SOVAMAT

CARBON CONSTRAINED SCENARIOS AND THE FUTURE

OF THE MATERIAL PRODUCING INDUSTRIES

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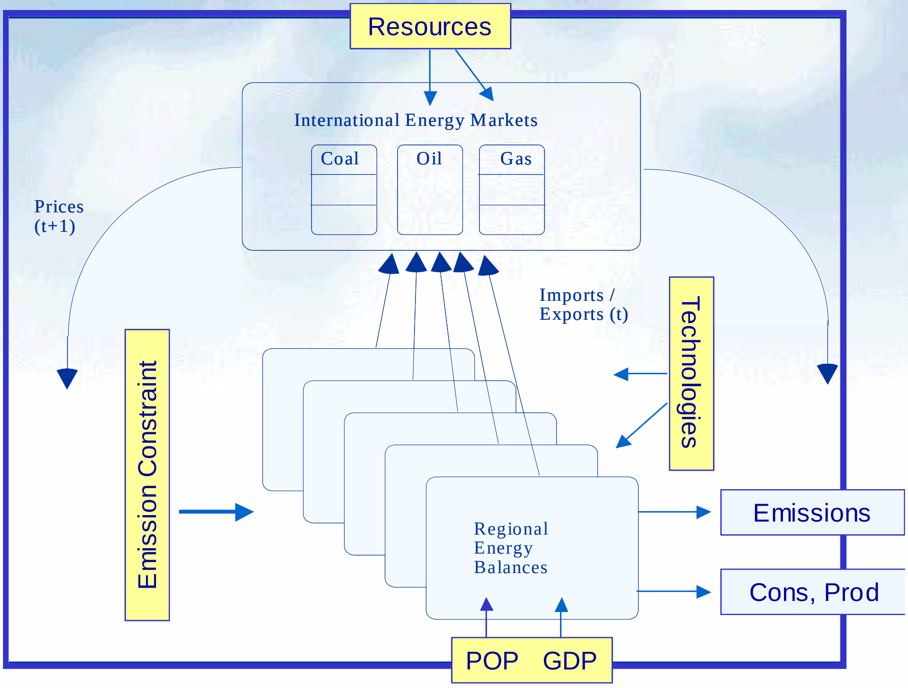
CARBON CONSTRAINED SCENARIOS AND THE FUTURE OF THE MATERIAL PRODUCING INDUSTRIES

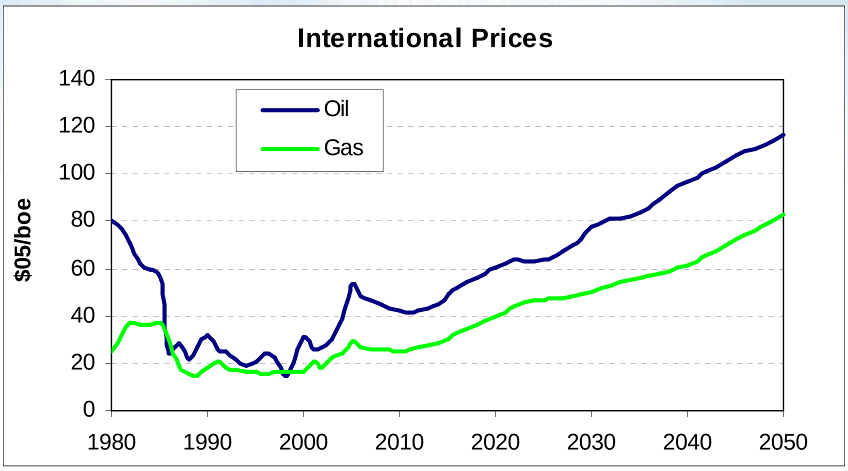
- Methodology and modelling tool
- The reference case
  - World Energy Prices
  - Oil and gas production profiles in the Reference projection
  - The world energy balance and emission profile
- The Carbon Constraint Case
  - Impacts on the energy markets
  - Impacts on final consumption by sector
  - Impacts on the structural materials industry
- Conclusion

The POLES model



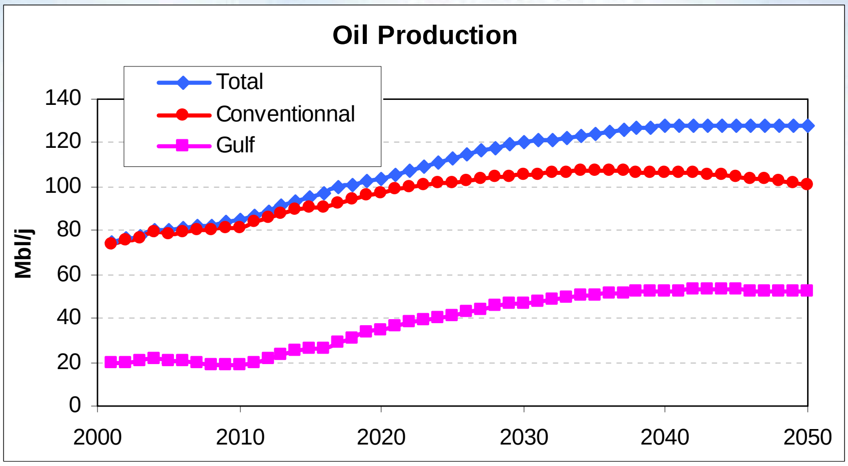
International oil and gas prices

- Progressive rarefaction of resources involves a constant rise of the prices which slow down the world demand and stimulate the world supply
- the raising of gas prices follows that of oil, because of similar factors of rise
- the price of coal also increases, but the differential with the Mtoe does not cease growing



Oil production

•Conventional oil production will increase until 2030, then stabilize and begin to decline around 2050.
•The model's oil peak is relatively flat and also low, since it is only 20% more than current production.
•To enable this stabilization of the conventional global oil supply, the Arabian Gulf countries will have to more than double their production.



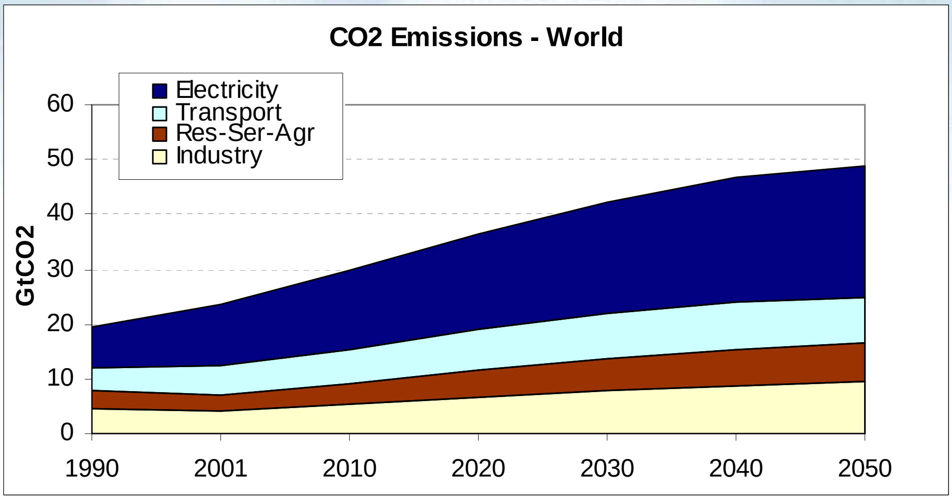
Primary production

•The consumption of primary energy in the world is expected to reach 26 Gtoe in 2050, from the current 10 Gtoe.
•Oil (including non-conventional) and coal provide 6.6 and 6.5 Gtoe and natural gas 4.7 Gtoe; renewable and nuclear energy contribute 3.7 and 4.3 Gtoe.
•This represents a significant structural change in the world fuel-mix, in particular after 2030, when renewable and nuclear energy sources benefit from quite a massive development, which translates in a rapid increase of their market share: in 2050, 30% of world energy supply comes from non-fossil sources.

