Country Report France
IEA Bioenergy Task 42

Alba Departe

ADEME - Direction Productions et Energies Durables
20 avenue du Grésillé
BP 90406 - 49004 Angers cedex 01
France

Web : ademe.fr

List of content

Country introduction

In 2007, the European Commission has settled ambitious goals for 2020, in order to fight against global warming, and notably:

- cutting off at least 20 % of the greenhouse gas emissions in the industrial sector (year 1990 as the baseline),
- increasing at least up to 20 % the share of renewable energy in the total consumption of the European Union.
- reducing at least 20% of the primary energy use, by improving energy efficiency.

To achieve these goals, the European Union Member States adopted in April 2009 a directive promoting the use of energy from renewable sources (2009/28/EC). The is a global goal for the European Union and Member States have been assigned differenciated objectives to comply with the global target of 20% share of renewable energy. France has been assigned a 23 % share target of renewable energy in the national energy consumption. Among the measures, the directive also targets on a minimum use of 10% of renewable energies in the total fuel consumption of the transport sector by 2020.

At a national level, France has been working on an ambitious strategy to develop renewable energies since 2007. Between July and November 2007, a large stakeholder consultation, called «Grenelle de l'environnement» has been carried out, in order to define the priority goals concerning energy management and renewable energy development. This consultation has resulted in the definition of several measures and objectives in order to reach the objective of 23 % of renewable energy. As a result, two laws have been ratified: Grenelle1 (orientations and objectives) in 2009 and Grenelle2 (measures and implementation) in 2010.

Energy production and consumption based on biomass

Current energy production and consumption (mtoe)
Source: (SOeS 2009)

- Total national primary energy production in 2008: 5736 PJ
- Total national primary energy consumption in 2008: 11472 PJ

Current production of renewable energy and energy from biomass
Source: (SOeS 2009)

Total national primary renewable energy production in 2008: 879 PJ**,** ie 15.3 % of the national primary energy production:

- **Energy from biomass: 544 PJ** (9.5 % of the total primary energy production)
  - Power and heat: 415 PJ
  - Biofuels: 84 PJ
  - Biogas : 29 PJ (heat and power)
  - Others (farm residues) 17 PJ

- **Other renewable energies: 322 PJ** (5.6% of the total primary energy production)
  - Water power : 230 PJ
  - Urban waste combustion: 50 PJ
  - Others (wind power, heat pump, geothermal heat, solar heat and power): 42 PJ

Remark: *these figures are different from the global data given by the SOeS (795 PJ of renewable energy production in 2008) because the latter don't take into account the power generated from wood and biogas.*

Table FR1. Import/export of biomass for bioenergy (in ktons)

Unit: ktons	National production (for energetic use)	Importations (ktons)		Exportations (ktons)		Net balance
Figures for 2006		**EU**	**Non EU**	**EU**	**Non EU**	
Wood and residues from forest exploitation	29 030	43.1	1.4	551.1	8.6	28 515
Wood residues from wood transformation industries (sawmills, recycling), coproducts of the pulp and paper industrie (black liquors)	30 748	1 613.4	172.9	1 631.0	313.0	30 590
Agricultural crops (cereals, oilseeds, corn, sugar beet)	3 453	0	0	0	0	3 453
Agricultural byproducts (straws, manure, animal fats, oilseed cakes…)	1 273.5	0	0	45.2	0	1 228.3

Source: (France National Renewable Energy Action Plan, 2010)

Table FR2. Consumption and import of liquid biofuels

Unit: PJ	National consumption	National production	Importations (EU and non EU)
Figures for 2008			
Bioethanol	17.2	15.7	1.5
Biodiesel	78.5	65.7	12.8
Total	95.7	81.4	14.3
Estimation for 2020			
Bioethanol	27.2	25.1	2.1
Biodiesel	119.3	102.6	16.7
Total	146.5	127.7	18.8

Sources: (France National Renewable Energy Action Plan, 2010; SOeS, 2010)

