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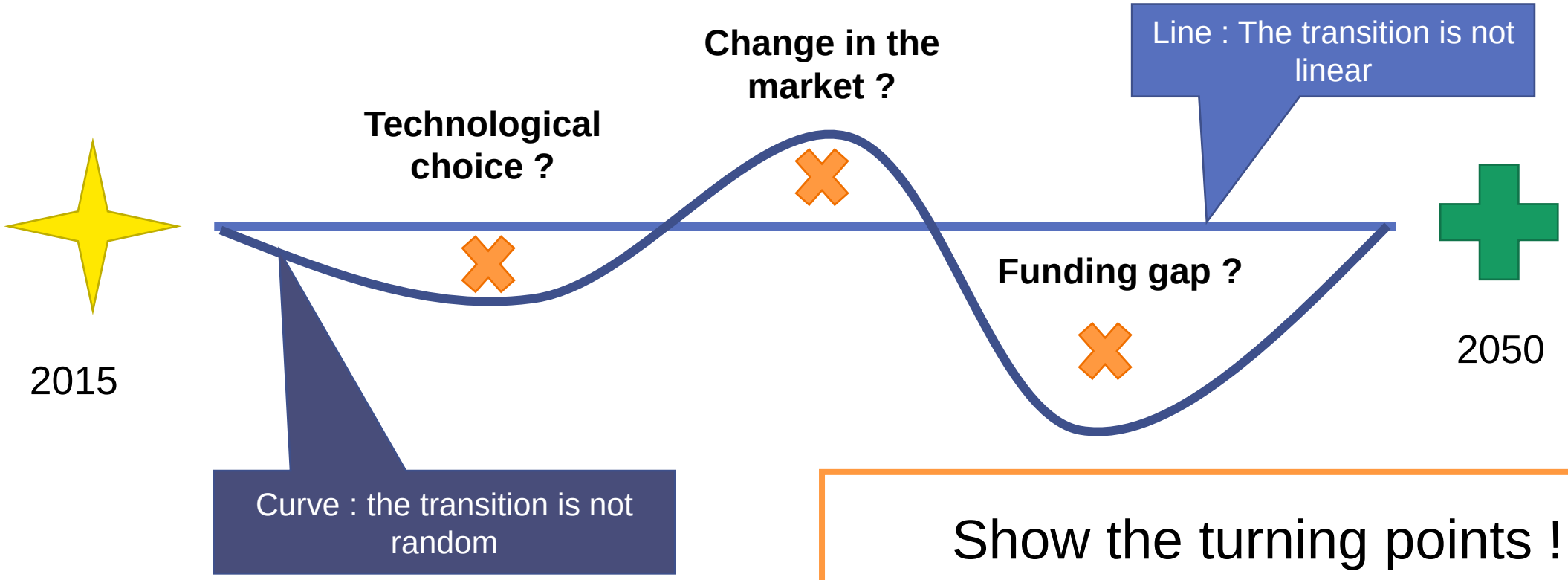
AGENCE DE LA TRANSITION ÉCOLOGIQUE

Transitions pathways for ammonia deep decarbonization: a case study of France

Life

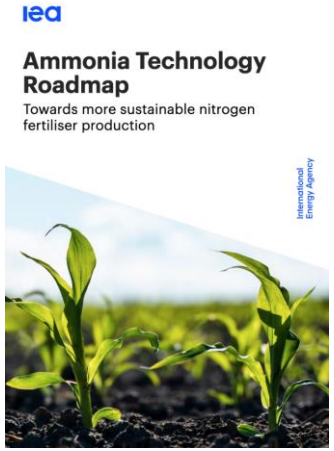
Finance ClimAct

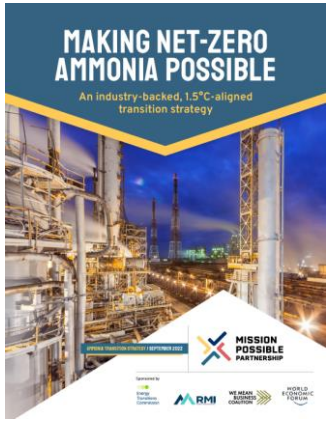
What is the purpose of an industrial net-zero pathway ?

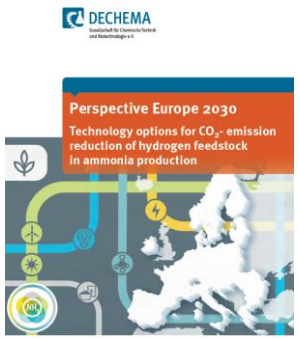


Show the turning points !

What are the limits of industrial net-zero pathways ?







Compared to global and European net-zero pathways, France has :

- Not the same ammonia market
- Not the same industries
- Not the same energy resources and prices

Not adapted to the French situation

➢ Transcription needed

ADEME's pathways

Systemic

TRANSITION(S) 2050
DECIDE NOW
ACT 4 CLIMATE

https://librairie.ademe.fr/recherche-et-innovation/5258-prospective-transitions-2050-synthesis.html