	2001	2010	2030	2050	*t.c.a.m.* 2001/10	2010/30	2030/50
Primary Production (Mtoe)	**9779**	**12807**	**19624**	**25901**	***3,0%***	***2,2%***	***1,4%***
Coal, lignite	2351	3184	4875	6546	*3,4%*	*2,2%*	*1,5%*
Oil	3487	3973	6111	6635	*1,5%*	*2,2%*	*0,4%*
Natural gas	1929	3330	4703	4685	*6,3%*	*1,7%*	*0,0%*
Nuclear	671	753	1858	4343	*1,3%*	*4,6%*	*4,3%*
Hydro, geothermal	232	276	365	425	*1,9%*	*1,4%*	*0,8%*
Wind, solar	7	21	200	751	*12,5%*	*11,9%*	*6,8%*
Biomass and wastes	1101	1270	1513	2516	*1,6%*	*0,9%*	*2,6%*

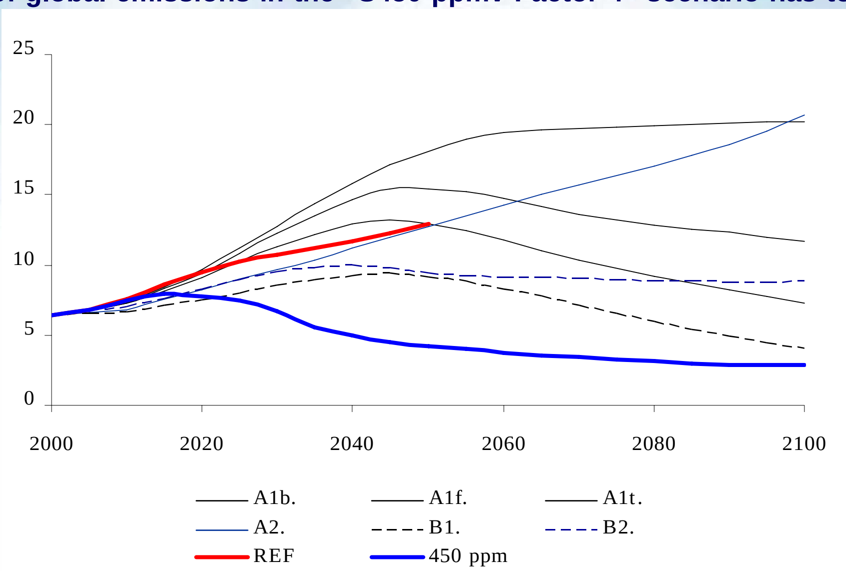
CO2 emissions

• World CO_2 emissions in the reference more than double in 2050 in comparison with 1990.



Profiles of CO2 emissions, REF and S450, compared with SRES scenarios

- The stabilisation at a level of 450 ppmv by 2050 or below would require that CO_2 emissions do not exceed 4 GtC in 2050.
- In a 450 ppmv stabilisation scenario emissions in industrialised countries should in 2050 be brought down to 20 to 30 % of their 1990 level.
- The profile of global emissions in the "S450 ppmv-Factor 4" scenario has to decrease by 2020.



Carbon value

• In order to follow this profile of GHG emission it is necessary to introduce a carbon value in the economic system either in the form of a tax or by quotas on carbon emissions.
•In our modelling exercise it is assumed that Europe will take the lead in implementing climate policies, followed by rest of annex B countries and developing countries in a later stage.

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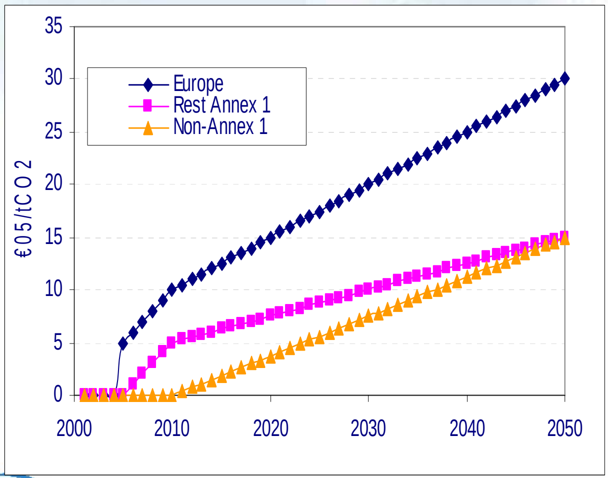

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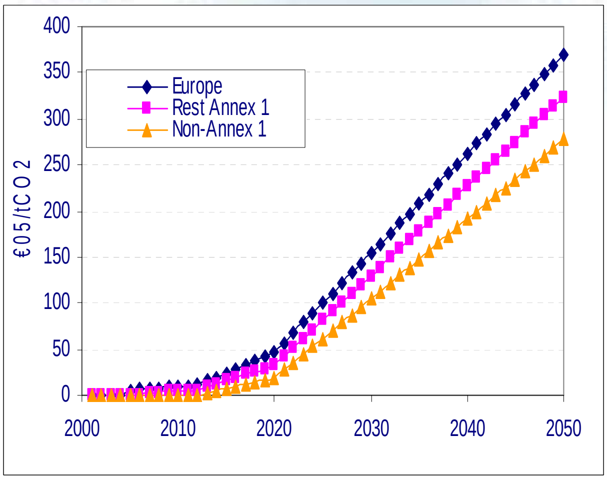

Primary consumption

Several important modifications are apparent in the energy mix, developing from 2020 to 2050, with:

- a significant reduction in the primary energy consumption from 24 Gtoe to 12 GTtoe as a result of increasing prices of energy
- and an increased contribution of renewable and nuclear power (not so much in absolute volume but significantly in share)

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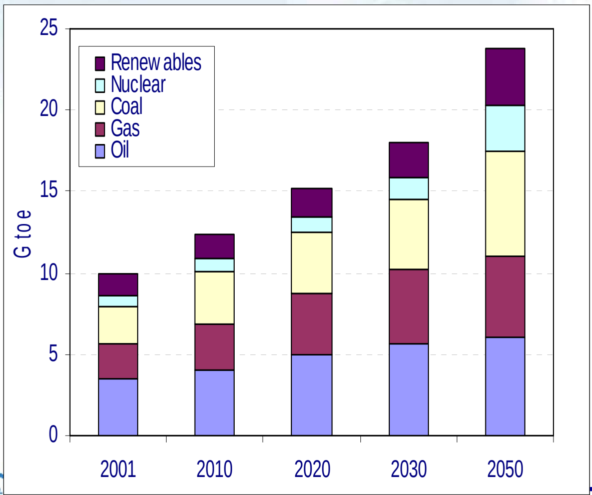

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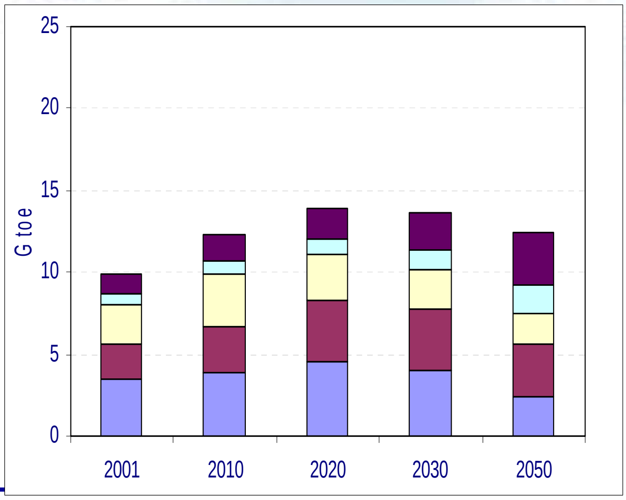

International prices

- One major feature of this scenario is the impact on the international prices, with a fully different trajectory for the oil and natural gas prices, which stabilize after 2020, due to the strong reduction in demand.
- Of course, final consumer prices increase anyway as a result of the introduction of carbon taxes or tradable emission quotas.

