DECARBONATION STUDY OF DRYING AND COOKING PROCESSES

ALLICE

Net Zero Carbon Industry 30 Jan 2024



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ALLICE

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Federate and innovate to decarbonise industry

Our missions

- ✓ **Bringing together all the players** in the sector to innovate collectively
- ✓ **Supporting the development of a range of high-performance, differentiating decarbonisation solutions** in France and abroad
- ✓ **Supporting manufacturers** in accelerating their decarbonisation



Collective studies

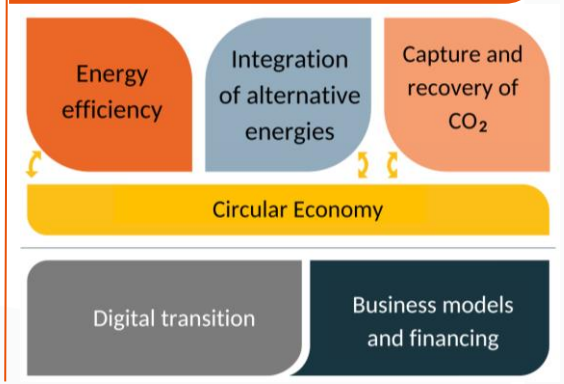


Representation of the sector

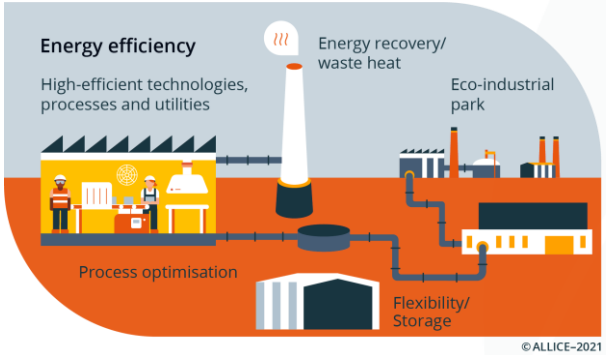
Our structure

- ✓ A **membership-based model**
- ✓ An **independent facilitation organisation**
- ✓ More than **100 members and partners**

Our areas of intervention



#19 Decarbonation study of drying and cooking processes



- Comparing different decarbonisation solutions based on case studies
- Guide manufacturers in decarbonising their processes

- Modelling of 3 case studies from various industries
- Estimation of CAPEX, OPEX and CO2 emissions
- Projection to 2050*

- Study different solutions for drying and baking processes: energy efficiency, electrification, renewable and recoverable energy
- Analysis and comparison of possible solutions
- General conclusions for industry players