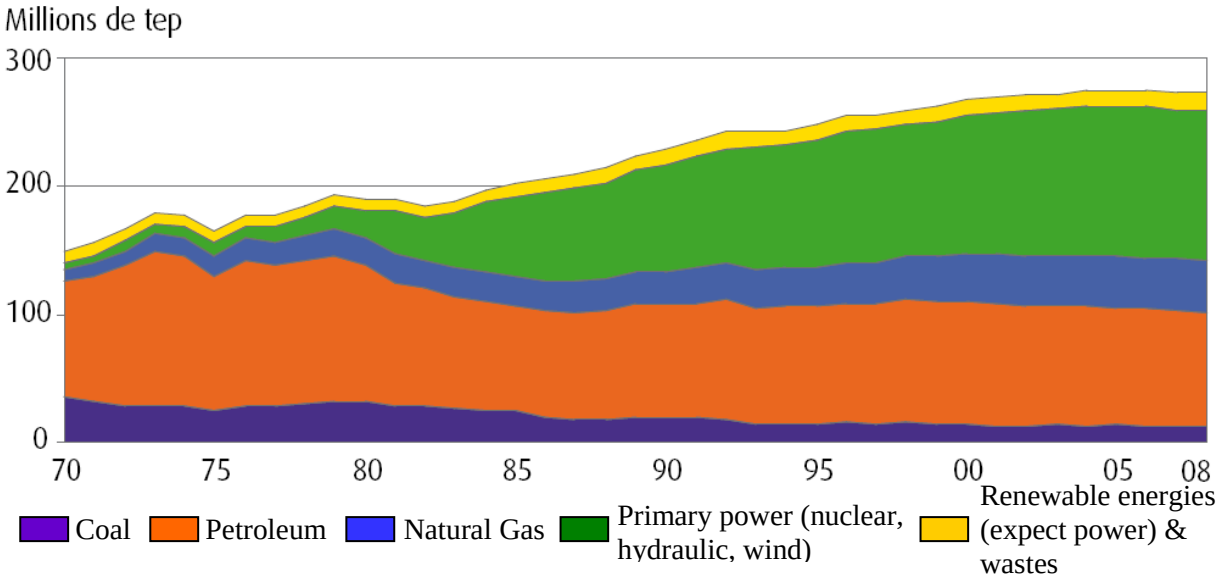

Figure FR1: Historical trend for French energy consumption *(source: SOeS, 2010)*