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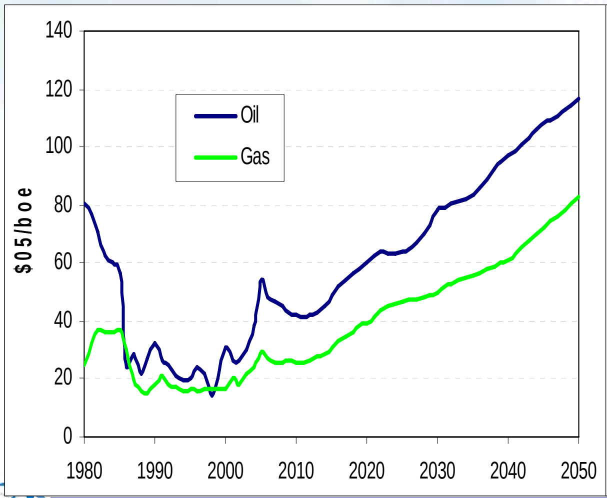

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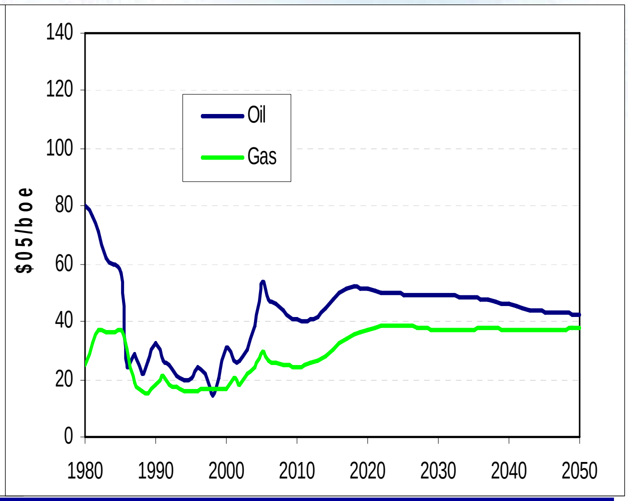

Regional CO2 emissions

- In 2050, Instead of the doubling of the CO2 emissions projected in the reference sce-nario, the S450-F4 scenario allows decreasing emissions of about 40 % compared to the situation in 1990.
- The reduction is much more important in industrialised countries but nevertheless very significant in emerging countries.

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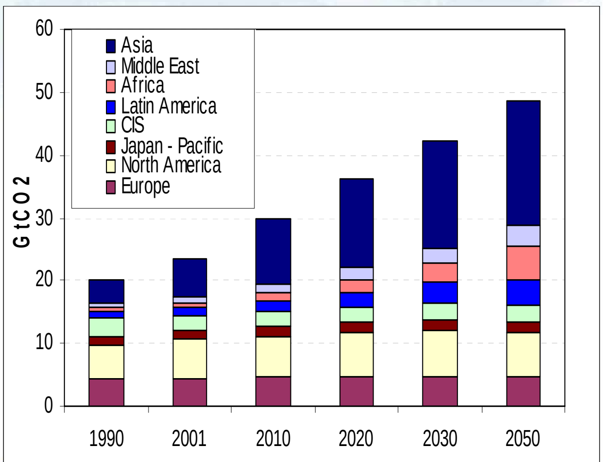

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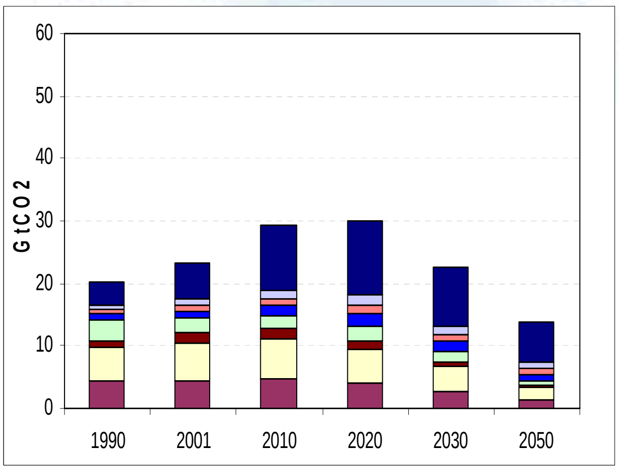

Final Consumption

- **Efforts appear equally spread between residential, industry and transport sectors but this global picture may hide more differentiated situations among industrialized and developing nations.**

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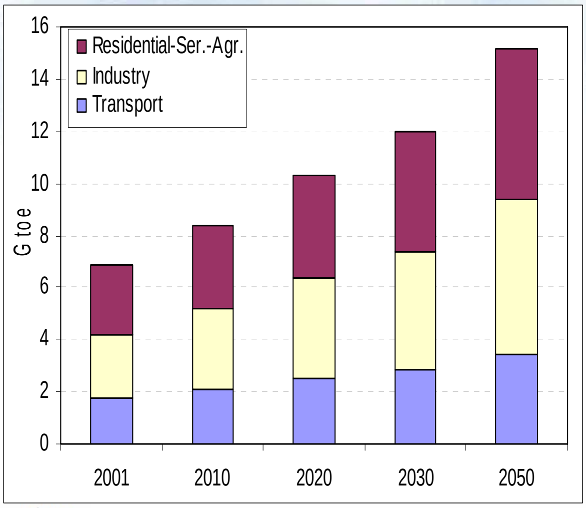

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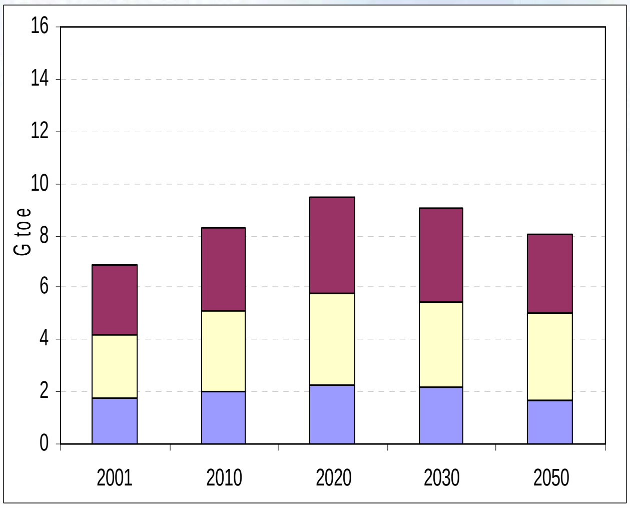

Market shares of Low Energy Buildings

- **Reductions in final energy consumption in the building sector are compatible with the increase of dwellings area and comfort levels, thanks to the accelerated introduction of low and very low energy buildings.**

