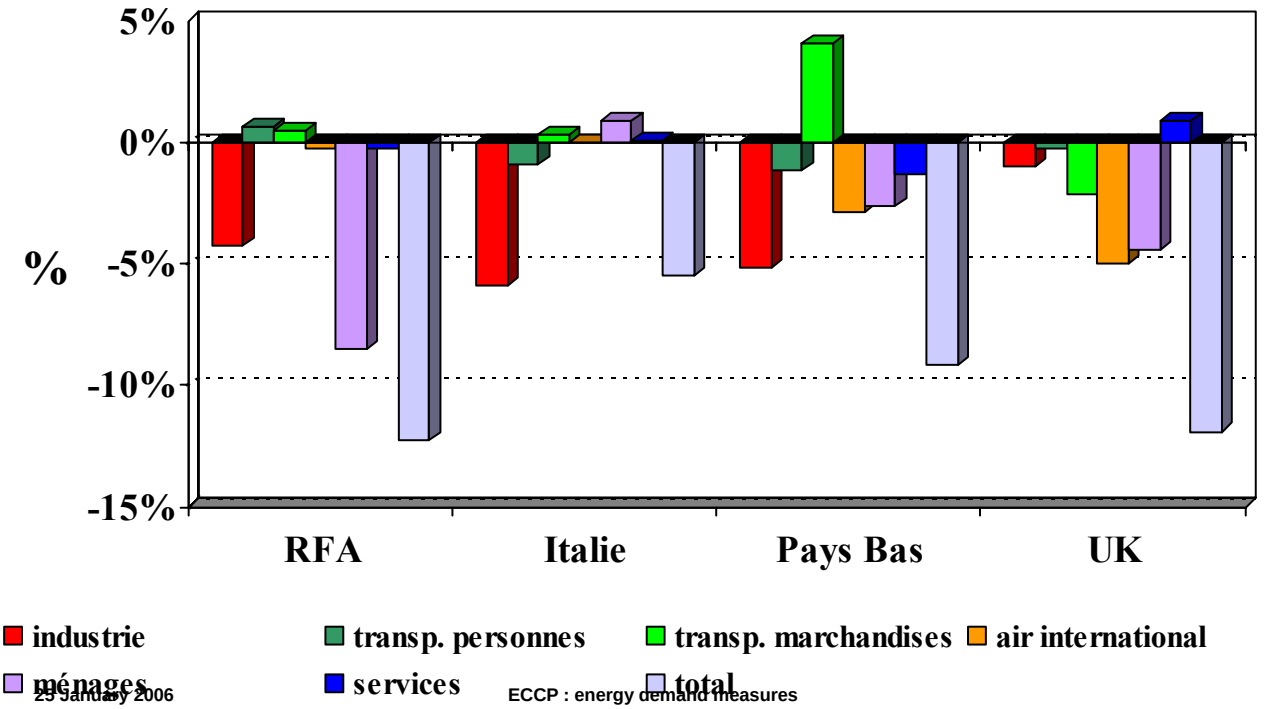
Sectoral contribution in the adjustements to the caracteristics of France (2000)



