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The challenges of biomass closure of the French climate-energy strategy

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French climate energy strategy

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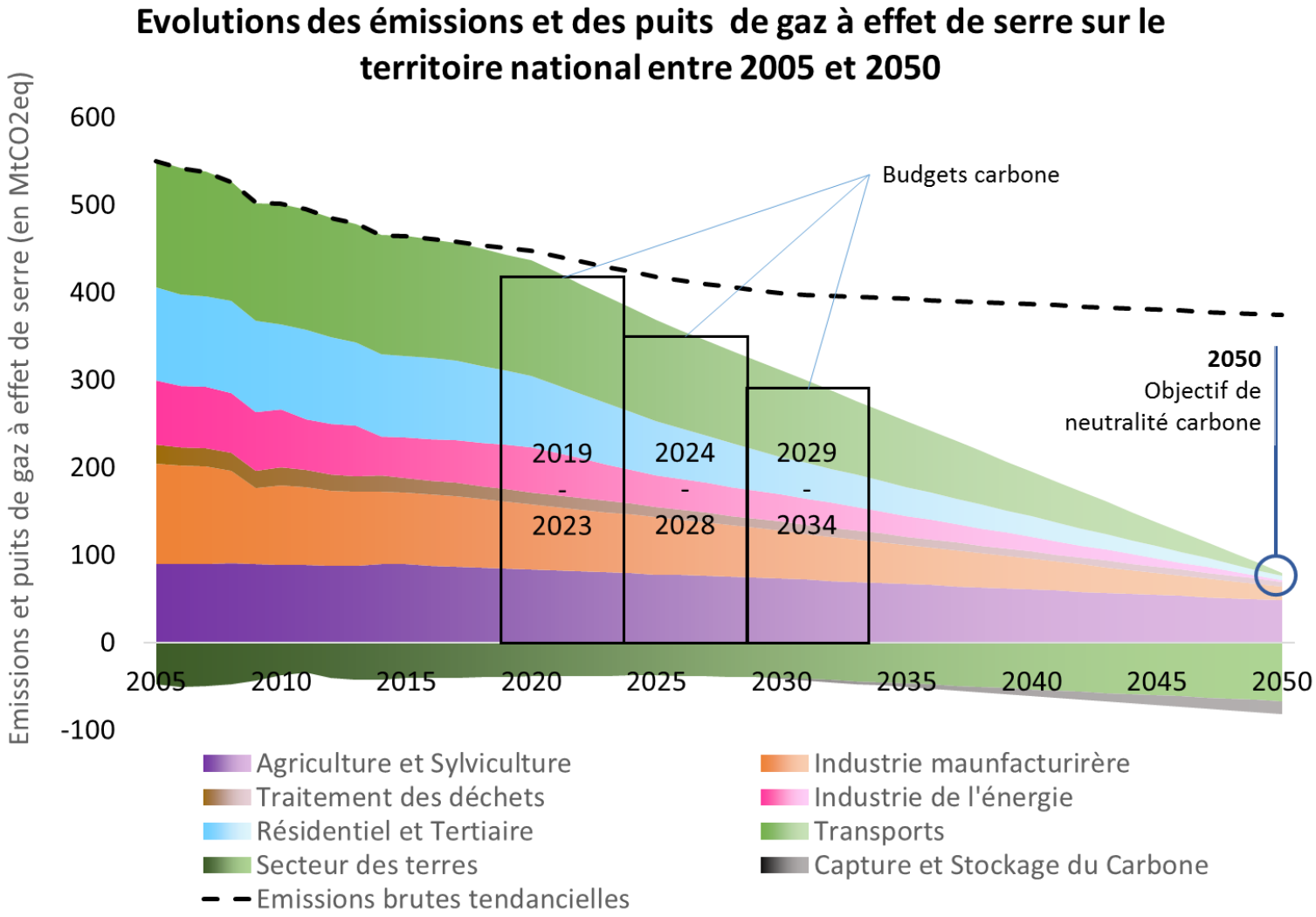
The national low-carbon strategy