S1 FRUGAL GENERATION

S2 REGIONAL COOPERATION

S3 GREEN TECHNOLOGIES

S4 RESTORATION GAMBLE

Transition Sectorial Plans

- Market efficiency/recycling
- Energy efficiency
- Energy mix
- CCS/CCU

Techno

Cost

- Abatement cost of technologies
- Cost structure (OPEX/CAPEX)
- Financing

Several scenarios

Market

- Demand evolution
- Employment/skills
- Risk analysis
- Business models

Public and private action plan

…es, subsidies,…
European policies
- Private funding

Ammonia French market

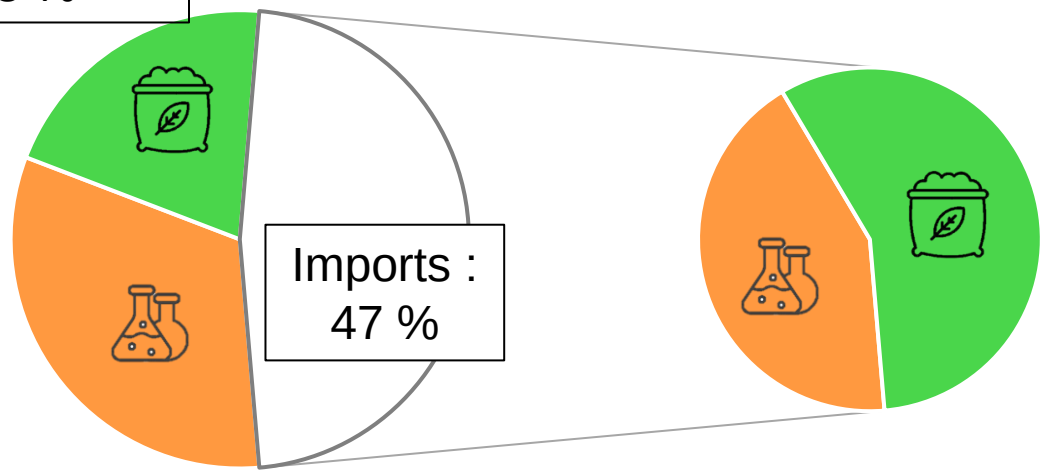
Large share of imports

Origin of nitrogen products consumed in France (2015)

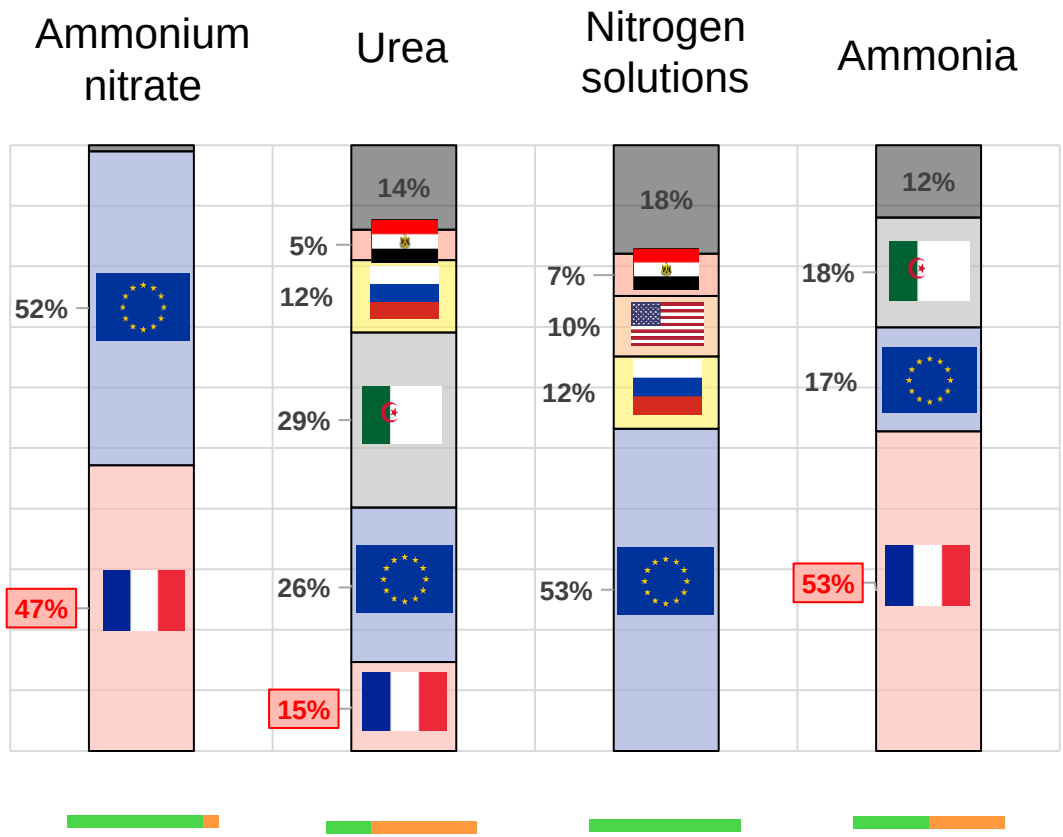
Ammonia consumption in France (2015) : 1,7 Mt