**Sources: Enerdata, ADEME, ENEA, CEREMA, CETIAT*

Case studies on three various industries



Brick and tile

#1 Tile drying and firing tunnels



Mechanical

#2 Drying and polymerisation tunnels for powder paint



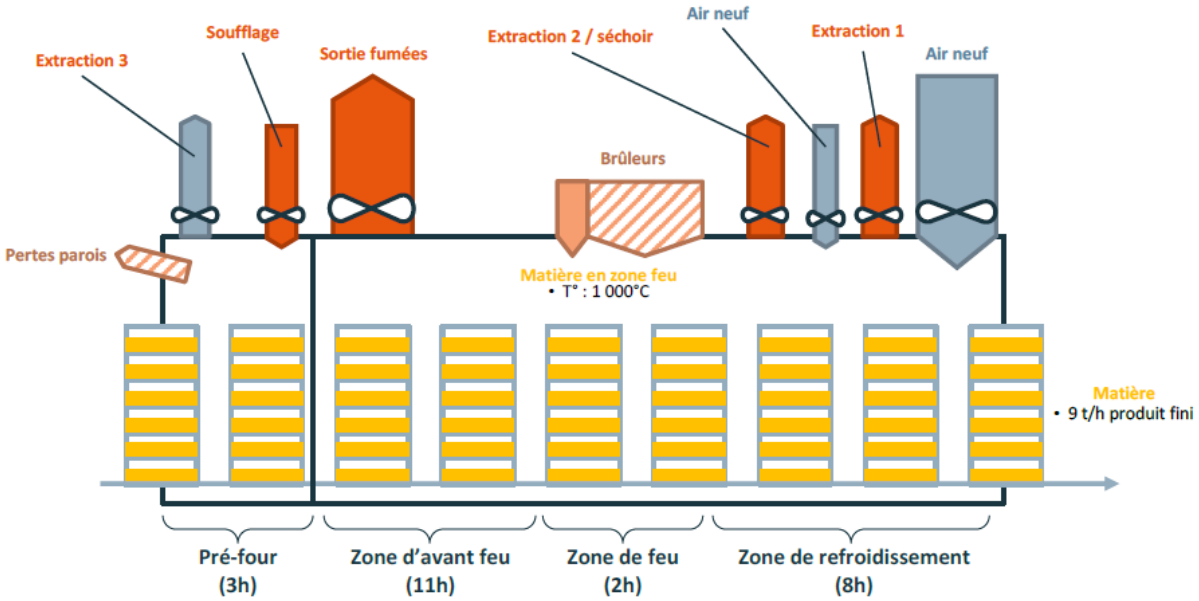
Food

#3 Malt drying process

Criteria	Case 1 – roof tiles	Case 2 – paint line	Case 3 – malt drying
Duration (cycle or per year)	2 x 24h (continuous)	4 200h/yr	24h (batch)
Quantity of product (T)	9T/h tiles	2,6T/h painted	150T/batch malt dried
Annual gas consumption (GWh/yr)	53	5	19
Annual electricity consumption (GWh/yr)	2,4	0,1	1,5
GHG emissions (kTCO2/yr)	11 000	1 000	3 500

Case 1 - Brick and tile process

Reference case

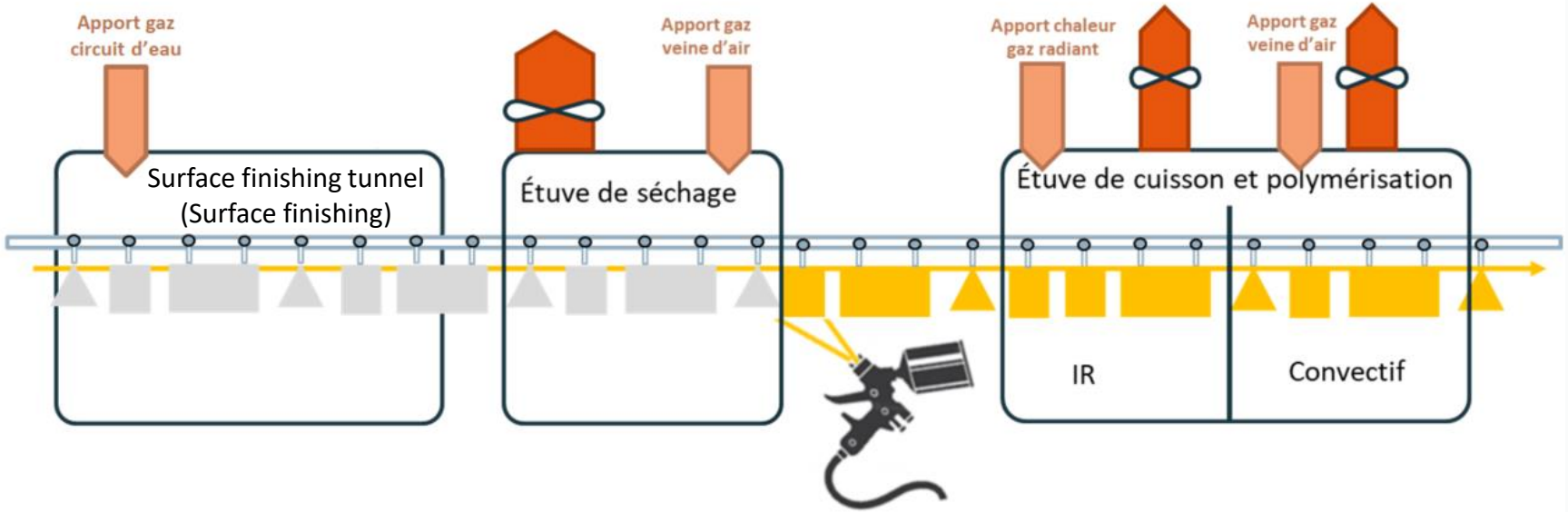


- **2-stage process**
  - Drying (1500 kW)
  - Baking (6000 kW)
- **Features**
  - 9 t/h of final product
  - Drying at 90°
  - Baking at 1000°C
- **Consumption**
  - **Electricity: 2,4 GWh/yr**
  - **Gas: 53 GWh/yr**

