



EVALUATION OF THE FRENCH ENERGY TRANSITION FOR GREEN GROWTH LAW WITH TIMES-FR

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INTRODUCTION

- Targets of the energy transition law for green growth (2015):
 - 40% less greenhouse gas emissions in 2030 et 75% in 2050 compared to 1990
 - 30% less fossil fuel consumption in 2030 compared to 2012
 - Increase the share of renewable energy sources to 32% of the final energy consumption and 40% of the electricity production
 - Reduce final energy consumption by 50% in 2050 compared to 2012
 - Reduce the share of nuclear power in electricity production to 50% by 2025
- Tools associated:
 - National low carbon strategy:
 - Overarching and sectoral policies orientation
 - Carbon budgets
 - Multi-annual energy planning

EVALUATION OF UNDERLYING PATHWAYS

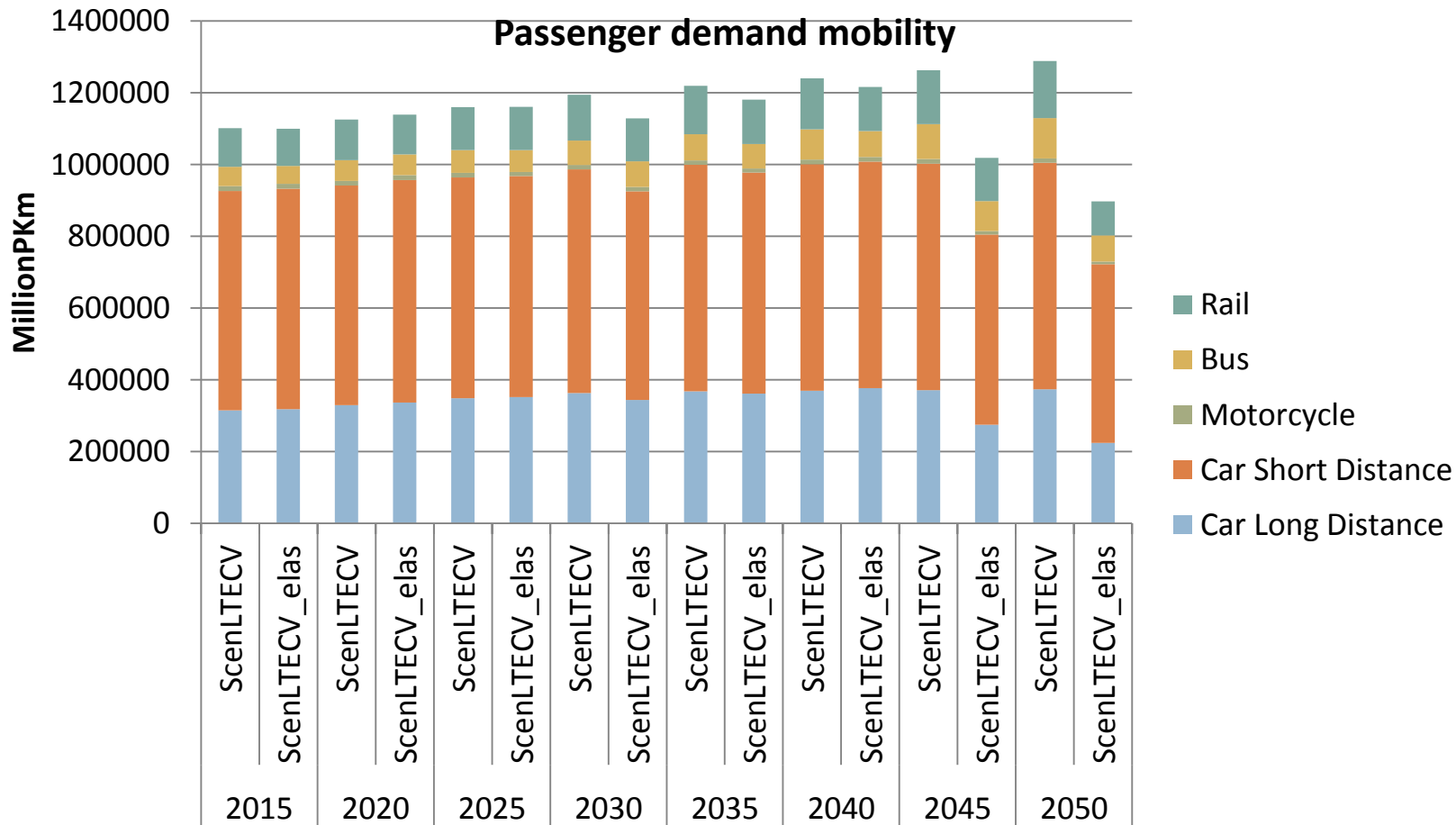
- New base year for the calibration : 2014
- Main hypothesis : provided by the prospective scenarios of the French ministry of ecology that were used for the reference scenario of the low carbon national strategy
 - Discount rate 4%
 - Carbon tax : 56€/tCO₂ in 2020 and 100€/tCO₂ in 2030 (excluding the ETS sectors)
 - Demand scenario : same assumptions until 2035

SCENARIOS

- Reference scenario: AME_Times
 - Based on the hypothesis mentioned previously
- Scenario with the 5 goals of the french law: LTECV
- Variations with the different goals:
 - ScenCO2: constraint CO2
 - ScenCO2_ENR: constraint CO2 and ENR
 - ScenCO2_ENR_Nuc: constraint CO2 and ENR and Nuclear
 - Etc...

IS THE EVOLUTION OF THE DEMAND CONSISTENT WITH THE TARGETS?