Production : 53 %

Imports : 47 %

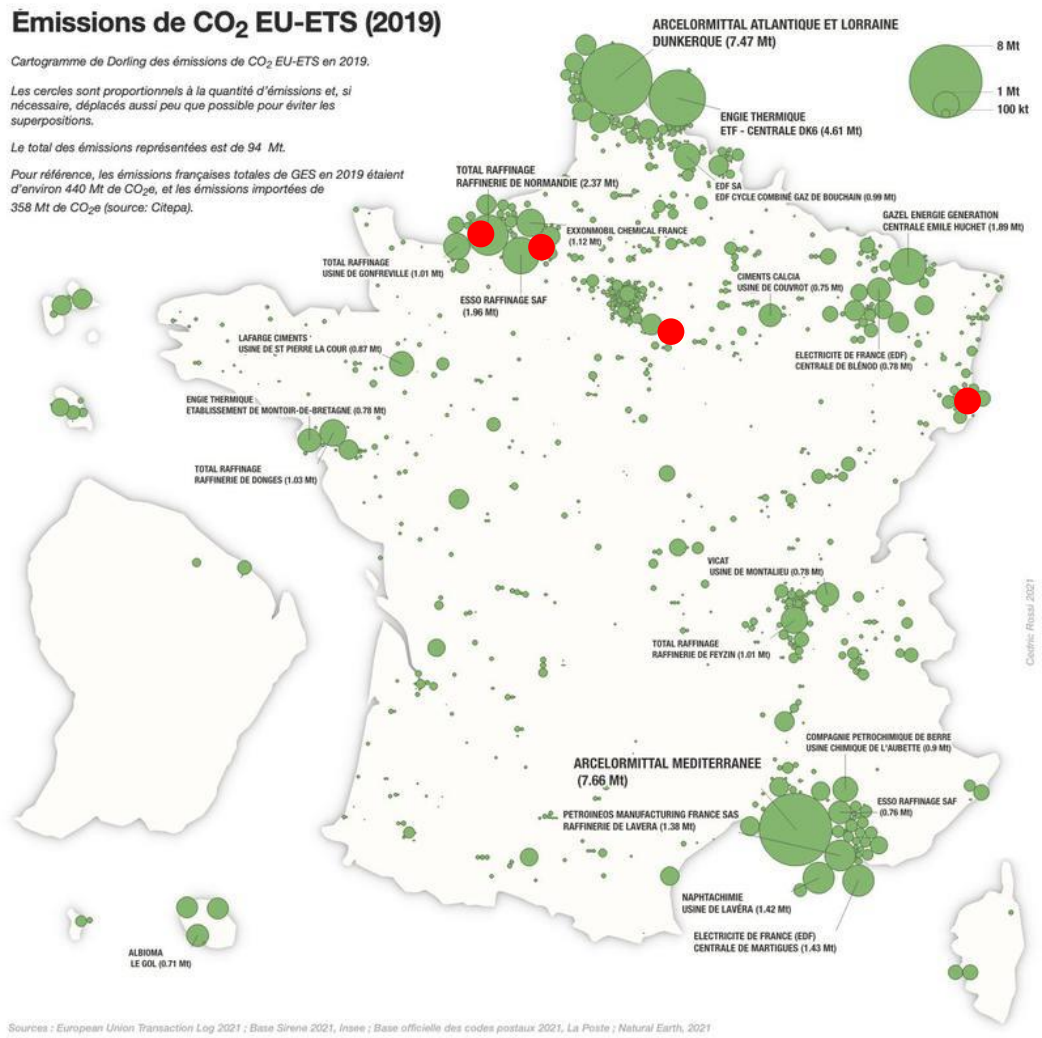


Large share for chemistry



Specific fertilizer mix

Ammonia French industry



Small and medium sites

4
Sites

1,5 Mt
Capacity

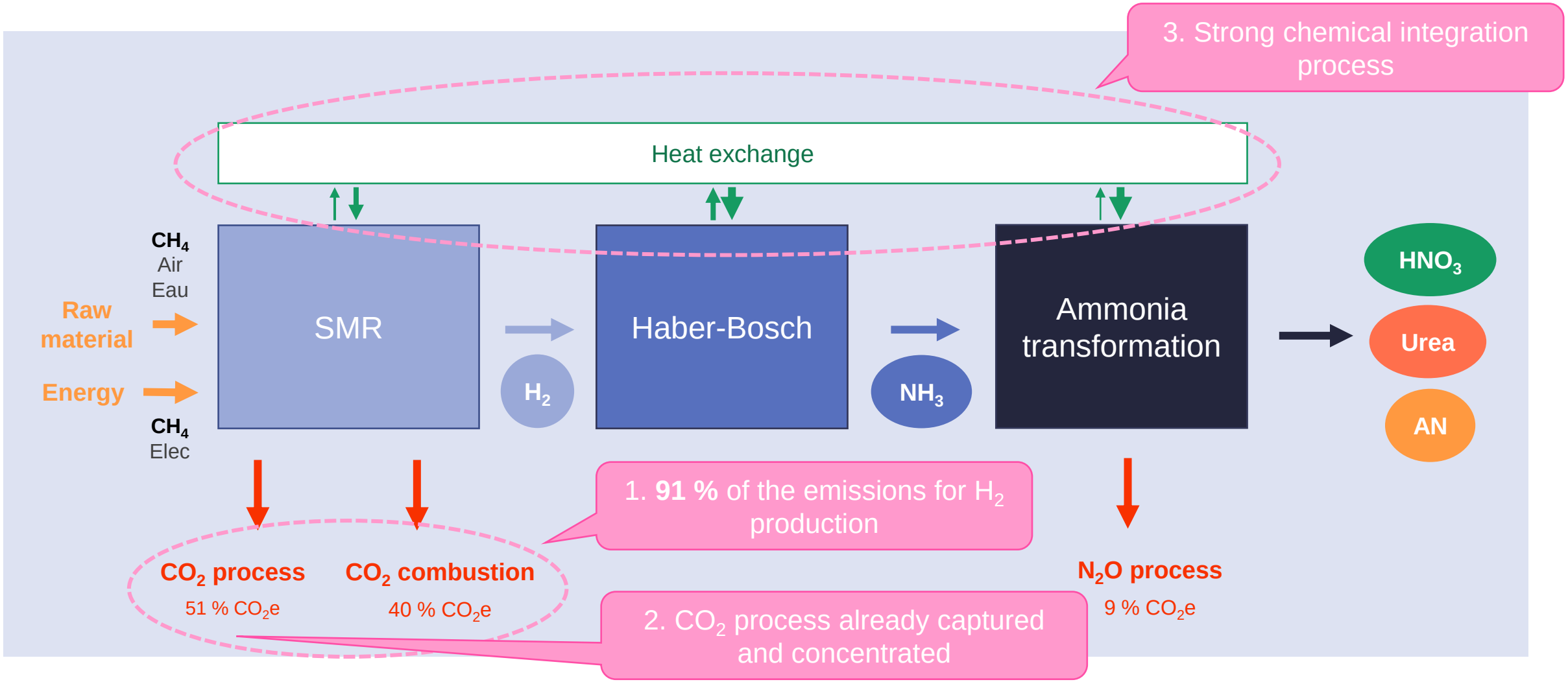
11 MWh/tNH_3
120 % BAT

