

Renewable Energy :The Future of Biofuels

January 20, 2017



ADEME



Agence de l'Environnement
et de la Maîtrise de l'Energie

Presentation outline

I- Introduction to the Investment for the Future Program

II- Example of projects funded

III- Bio-sourced chemistry & Investment for the Future Program

ADEME is a public body dedicated to renewable energies and environment

French Agency for Environment and Energy Management (ADEME)

- Public body created in 1991
- Around 1,000 employees



3 main missions

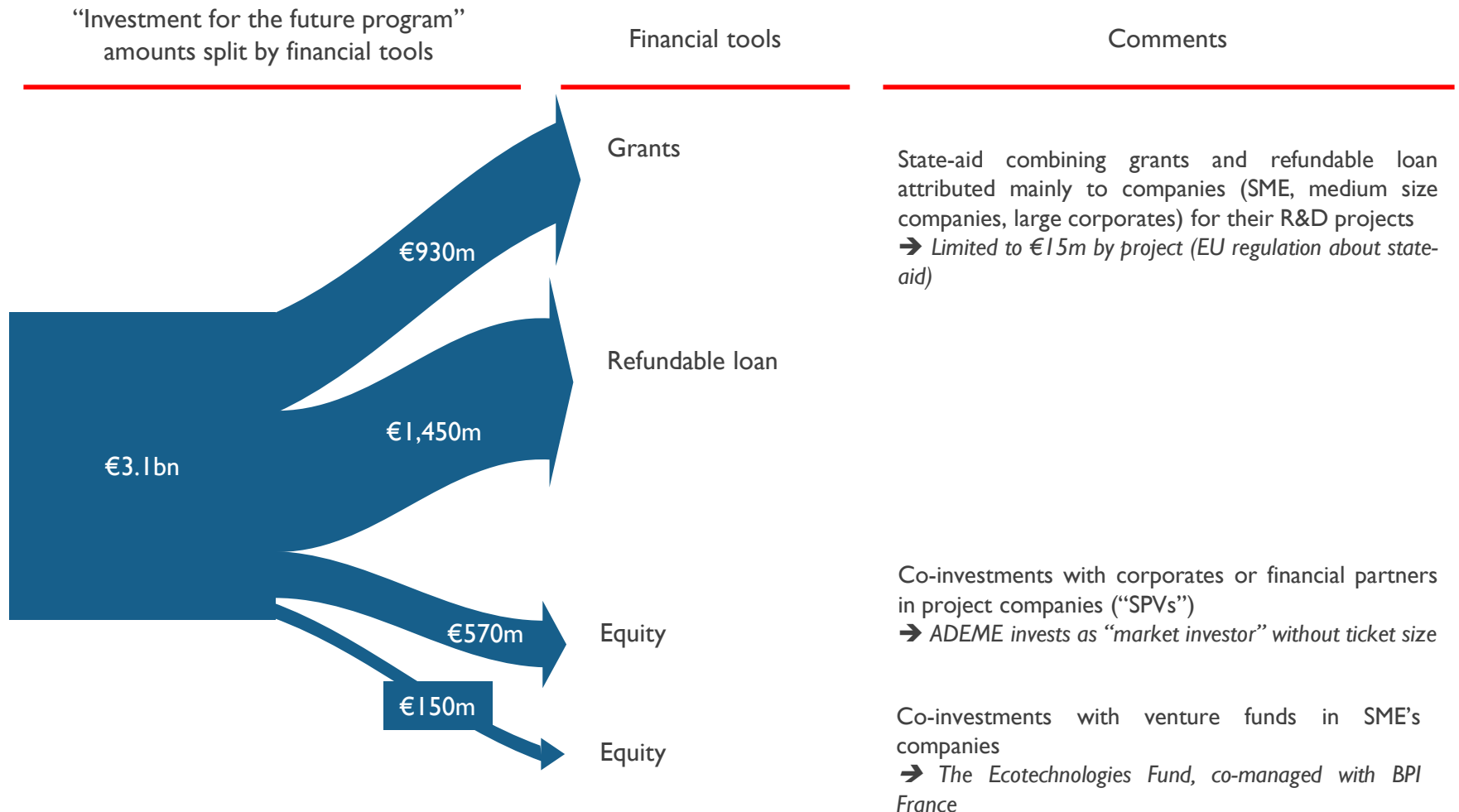
- Promoting new solutions for transition through Research, Innovation and Experimentation
- Providing expertise for public and private actors
- Supporting the generalization of good practices for energy transition among all actors