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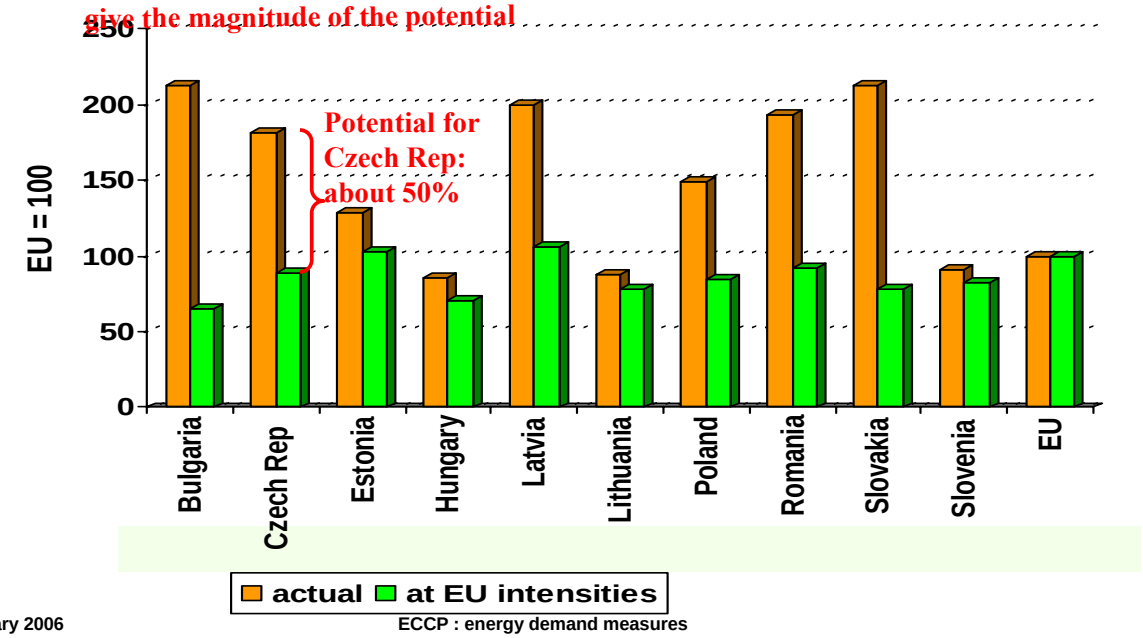
Potential of energy intensity improvement in manufacturing in New EU Member countries: use of a target energy intensity of manufacturing

Target intensity calculated with the EU average sectoral intensities (ie performance) and the industry structure of each country : difference between these two intensities give the magnitude of the potential



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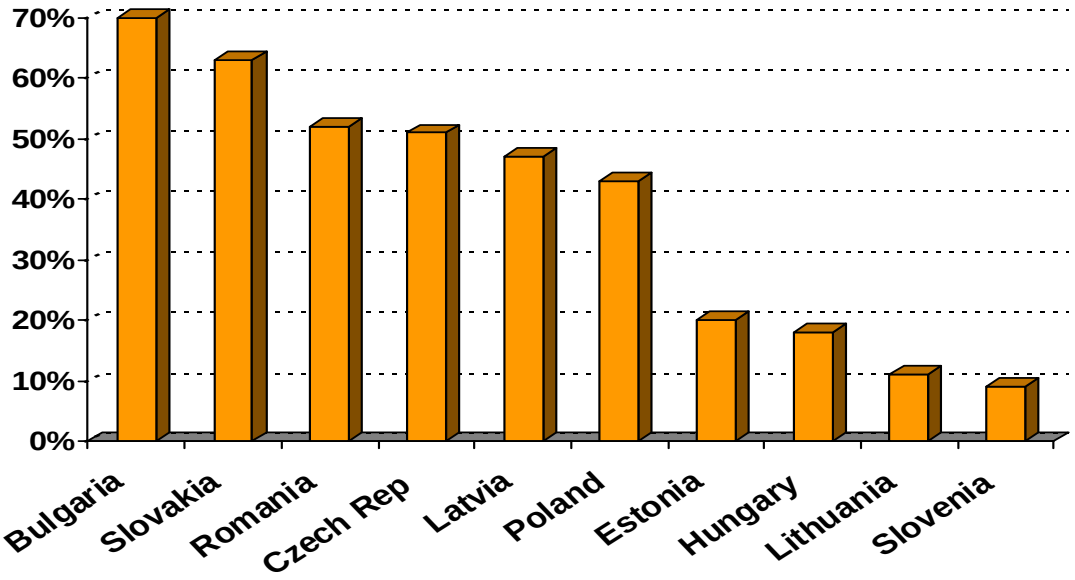
Potential of energy intensity improvement in manufacturing if all countries had the sectoral intensities of the EU