Energy efficiency required

2,0 tCO_2e/tNH_3
EU-ETS benchmark 2015 : 1,62

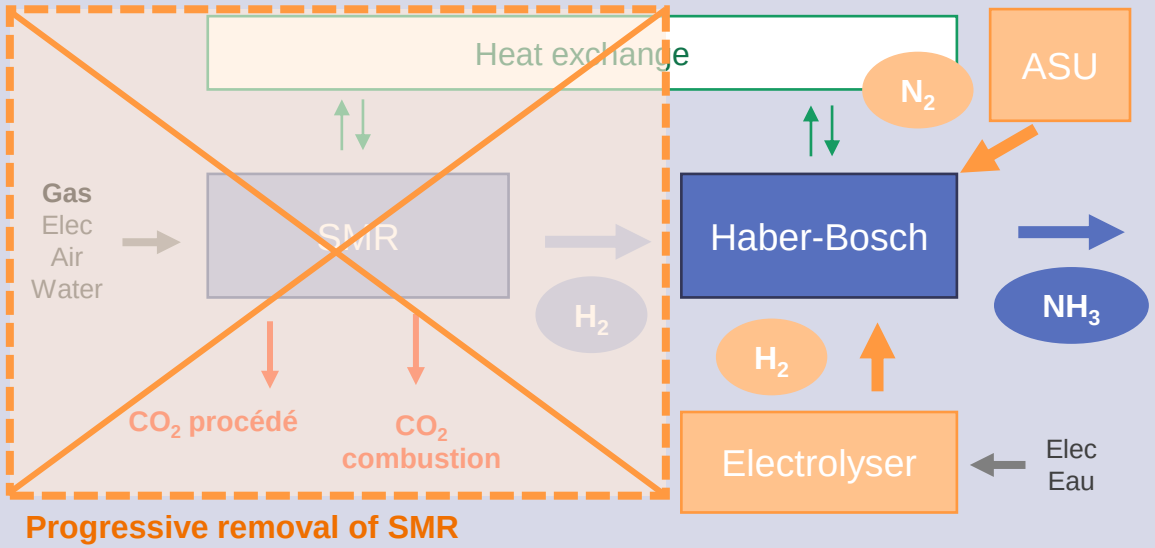
3 %
industrial emissions

SMR : 3 decarbonization challenges



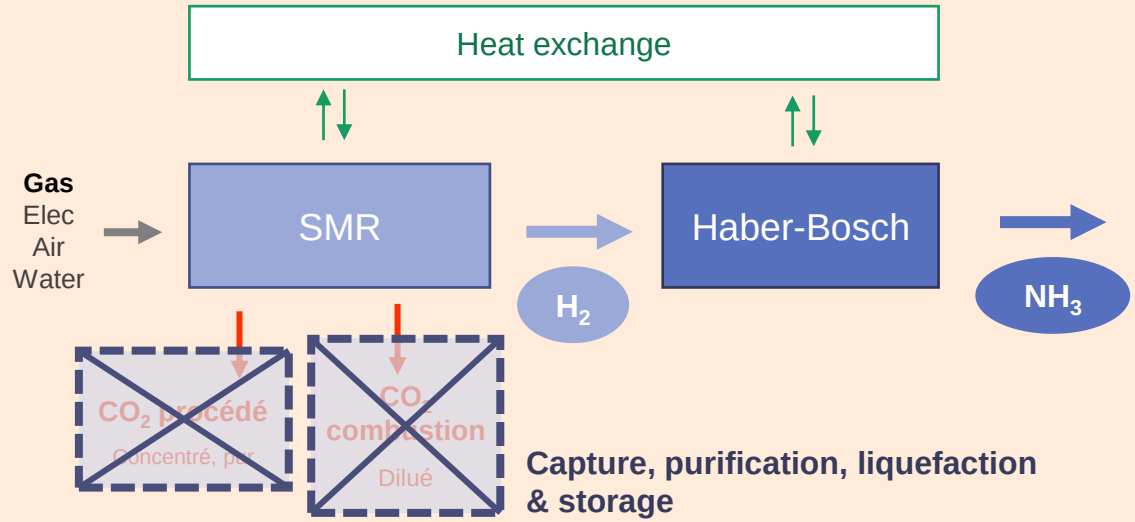
H_2 & CCS : 2 deep decarbonization levers…