2 main levers

- Own budget (€590m p.a.)
- “Investissements d’Avenir /Investment for the Future Program” (multiyear program)
 - €3.1bn for innovation in energy transition



ADEME is managing a €3.1bn program dedicated to environment and renewable energies sectors



22 topics covered by ADEME's Investment for the Future Program

Low carbon energies (15 topics)

Wind energy	Eco-efficient building sector
Solar energy	Eco-efficient industrial process
Marine renewable energies	Bio-based chemistry
Geothermal energy	Waste treatment
Hydrogen	Water treatment
Smart grids	Sites and soil decontamination
Energy storage	Biodiversity
CO ₂ capture and storage	

Future transportation vehicles (7 topics)

Electric vehicles
Thermal and hybride engines
Vehicles weight reducing
Heavy vehicles
Logistic and mobility
Rail transport
Future ships



Objectives

- Fostering innovation in environment and energy
- Public / private risk sharing for marketing of innovative technologies and services

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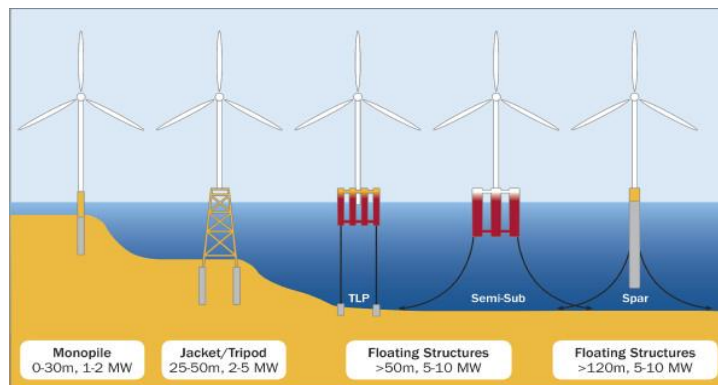
Call for financing of pilot floating wind farms

Pilot floating wind farms



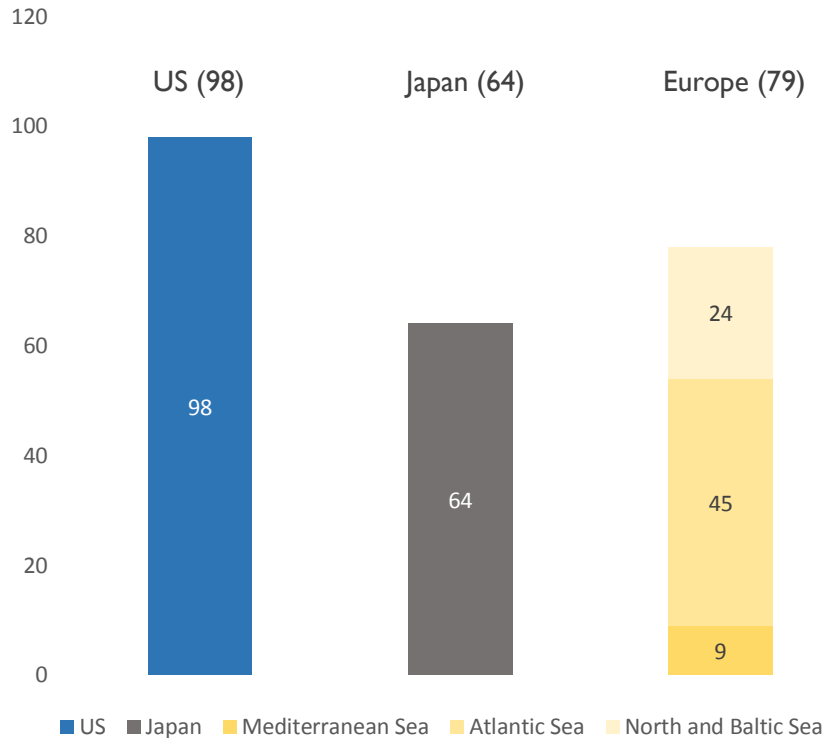
- **Floating offshore wind**
 - Market segment of the offshore wind market
 - Horizontal axis WTG & a floating foundation
- **Well adapted to deep water zones (>50m)**
 - Increasing distance to shore (higher winds and local acceptability)
 - Deep seas (Japan, US Pacific coast, Mediterranean) or complex sea beds (China)
- **A way to maximize the offshore wind LCOE ?**
 - Higher yield (winds > 8m/s)
 - Installation cost reduction (low geotechnical studies cost, no need for heavy installation vessels, less dependency to weather windows)
 - Trend for larger capacity turbines (6-10 MW)