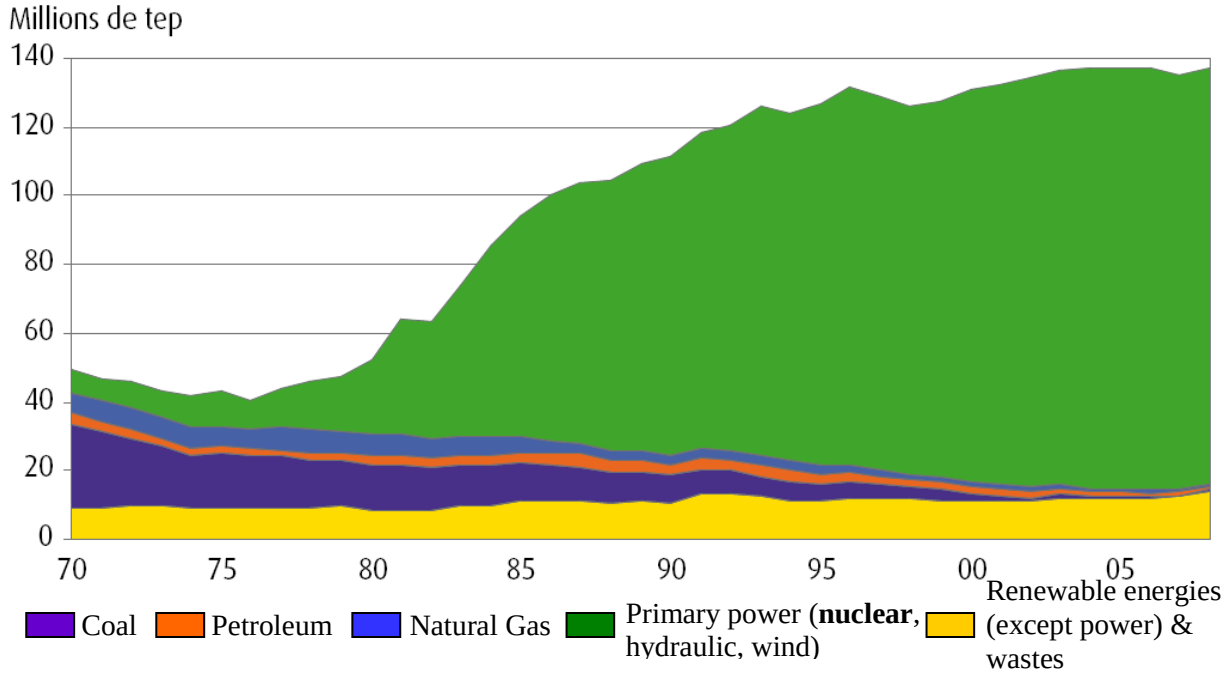

Figure FR2: Historical trend for French energy production *(source: SOeS, 2010)*

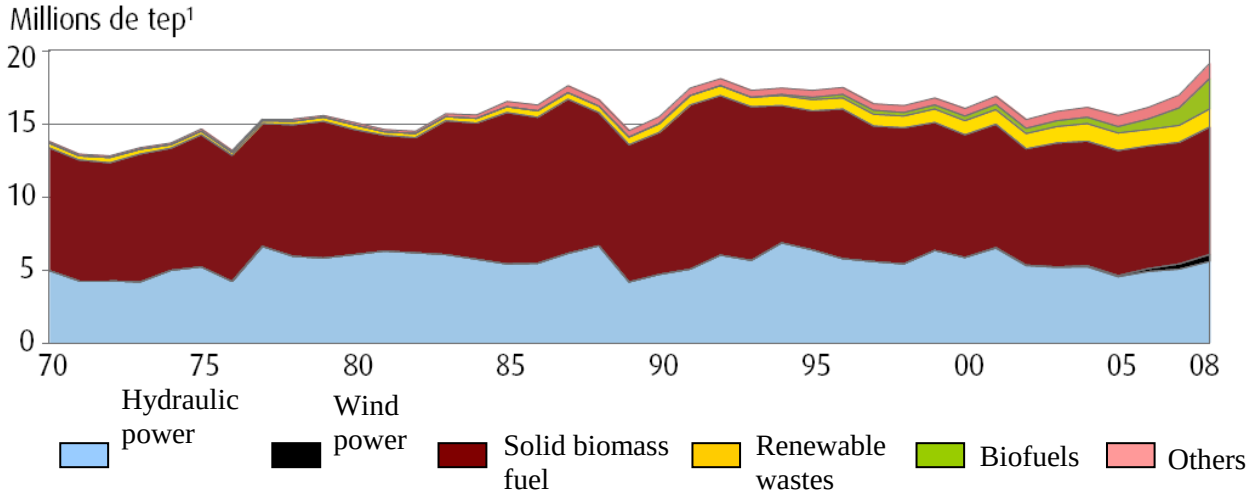

Figure FR3: Historical trend for French energy production of renewable energies (heat and power) and wastes *(source: SOeS, 2010)*

Table FR3. Current bioenergy production in France:

Use	Year	Unit	Amount	% of total bioenergy	Feedstock(s)	Number of plants
Power	2008	PJ	51	9.4	Wood and forest residues	n.a.
Heat	2008	PJ	364	67.4	Wood and forest residues	n.a.
Bioethanol	2008	PJ	16	2.9	Sugar beet	15
Biodiesel	2008	PJ	66	12.2	Rapeseed and sunflower	19
Biogas	2008	PJ	29	5.3	Landfill, sewage	n.a.
Other	2008	PJ	15	2.8	Farm residues (straws...)	n.a.

(SOeS, 2010). Metropole seulement. EurObserv'ER (2010), SNPAA.

Table FR4. Breakdown of French biomass energy use on feedstock:

Source	Year	Unit (Mm^3 or kton)	Amount	% of biomass energy reported above
Round wood	**2006**	kton	23 200	n.a.
Forest wood chips	2009	Kton	300	n.a.
Wood industry residues (sawmills)	2009	Kton	530	n.a.
Wood pellets/briquettes	2009	Kton	305	n.a.
Sludge	**2006**	Kton	1000	n.a.
Black liquors			n.a.	n.a.
Wastes (organic fraction)	**2006**	Kton	12950→ incineration* 147 → methanation	n.a.
Straw/agricultural residues	2008	Kton	11 (pour prog Bois Energie collectif)	n.a.
Sugar beet	2009	kton	3700	n.a.
Cereals (grain, corn)	2009	Kton	1420	n.a.
Oilseeds	2009	kton	3400	n.a.
Others : (life ending wood products)	2009	Kton	500	n.a.

* only 50% of the energy produced from incineration is considered as renewable.

Sources:(France National Renewable Energy Action Plan, 2010); (SOeS, 2010); CGB, Meunerie française; (ADEME, 2009); (FranceAgriMer, 2010)

Biomass used for non-energy purpose

Table FR5. Use of biomass for non-energy purpose:

Use*	Year	Unit	Amount
Wood for particle boards	**2007**	Mt	6.8
Wood for pulp and paper	2009	Mt	6.3
Wastes from pulp and paper	2009	Mt	0
Chemicals from biomass	**2005**	Mt	0.16
Cereal production	2009	Mt	70.2
Sugar production	2009-2010	Mt	4.7
Starch production	2008-2009	Mt	2.8
Oilseed production	2009	Mt	7.4
Algae production			n.a.