H_2 : a new process is mandatory



- Progressive activation (< 15 %) with energy penalties …
- …then new process mandatory : retrofit
- 90 % of emissions avoided

CCS : 2 CO_2 sources to consider



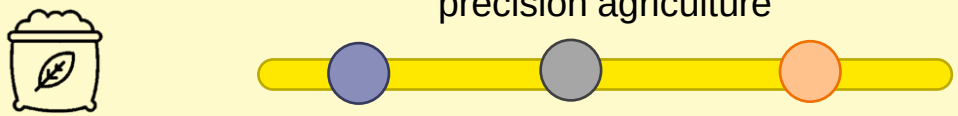
- Identical process + new capture equipment
- 90 % of emissions captured
- Need of CO_2 infrastructures : likely not everywhere

3 pathways for ammonia industry decarbonization

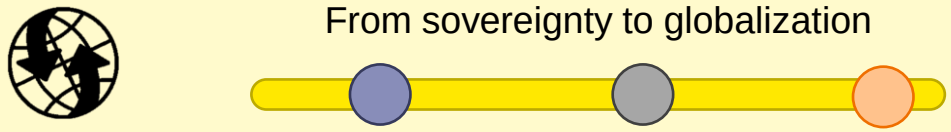
Context transition

MARKET

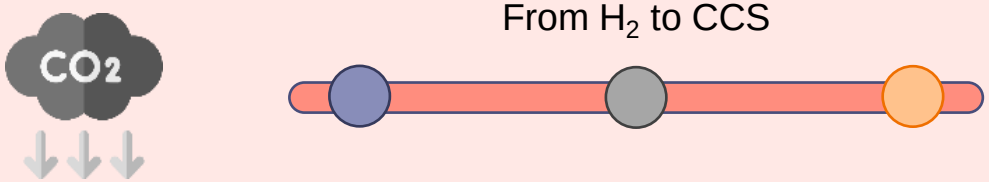
Agriculture : from agroecology to precision agriculture



From sovereignty to globalization



TECHNO

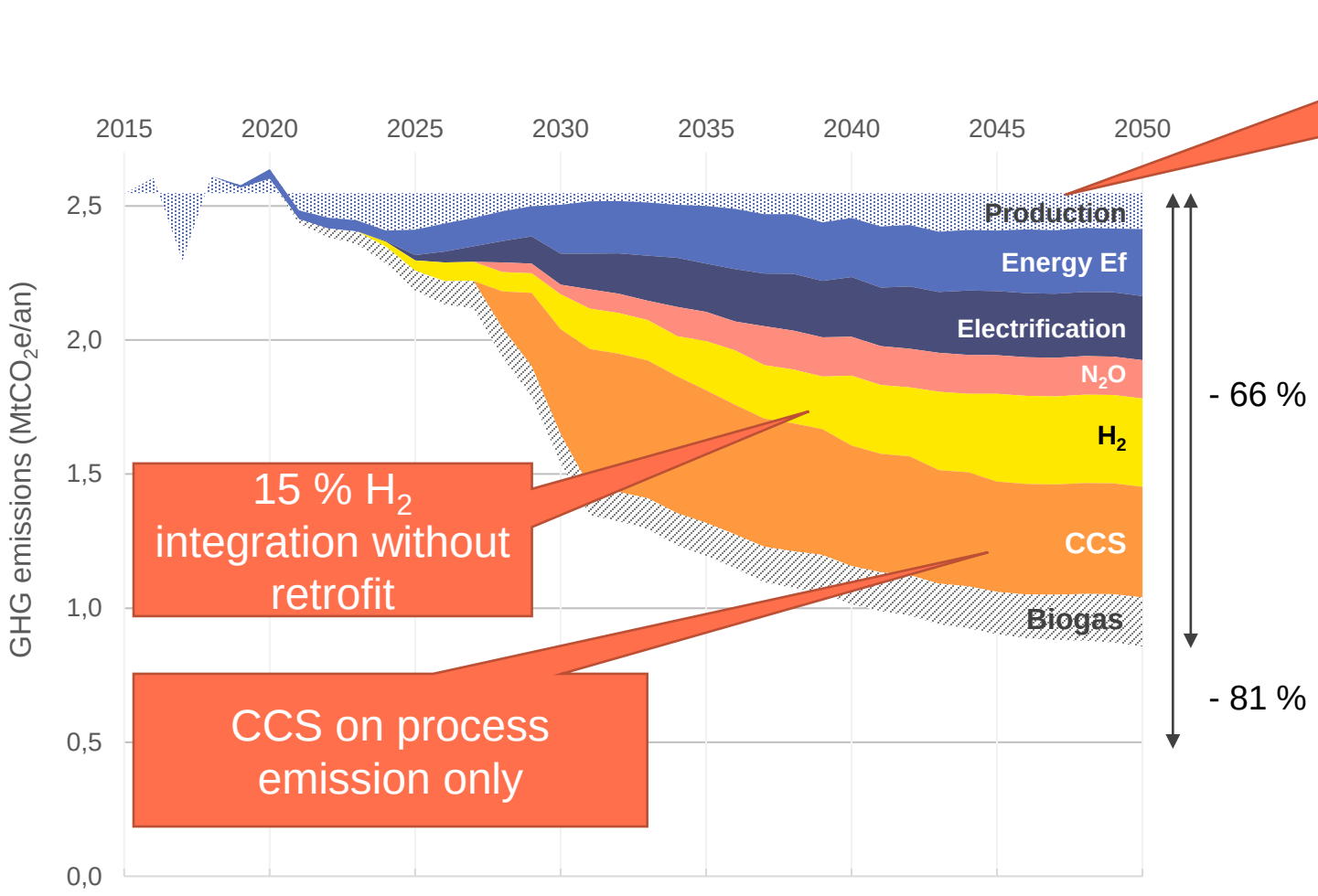


From H_2 to CCS

Pathways

"Resilience and renewable ammonia"	"Reference"	"Low-carbon ammonia and globalization"
Based on organic agriculture, strong EU, autonomy, electrification, H2 infrastructures development	Based on trends for agriculture, international exchanges, industrial decarbonization announcements, stated policies, extrapolation	Based on specialized agriculture, intensive exchanges, lack of competitiveness, CCS development