Target indicators can be built for more detailed indicators : space heating, steel, cement, cars

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2. The Micro-Economic approach
The steps to be taken

1. **Segmentation of the reference consumption by elementary energetical operation**
2. **Identification et qualification of energy efficiency technologies (energy performances, extra cost, penetration rate , speed of diffusion etc) through surveys or interviews.**
3. **Potential par segment for each technologies**

   potential = energy savings with a 100% penetration rate of the technology

1. **Modelling**

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Energy efficiency potentials in industry
A case study from France (ceren)

- **ADEME study realized by CEREN on the manufactory industry field (2001)**
- **200 efficient technologies under assessment**
- **Qualification of identified technologies through :**
  - **Energy performance**
  - **Investment over cost**
  - **Current distribution or penetration rate in 1999 in each activity branch**
- **Source**
  - **Equipment manufacturer panel (CEREN)**
  - **Analysis of demonstration operations**
  - **Face to face interviews with industry**
  - **Periodic inquiry on industry energy consumption**

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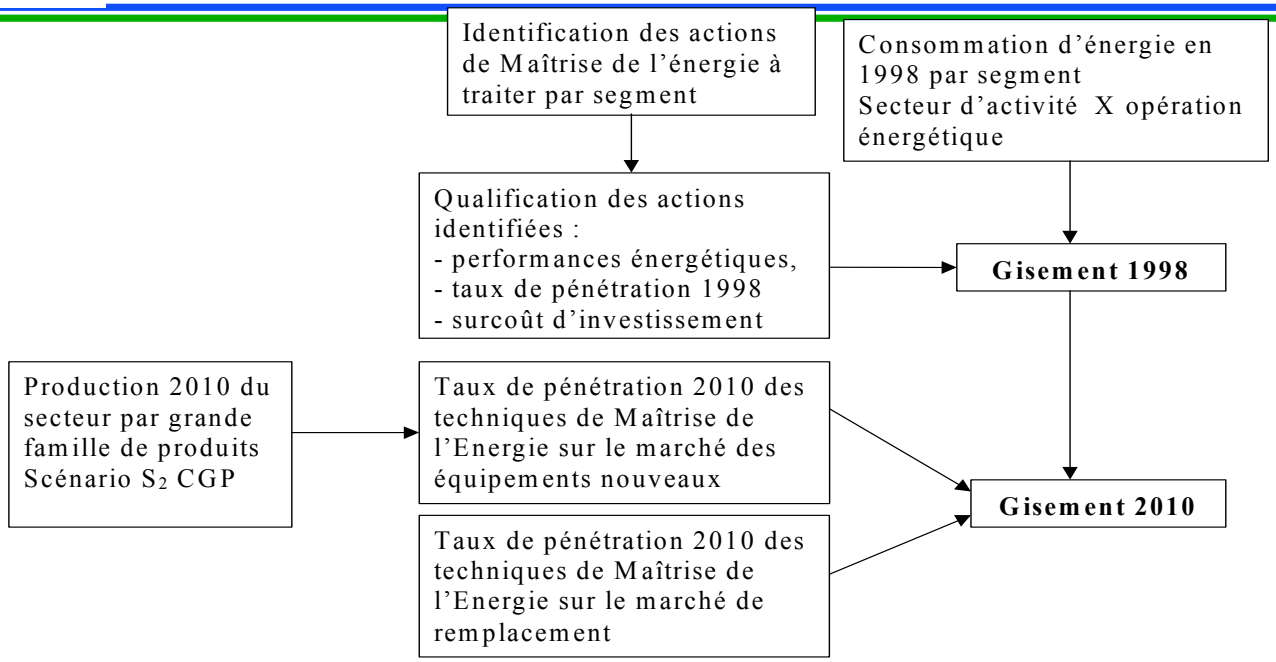
General method



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Energy efficiency potentials in industry in France