Carbon neutrality in 2050

Reduction of greenhouse gas emissions by -55% in 2030

The need for a doubling of the rate of reduction of greenhouse gas emissions



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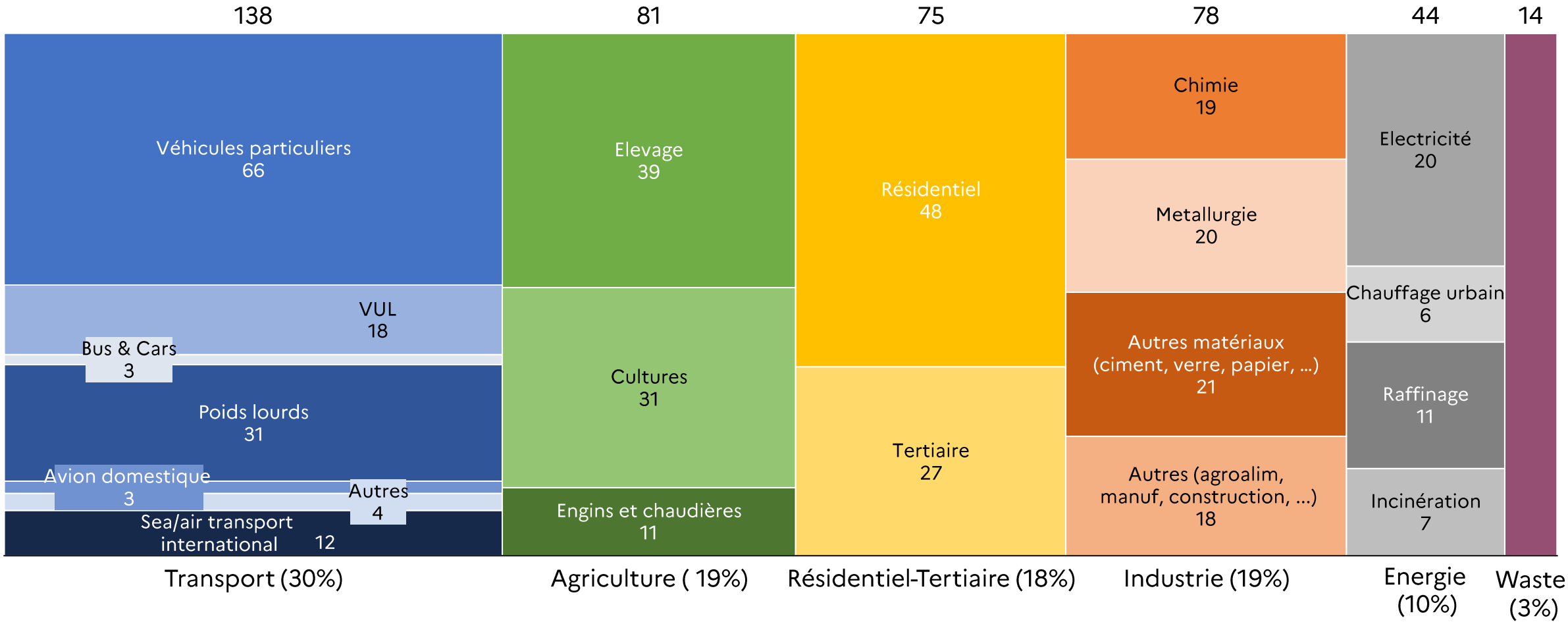
Annual national greenhouse gas emissions (2021, in $MtCO_2e$)



Source: CITEPA-SECTEN, baromètre mensuel – excluding LULUCF

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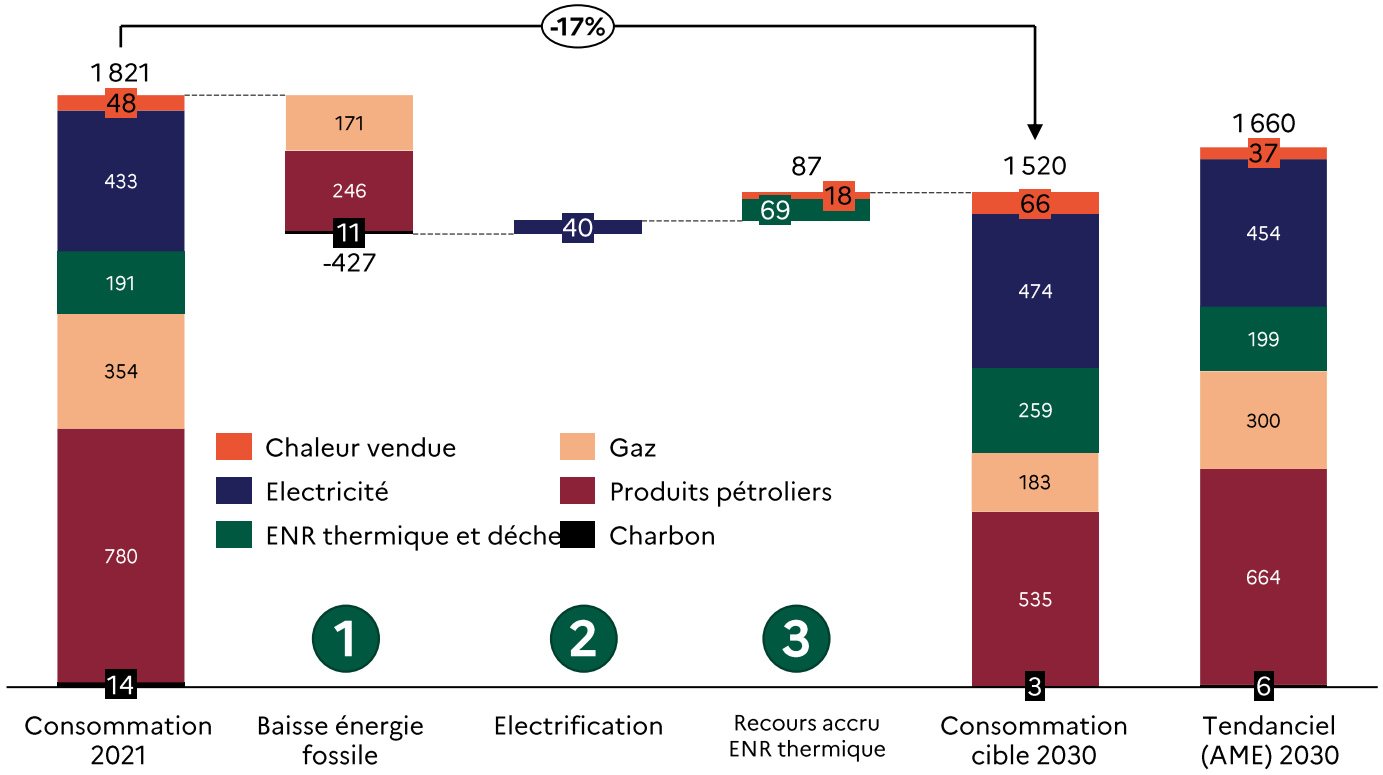
The transition in 3 pillars: energy savings, electrification and mobilization of thermal renewable energy