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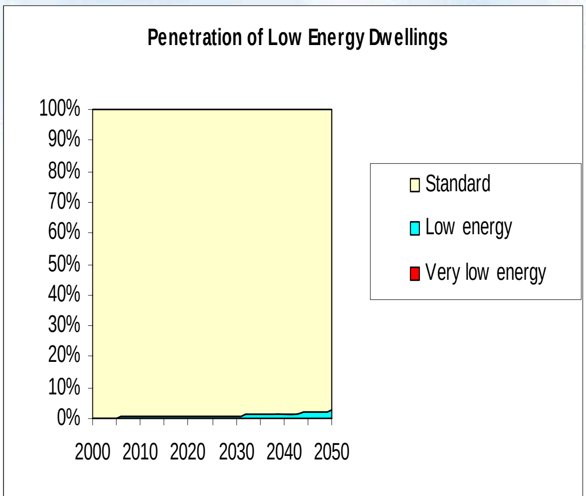

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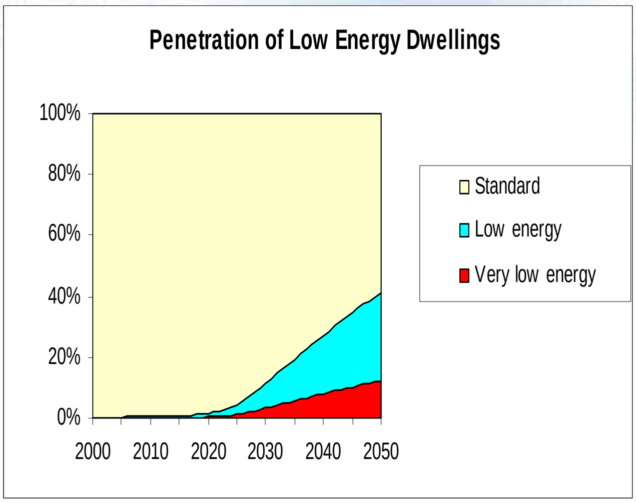

Market shares of transport technologies

- Reductions in the consumption of the transport sector are reached with the rapid introduction of low emitting transport technologies such as electric and hybrid vehicles.
- Note than in this scenario fuel-cell vehicles do not show a significant devel-opment due to insufficient competitiveness

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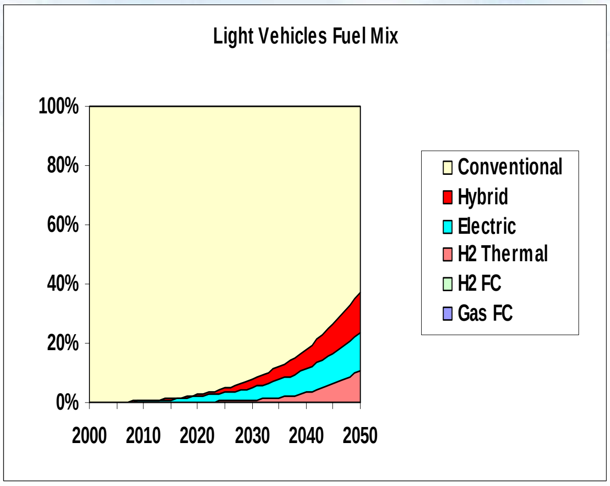

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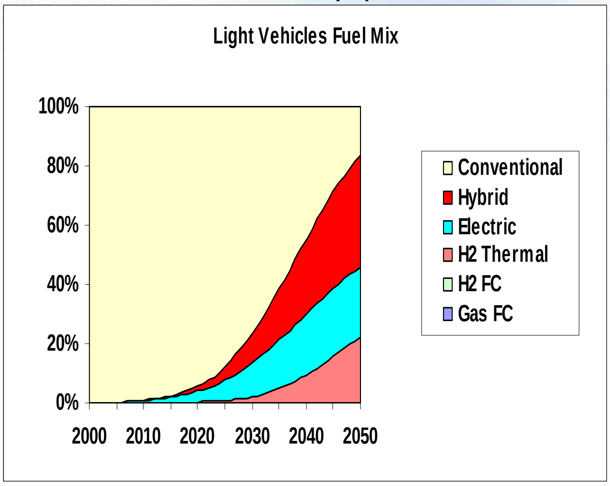

Transport consumption

- Reductions in the total consumption of the transport sector are accompanied by an slight increase of the consumption of H2, electricity and biofuels

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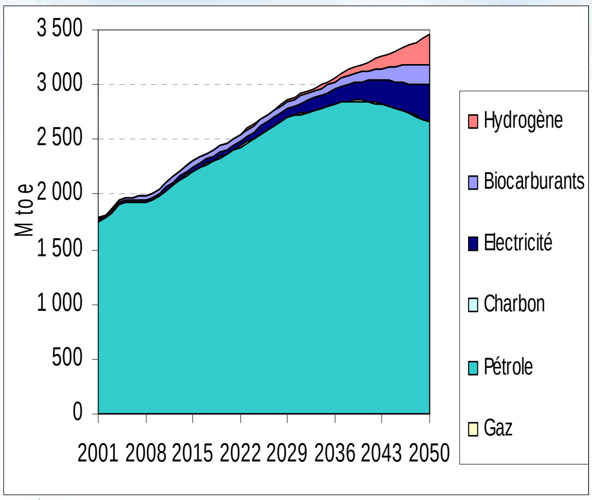

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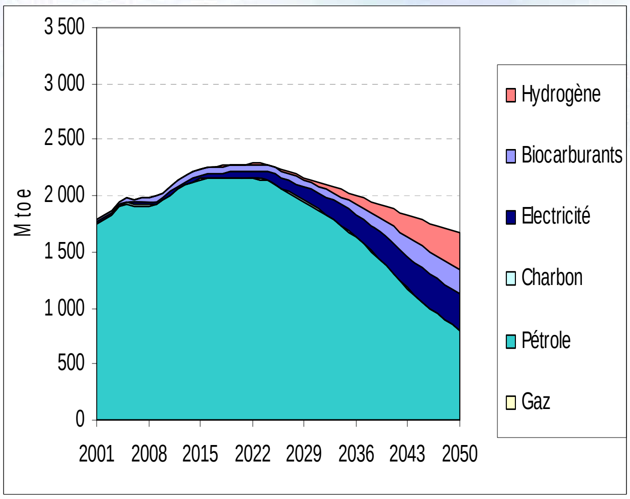

Steel demand by region

- In the structural material sector, the global demand for steel decreases in F4 compared to the Reference (-8.6 % in 2050).

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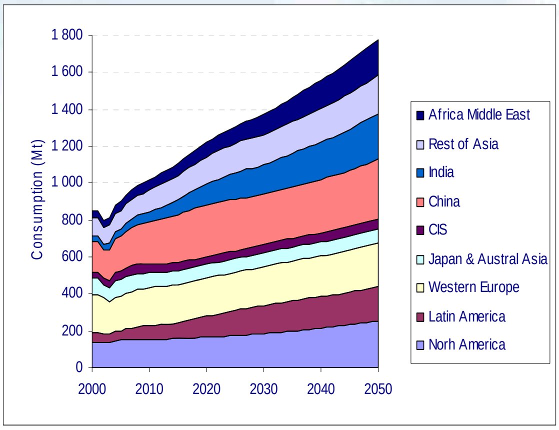

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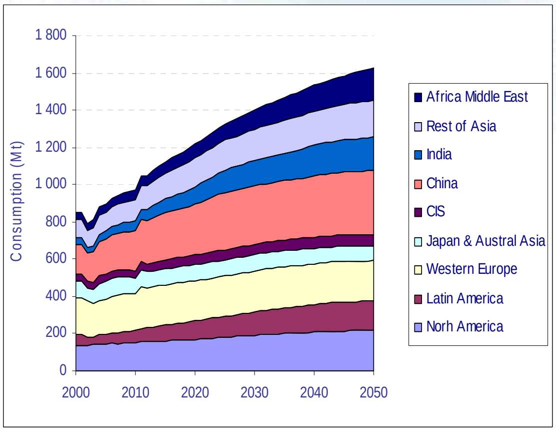

Steel demand by sector

- In the transport sector, the assumed decrease in the unit steel consumption of the vehicles (reduction of the vehicles' weight) compensates for the increase in the renewal rate of the vehicle stocks that is implied for the rapid diffusion of new efficient vehicles.
- On the contrary, the acceleration of the building sector activity, due to the accelerated scraping of low quality buildings, more than compensates the decrease in unit consumption of steel in buildings.

