

# CCUS technologies perspective in France

Forum: How to improve France-Norway  
collaboration CCUS



Aïcha EL KHAMLICHI- Industry Department  
ADEME

La Défense, 23 mai 2019



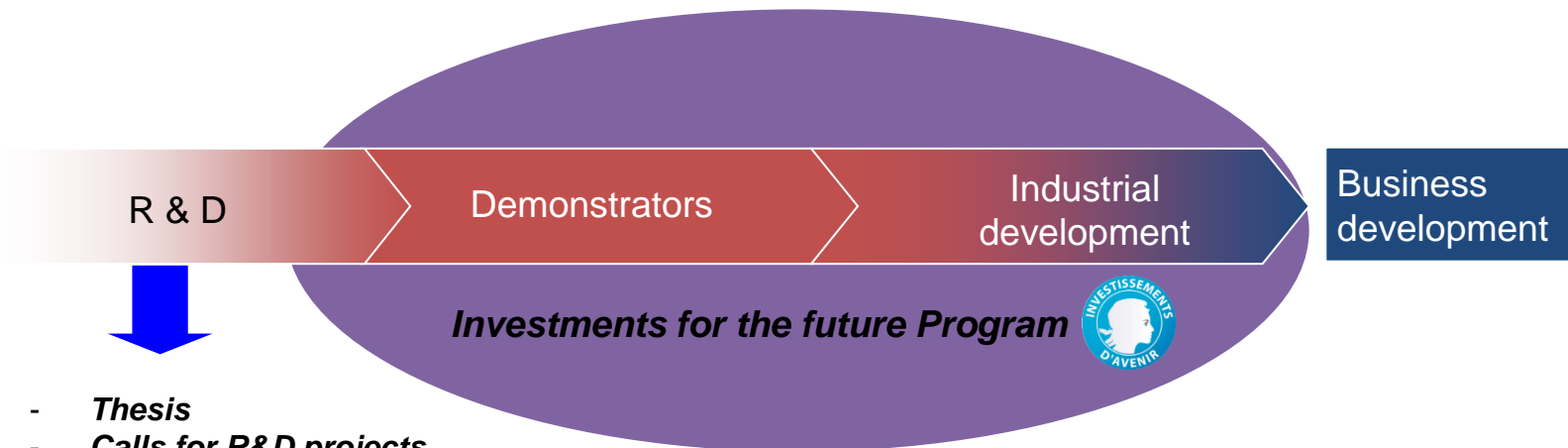
# French Agency of Environment and Energy Management

- Created in 1992, **ADEME is under the joint authority of the Ministry in charge of Sustainable Energy Transition & Energy and the Ministry in charge of Research**
  - **ADEME's objectives**
    - Program, finance and develop research and technological innovation
    - Give advice and expertise to companies, public authorities and individuals
    - Develop practical tools and disseminate best practices
    - Finance decision-making assistance, exemplary operations and dissemination projects
    - Share information, provide training and conduct communication campaigns
  - **Organization**
    - ~ 900 employees in 3 central services (Angers, Paris, Valbonne), 13 regional offices + 3 TOM and 1 office in Brussels
  - **Budget:**
    - Incentives (2018): 540 M€
    - Investments for the future (2010-2019): 4 bn€ -> on behalf of the government
- ~9 000 contrats / an

# ADEME: tools for financing innovation at different stages



- **R&D phase:** ADEME thesis, calls for R&D projects, contribution to European calls
- **“Investments for the future” program**
  - Demonstrators and industrial development
  - A ten-years program
  - Budget of € 4 bn operated by ADEME
  - Two ways of funding: State aid according to the European framework (subsidies and refundable grants) and capital investment