Offshore Foundations type by water depth



Floating wind market

Main geographic markets (in GW)



Source : Etude BearingPoint

■ Main markets by countries

- US, Japan and Europe
- South China Sea (China, Taiwan)
- Other : Chile, India, Spain, Portugal

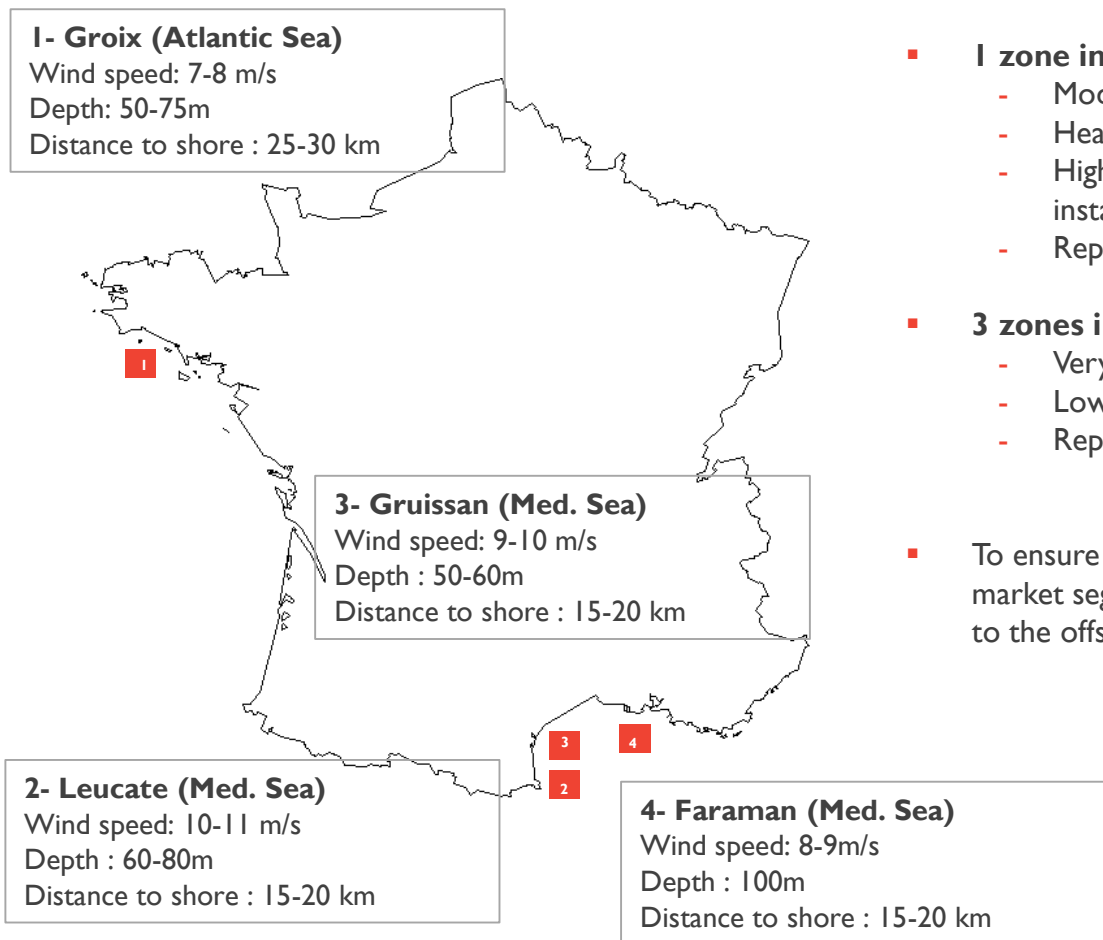
■ UK has the highest potential in Europe

- Scotland and Northern Ireland
- France : 2nd European Market (Atlantic and Mediterranean seas)

■ When will the floating wind market take-off?