- **Assessment of the technical potential of energy savings and CO2 emissions reductions, linked to scenarios of technologies penetration in industry**
- **Maximum potential remaining in 1999 (2001 study)**
  - **12 M toe (23% of energy consumption in industry)**
  - **20,5 M tons CO2**
- **2/3 of the potential could be reached by technologies concerning the "process uses" and 1/3 by transversal actions (cold generation process, boilers, compressed air…)**

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Energy saving potential in industry : 23% of energy consumption and 20.5 M ton CO_2

	Potential 1999 M toe	Potential 1999 % of consumpt	Of which : Process M toe	Of which Out process M toe	CO2 reduction 1999 MtCO2
Food Ind.	1.0	28	0.7	0.3	2.7
Metals	3.5	27	3.3	0.2	4.8
Equipment	1.7	24	0.8	0.9	1.2
Cement…	1.0	18	0.8	0.2	1.7
Chemical	2.6	20	1.8	0.8	4.9
Paper	1.0	20	0.6	0.4	2.5
Other	1.1	22	0.6	0.5	2.6
TOTAL	12.1	23	8.5	3.6	20.5

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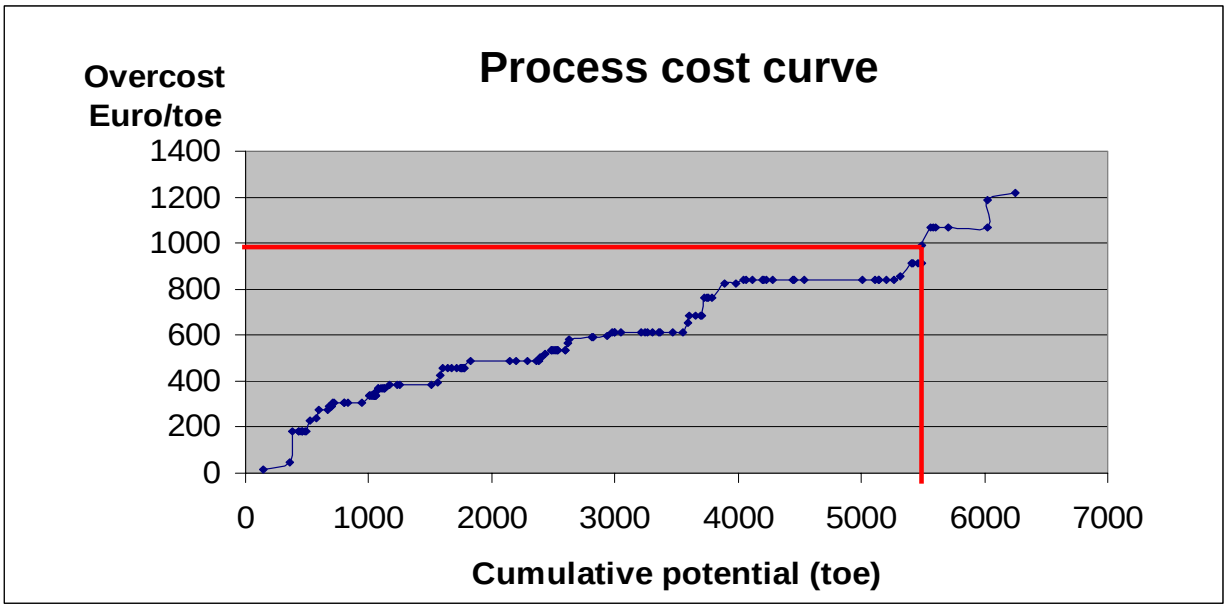
Technical potential for over costs in investment < 1000 /toe is 7 M toe, a reduction of 12 M t CO_2 (process + transversal)