Expected evolution by 2030 of our final energy consumption, TWh PCI (incl. bunkers and non-energy consumption)



Source: DGEC AMS file

1 **A 17% reduction in our final energy consumption by 2030 embedded in the sectoral trajectories**
- Energy efficiency (e.g. renovation, electrification), and sobriety (e.g. transport, heating), etc.
- … and despite additional consumption (reindustrialization, H2, CCS)

2 **Rapid electrification of uses**
- Electric vehicles, PAC, H2 production by electrolysis, industrial processes

3 **Increased use of bioenergy and other renewable heat**
- Biomass: wood energy, bio-fuel, biogas
- Solar thermal
- Geothermal
- Waste

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Why look at biomass looping?

- Most of the strategies of the sectors are based on the substitution of fossil fuels by biomass – *e.g.* roadmaps from « *Industrial sector strategic committee* » and « art 301 »
- The resource will not be sufficient to meet such demand
- Conflict with other objectives – e.g. ensuring France's food self-sufficiency, strengthening the carbon sink to achieve carbon neutrality, action in favour of biodiversity, etc.
- The import of biomass is excluded in the first approach:
  - Contradiction with the objectives of industrial and energy sovereignty
  - Since France has one of the largest agricultural and forestry areas in Europe, it is reasonable to aim for self-sufficiency in a context where other possibly less well-endowed countries will also aim for carbon neutrality, within the EU and worldwide. This will likely increase the strain on this resource and complicate imports (not to mention the sustainability issues of these imported resources)

- A balance between biomass supply and demand is thus targeted
- A hierarchy of uses is necessary in the long term

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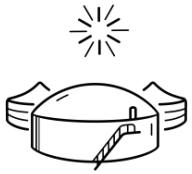
Competing uses between energy to prioritize



	Biomass heat	Biofuels	Biogas	Pyrogazeification
Dedicated food crops		✓	✓	
Dedicated lignocellulosic cultures		✓		✓
Intermediate crops		✓	✓	
Crop residues		✓	✓	
Forest biomass	✓	✓		✓
Residues from wood industries	✓	✓		✓
Wood waste, CSR	✓	✓		✓

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SFEC Modelling Process

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Modelling architecture

Agricutur WG

Transports WG

Building WG

Iindustry-waste-energy WG

WG forests/soils

Sector models

MoSUT – agriculture (Solagro)
Forest Wood Calculator (DGEC)
Artificialization – DGEC tool
MENFIS Residential Heating (CSTB)
Other residential uses (DGEC)
Tertiary Model – Tertiary (CGDD)
MICO - Air Conditioning (DGEC)
Modev Traffictransport (CGDD)
Fleet Models – Fleet Transportation (DGITM)
Aviation Model – CMB
EnerMED – industrie, énergie (Enerdata)
Waste – ADEME tool (DGEC)
F-gas (CITEPA)

Biomass looping

Energy aggregation
Enerdata

Production of energy balances in SDES format

Overseas Scenario (DGEC, MOM)

GHG aggregation
CITEPA

Production of inventories in UNFCCC and SECTEN-1 and 2 formats, in metropolitan areas, DOM, Kyoto and France as a whole

Use of Titan (CGDD)

Footprint projections (DGEC, CGDD)

Macro-eco evaluation (CIRED, ADEME)

Emissions of air pollutants (CITEPA)

Investment costing (DGEC, I4CE)

Material coherence (MatMat, ADEME)

Socio-Eco Assessment (Prometheus, CGDD)