Case 2 - Painting line

Reference case

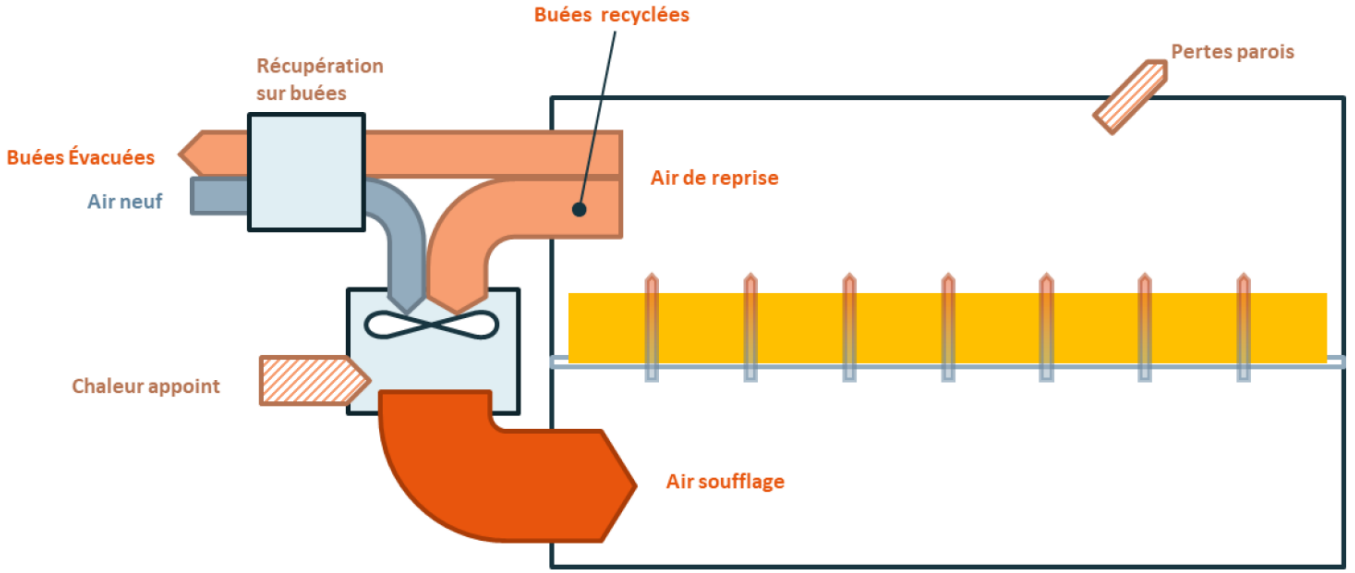
- **3-stage process**
  - Surface finishing bath
  - Drying
  - Paint baking
- **Features**
  - 2.6 t/h of steel products for painting
  - Drying at 120°C, baking at 220°C
  - 4200h/year
- **Consumption**
  - **Electricity: 0,1 GWh/year**
  - **Gas: 4,8 GWh/year**



Case 3 – Malt kilning

Reference case

- **3-stage process**
  - Free drying (16.5h)
  - Forced drying (5h)
  - Curing (2.5 hrs)
- **Features**
  - 150 tonnes of barley per batch
  - Drying at 60°C, Firing at 85°C
- **Consumption**
  - **Electricity: 1,5 GWh/yr**
  - **Gas: 19 GWh/yr**