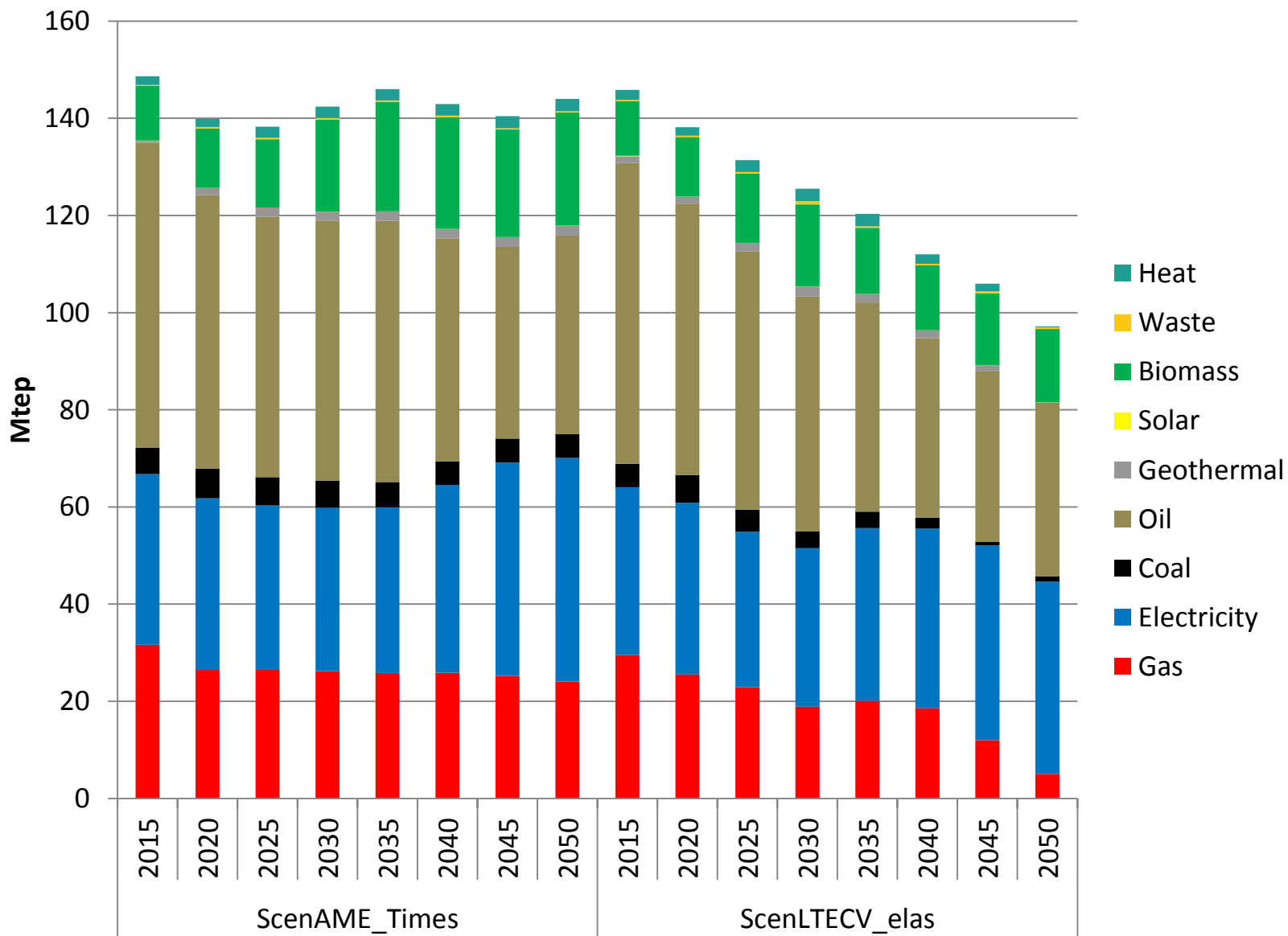
- Without elasticity, the system is overconstrained (dummy imports) → significance of reducing the demand to meet the CO2 target



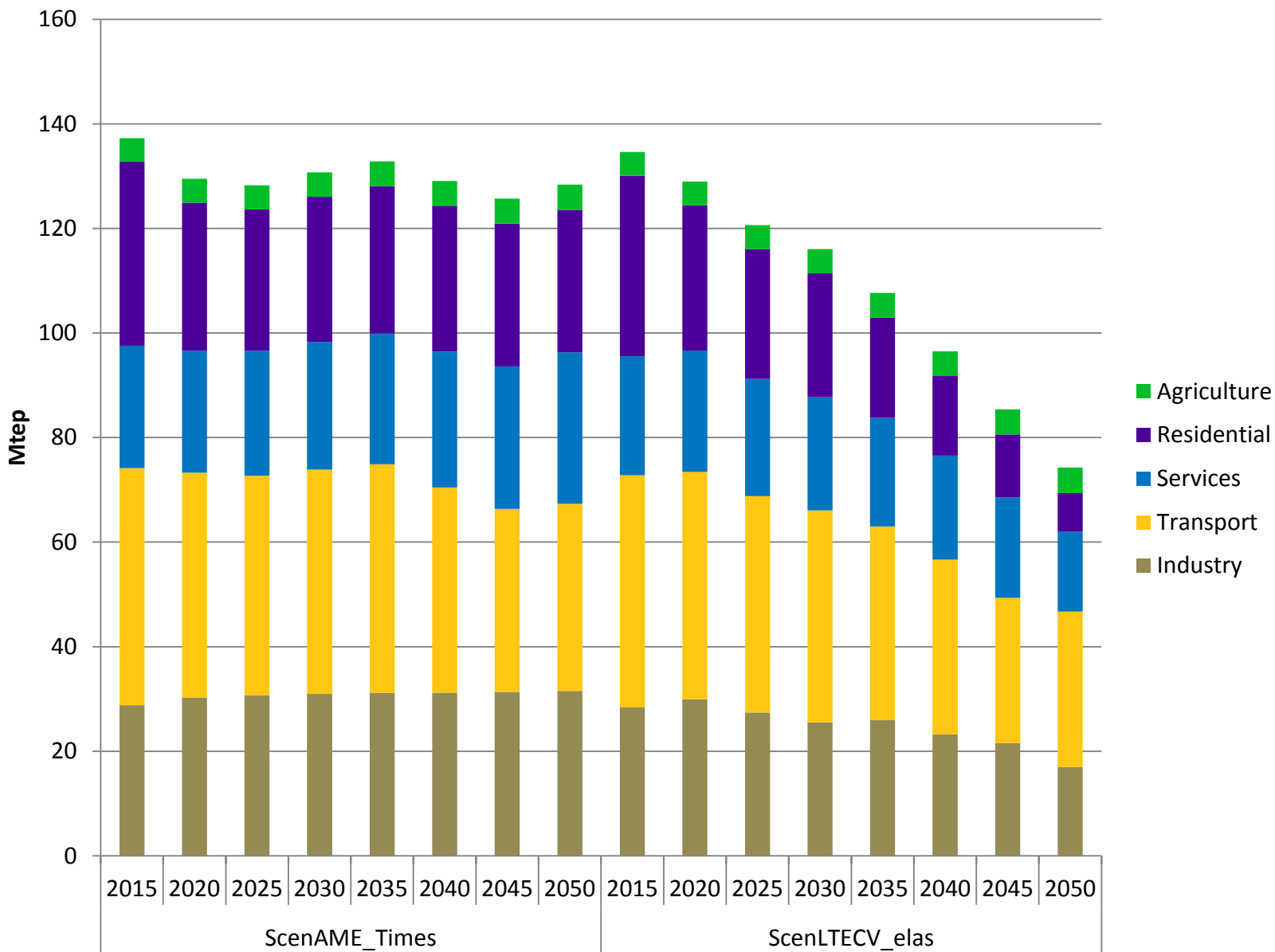


FINAL ENERGY CONSUMPTION

HOW EVOLVES THE ENERGY MIX ?



FINAL ENERGY CONSUMPTION



WHAT SAYS THE REFERENCE SCENARIO OF THE SNBC ?