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Modelling results

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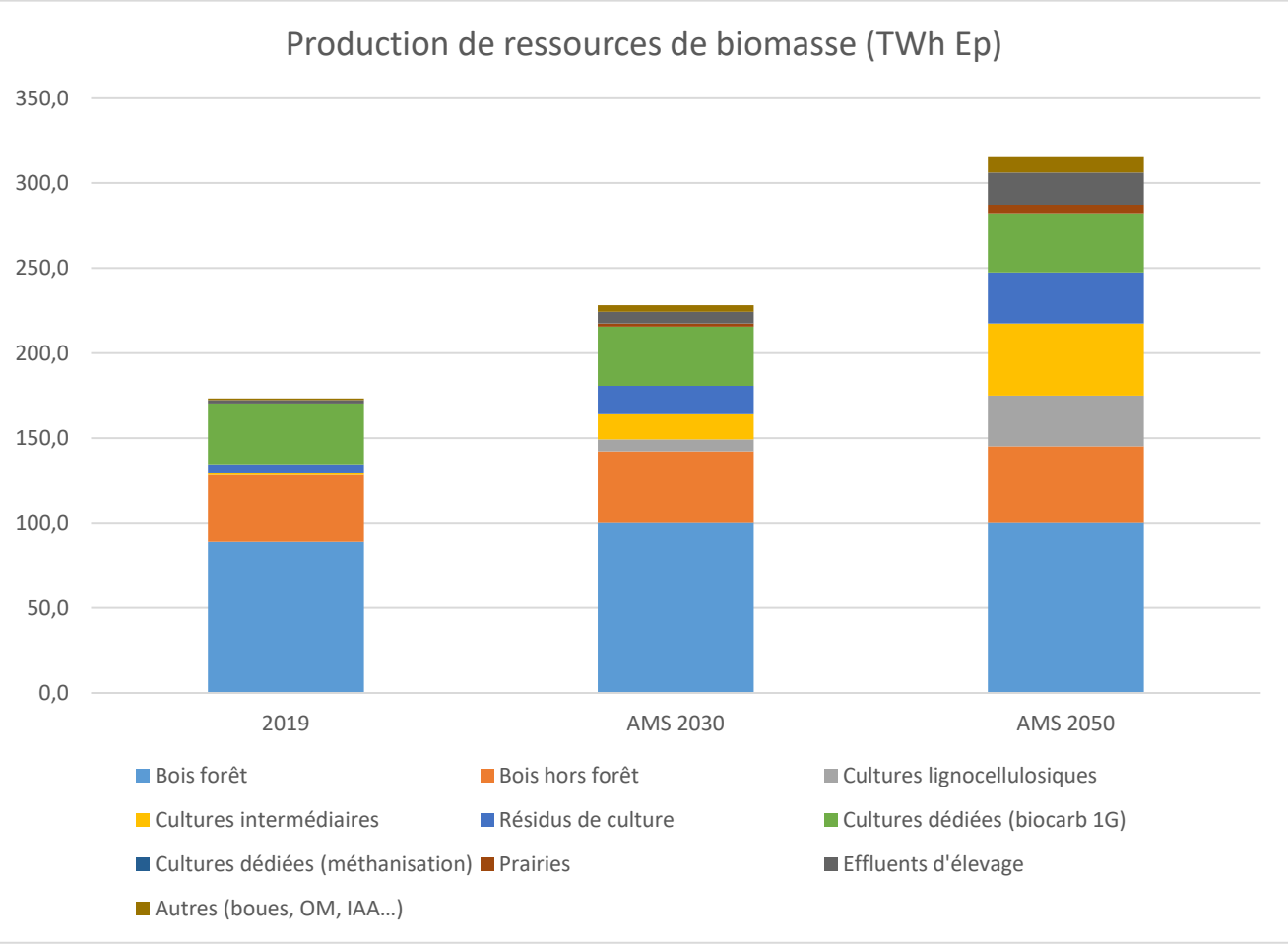
Biomass supply in run 2

Imports not taken into account: domestic production only (except on «dedicated crops»: about 10 TWh of biofuels 1G import)



Agriculture: Increase of about 122TWh, notably through the recovery of crop residues, intermediate crops, lignocellulosic crops, wood outside the forest and livestock effluents.

Forest: Slight increase in «forest biomass» (+12TWh in 2050). The reduction of BE's share in the harvest (resulting from the orientation towards wood products) is offset by the net increase in the recovery of wood products at the end of life

- Maximum Vision:
  - Very significant effort by the agricultural sector
  - INRAerun2 optimistic assumptions