Sources: Agreste, Usipa, Copacel, FBCA, ADEME, Alcimed

1) Materials / chemicals

Breakdown of chemicals from biomass - **159 ktons produced in 2005:**
(Source: ADEME, Alcimed, 2007)

- Biolubricants: 1 ktons (in 2005)
- Surfactants: 110 ktons
- Solvents: 8.7 ktons
- Materials :
    - Polymers : 10 ktons
    - Composite materials (they're not included in the previous table, as they're not 100% biobased) : 18.5 ktons
- Vegetal inks : 10 ktons
- Vegetal paints : 19.5 ktons

The figures above come from a study carried out by Alcimed in 2007. This study, covering the whole bio based markets for materials and chemicals, is the more recent currently avaibable.
Other studies have been carried out from that time but they only cover specific applications fields.

The starch industry activity has been decreasing the past years, due to some difficulty in the pulp and paper industry.

2) Feed (harvest 2009/2010):

- Cereals *(source: FranceAgriMer, 2010):* 10.4 Mt
    - Wheat: 5.3 Mt / Corn: 2.6 Mt / Barley: 1.7 Mt / Others: 0.8 Mt
    - The trend is given in Figure FR4

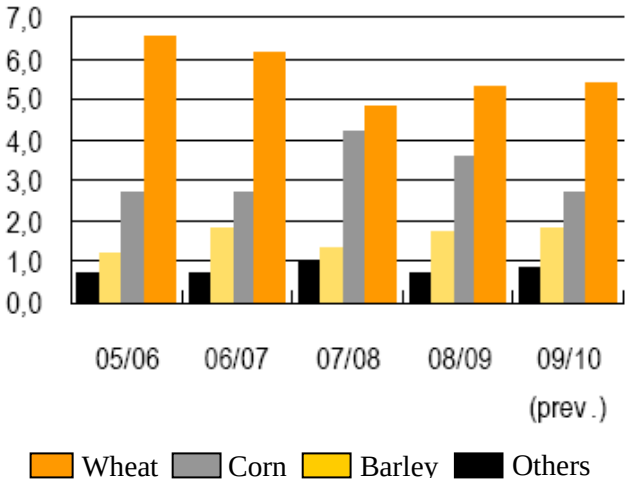

Figure FR4: Cereals used in the feed industry, in Mtons *(source: FranceAgriMer, 2010)*

Between the harvest of 2008 / 2009 and 2009 / 2010, the volume of cereals for the feed industry has decreased (10.96 Mt in 2008/2009). This decrease mainly concerns the corn (-25% between 2008/2009 and 2009/2010). This evolution is due to two factors: a decrease in the animal production and an increase in the use of products directly produced at the farm.

- oilseeds - whole grains (source: FranceAgriMer, 2010): 0.23 Mt
    - Rapeseed:165 ktons / Soy: 50 ktons / Sunflower: 15 ktons
    - Trend is given in Figure FR5

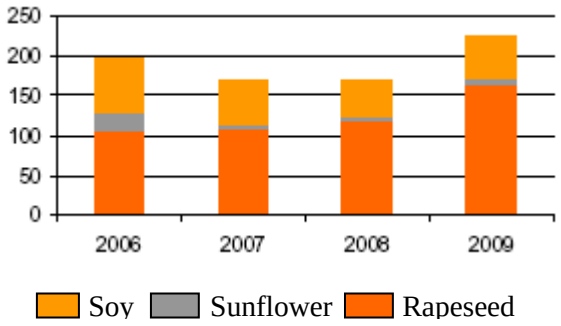

Figure FR5: Oilseeds used in the feed industry, in Mtons *(source: FranceAgriMer, 2010)*

Policy issues related to biomass, bioenergy or biorefineries

Policy targets for energy – renewable energy, bioenergy, biofuels

Member States of the European Union adopted in April 2009 a directive promoting the use of energy from renewable sources (2009/28/EC). France has been assigned by the EU to reach a 23 % share of renewable energy in the national total energy consumption by 2020. To reach this target, France will have to produce a supplement of 879 PJ of renewable energy (baseline: 2006), among other measures (reduction of the global consumption...). In the framework of the ”Grenelle de l’Environnement” (large stakeholder consultation, see introduction), a pathway has been

established, describing how the different renewable energy technologies will contribute to the 879 PJ supplement. This scenario is still relevant today.