- From now to 2020 : pilot wind farms (<10 WTGs)
- Around 2025 : first commercial floating wind farms (50-100 WTGs)
- 2030 : Commercial market take-off

Pilot wind farm call: 4 selected development areas



- 4 areas selected before the call for financing
- **1 zone in Brittany**
 - Moderate wind speed
 - Heavy swell
 - High dependency to weather conditions during installation and maintenance phase
 - Representative to « open sea » market conditions
- **3 zones in Mediterranean sea**
 - Very high wind speed
 - Low swell
 - Representative to «closed sea » market conditions
- To ensure a pre-commercial track-record on two different market segments (« open » vs « closed seas » conditions) to the offshore floating wind industry

4 pilot farms financed

Project Name	Sponsors	Zone	WTG (installed capacity)	Floating foundation manufacturer and type	Picture
GROIX	Eolfi & CGN EE	Atlantic Sea	GE (4 x 6 MW = 24 MW)	DCNS (semi-sub)	
EOLMED GRUISSAN	Quadran	Med. Sea	Senvion (4 x 6,15 MW = 24,6 MW)	Idéol (damping-pool)	
PROVENCE GRAND LARGE	EDF EN	Med. Sea	Siemens (3 x 8 MW = 24 MW)	SBM Offshore (tension-leg platform)	
EFGL	ENGIE & EDPR	Med. Sea	GE (4 x 6 MW = 24 MW)	Principle Power (semi-sub)	

- **4 projects financed by means of**
 - State-aids (grants and refundable advance) for €300m
 - Feed-in tariff for electricity produced
- **3 types of floating foundation technology**
 - Semi-sub (steel / steel-concrete)
 - Damping pool (concrete)
 - Tension leg platform (steel)
- **Yards and O&G companies consider offshore wind (fixed and floating) as a new growth driver**

ADEME's SPV equity tool

ADEME's SPV equity tool

Project	Type of investment	Description	Type of financing	Pictures
Exosun	Direct investment in SME with a PE fund	Solar trackers for utility-scale power plants	Venture capital	
Alstom Offshore France	Joint-venture with GE (ex- Alstom)	Mass-production of offshore high-power wind turbines generators (WTG)	Production plant financing	
Hybrid Air	Joint-venture with PSA	Development of a new type of a full hybrid gasoline system	R&D financing	
Areva H2 Gen	Direct investment in SME with Areva	Mass-production of PEM water hydrogen generators	Venture capital	
Ecotitanium	Joint-venture with Eramet	Recycling of aviation grade titanium	Production plant financing	
Enersens	Direct investment in SME with PCAS	Development and mass-production of silica aerogels	Venture capital	
Speedinnov	Joint-venture with Alstom Transport	Development of a new high-speed train technology	R&D financing	
Merkur	HoldCo with GE	Offshore wind farm located in Germany using GE's new 6MW WTG	Infrastructure project financing	



- Minority investments (<49% of share capital)
- In the name and in behalf of the French State as a “market investor” → specific requirements on investments return and liquidity
- 8 investments for a total amount exceeding €300m

Presentation outline

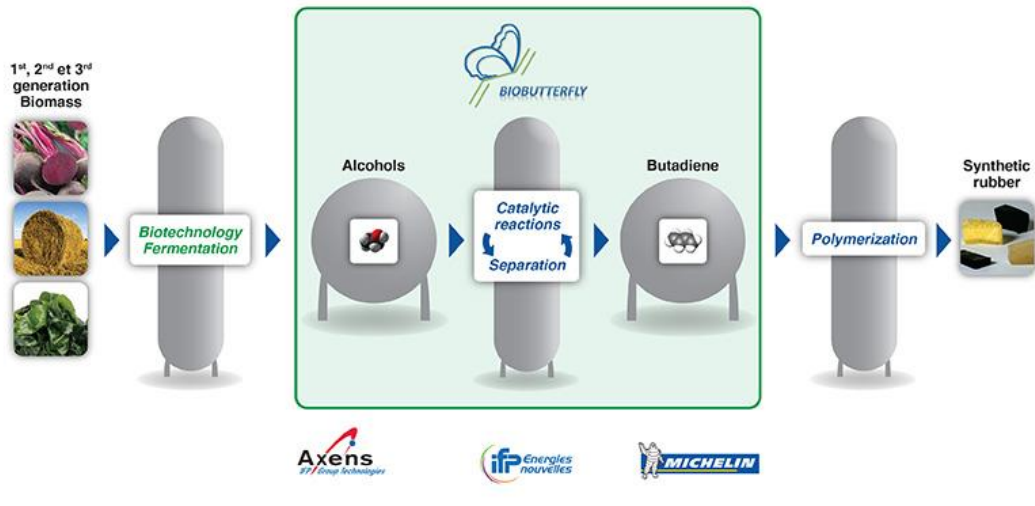
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Example: BioButterfly