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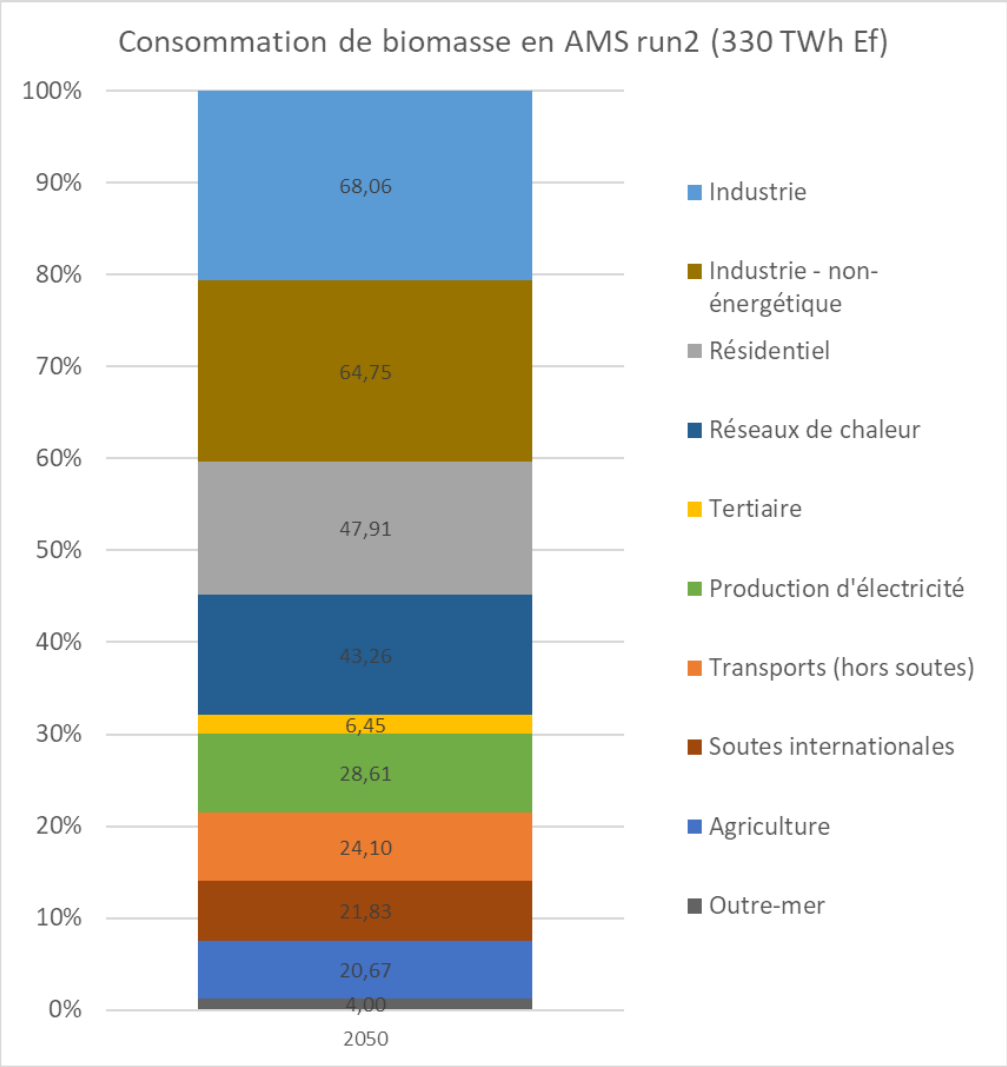
Biomass demand in run 2 in 2050



Industrie (133 TWh Ef) :
- 23 TWh solid/ 43 TWh biogas/ 1 TWh liquid for energy
- 1 TWh solid/ 14 TWh biogas/ 50 TWh liquid for non-energy

Residential (48 TWh): 30 TWh solid biomass + 17 TWh biogas

Heat networks (43 TWh): 35 TWh solid/ 8 TWh biogas

Tertiary (6.5 TWh): 0.5 TWh solid/ 6 TWh biogas/ 1 TWh liquid

Electricity production (29 TWh): 22 TWh solid/ 7 TWh liquid

Transport out of bunkers (24 TWh) : 7 TWh biogas (trucks)/ 17 TWh liquid (trucks and aviation)

International (22 TWh) : 3 TWh biogas (maritime)/ 19 TWh liquid (aviation)

Agriculture (21 TWh): 4 TWh solid/ 1 TWh biogas/ 16 TWh liquid

Overseas (4 TWh): 4 TWh of bioliquids imported from mainland France for electricity production

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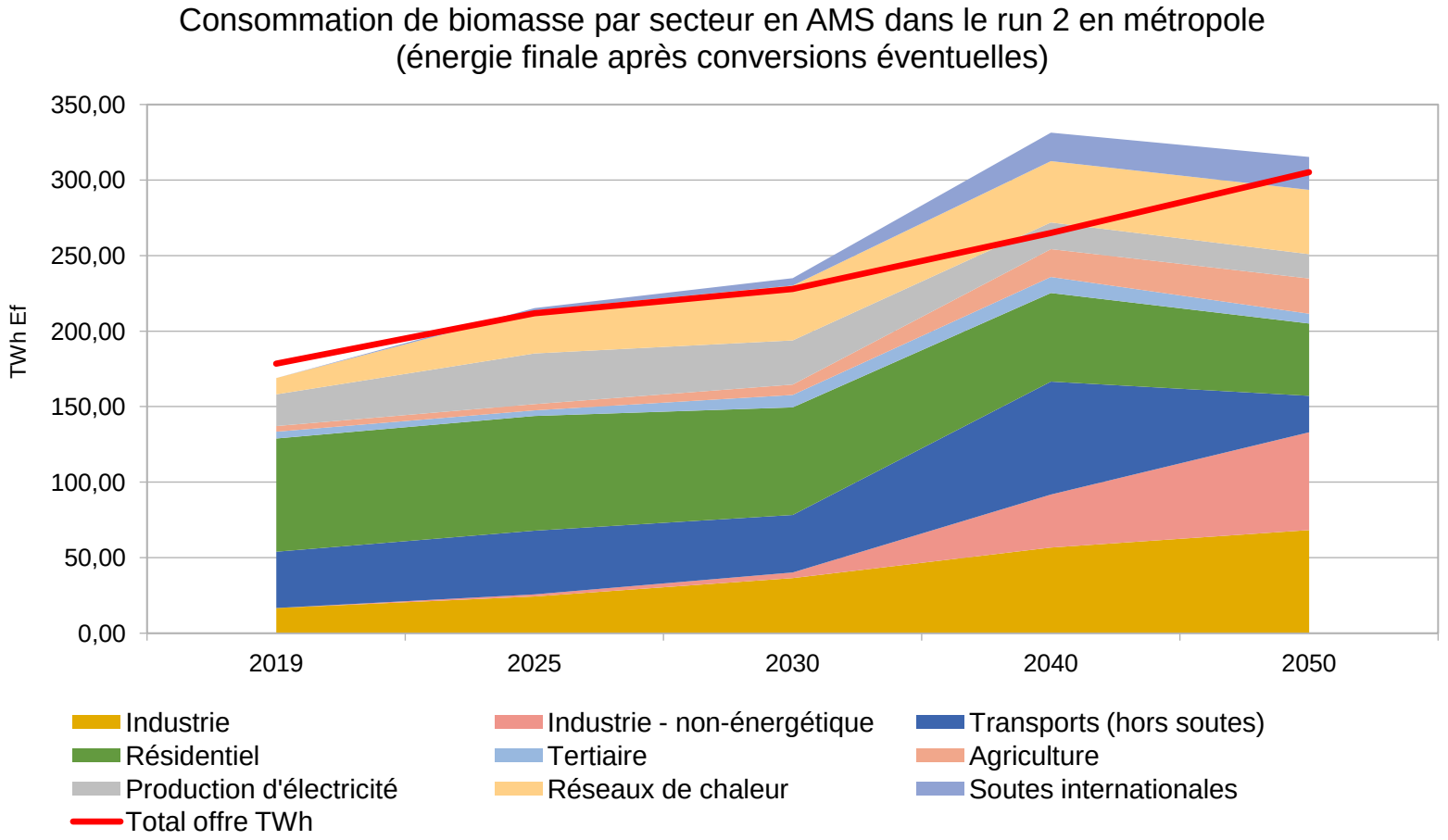
Supply-demand comparison by sector