- **Thesis**
- **Calls for R&D projects**
- **European calls for projects**

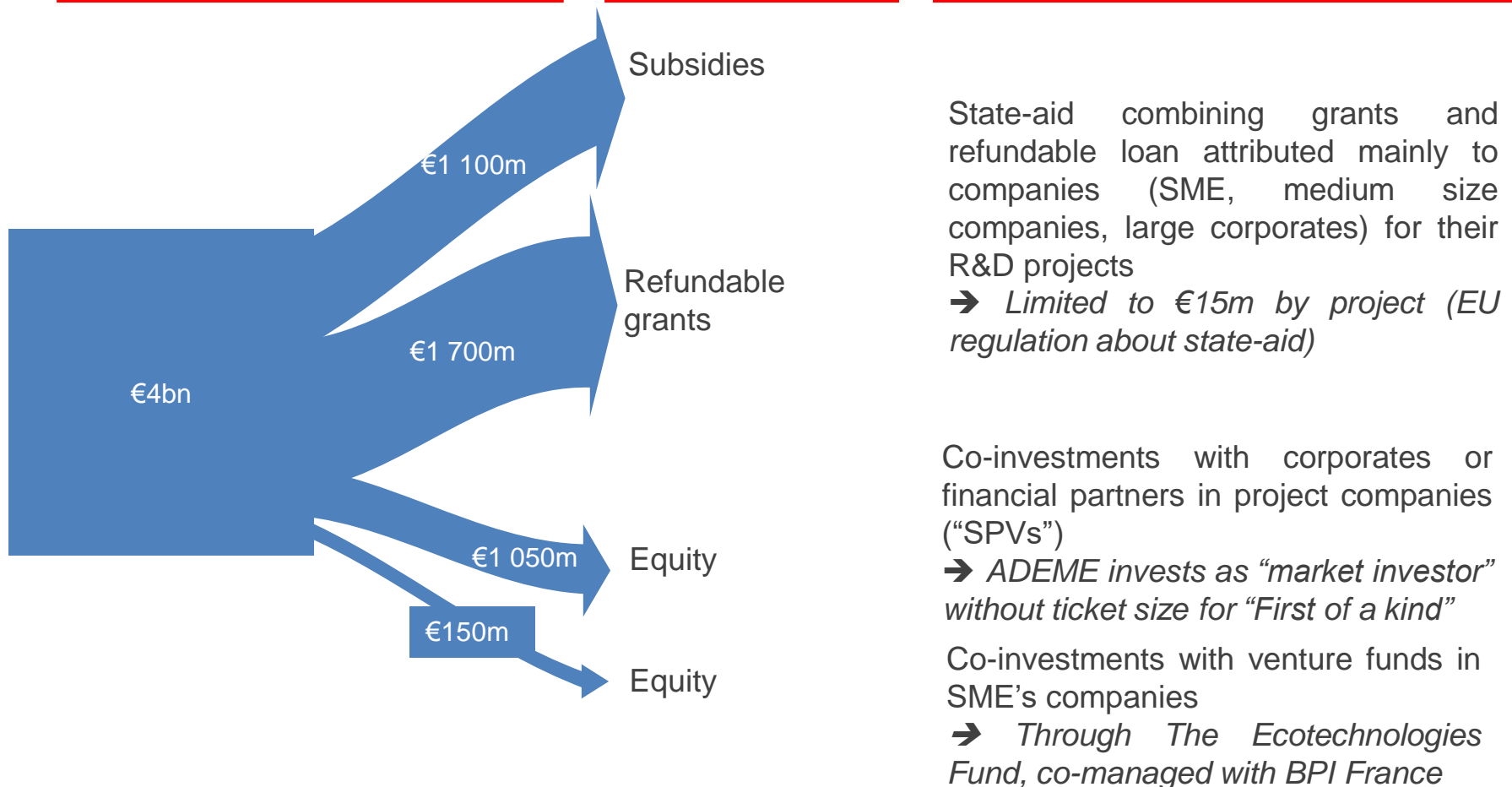
# ADEME is managing a €4bn program dedicated to environment and renewable energies sectors