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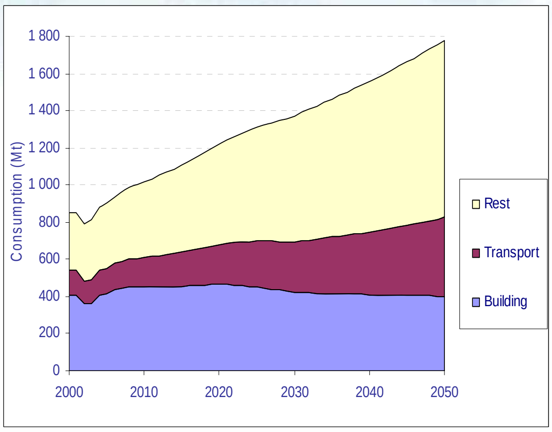

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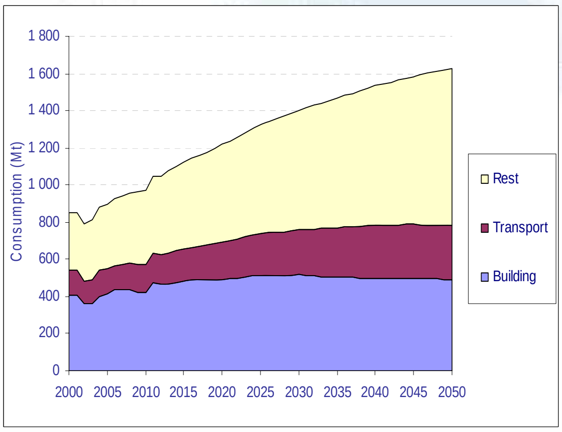
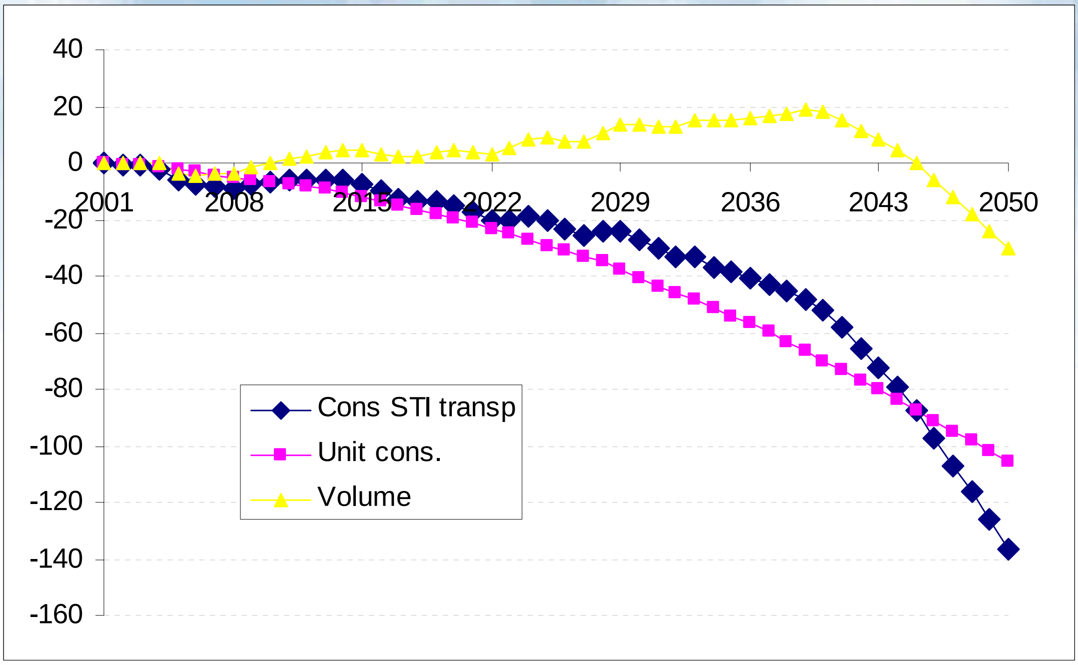
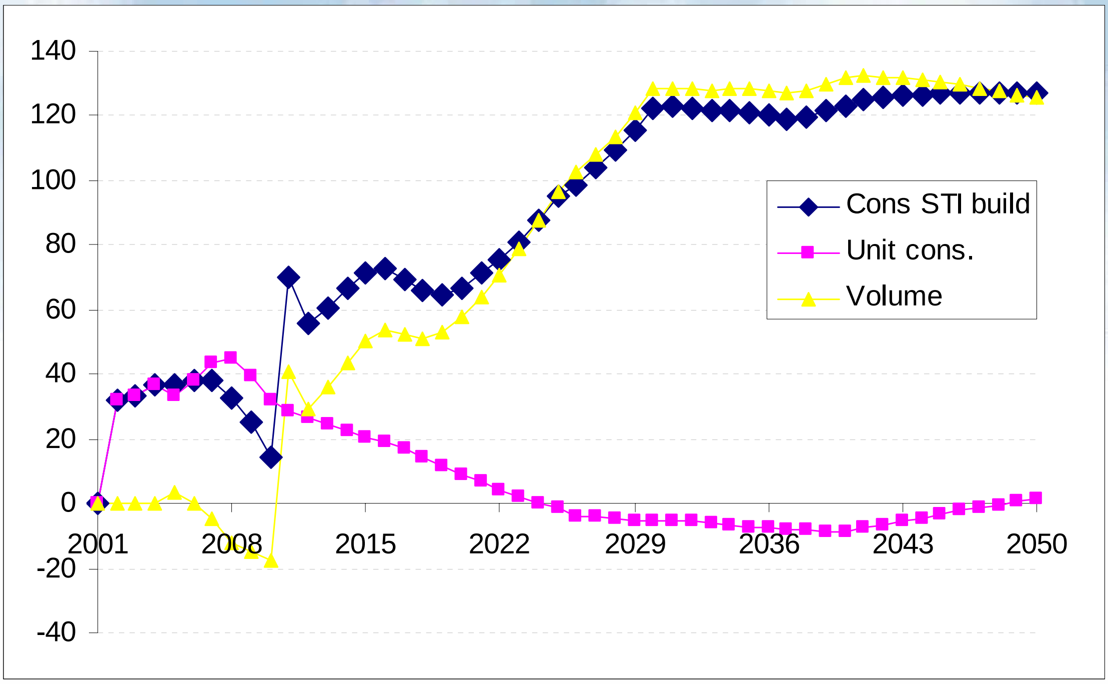


Volume and unit consumption impact on the consumption of steel in the transport sector



Volume and unit consumption impact on the consumption of steel in the building sector



Cement demand by region

- In the F4 scenario the total cement demand is 10 % higher in 2050 in F4 compared to REF because :
  - of the assumptions of higher reconstruction rates
  - despite the assumptions of the decrease of the unit cement consumption

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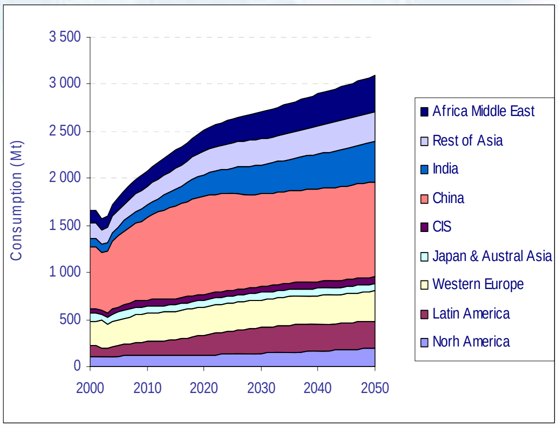