Reference : emissions lock-in



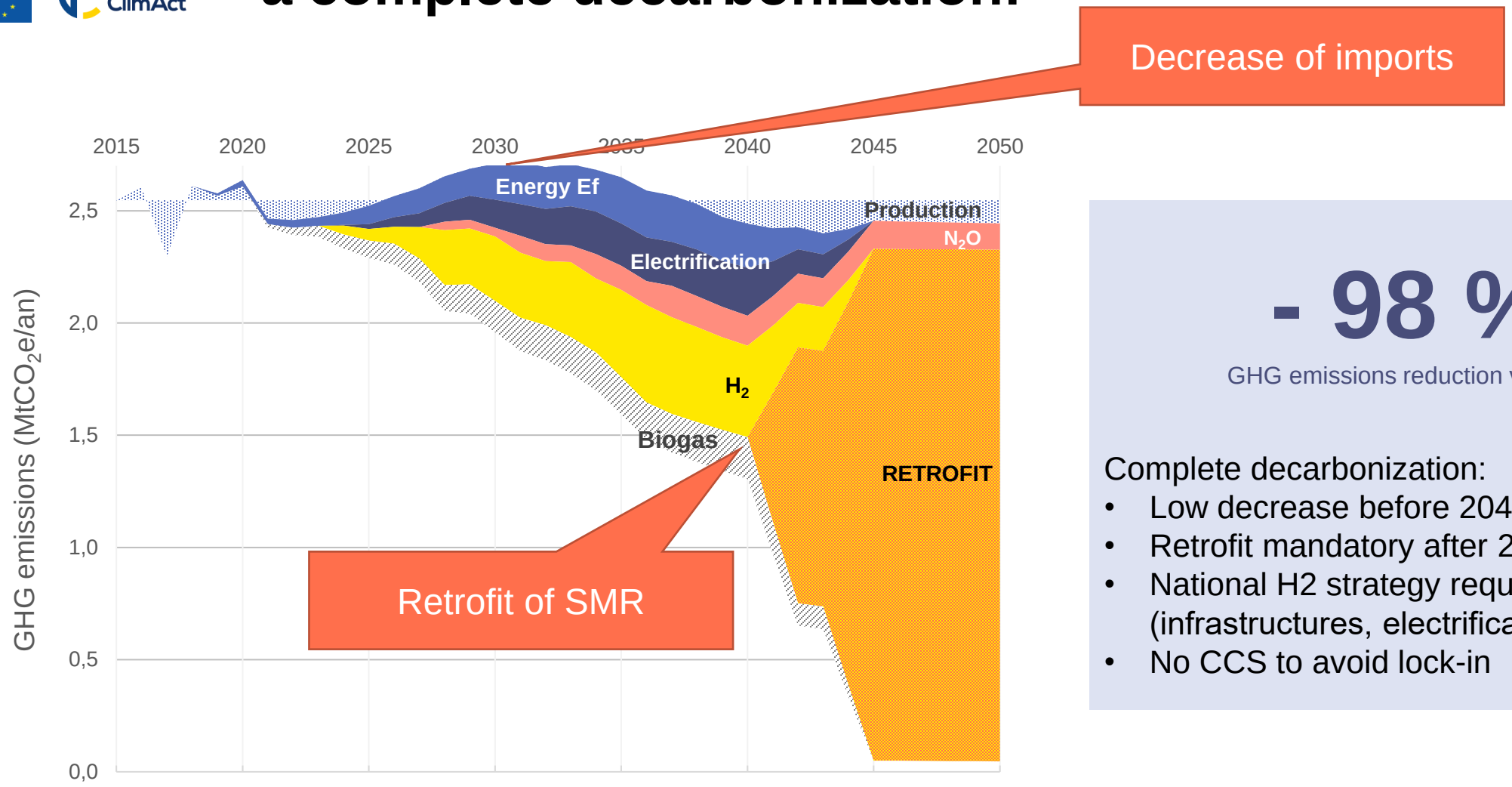
- 66 %

GHG emissions reduction vs 2015

Insufficient decarbonization:

- Stated policies are not sufficient
- Industrial decarbonization plan are note ambitious enough
- Need of infrastructures
- Lock-in of emissions after 2035

Resilience and renewable ammonia: a complete decarbonization!