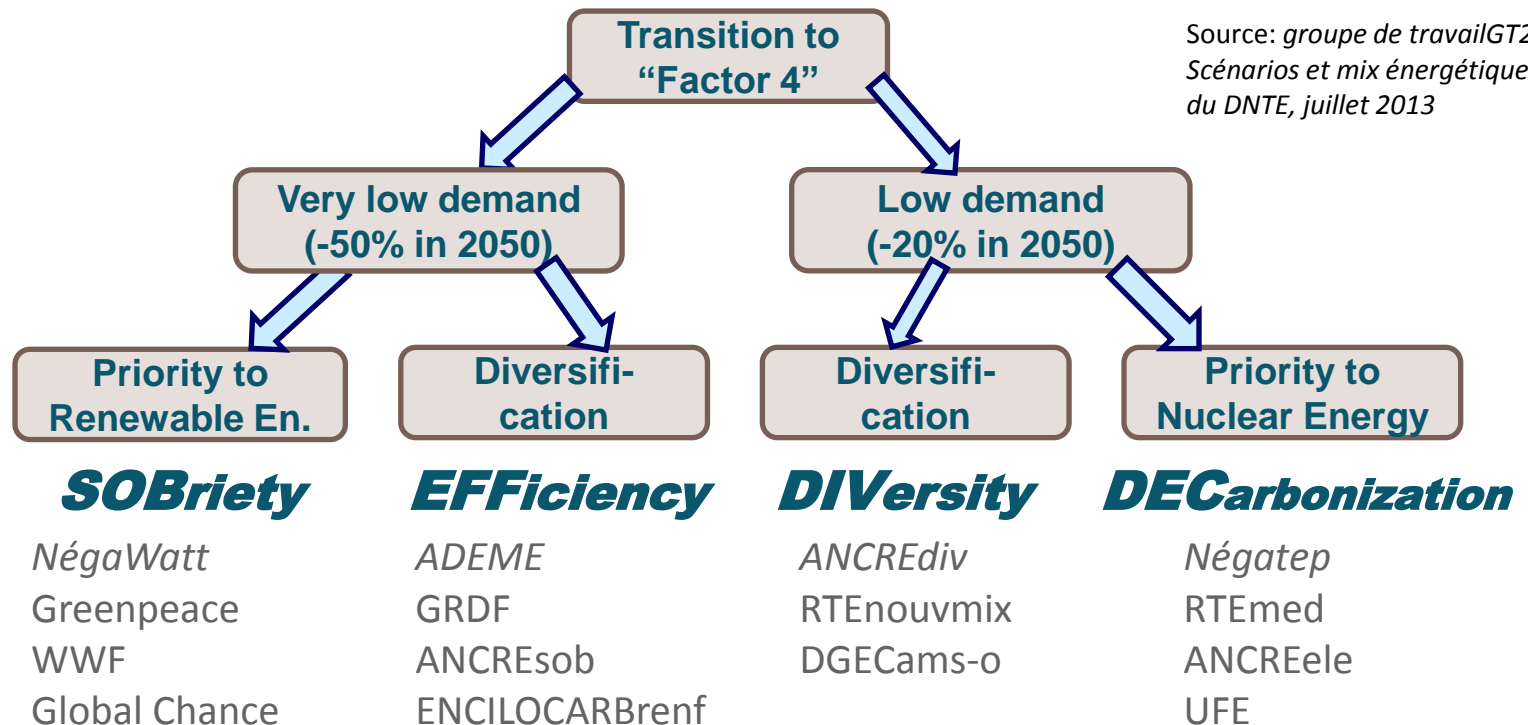
Variation between 2010 and 2030

(%)	Scenario	
Sector	AMS2 DGEC	LTECV Times
Industry	-11.7%	-10.2%
Building	-28.8%	-37.8%
Agriculture	-30.1%	3.2%
Transport	-17.8%	-18.1%
Total	-21.7%	-25.3%

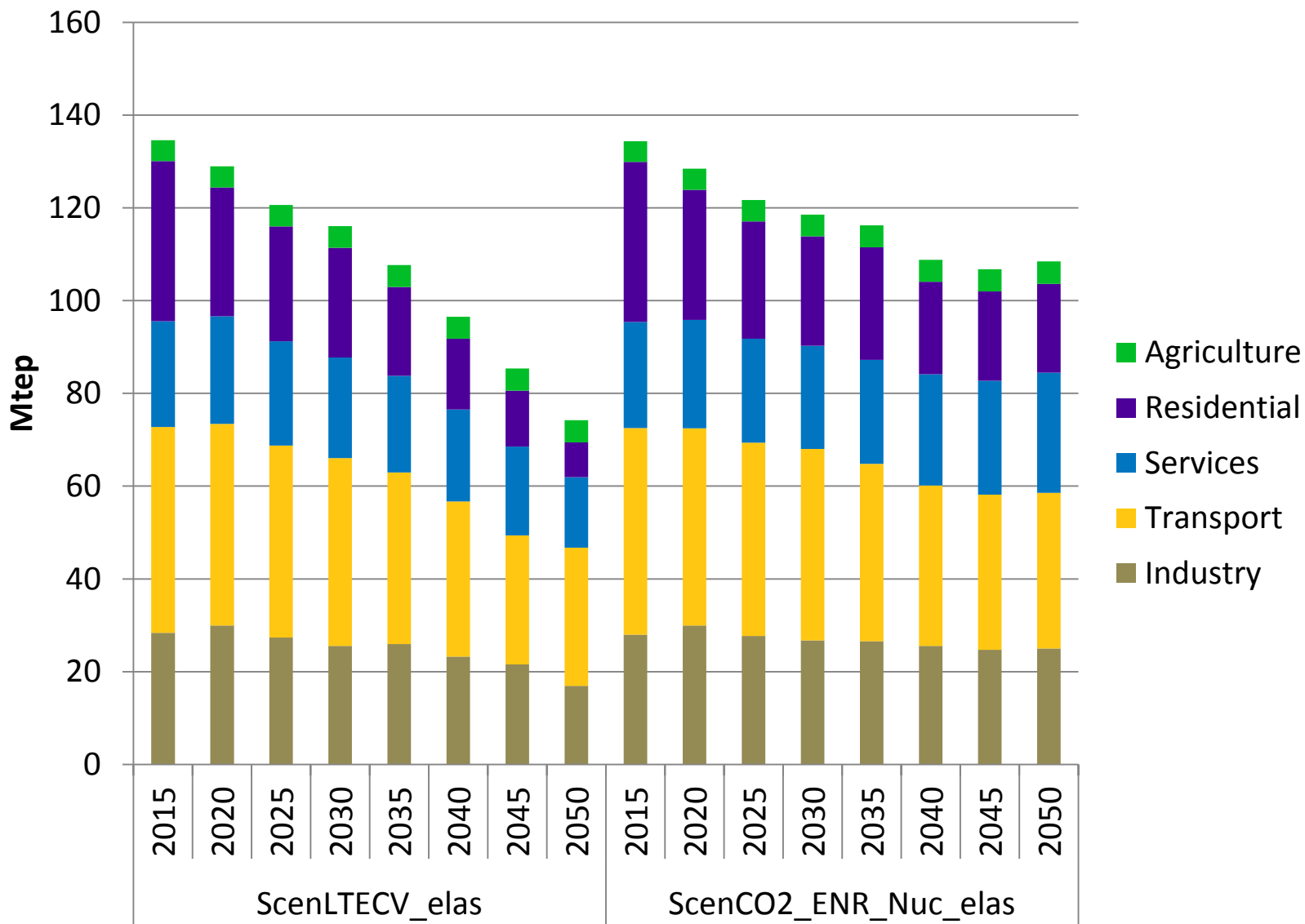
Mtep	Scenario	
Sector	AMS2 DGEC	LTECV Times
Industry	-3.9	-2.9
Building	-19.5	-27.5
Agriculture	-1.3	0.1
Transport	-8.8	-8.9
Total	-33.5	-39.2