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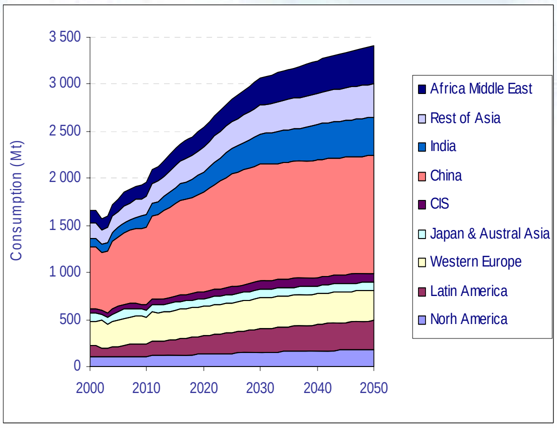

Cement demand by sector

- The increase of the total cement consumption in 2050 results from the increase of the cement consumption in buildings (+ 26%) in F4 / REF
- The cement consumption in other sectors decrease 9% in F4 compared to REF.

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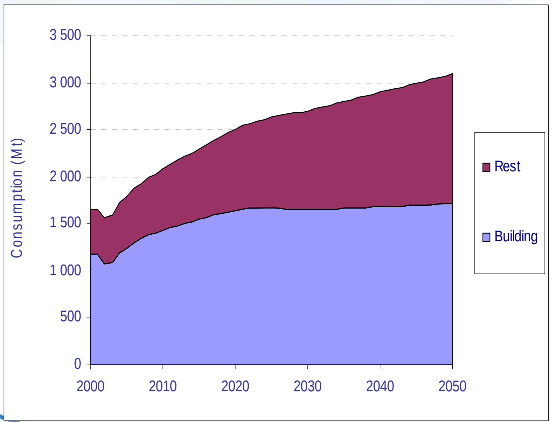

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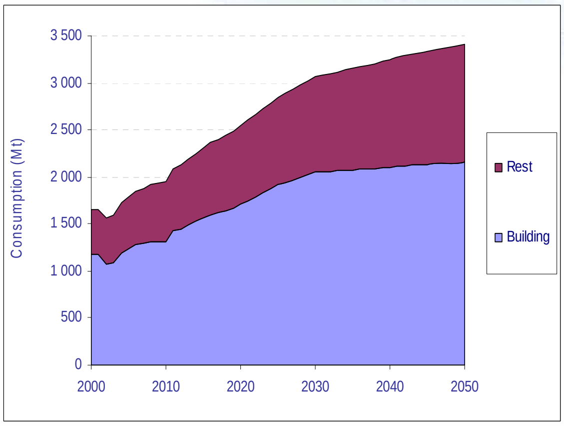
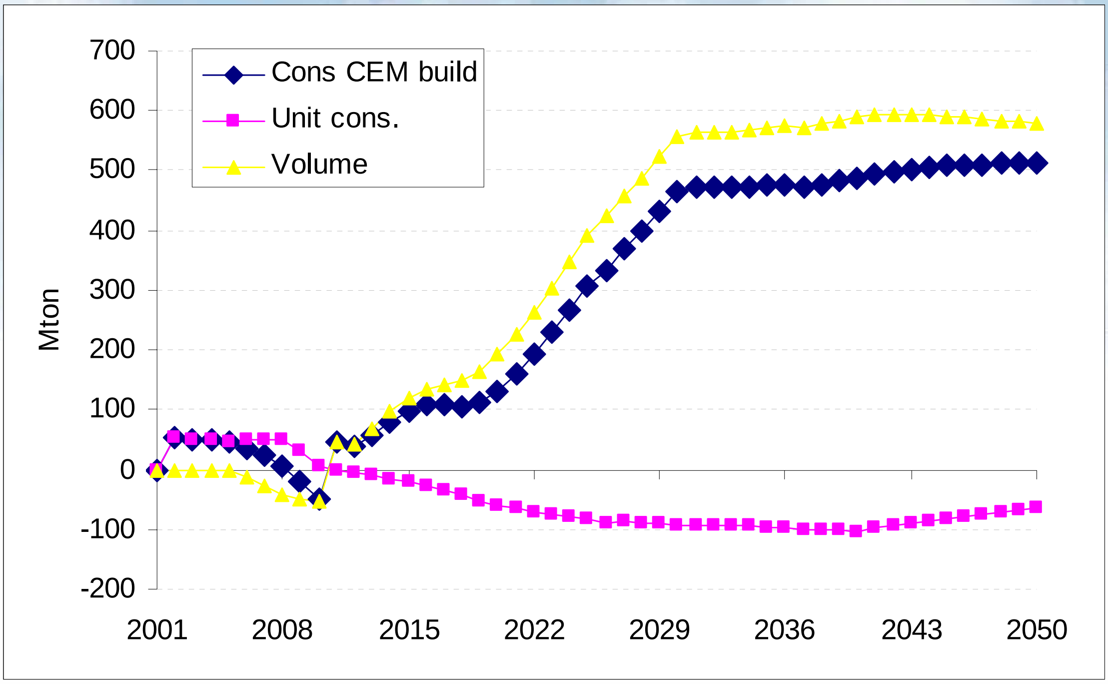


Volume and unit consumption impact on the consumption of cement in the building sector



Aluminium demand by region

- Total aluminium demand decreases slightly in 2050 (7%) in F4 compared to REF case

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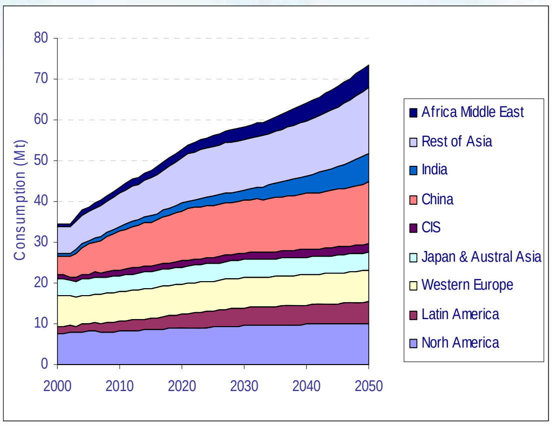

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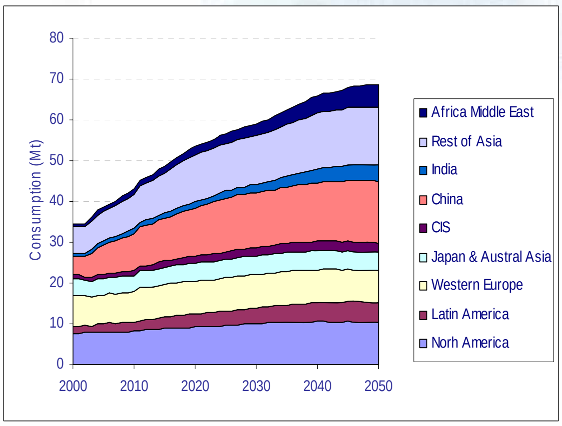

Aluminium demand by sector

- In 2050, the aluminium consumption in the F4 scenario :
  - increases by 29 % compared with the REF case in buildings
  - Is devided by two in the electricity generation sector and
  - decreasis respectively by 3 to 5% in the transport and other sectors