“Investment for the future program”  
amounts split by financial tool

Financial tool

Comments



# Environment and renewable energies sectors covered



## Demonstrators for energy and ecological transition

- Geothermal energy
- Marine energy
- Solar energy
- Wind energy
- Bioresources
- Buildings
- **Carbon capture, utilisation and storage**
- Green chemistry
- Industries and agriculture
- Energy storage
- Hydrogen vector
- Smart grid
- Waste and industrial ecology
- Polluted sites remediation
- Water and biodiversity

## Transport for the future

- Electric vehicle and reloading infrastructure
- Hybrid and thermal power train
- Vehicle lightening
- Heavy trucks and buses
- Mobility and logistic
- Boats of the future
- Rail transportation



# Context: after Paris Agreement



## Europe: Long Term Strategy:

Include CCUS for Electricity, Industry and Transport (CCU)

CCS: one of the 7 blocks of the LTS

## 7 blocks

Energy Efficiency  
REN  
Transport  
Industry  
Infrastructure  
Bio-economy  
CCS

## France: SNBC- National Low carbon Strategy

Include CCUS for Industry and Transport (CCU)

CCS: one of the technology identified to reduce residual emissions in industries ( around 5 MtCO<sub>2</sub> by 2050)

BECCS: could help to reach the target of neutrality (potential of 10 MtCO<sub>2</sub> by 2050)

**Total : CO<sub>2</sub> emissions reduction with BECCS/CCS: 15 MtCO<sub>2</sub> by 2050**

# CCUS in France: storage capacity

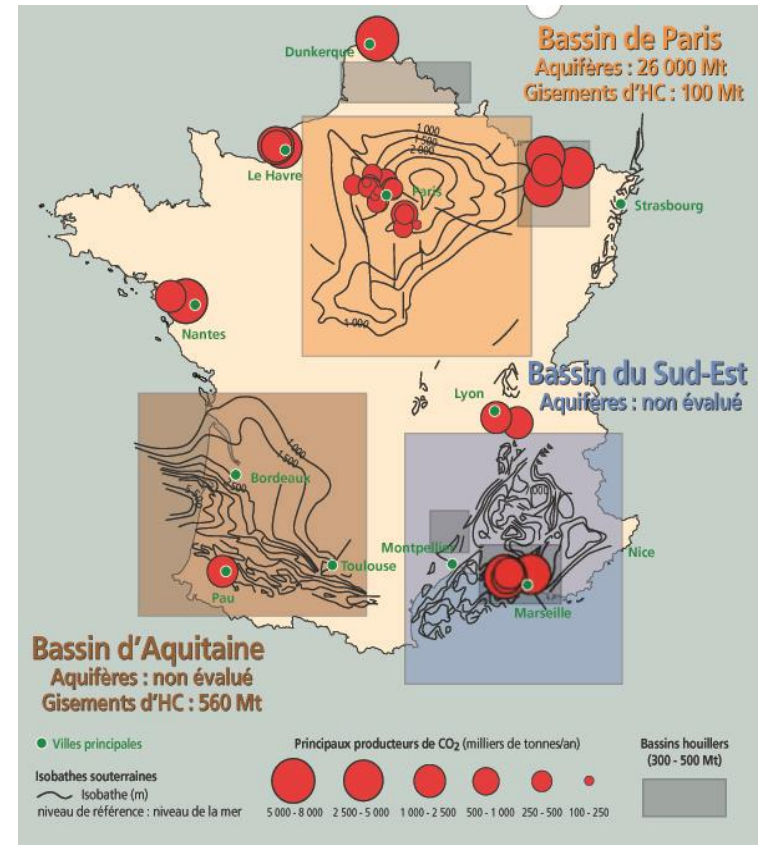


**Storage site** : capacity estimated around 1200 Gt by IPCC over the world

- Saline aquifer -> the higher capacity and the most distributed around the world
- Depleted gas/oil field
- Depleted coal bed

**In France:** capacity estimated around 27 Gt

- Saline aquifer : Paris bassin (Trias and Dogger) and Aquitain Bassin and South-East
- Depleted gas/oil field: Paris Bassin (Trias and Dogger)
- Depleted coal bed