Latest innovation: the “BioButterfly” Project



- Need to find sustainable alternative sourcing channels for elastomers
- Objective: production of an environmentally-friendly synthetic rubber
- Technology: butadiene synthesis based on bio sourced alcohol

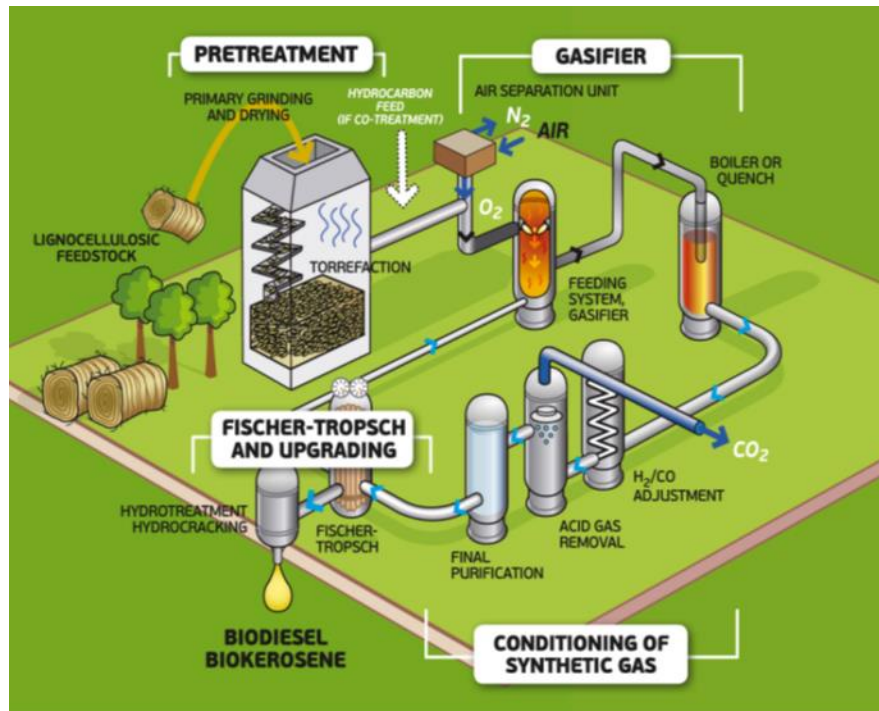
Collaborative project

- 3 partners (Axens, IFPEN, Michelin)

Large scale project

- From R&D to the industrial demonstrator
- €52m project with €14.7m of subsidies (grants and refundable loans)

Example: BioTfuel



- Developing and marketing an end-to-end chain of technologies for converting biomass into 2nd generation biofuels via thermochemical conversion
- **Objective** : Produce 200,000 metric tons of renewable diesel and jet fuel per year from one million metric tons of biomass by 2020
- **Process** : 4 steps
 - Biomass pre-treatment and torrefaction
 - Gasification
 - Syngas clean up and conditioning
 - Fischer-Tropsch synthesis and upgrading
- Main technological risks are the biomass torrefaction (at large scale) and the syngas conditioning (important R&D expenses). FT technology is proven