Slight deficit appears from 2025, stabilizes in 2030 before increasing in **2040 (-66TWh).** Closing in 2050.

NB: sharp drop in transport consumption after 2040 due to the end of sales of thermal vehicles in 2035, which largely run on biofuels over this period

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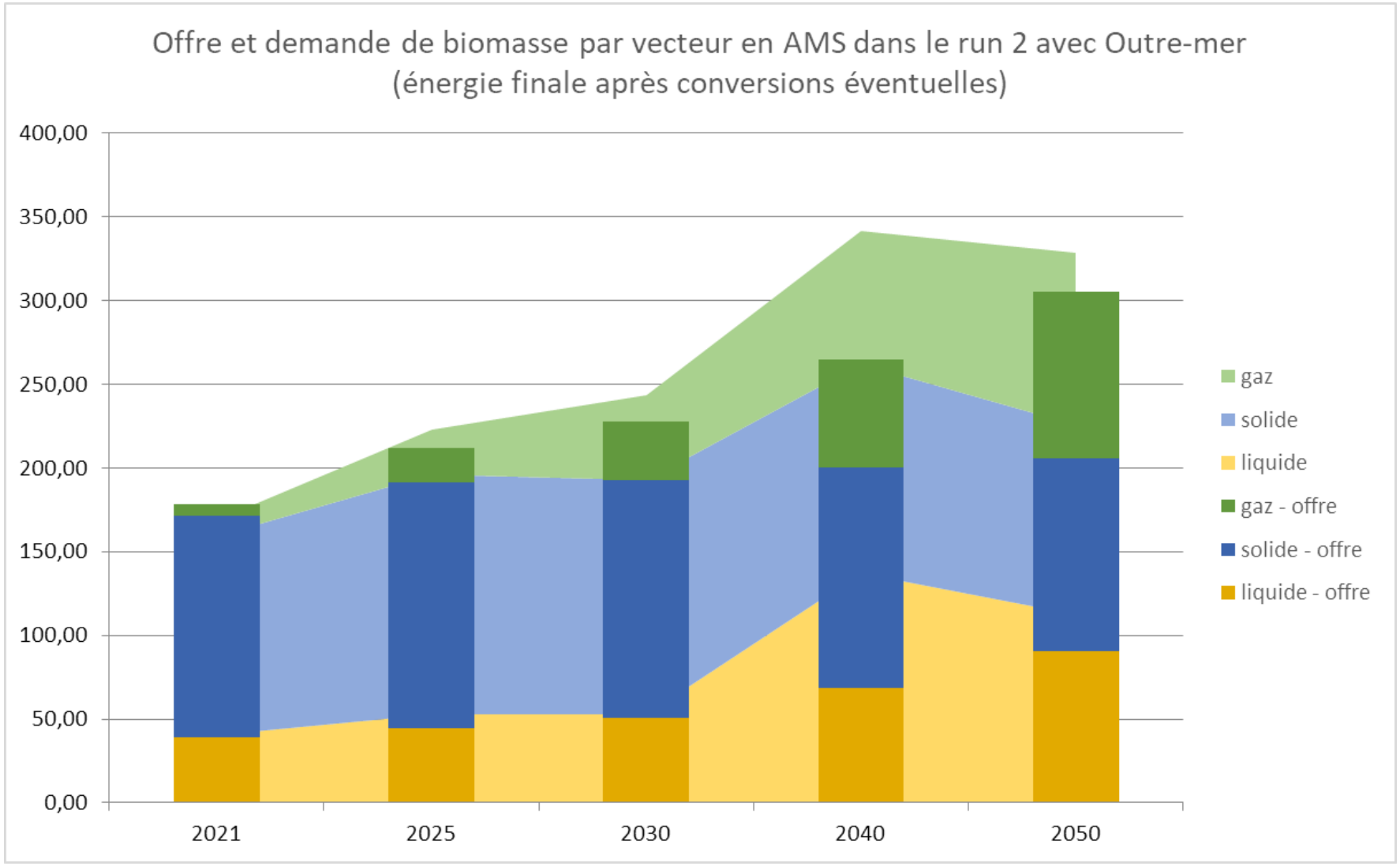
Supply-demand comparison by vector