# CCUS in France: storage projects



Study on prefaisability of CCUS integrated chain in Le Havre

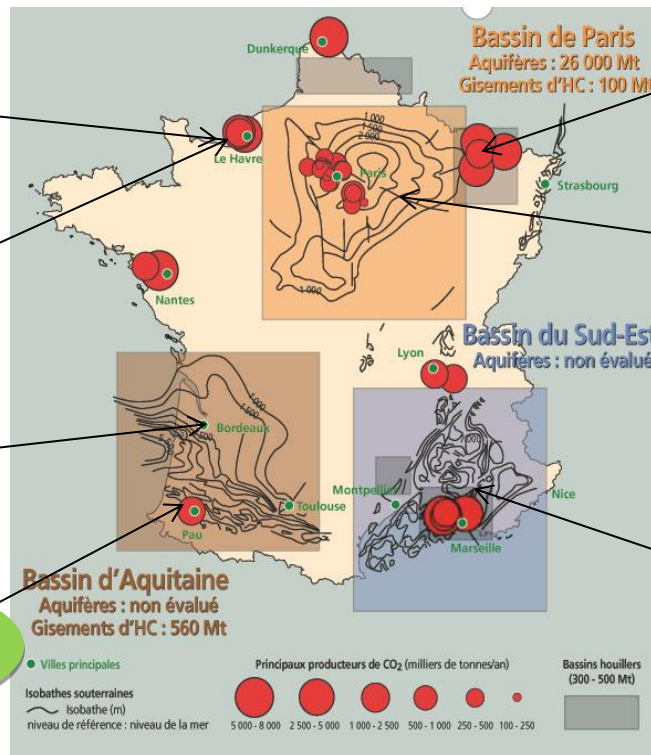
**DEMOCO2**  
Development of monitoring tools for geological storage  
Univ of Bordeaux

**Lacq-Rousse**  
Integrated CCTS pilot-  
60 000 tCO<sub>2</sub> stored  
**Total**

R&D

Demonstrator fund

Investment for future



**TGR – BF**  
Feasibility of Capture, transport and storage of CO<sub>2</sub> from Steel industry  
*ArcelorMittal*

**France Nord**  
Storage in saline aquifer  
**Total**

**VASCO**  
Study on prefaisability of CCUS integrated chain in Marseille area

Source BRGM (projet européen GESTCO)



# Focus: France Nord Project



- Joint Industry Project
  - Funded by ADEME
  - 4 public research institutes
  - 7 industrial partners
- Main goal:
  - Feasibility of CCS in the Northern part of Paris Basin (France)



Qualify, on the basis of available data a site to store at least 200Mt of CO<sub>2</sub> in the deep saline aquifers of the Paris Basin



All the result were largely under the objectives of the France Nord project

## Comparison with previous estimations

	JOULE II (1996)	Projets GESTCO (2003) et EU GEOCAPACITY (2009)			France Nord (2009-2011)
	Traps	Traps	Total	Conservative	Flow models
<b>Dogger</b>	189 Mt (E=0.18%)	9 Mt (E=0.01%)	4320 Mt (E=6%)	1440 Mt (E=2%)	Potential Conflict with geothermal resources
<b>Keuper</b>	529 Mt (E=0.18%)	130 Mt (E=0.18%)	4331 Mt (E=6%)	72 Mt (E=0.1%)	90-180 Mt
<b>Buntsandstein</b>	Conflict with fresh water	529 Mt (E=0.18%)	17640 Mt (E=6%)	5880 Mt (E=2%)	~ 90 Mt
<b>Other fm.</b>	91 Mt	-	845 Mt	530 Mt	-
<b>TOTAL</b>	809 Mt	668 Mt	27136 Mt	7922 Mt	180-270 Mt

# CCUS in France: capture projects



**CRYOCAPT™**  
CO<sub>2</sub> cold capture system  
on hydrogen production  
plant  
100 000 tCO<sub>2</sub>/year  
*Air liquide*