REDUCING BY 50% THE FINAL ENERGY CONSUMPTION IN 2050 IS THE MOST CONSTRAINING

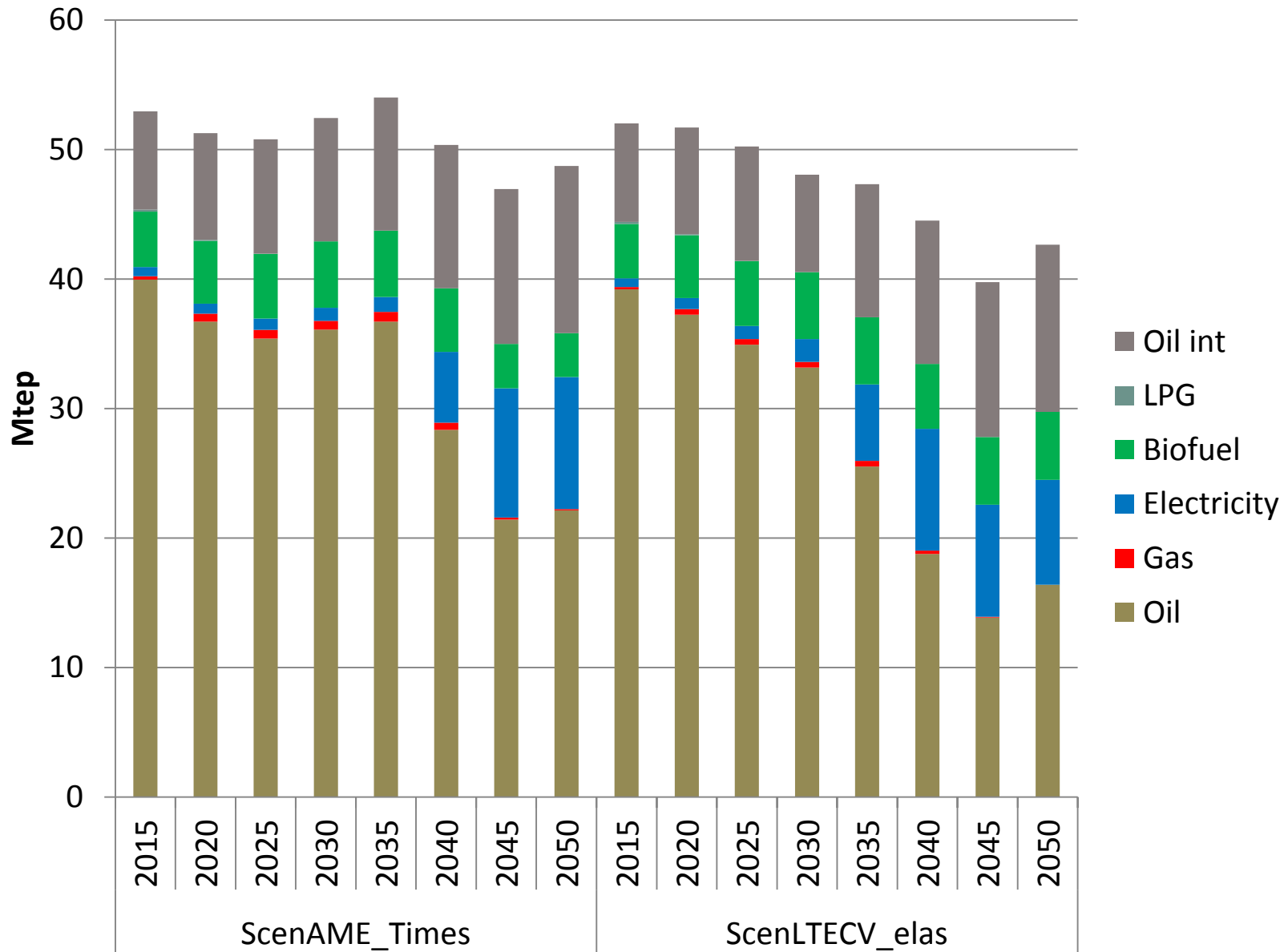
- This target can not be achieved by the model without elasticity
 - Should be consistent with a reduction of the demand
- French national debate (DNTE) : 4 scenarios
 - At the moment : no sobriety considered → inconsistency