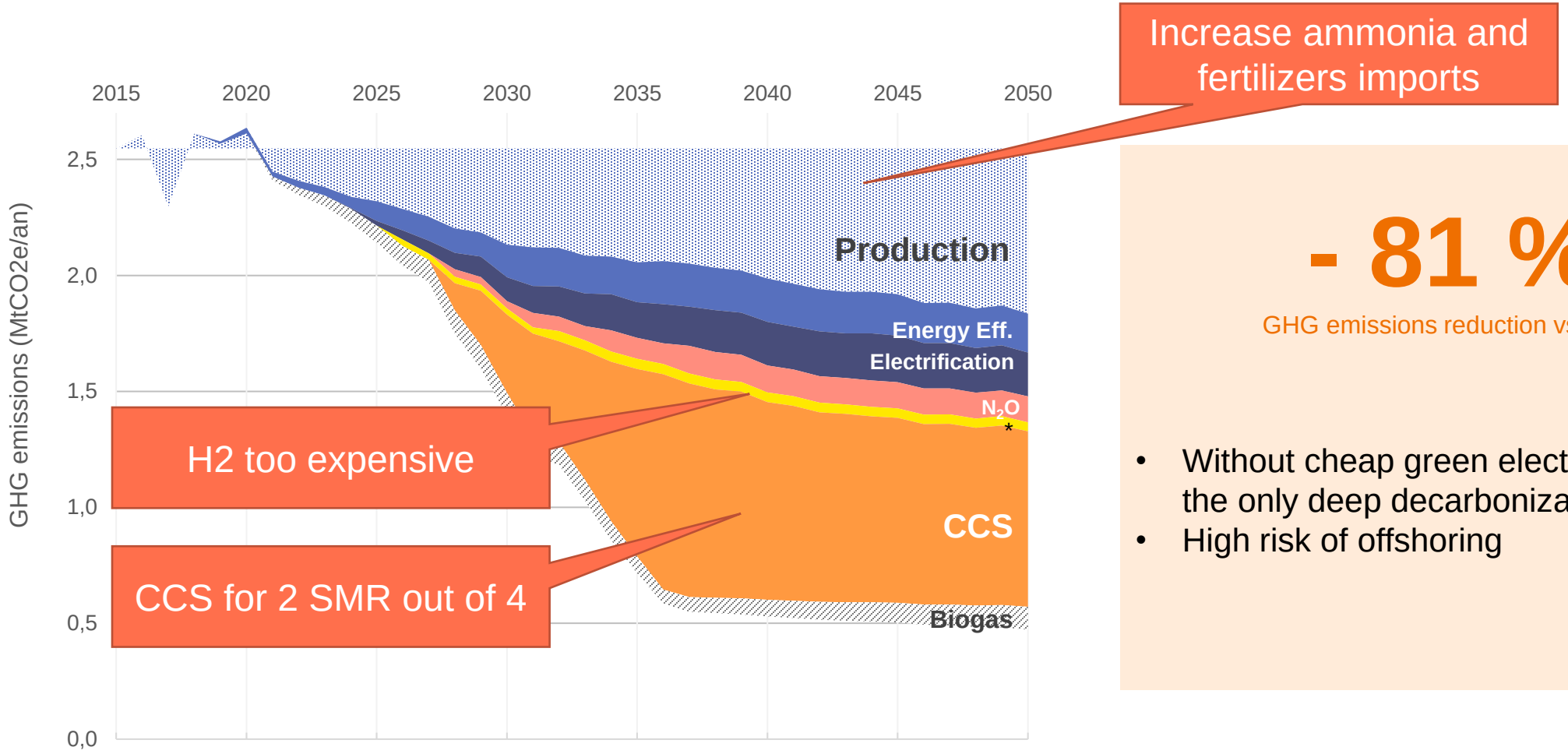
- 98 %

GHG emissions reduction vs 2015

Complete decarbonization:

- Low decrease before 2040
- Retrofit mandatory after 2040
- National H2 strategy required (infrastructures, electrification…)
- No CCS to avoid lock-in