**IGAR**  
Validation at demonstrator  
scale of reducing gas steel  
injection in blast furnace  
*ArcelorMittal*

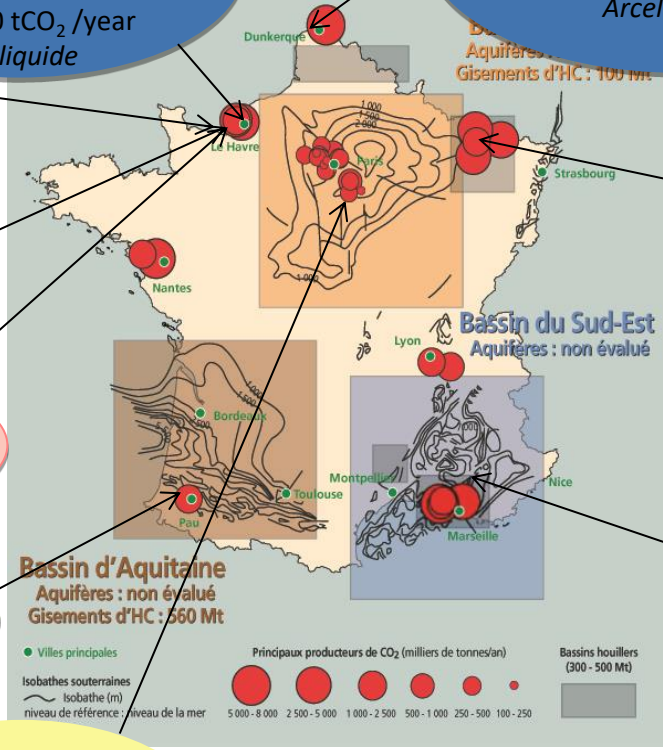
**TGR – BF**  
Feasibility of Capture,  
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*ArcelorMittal*