FINAL ENERGY CONSUMPTION



FOCUS ON THE TRANSPORT SECTOR

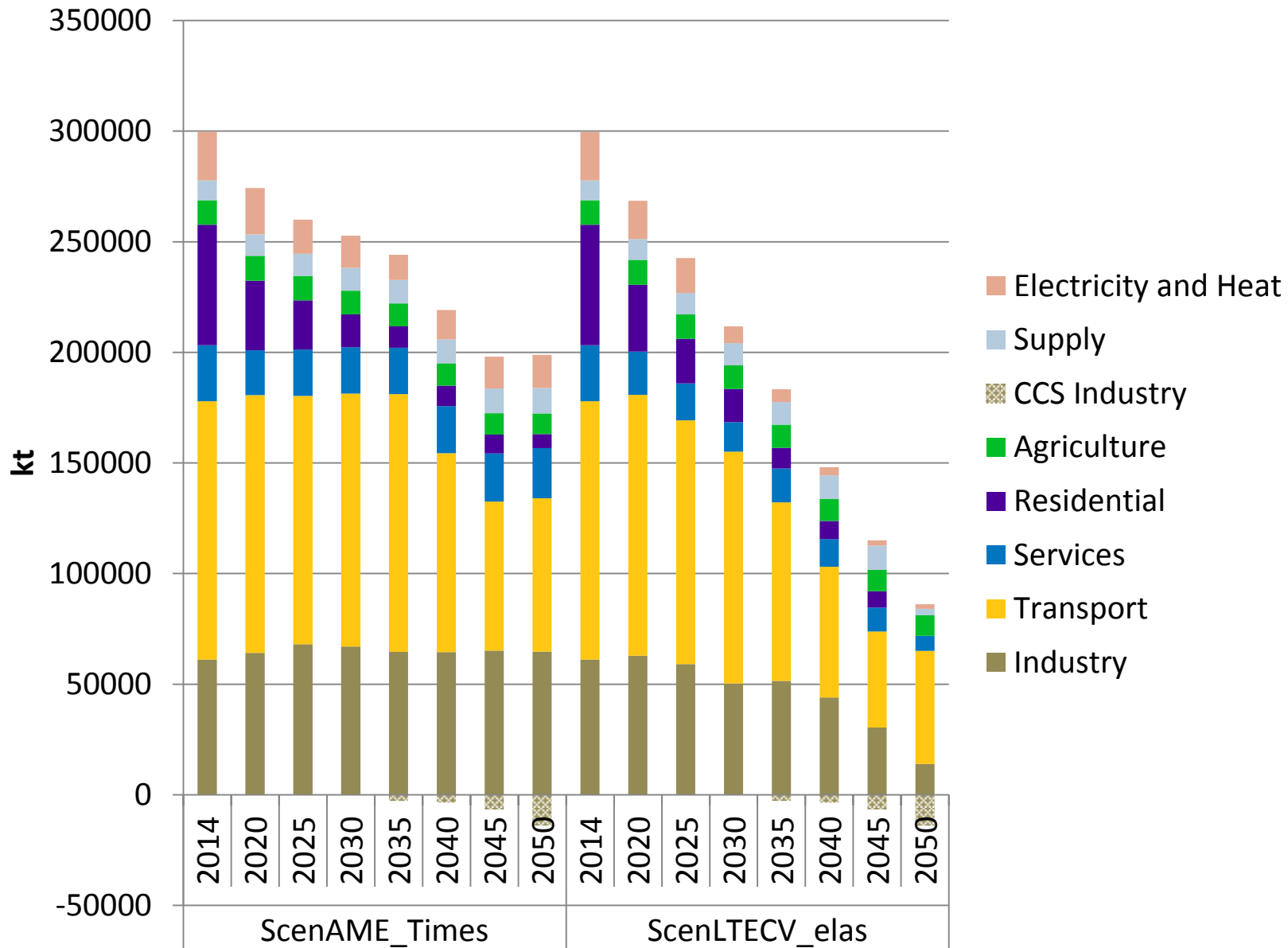




$$\frac{1}{(1 + \alpha)^{n(t-1)}} \sum_{i \in TCH} in$$
$$\times \left(\sum_{i \in TCH} fixom_i(t) \right)$$
$$+ \sum_{i \in ELA} \sum_{z \in Z} \sum_{y \in Y} varo$$
$$+ \sum_{k \in ENC} \sum_s cos_{ks}(t)$$
$$+ \sum_s \sum_{z \in Z} \sum_{y \in Y} price_{zy}$$
$$- \sum_s \sum_{z \in Z} \sum_{y \in Y} price_{zy}$$

CO2 EMISSIONS

EMISSIONS CO2



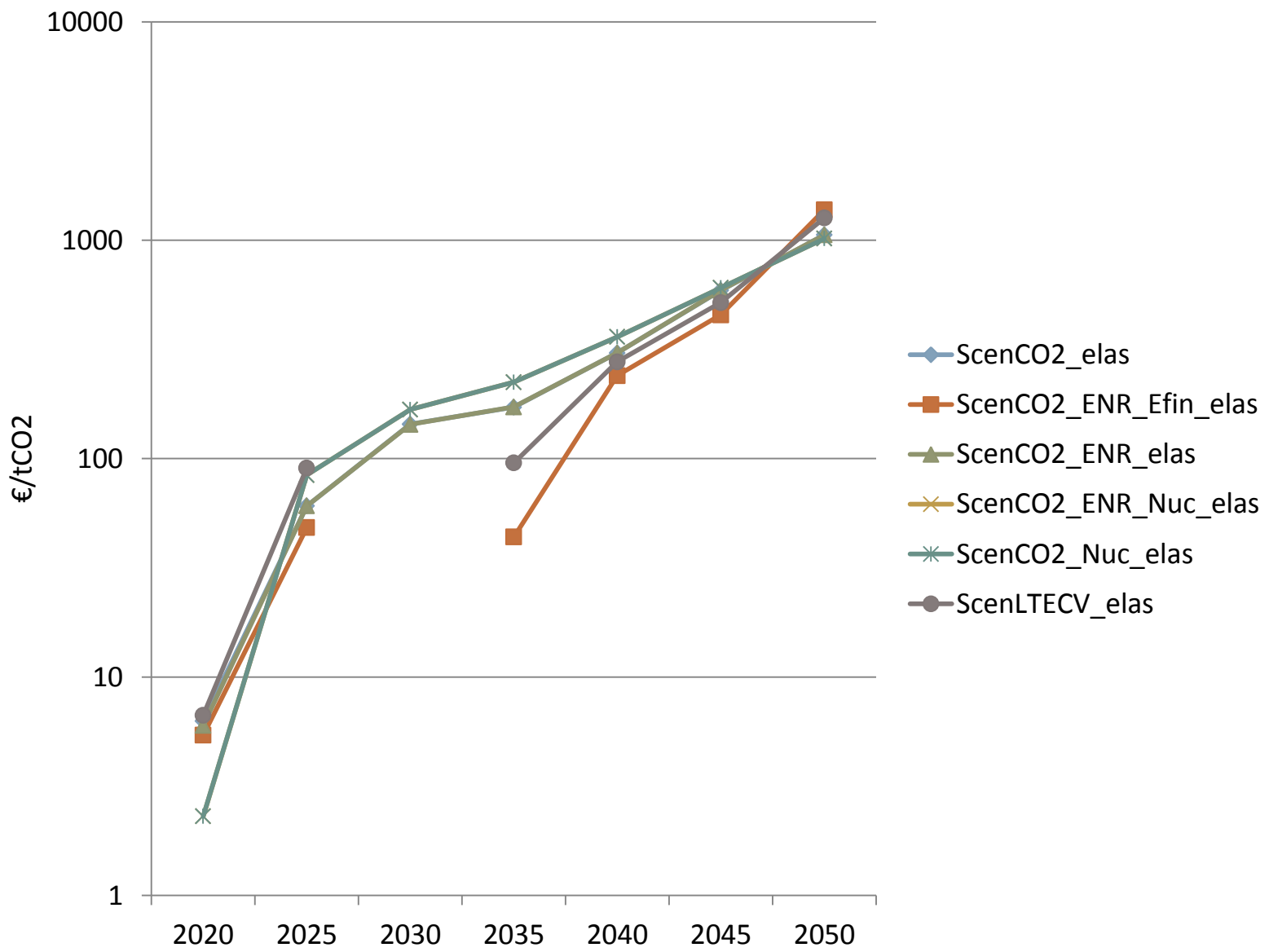
WHAT SAYS THE REFERENCE SCENARIO OF THE SNBC ?