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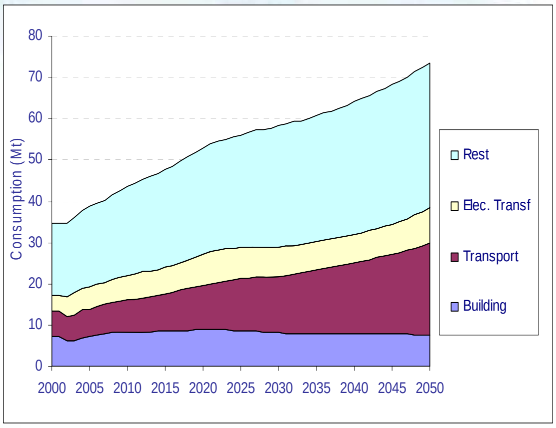

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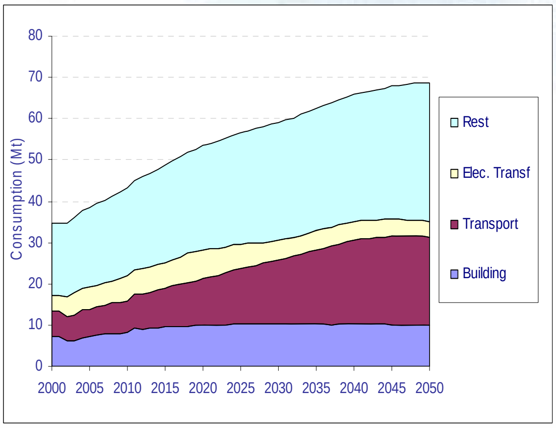
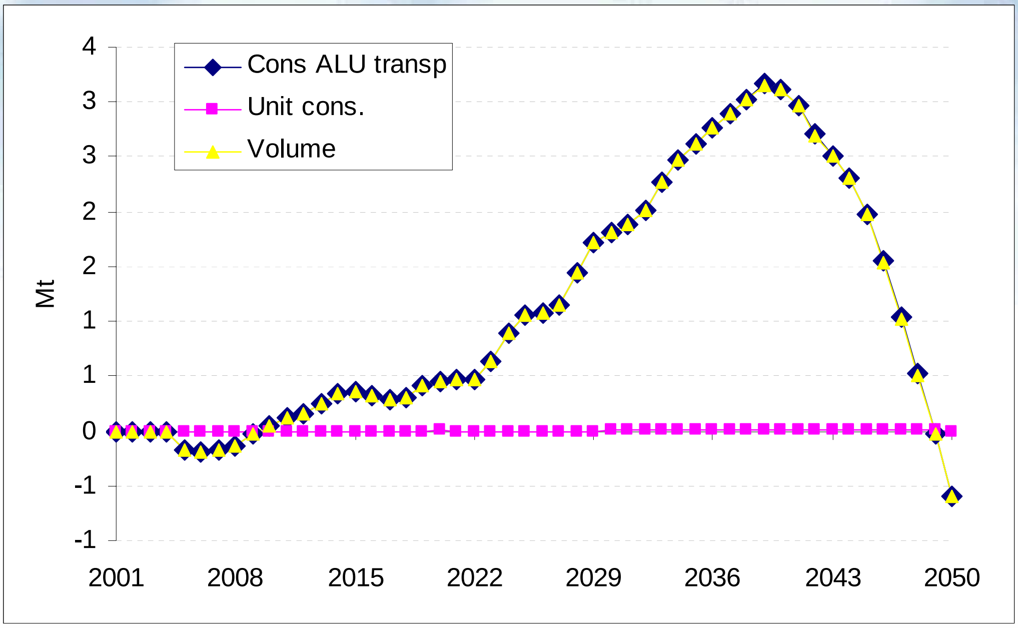
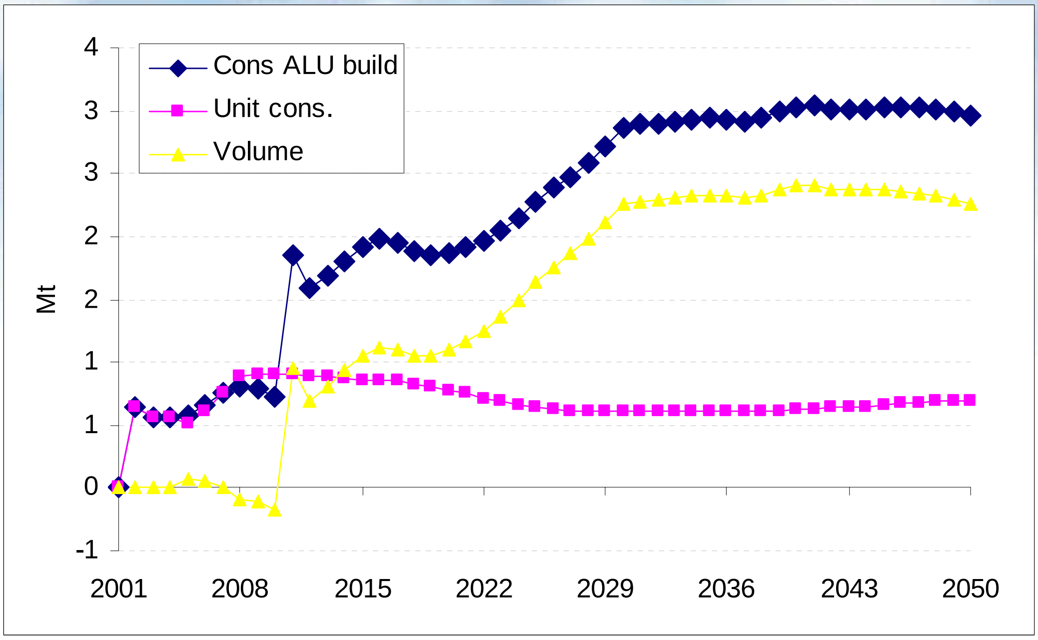


Volume and unit consumption impact on the consumption of aluminium in the transport sector



Volume and unit consumption impact on the consumption of aluminium in the building sector



Flat glass demand by region

- Flat glass demand increase 63 % in 2050 in F4 / REF
  - because of vigorous development assumptions of double glazing and solar water heater solaires, and
  - the increase of the specific flat glass consumption

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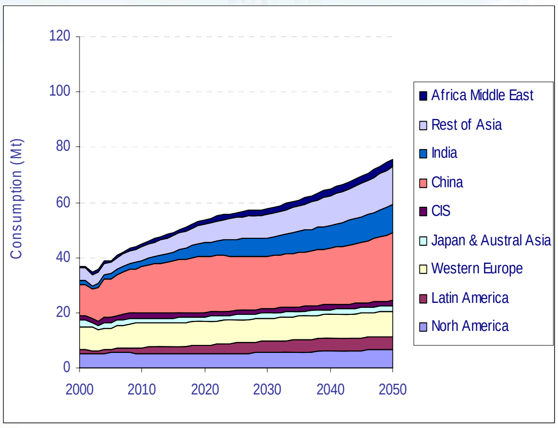

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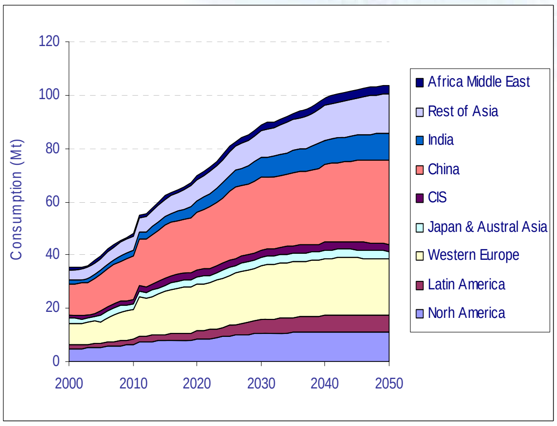

Flat glass demand by sector

- Flat glass demand in building double in 2050 in F4 / REF
- Flat glass demand in transport is similar in both scenarios
- In F4 scenario flat glass demand in other sectors decrease 16% in comparison with the reference case.