Low-carbon ammonia and globalization: a risk for the french industry



- 81 %

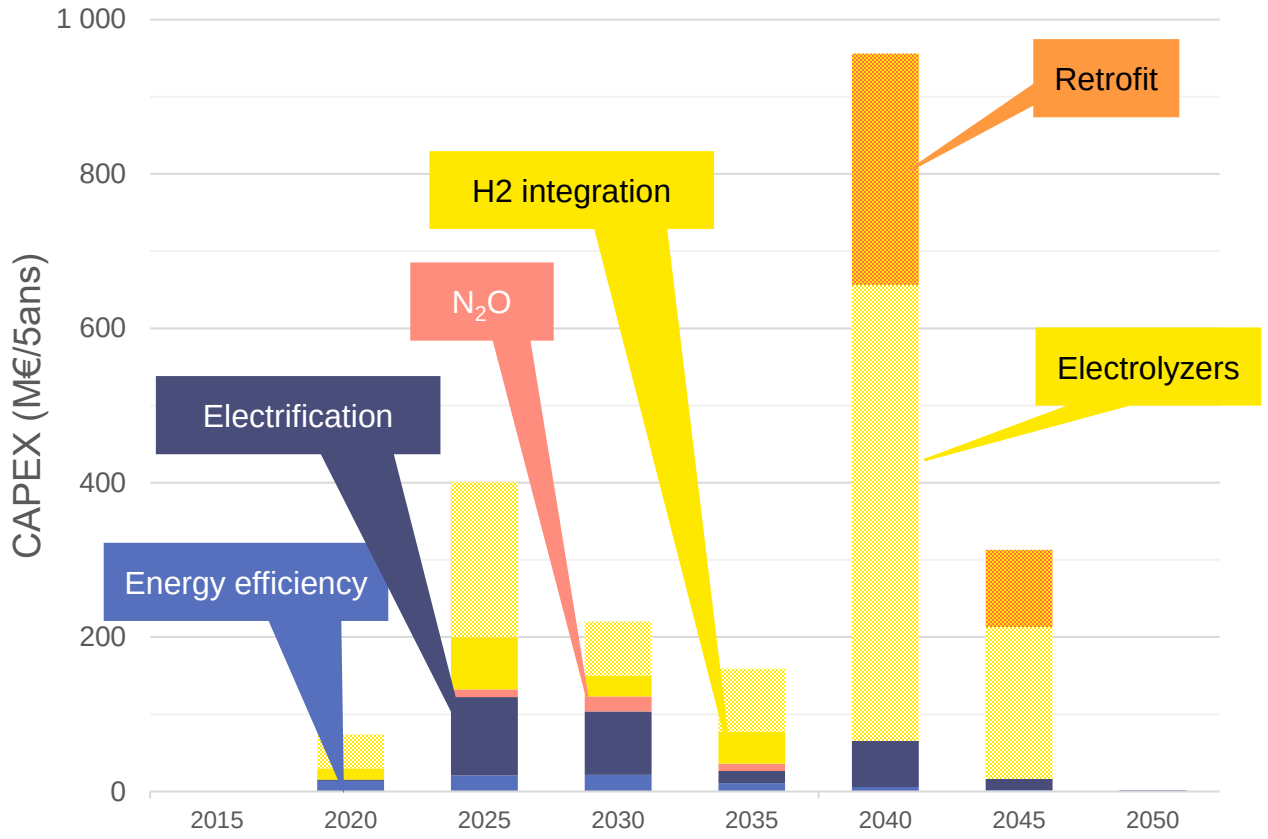
GHG emissions reduction vs 2015

- Without cheap green electricity, CCS is the only deep decarbonization lever
- High risk of offshoring

Investments comparison

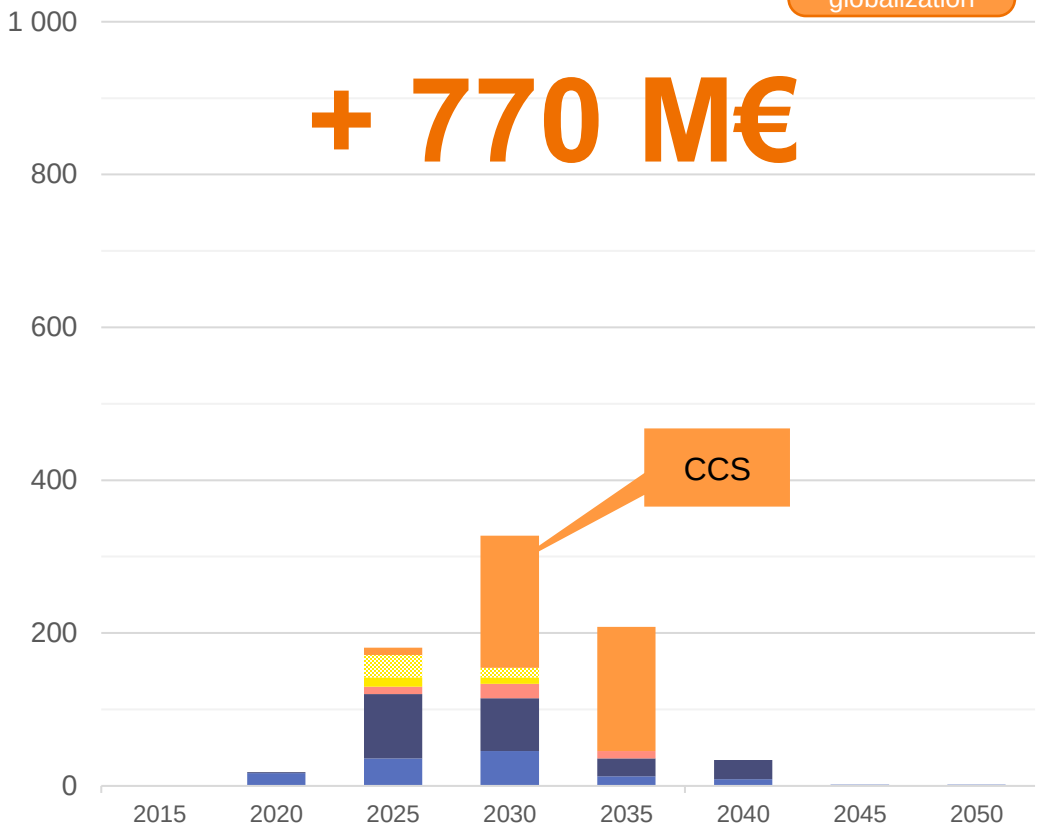
Resilience and renewable ammonia

+ 2 100 M€



Low-carbon ammonia and globalization

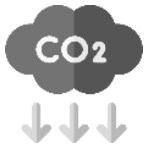
+ 770 M€



Summary for decision makers

The decrease in fertilizer consumption can be offset by the reinforcement of the value chain:

- Agriculture: choose AN (more efficient) rather than nitrogen solutions, green certification label
- New renewable ammonia markets: maritime transport, H_2 storage and transport



Need of H_2 and/or CCS strategies:

- 2 sites require H2 integration then retrofit
- 2 sites have the choice between CCS and H2, but have to chose today to avoid lock-in emissions after 2035

A mandatory public support to help start the transition

- Infrastructures and electrification required
- H2 is very expensive and need to be supported (CfD, PIIEC, gas taxes, …)

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