Solutions of decarbonisation considered

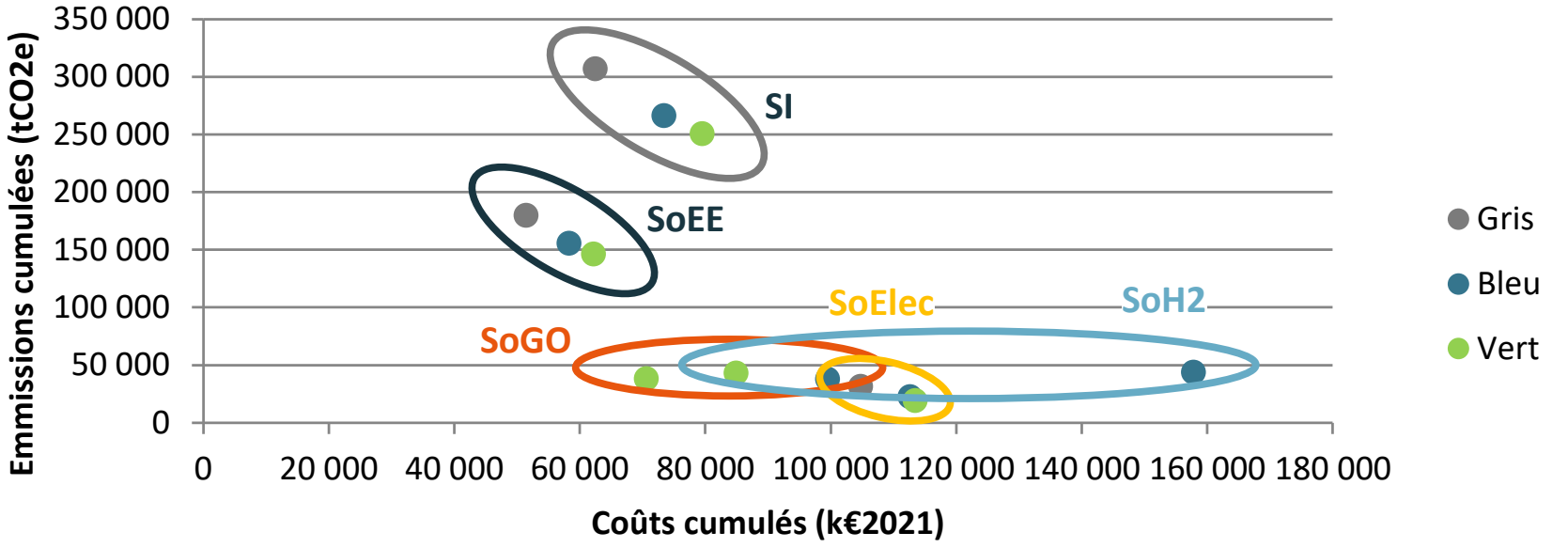
Solutions	Case 1 – roof tiles	Case 2 – paint line	Case 3 – malt drying
Energy efficiency* (SoEE)	X	X	X
Guarantees of Origin (SoGO)	X	X	X
Electrification (SoElec)	X	X	
Hydrogen (SoH2)	X	X	
Solar (SoSol)		X	X
District heating network (So			X
Biomass			X

**Energy efficiency is applied to all solutions considered, as it is the 1st decarbonation lever to activate and the best option to reduce GHG emissions as well as costs.*

Energy efficiency solutions

- **Case #1 roof tile**
  - Drastic increase in convection to improve exchanges.
- **Case #2 painting line**
  - Reduced silhouettes and air extraction
  - Capture of kiln fumes to dryer
  - Surface finishing preheating with dryer vapours
  - Installation of a HT heat pump
- **Case #3 malt drying**
  - Switching to double tray
  - Optimising instructions
  - Installation of a HT heat pump

Results for case #1: GO appears as the best solution… electrification and hydrogen are promising



Conclusions and outlook (1/3)

- **In all three cases, energy efficiency remains the main source of gains**
  - (Change of technology / Transition to continuous operation)
  - Setpoint control / optimisation
  - Energy recovery
  - Economic and environmental gains

Electrification vs Renewable Energy: two key factors

- Energy efficiency of systems

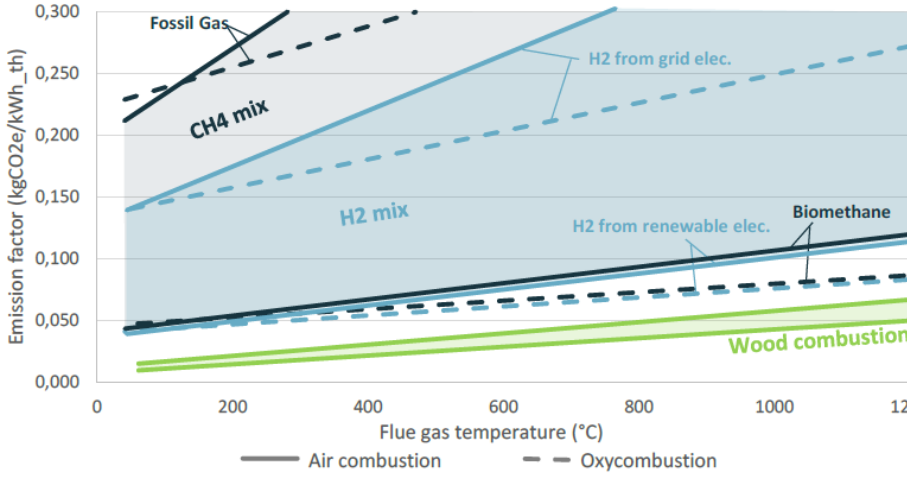


Figure 4 : Typical GHG emission factors for thermal energy generated by different fuels (source CETIAT)