Study on prefaisability  
of CCUS integrated  
chain in Le Havre

**C2A2**  
Coal - Advanced amine  
capture  
1t CO<sub>2</sub>/hour  
*EDF, ALSTOM*

**Lacq-Rousse**  
Integrated CCTS pilot-  
60 000 tCO<sub>2</sub> stored  
*Total*

**VASCO**  
Study on  
prefaisability of CCUS  
integrated chain in  
Marseille area



R&D

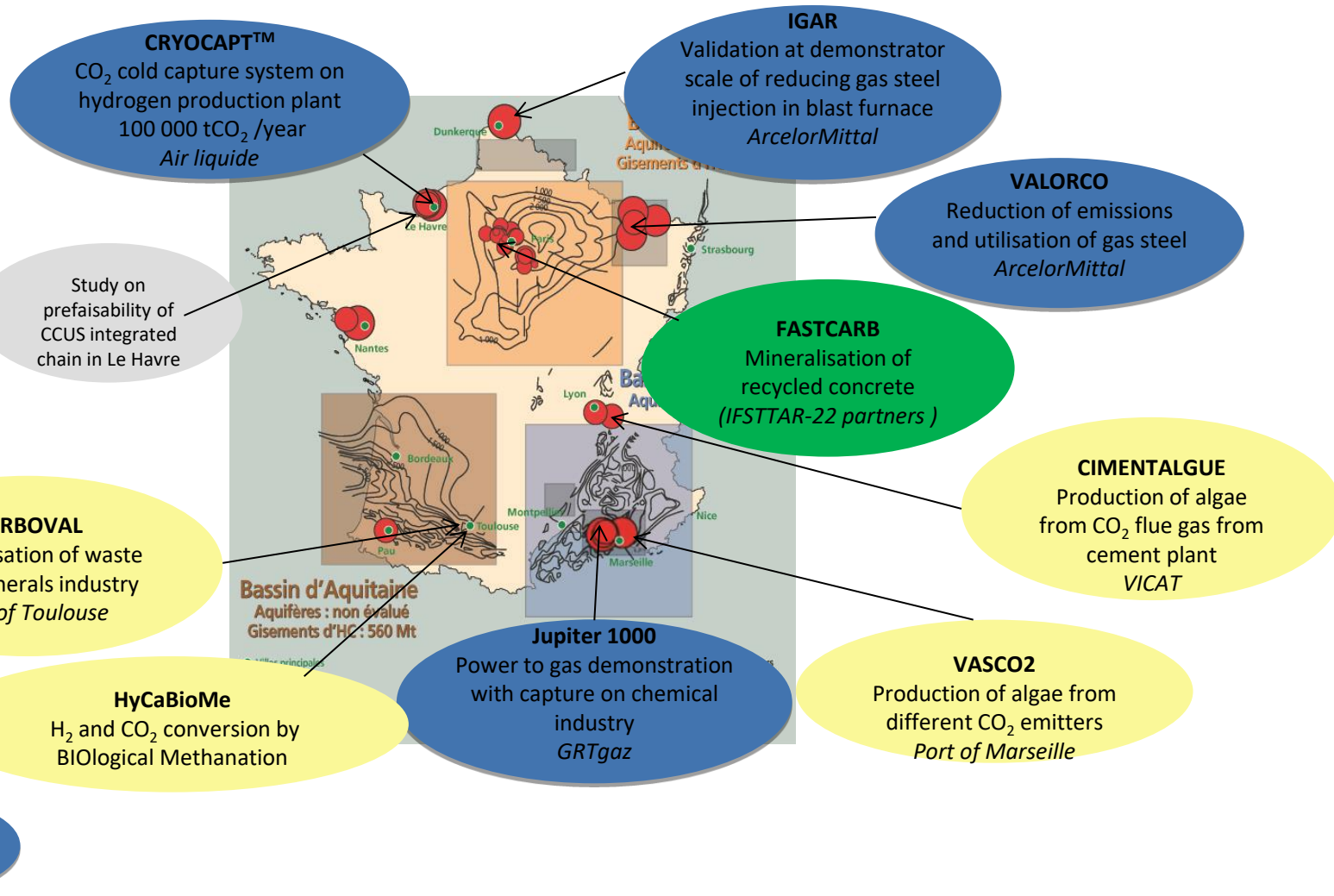
Demonstrator  
fund

Investment for  
future

**CALICE**  
New capture  
technology using  
porous materials  
*BRGM*

Source BRGM  
(projet européen GESTCO)