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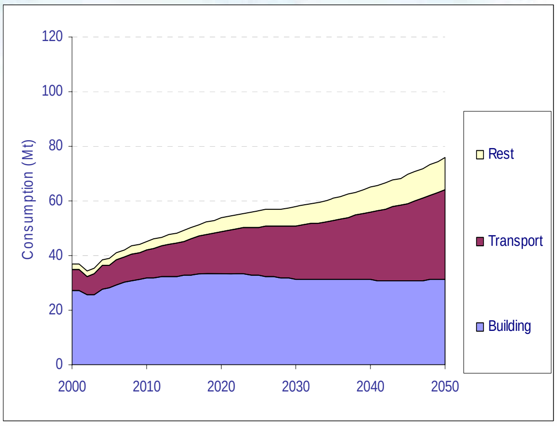

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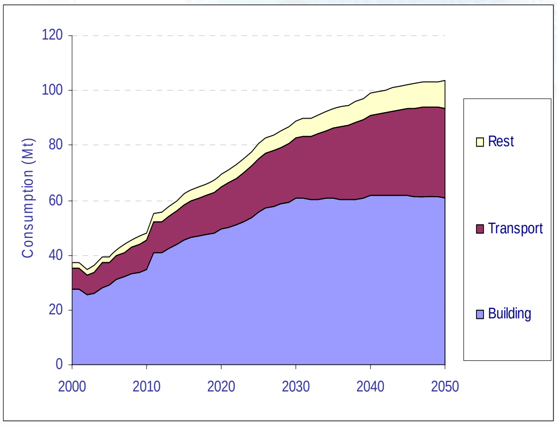
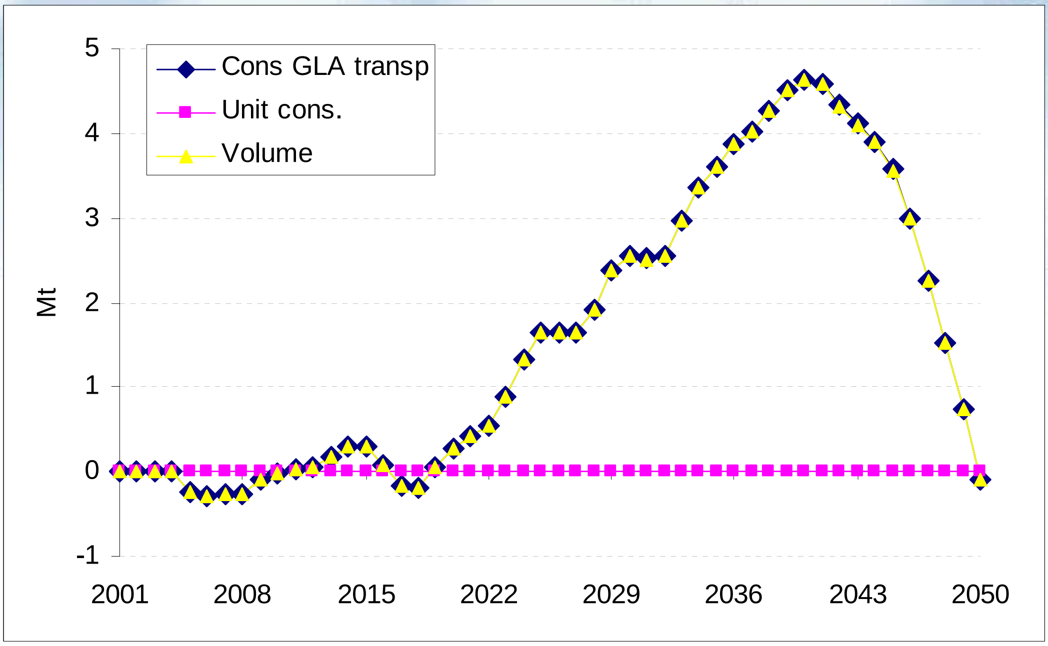
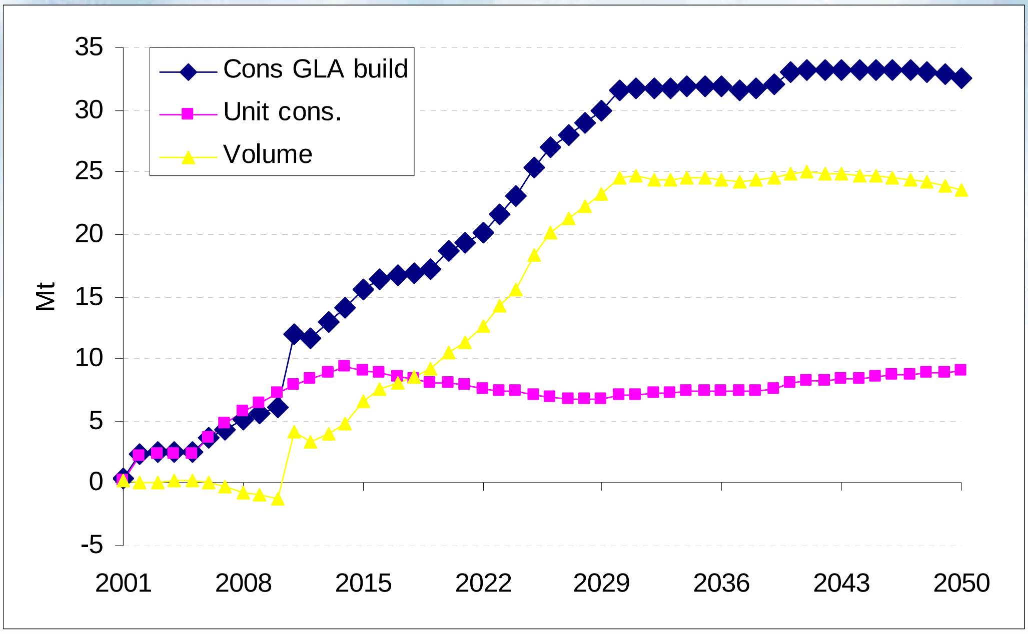


Volume and unit consumption impact on the consumption of flat glass in the transport sector



Volume and unit consumption impact on the consumption of flat glass in the building sector



Conclusions

- The above-described S450-F4 scenario responds to the EU target of limiting temperature increases to less than 2°C from pre-industrial situation.
- It provides a preliminary description of the consequences of the development of low carbon societies.
  - As far as the fundamentals of the energy system are concerned, the scenario indicates that strong climate policies may have a dramatic impact on the dynamics of primary energy markets.
  - In particular the prices of oil and gas may be much lower than in the Reference case, which constitutes a double-dividend of climate policies, at least from the consumer countries' perspective.
- As far as the structural materials – steel, cement, aluminium and flat-glass – are concerned, it comes out that the demand for these materials is much less impacted by the GHG stabilisation scenarios than the demand of energy.
- From this very preliminary analysis it comes out that :
  - the impact of total demand crucially depends on the balance of two contradictory effects the one of an accelerated production of new dwelling and transport vehicles (needed to meet much higher energy-performance standards) the one of a lower materials intensity of the new cars and buildings.
  - This is the result of simple preliminary approaches to long term materials demand, which will have to be made more comprehensive in the future.
  - Similarly the consequences of the S450-F4 scenarios on production technologies dynamics and on the localization of production still need to be examined with more detail.