Collaborative project

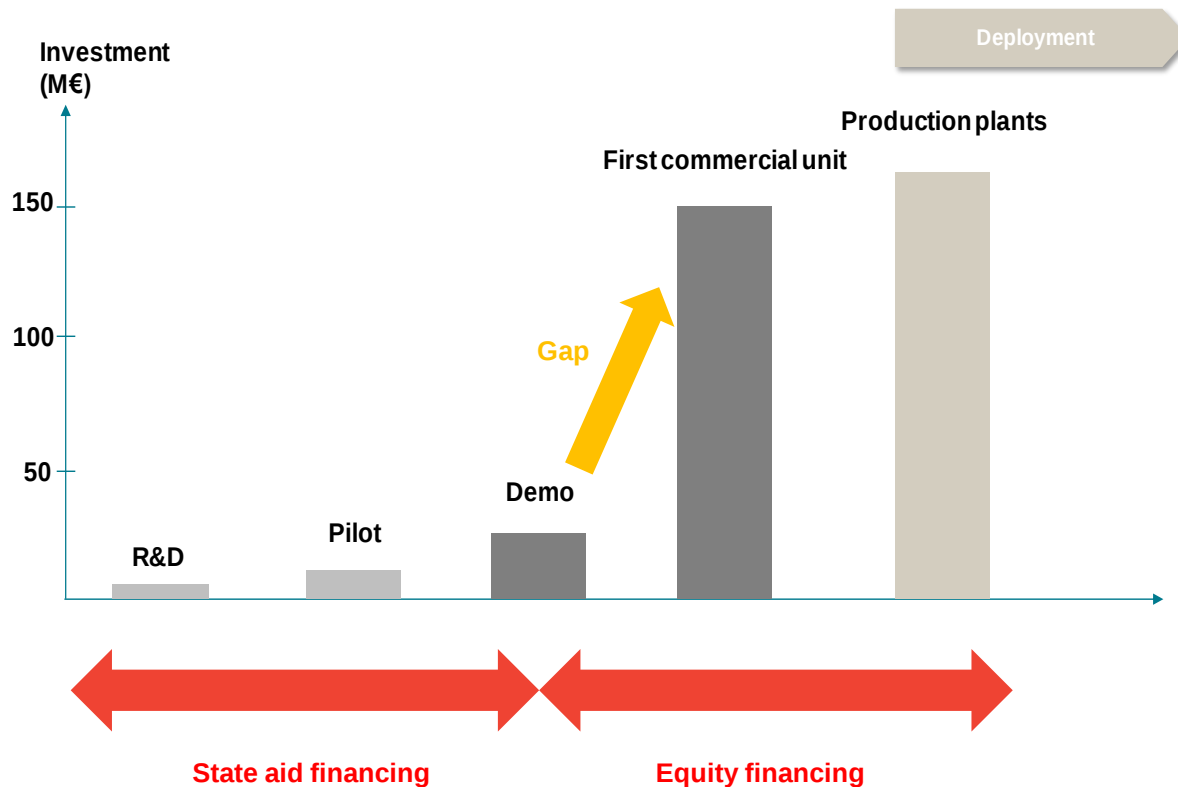
- 6 partners

Large scale project

- After 5 years R&D, construction of a demonstrator in Dunkirk
- €113m project with €33.3 of state-aids (grants and refundable loans)



Bio-sourced chemistry sector financing



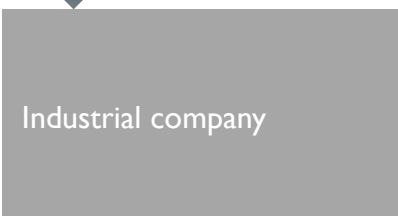
- Since 2005, direct R&D subsidies and refundable loans from French State (via Agence Nationale de la Recherche, PSPC, Investment for the Future Program):
 - €40m on the sourcing
 - €600m on processes
- Financing of industrial demonstrator and first commercial unit requires high CAPEX and characterized by first operating years negative cash flows
- Best way to finance high CAPEX units: equity financing (private / public risk sharing) as venture and PE funds are reluctant to invest

Example of a potential demonstrator equity financing

Structure



Tolling agreement
& other contracts
(accounting, tax, legal, ...)



Main activities

- Owns the industrial asset
- Operates the unit versus “tolling fee”

- Responsible for R&D
- Markets and sells the SPV’s output

ADEME SPV’s tool fully operational

- More than €300m invested / committed in equity
- Few projects with large amount invested
- Flexible tool

A Market-like investor tool well adapted to bio-sourced chemistry sector

- Subsidies are limited by the EC framework on state aids (art 107-3 c/ of the Treaty) in terms of intensity of public financing and more specifically for green chemistry in terms of eligible costs (limited to ‘pure’ r-d activities)
- Over this limit, the only capacity for State intervention is within the principle of the “market-like investor”