# CCUS in France: CO<sub>2</sub> utilisation projects



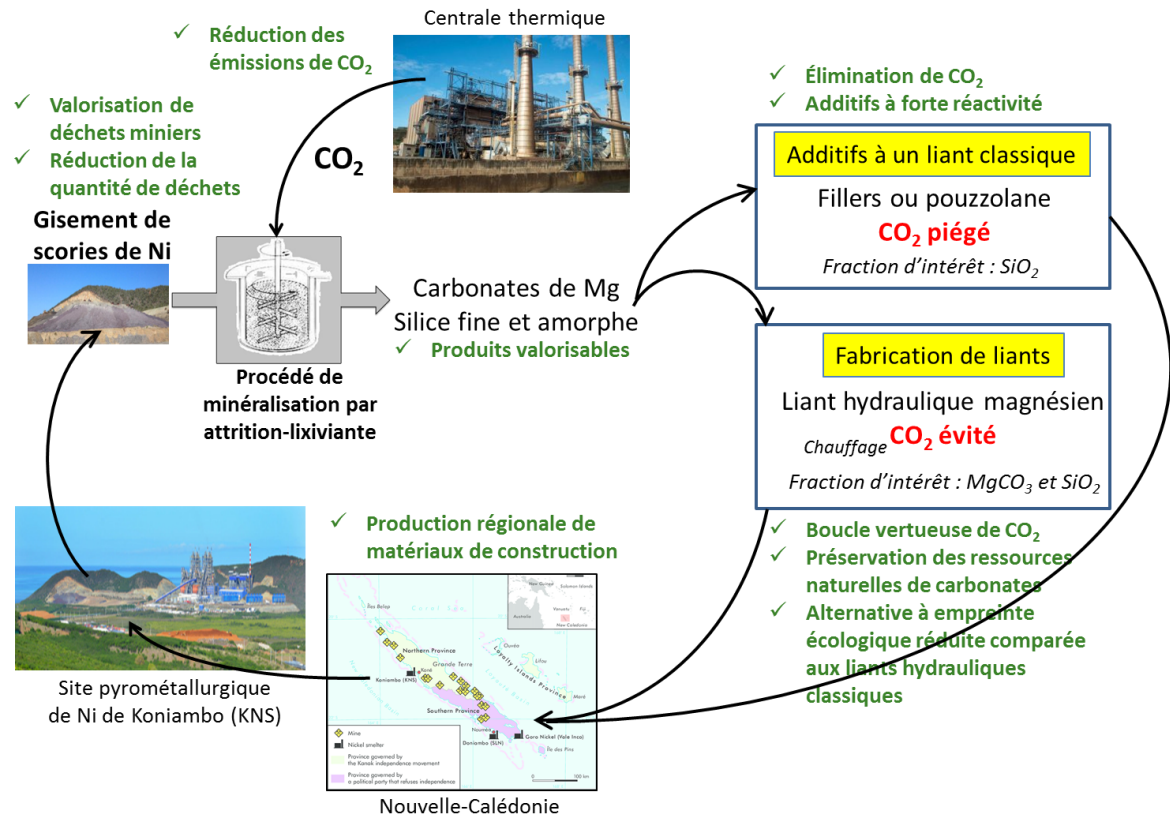
# Focus: CARBOVAL Project



- CARBOVAL: Integration at territorial scale of the development of mineralisation technology

Project leader: laboratoire LGC


Partners: laboratoire LMDC,  
l'IFSTTAR, l'IRSTV,  
l'Université de Nantes,  
BGRM and CNRT



# CCUS in France: national background



- **European Climat- Energy Policy:**
  - Target 4 for France: 75% of GHG emissions reduction by 2050
- **National policy:**
  - Energy Transition Law for Green Growth, Circular Economy Roadmap
  
- **After Paris agreement: Revision of National Low Carbon Strategy to reach « carbon neutrality »**
  
- **Regulatory aspect:**
  - France transposed the European geological storage directive in 2012
  - London Protocol: not ratified by France to allow the CO<sub>2</sub> storage offshore (only 5 countries) -> undergoing
  
- **For industries: CCUS : one tool for CO<sub>2</sub> emissions reduction target**

 *consistent and recognized methodologies for the environmental assessment and quantification are required*



- **DGEC: French Energy ministry : member of Mission Innovation**
- **MESR: French Research ministry via participation to:**
  - ERANET ACT (CCS and CCU)
  - Initiative Phoenix on CCU ( Germany, Netherlands, France and Spain):  
*Main goal of PHOENIX is to build a business case with respect to CO<sub>2</sub> utilisation to ensure an optimal use of public funding and private investment*
- **ADEME : French representative for DGEC at IEAGHG and Mission Innovation, member of ERANET ACT on behalf of MESR**
- **Involvement in the workshop of MI (Houston,2017) and in the ISO/TC265 from French partners (ClubCO2 and academics)**

# Club CO<sub>2</sub>: the French team of CCUS



- **Club CO<sub>2</sub>** is a forum for exchanges of information and initiatives concerning CO<sub>2</sub> capture, transport, underground storage and re-use (CCUS) between industrial, research and local government players in France



Website: <http://www.captage-stockage-valorisation-co2.fr/>

# Upcoming

- Potential projects with norwegian partners:
  - ACT -2 : new projects will be funded with french and norwegian partners
  - 3D project with ArcelorMittal as coordinator (H2020) (include norwegian partners)
  - Potential CO<sub>2</sub> hub at Dunkirk with storage in North Sea







**Thank you for your attention  
so next?**

Projects ' description are available on the website of ADEME:

[www.ademe.fr](http://www.ademe.fr)

*[aicha.elkhamlichi@ademe.fr](mailto:aicha.elkhamlichi@ademe.fr)*