For 1000 €/toe overcost 5.5 M toe in process + 1.5 out of process = 7 M toe

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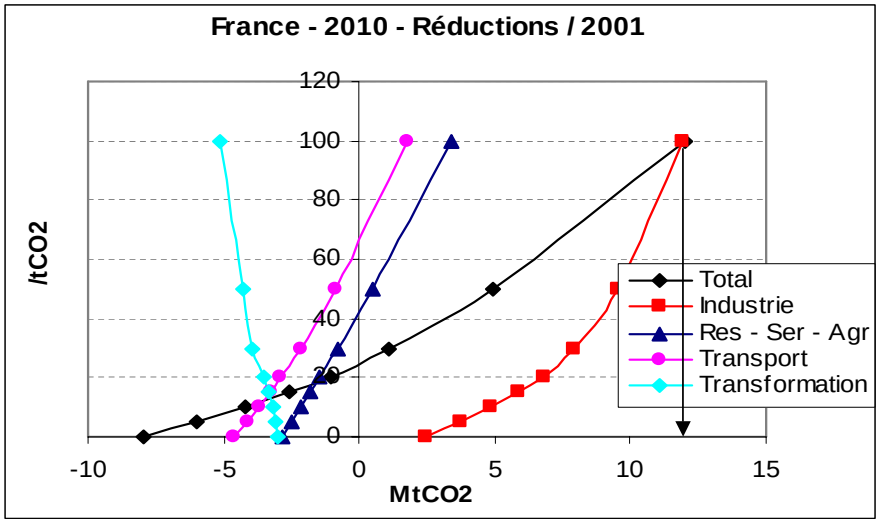
According to marginal cost of CO_2 in industry and price elasticity (POLES), this potential may be mobilized at a price of 100 /t CO_2



The economic potential is much lower and expected effect of ETS could range between 1.6 and 4.7 M t CO2 (mediane hypothesis 2.8 M t CO2)

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Hypothesis and limits

- Lack of information
- Vision technico-economic vision of the ex ante evaluation:
- Few direct taking into account energy price mechanisms
- Closer to the economic rationality of industrial (private) rather than those of collectif interest

⇒ under estimation of the potential

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Hypothesis and limits (cont)

- Energy performances.
  - **How to be sure of the benchmarking? How can we not forget some technologies? Quid of technologies post 2010 (NTIC). Performances of each single technologies are taken constant**
- The extra investisment cost:
  - **No scale efficiency, same running cost running , no economic actualisation of the costs, the industrial investissement selection is based on the total investissement cost rather than on the extra cost.**

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Hypothesis and limits (cont)

- Criteria of choice for the alternative technologies
  - **Yes or no; optimisation based on energy, environmental criteria or based on the least costs?, qualitative amendment**
- Penetration rate for 2010: expert jugement or modelling? Certainly multi-criteria
  - **Recent evolution of the diffusion; the field, quality of the processing, flexibility of usage, reliability, t environnemental inpact; regulation, economic growth etc.**

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Energy savings potential in building sector

- Heating and cooling :
  - Existing dwellings refurbishing potential (reduction of consumption by 200 kWh/m^2 /year of primary energy) : 50 TWh in 2010, 120 TWh in 2050
  - New Buildings : building codes reinforcement (2000 Thermal regulation vs previous one will provide 3 TWh gains in 2010 and 24 TWh in 2050). Reinforcement of 10% every 5 years
- Specific electricity consumption*

Potential	2020 TWh
Residential	24.7
Commercial	11.2
Public lighting	1

*40 to 100 g CO_2 /kWh according to specific electricity use

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Main measures in building sector

- AME (with existing measures)
  - Improvement of energy efficiency of new and existing buildings
  - Existing building code regulation
- AMS (with additional measures)
  - Reinforcement of the tax credit for efficient equipment and materials
  - European directive “buildings energy performance”
  - Energy savings certificates
  - Reinforcement of building codes every 5 years

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3.The integrated approach using scenarios

- To compare a reference scenario (BAU?) with alternative scenario which incorporate energy savings measures .
- If thy are not to much differences in the level and structure of the activity between the scenario, the difference can approximate the energy saving potential