- The energy source

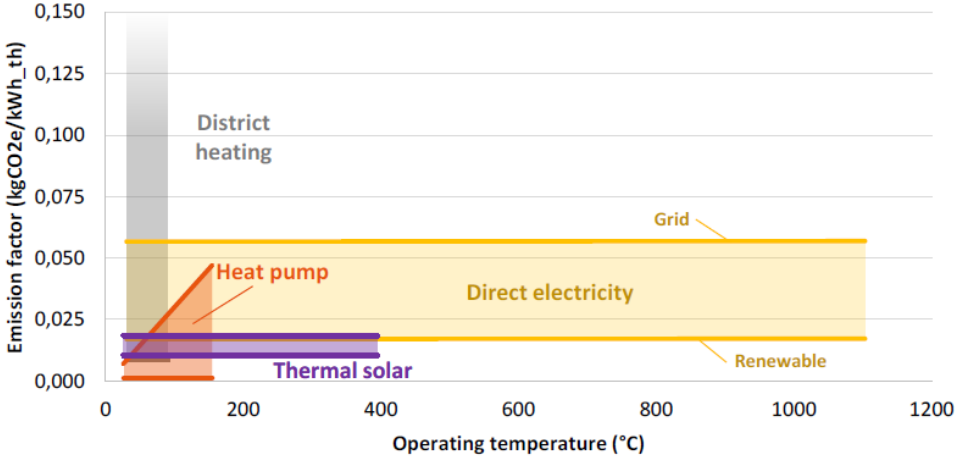


Figure 5 : Typical GHG emission factors for thermal energy generated by different systems and energy sources (source CETIAT)

This performance depends mainly on the temperature levels involved

Conclusions and outlook (3/3)

- **Availability of resources**
  - GO contracts: a limited solution
  - Renewable energy solutions not always applicable

- **Energy costs: an EU ETS brake**
  - Cost of allowances for Gas EU ETS too low to encourage decarbonisation
  - For non-EU ETS manufacturers: decarbonisation solutions = savings

- **What is the CO2 emissions scope?**
  - Consideration of scopes 1, 2 and 3
  - Consideration of LCA of energy efficiency systems
  - Consideration of biogenic CO2 emissions

THANK YOU

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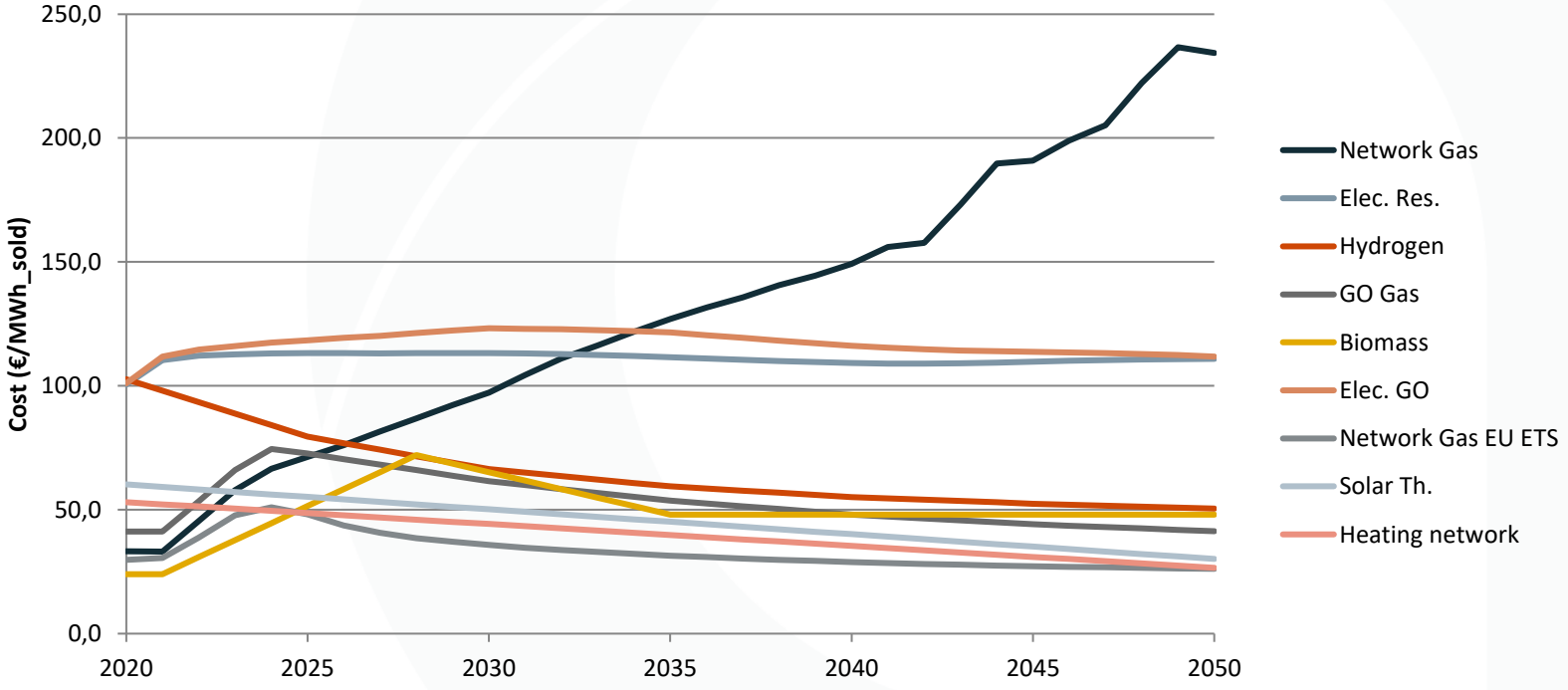
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contact@alliance-allice.com