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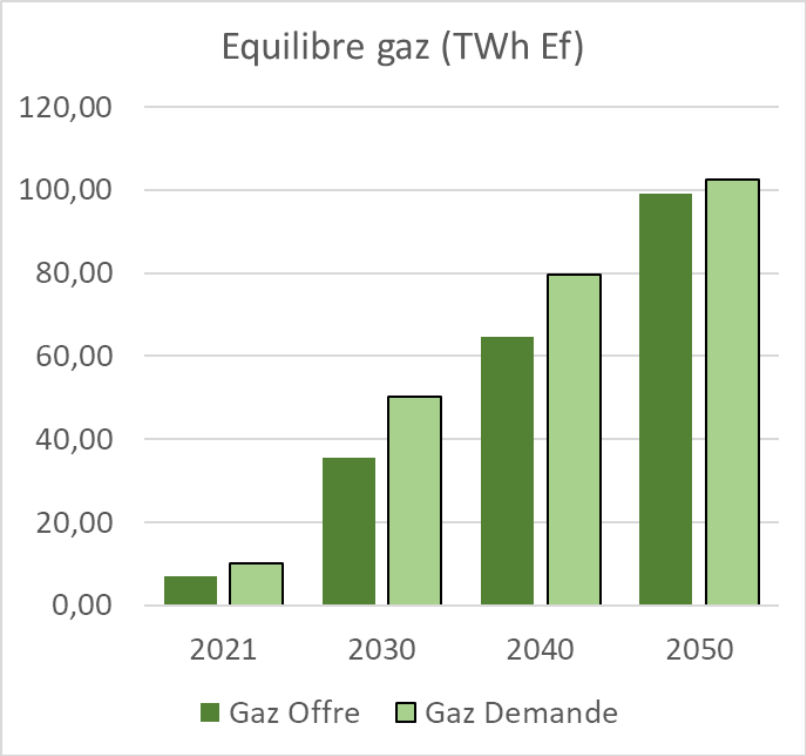
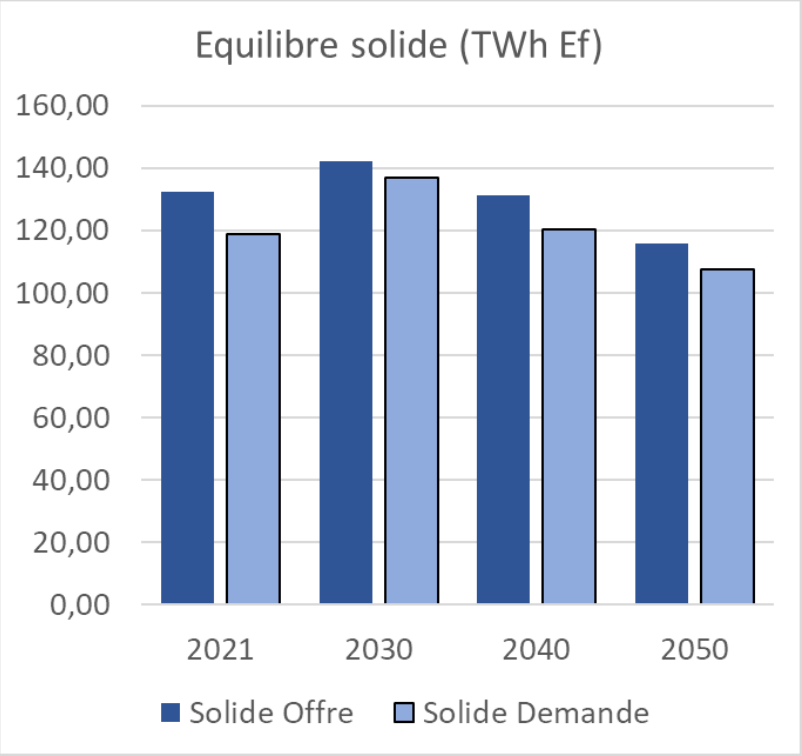
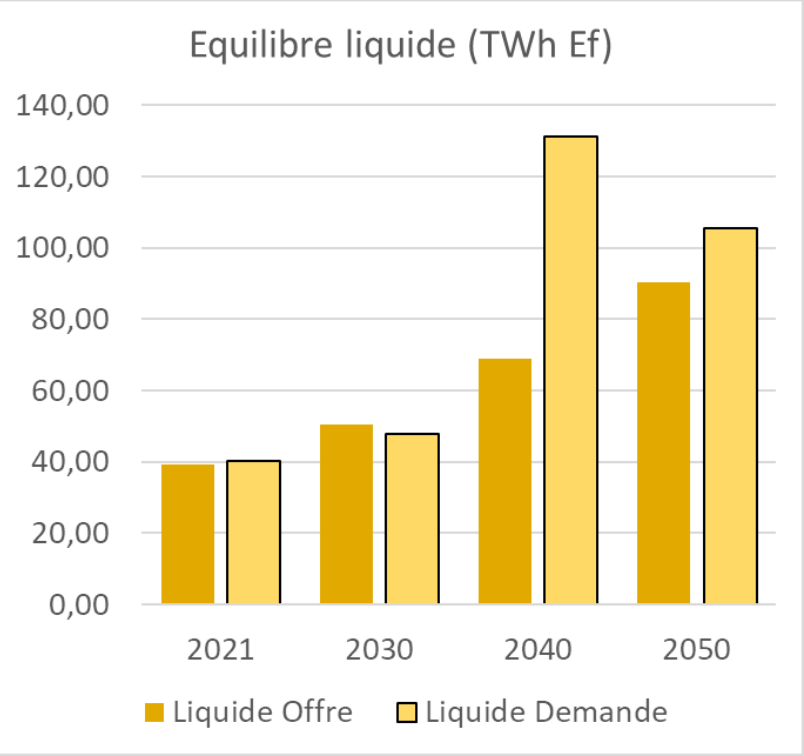
Supply-demand comparison by vector