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Projections for the 4th national communication (UNFCCC)

- **Two scenarios:**
  - **With existing measures (AME): measures implemented before the Climate Plan (1st of July 2004)**
  - **With additional measures (AMS) : with measures of Climate Plan implemented before the 1st of October 2005**
- **New projection:**
  - **AMS+: with all the measures of Climate Plan completely implemented (the whole potential used) and reinforcement of climate policy from 2010 in coherence with a factor 4 trajectory**

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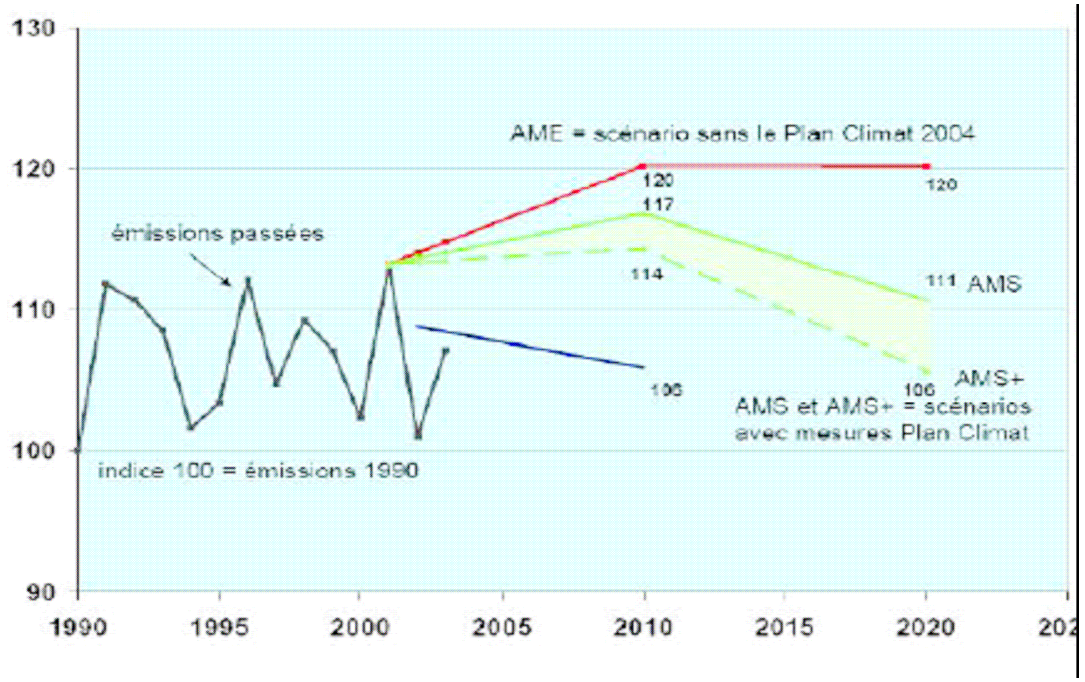
Building scenario *(100 in 1990)*
3 to 6 Mt CO_2 gain in 2010



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Potential in transport sector (road transport)

- **Evolution of energy consumption in transport (with existing measures) :**

Consumption M toe	2000	2010	2020	2030	2050
Urban travels	11.3	11.3	10.9	10.5	10.5
Interurban travels	12.4	12.5	12.4	12.3	12.2
Long and medium distance Freight	12.3	13.3	15.6	18.3	22.3
Urban freight	6.3	6.5	6.5	6.4	8.0
Total	42.2	43.7	45.3	47.5	53.0

⇨ Increase of long and medium distance freight traffic

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Energy savings potential is much stronger at long term

Energy savings potentials are more important through organizational issues (modal shift and transport demand management)

Energy savings Mtoe		2010	2020	2030	2050
Transport organization		2.3	4.7	5.0	6.6
Technologies		1.1	1.2	1.4	1.8
Total		3.4	5.9	6.4	8.4