Scenarios for energy costs and emissions

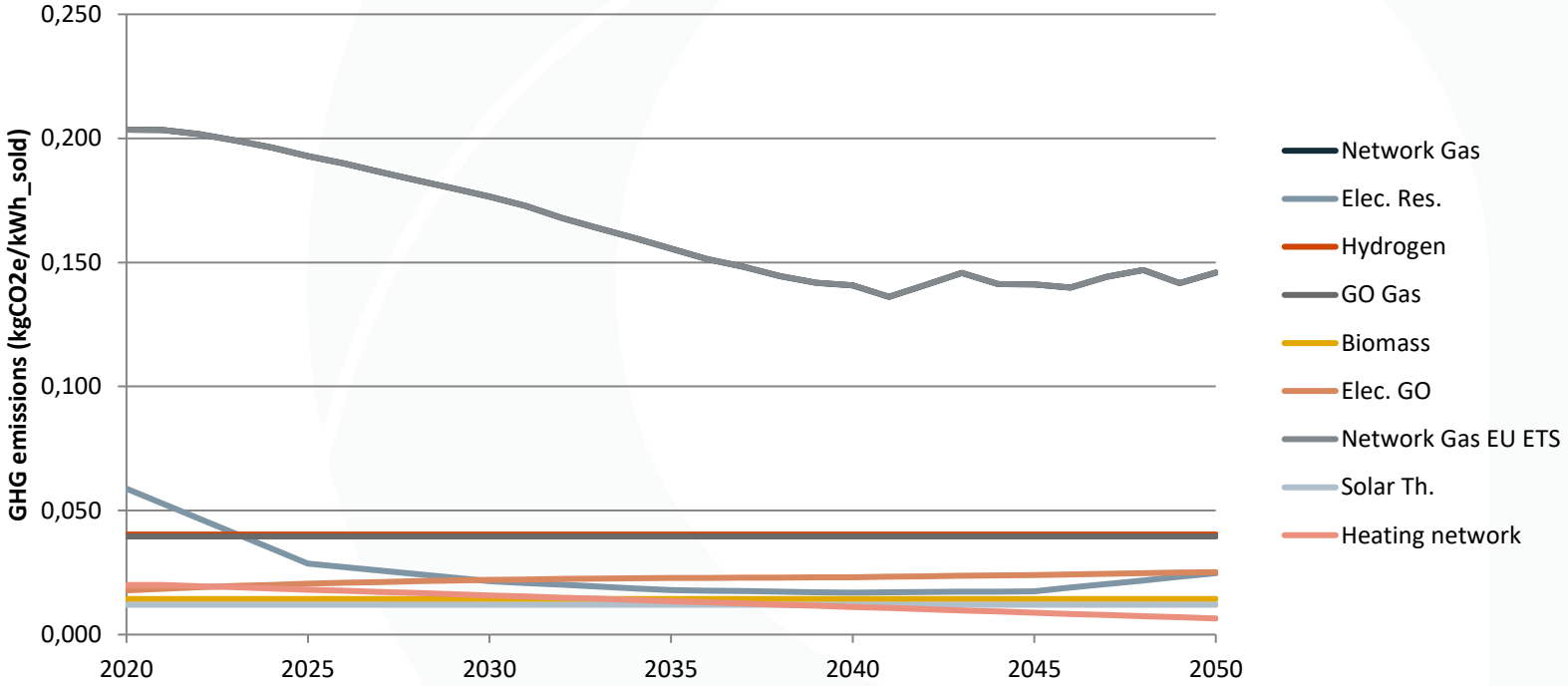
Energy costs



- **Sources: Enerdata, ADEME, ENEA, CEREMA, CETIAT**

Scenarios for energy costs and emissions

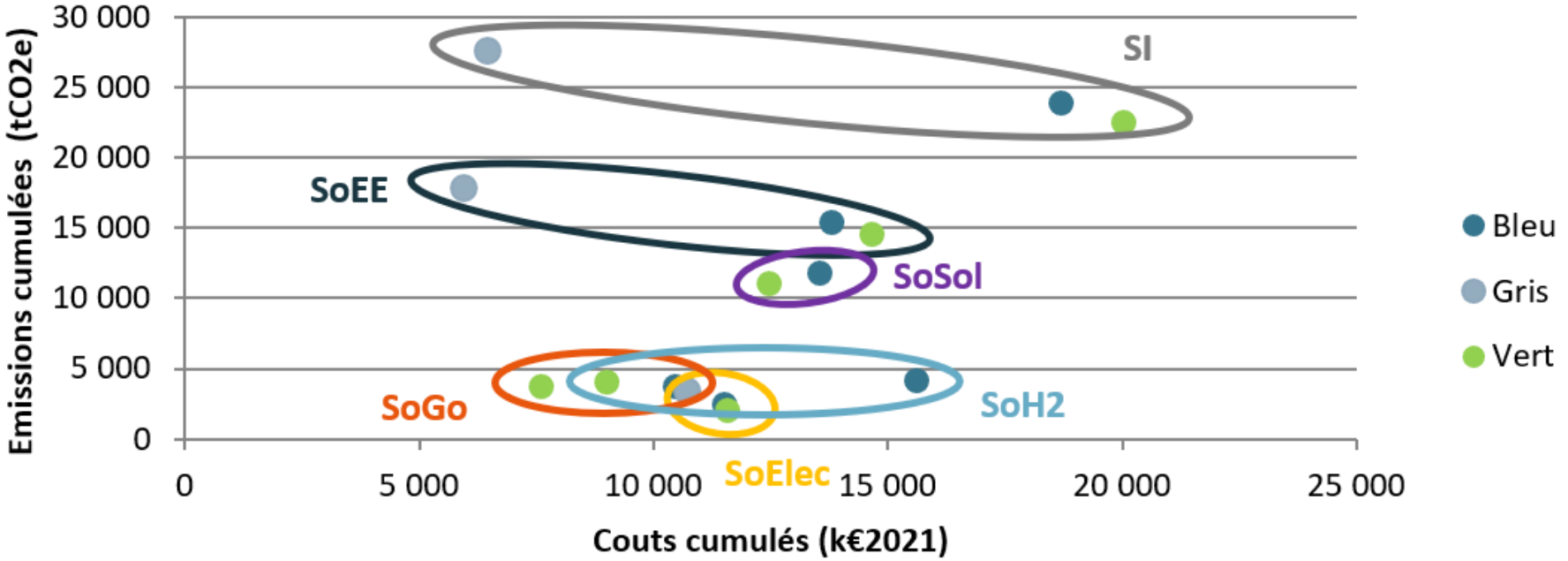
Emissions



- **SCOPES 1, 2 and 3**