Variation between 2035 and 2010

Sector	Scenario	
	AMS2 DGEC	LTECV Times
Transport	-43%	-39%
Energy industries	-52%	-74%
Building & Agriculture	-73%	-67%
Industry	-47%	-23%
Total	-54%	-50%

Sector	Scenario	
	AMS2 DGEC	LTECV Times
Transport	55079	51475
Energy industries	28236	44298
Building & Agriculture	73842	70599
Industry	31462	14045
Total	188620	180418

MARGINAL COST OF CO2

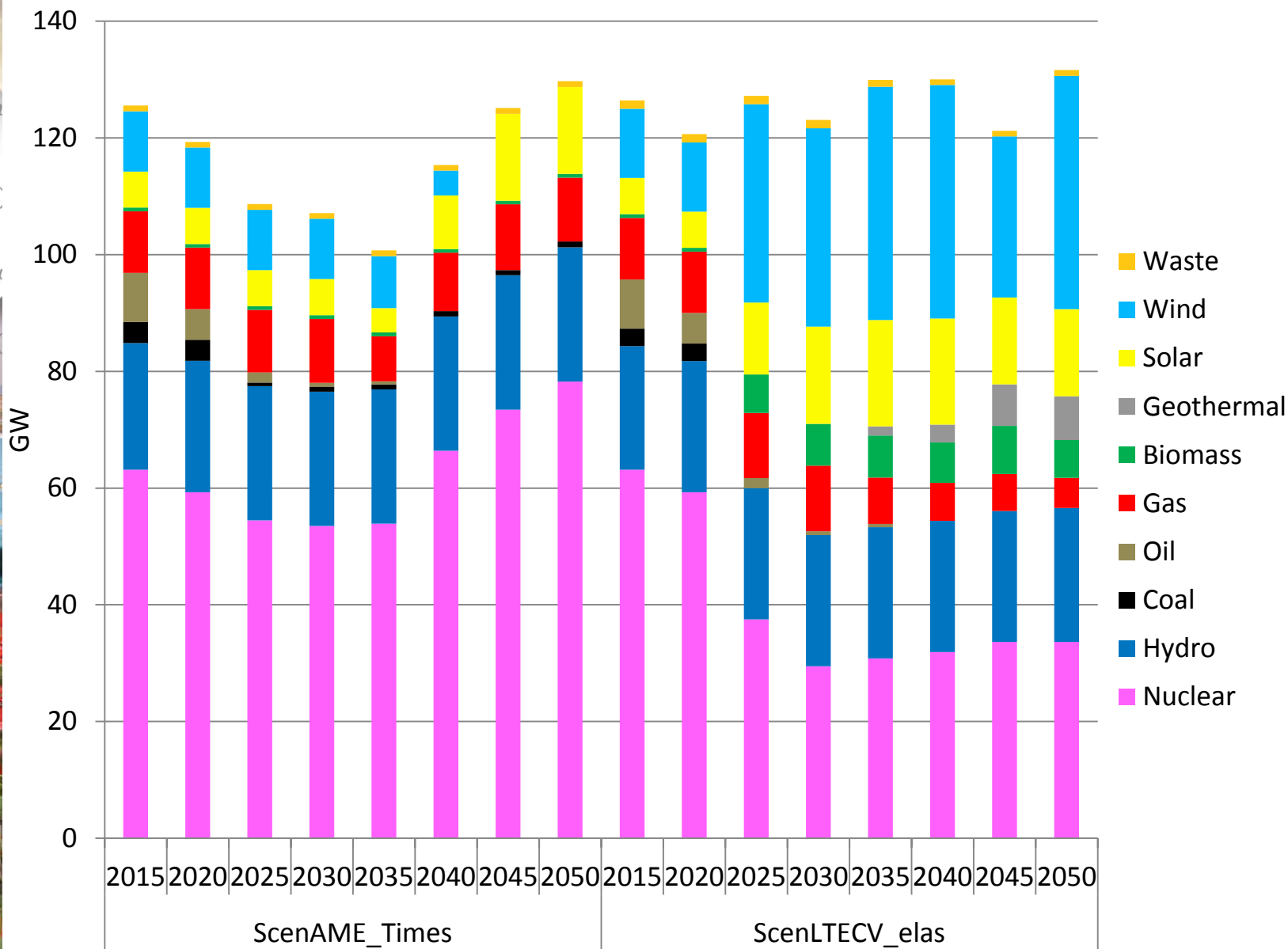




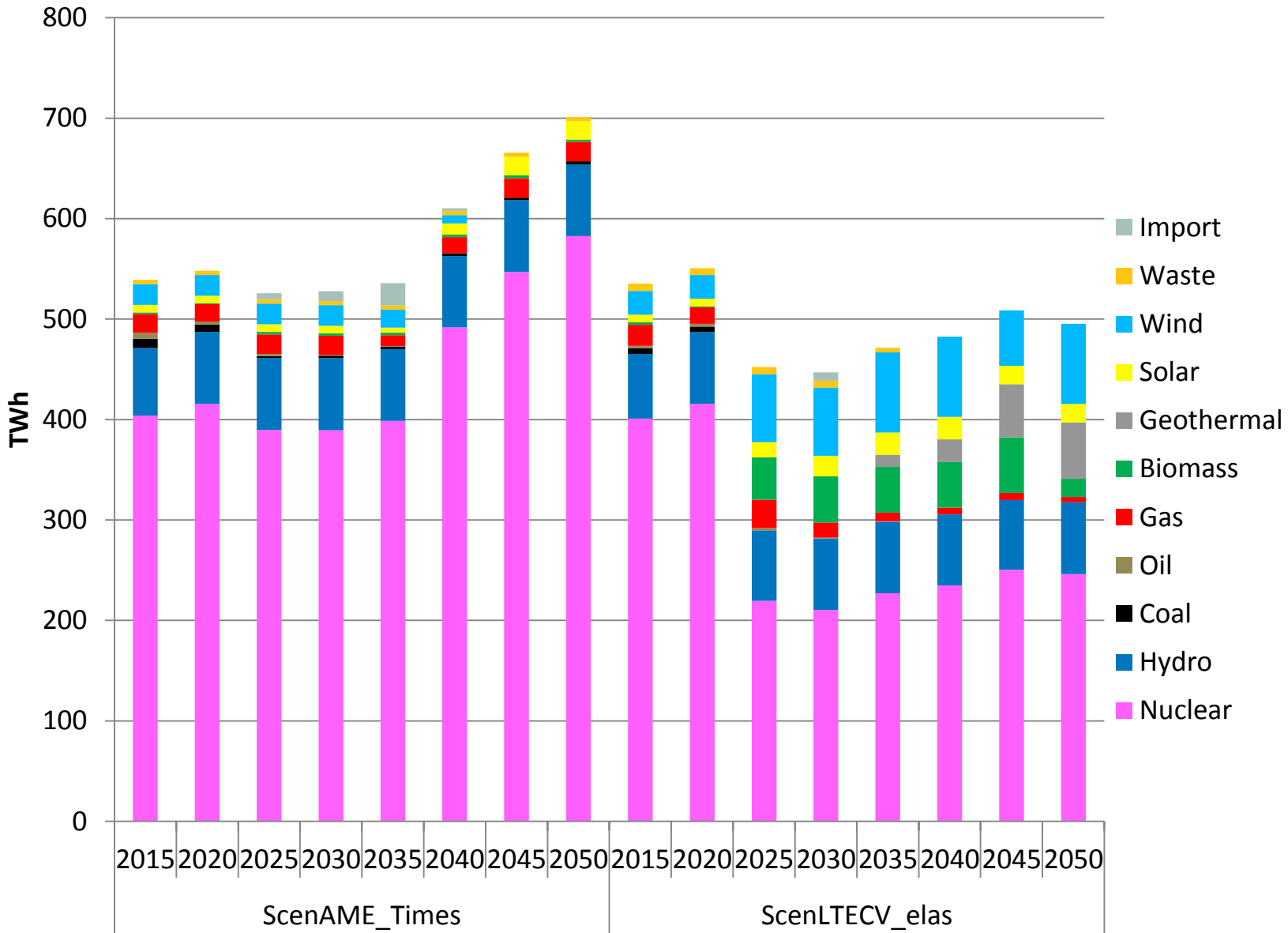
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$$+ \sum_s \sum_{z \in Z} \sum_{y \in Y} price$$
$$- \sum_s \sum_{z \in Z} \sum_{y \in Y} price$$