CO2 reductions $MtCO_2$		2010	2020	2030	2050
Transport organization		6.3	13.1	13.6	17.8
Technologies		3.4	3.3	3.8	4.8
Fuel diversification *		5.4	11.9	18.6	25.3
Total		15.1	28.3	36.1	47.9

* Including biofuels contribution

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Additional main measures

- AME (with existing measures)
  - Modal shift from road (freight and passenger)
  - Speed limitation controls
  - Biofuels
  - ACEA commitment
- AMS (with additional measures)
  - Indexation of car registration certificate on CO_2 emissions for the most emissive vehicles
  - Car labeling
  - (Increase of the biofuels use : 5,75% to 2010)

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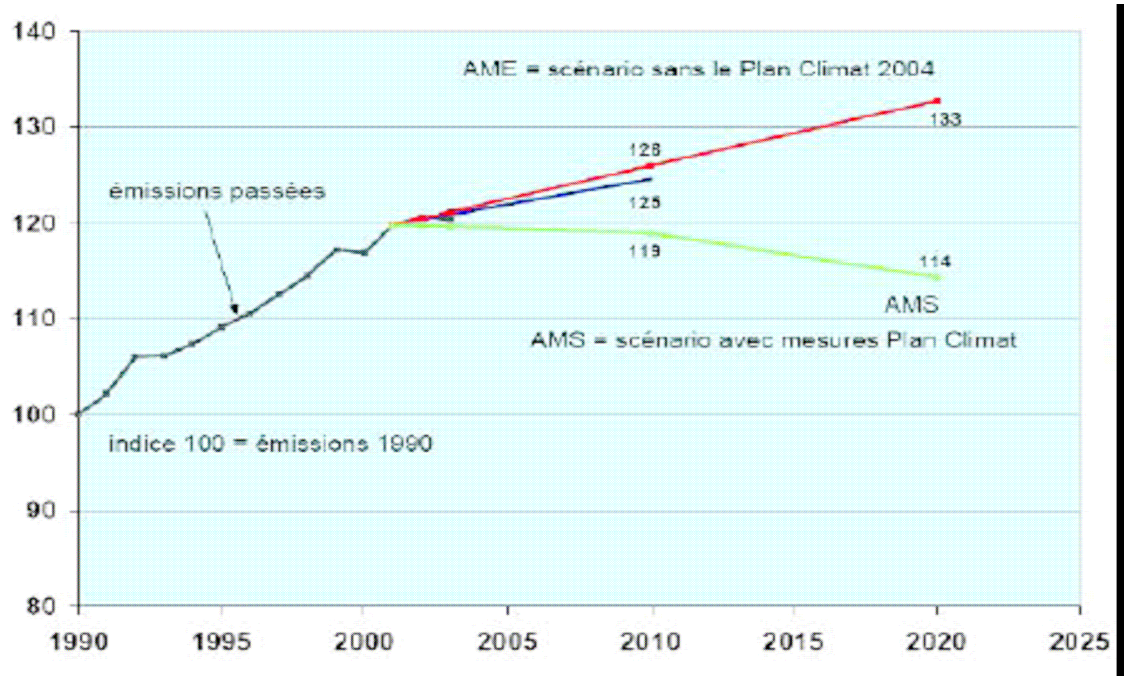
Transport scenarios (100 in 1990)

10 Mt CO_2 gain to 2010, decreasing further



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CO_2-emissions reductions expected by the implementation of «Plan Climat »

Million tons CO_2	CO_2-emissions in scenario AME In 2010	CO_2-emissions in scenarios AMS and AMS+ in 2010	CO_2-emissions reductions expected in 2010
Industry	87,6	[82,9 to 86]	[1,6 to 4,7]
Energy Production	77	68	9
Transportation	146	136	10
Building	102	[96 to 99]	[3 to 6]

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Total emissions GHG (MteCO2) (excluding sinks and JI/CDM)