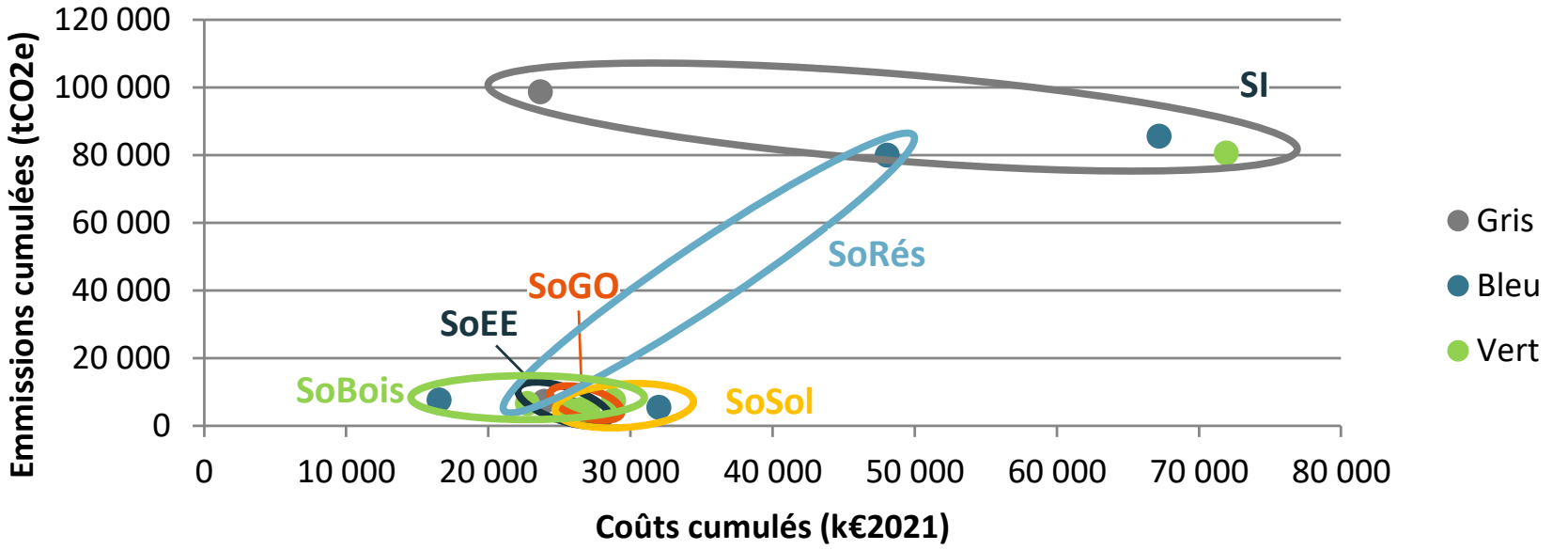
Case 2 - Paint line

Solutions studied - GHG balance



Case 3 - Kiln drying

Cross balance



Electrification vs Renewable Energy

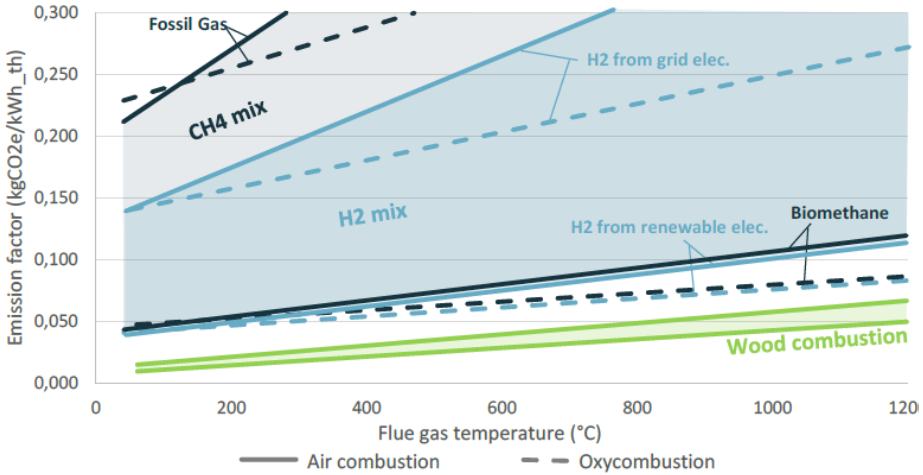