ELECTRICITY SECTOR

CAPACITY IN THE ELECTRICITY SECTOR

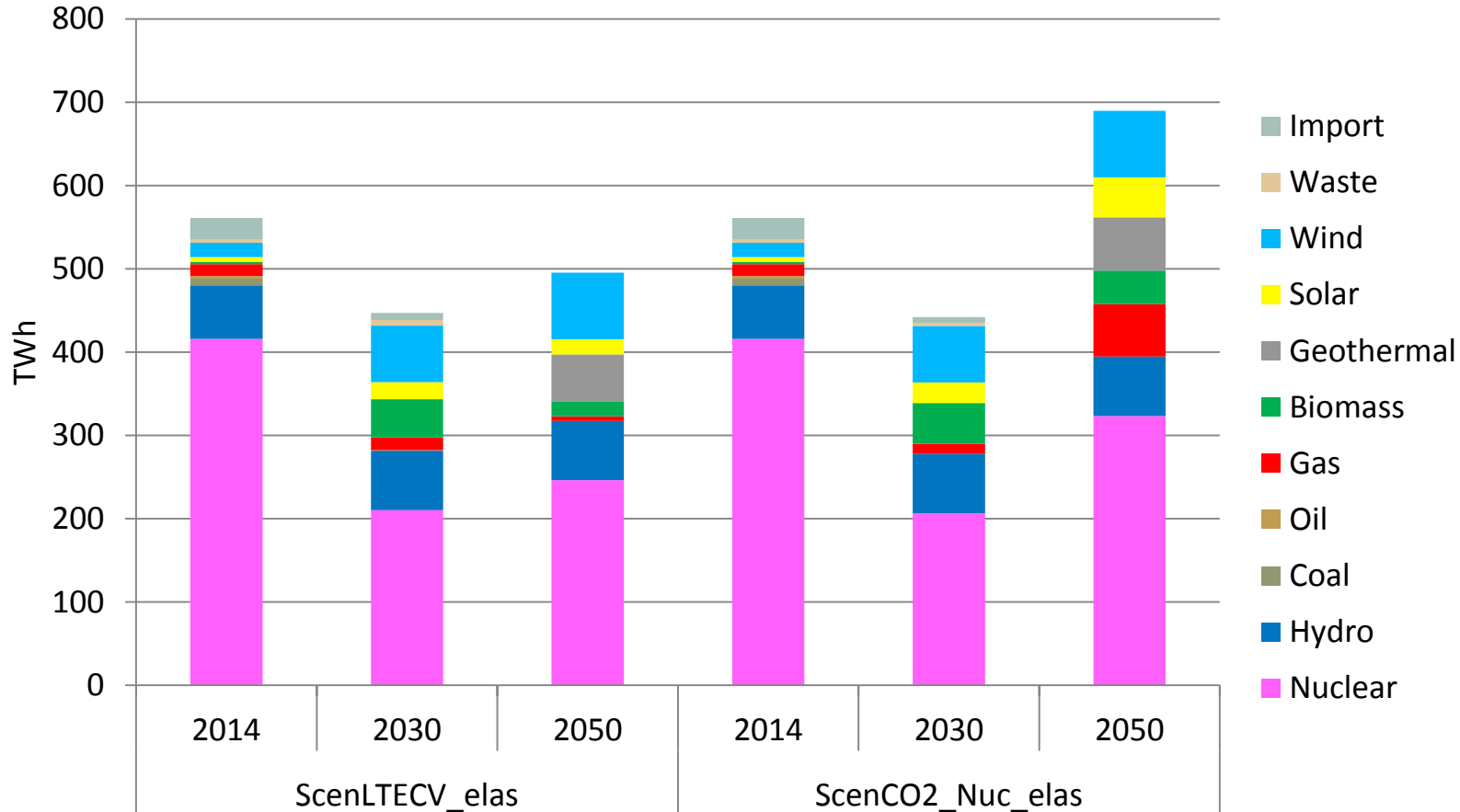


PRODUCTION

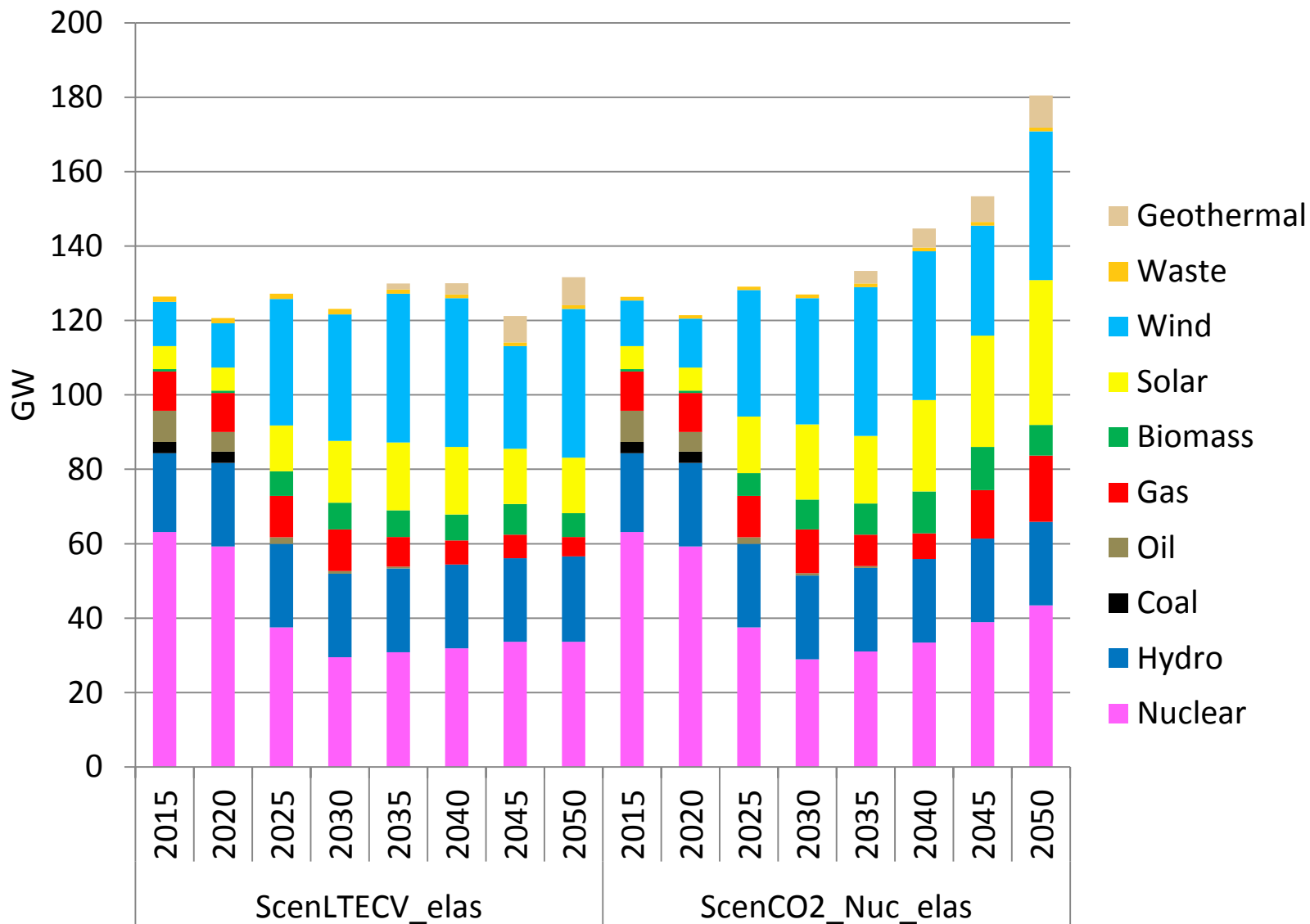


IF WE PUT 2 CONSTRAINTS ON CO2 EMISSIONS AND NUCLEAR CAPACITY, THEN...

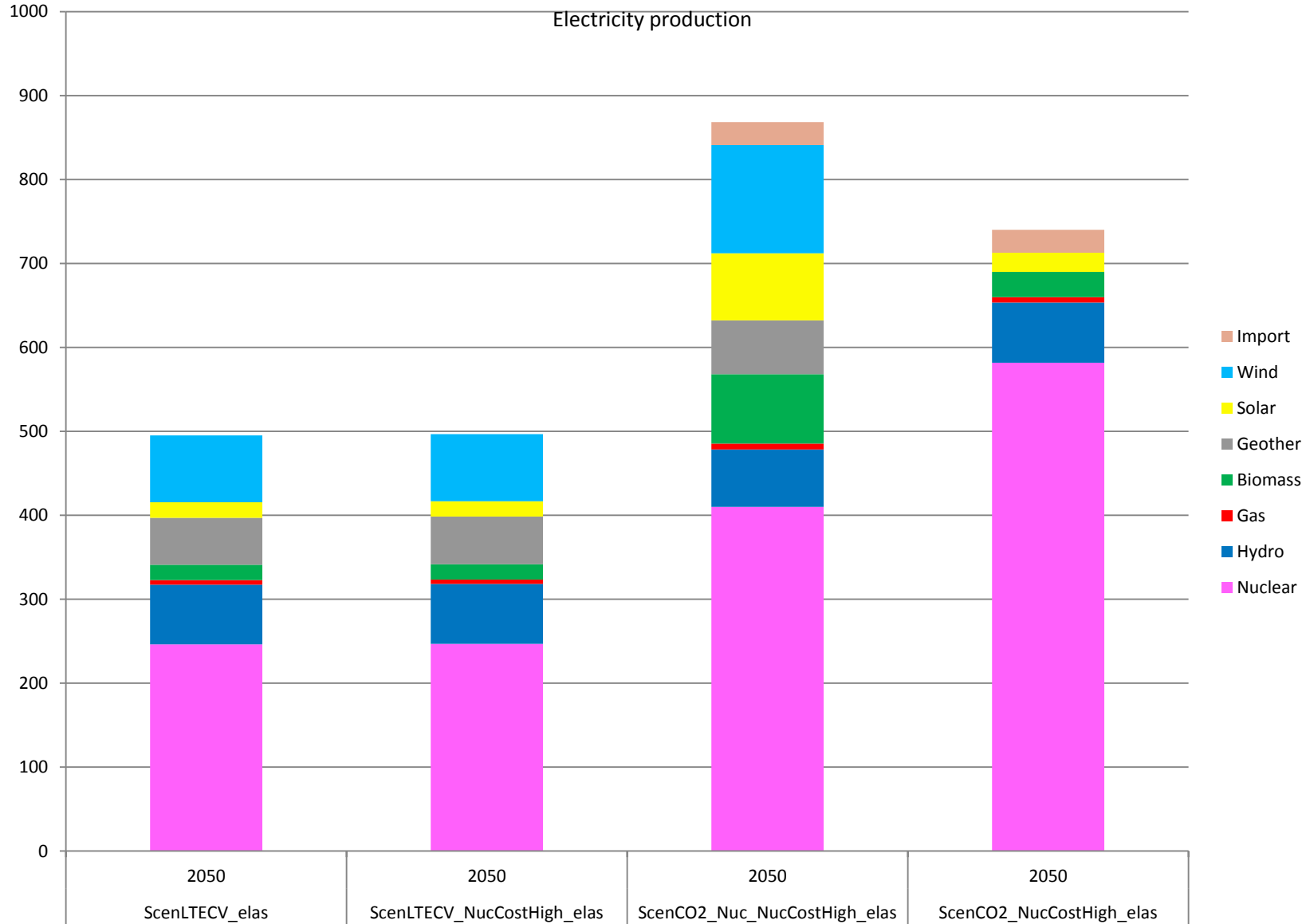
- Share of ENR in electricity production : 49% in 2030 > 40% (target of the law)



CAPACITY



WHAT HAPPENS IF THE NUCLEAR COST IS HIGH ?





CONCLUSION

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- Main findings :
 - Projection of the demand should be lower than expected if we want to meet the targets of the law
 - The target or reducing by 50% the final energy consumption is very constraining
- Lack of consistency in the long term between the targets of the law and the associated vision that was underlying the prospective modelling
- Limits of this evaluation and further work :
 - Projection of the demand until 2050
 - Updating of the scenarios by the french ministry of ecology → new assumptions ?