NB: in the gross outputs of the models of the agricultural and forestry sectors, «solid supply» is largely surplus to demand. The above graphs already integrate the switching of part of this solid offer to liquid or gas supply (via Fischer-Tropsch et pyrogasification type processes)
Such processes have yields of the order of 50% and therefore degrade the final supply with constant primary resource

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Prioritisation of uses

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Proposed prioritization of uses (version as of 04/10/2023)

Uses of biomass	Explanation
Uses to be considered as a priority	
Food	Food sovereignty issue
Animal feed	Protein autonomy issue - meeting the needs of domestic consumption of animal protein consistent with the overall transition scenario of diets
Carbon sinks – wood and forest products, agricultural soils	Higher than requirements determined by SNBC to ensure GHG loopback
Soil fertility (residues and cover)	Meets needs to maintain performance
Industry – high heat and non-energy	No carbon-free alternatives
Heat networks	Few alternatives to decarbonize the heat mix
Energy consumption of agriculture and the forest-wood sector	Especially for agricultural machinery. Possibilities of short circuits and valorization of energy production from agriculture (also possibility to consider more electrification) Forest-wood sector: self-consumption of own resources and energy production recoverable on site
Heavy construction machinery	Few low-carbon alternatives. Consistency to be ensured with the SNBC scenario for the construction sector.
Uses to be developed reasonably and under conditions	
Air traffic (domestic and international)	Possibility to reduce traffic through price signal, modal deferrals and sobriety. Limiting the biomass allocated to this sector, which will have to finance more e-fuel.
Marine bunkers	Possibility to use e-fuel (especially e-diesel from the production of e-kerosene). Question of the level of traffic, with on the one hand a desire to re-supply in France, and on the other a decline in imports in connection with the re-industrialization
Transportation – LP, Buses and Coaches	Possibility to electrify more (including via H2), question of having two infrastructures coexistanter H2 and GNV
Transportation - Light Duty Vehicles	Through controlled incorporation rates, and maintaining a priority given to the progressive electrification of the park
Industry – low temperature heat	Existence of carbon-free alternatives (CAP, solar thermal, RCU, etc.)
Residential and tertiary – solid biomass for efficient heating and DHW	Possibility to prioritize the user of solid biomass on high-performance (after 2005) and high-performance (after 2015) devices by encouraging the replacement of low-performance devices. Prioritize devices that replace fossil fuel/LPG equipment in rural areas.
Overseas (Mayotte, French Guiana, Corsica)	Questions on the sustainability of the import of metropolitan biomass into OM. Possibility of further development of renewable energy
Uses whose development is to be moderated	
Power generation	Favour other technical solutions (e.g., H2, batteries) to ensure advanced thermal production
Residential and Tertiary – Heating and Inefficient DHW	Reducing the useoflow-performing appliances (installed before 2005) consuming solid biomass
Residential and Tertiary – Cooking	Electric alternative (induction in particular) more efficient and less dangerous

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Prioritisation, a political issue

Industry

- Consistency with priority given to air and maritime
- Strengthen the use of biomass for industry (pyrogasification)
- Request to add priority to food and feed
- BTP: request to prioritize the «most powerful machines»
- Request to distinguish light vehicles on a separate line that would be "at the bottom of the category of uses to be surveyed"
- Request to depreciate the use of biomass for residential heating

Ministry of Agriculture

- Calls for material uses to take precedence over all energy use (reference to the SNMB 2018 hierarchy of uses), particularly in industry (non-energy)
- Request to complete the objective of soil yield by a more inclusive approach «quality of the productive ecosystem» (physico-chemical qualities, water, biodiversity)
- Calls for heat networks to be in the last "moderate" category

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