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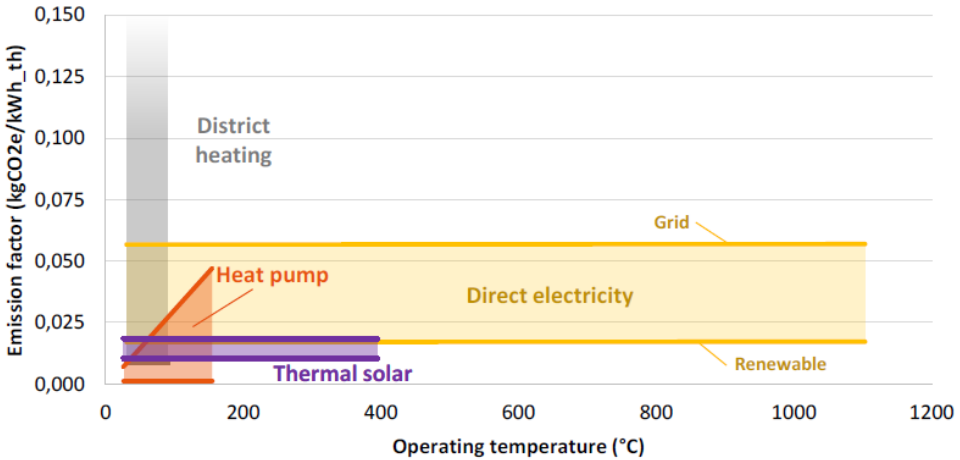


Figure 5 : Typical GHG emission factors for thermal energy generated by different systems and energy sources (source CETIAT)

Our areas of intervention

The levers for the industry's decarbonisation