Table FR6. Breakdown of the 879 PJ supplement on renewable energies (in PJ):

	2006	2020	Supplement
Renewable energy	670	1549	+ 879
Of which Biomass:	410	879	+ 469
- Renewable heat	373	653	+ 281
- Renewable power	8	59	+ 50
- Biofuels	29	167	+ 138

Still in the measures taken by the European Union concerning the promotion of the renewable energies, the directive (2009/28/CE) targets on a minimum use of 10% of renewable energies in the total fuel consumption of the transport sector by 2020. Biofuels will be the major contributors to the objective, as they are currently the main substitute to fossil fuels.
Financial measures have been established to promote the biofuel incorporation in fossil fuels (objective: $7\%_{LHV}$ (energetic share) incorporation in transport sector by 2010):

- in case of non-incorporation of the expected amount, fuels distributors have to pay taxes
- a partial tax exemption is assigned for biofuels (consumption tax), so they can be competitive with fossil fuels.

- <u>Policies regarding biomass production and use for bioenergy</u>

The European directive (2009/28/CE) defines several durability criteria regarding biomass production and its use for biofuels:

- an intensification of the expected reduction of GHG emissions from the biomass production to the biofuel consumption has been planned,
- biomass production is not allowed on different kinds of soils, known to present a high carbon content or a high biodiversity value.

Member States are expected to transpose these criteria into national laws by the end of 2010.

- <u>Policies regarding biorefineries or biomass derived products (materials and chemicals)</u>

No global policy for biorefineries or biomass derived products.

Biorefinery related funding programs

There is no running programs specific for biorefineries.

Running <u>research</u> programs

- **<u>European</u>** <u>funding programs for bioenergy and biorefineries</u>

    - **ERA-Net on Industrial Biotechnologies (ERA-IB)**

Since its creation in 2006, France is involved in the ERA-IB, funded from the European Union Sixth Framework Programme. ERA-IB is a joint initiative of 16 research program funding and/or management organisations of 12 countries with important initiatives in IB. This programme funds industrially relevant **applied research** projects.

Concerning the joint activities, two joint calls for proposals were achieved so far. Each ERA IB partner (funding agencies or ministries) funds the selected project partners from his country.

The applicants for funding must form consortia of 3 to 8 partners, from a minimum of three participating countries. Applicants: companies (actively encouraged to participate in projects), research centres, technical centres, national laboratories, universities.

- **1st call (2008):** 20 proposals in which 8 projects finally selected
    - Total cost: : 10 M€.
    - Two projects including French partners: total ADEME grant: 540 k€

- **2st call (2010):** 26 proposals – expertise in progress
    - available funding amount (ADEME): 500 k€

    - **ERA-Net on Bioenergies (ERA-Bioenergy)**

ERA-NET Bioenergy was launched in 2004 as a network of national government agencies and ministries responsible for coordinating and funding national research efforts in the field of bioenergy, especially solid fuel combustion and 2nd generation biofuels. The aim of this network is to strengthen national bioenergy research programmes through cooperation and coordination between national agencies.

4 joint calls were carried out so far in the framework of the ERA-Net Bioenergy:
- **1st call (2006):** small scale combustion / 5 selected projects – total cost: 1.9 M€
- **2nd call (2007):** gasification gas cleaning / 6 selected projects – total cost: 4.6 M€
- **3rd call (2008):** short rotation coppice / 3 selected projects – total cost: 3.1 M€
    - Total fund from France (ADEME): 290 000 € / 1 project
- **4th call (2009):** clean combustion / 4 selected projects – total cost: 6.3 M€
    - Total fund from France (ADEME): 220 000 € / 1 project + 1 jointly funded project: 250 000 €
- **5th call (2010):** Sustainable forest management and optimised use of lignocellulosic resources (including a topic “advanced biofuels and biorefineries”)

- Submission of proposals: before December 2010.
- Total public funding of 18.5 M€ will be jointly provided by 19 national funding organisations during 2011-2014, including 100 000 € from French funding organizations (France's Ministry for Food, Agriculture and Fisheries, French Institute of Technology for forest based and furniture sectors (FCBA), National institute for agronomic research (INRA)).

- **National** funding programs for bioenergy and biorefineries

  - **"Bioresources, Industry, Performances" program (BIP)**

Since 2008, the ADEME has been managing and funding a R&D program named BIP, "Bioresources, Industry, Performances". This programme, managed by the ADEME, funds **applied research in the following fields:**

- Substituting biomass to fossil resources, by developing biobased products and materials,
- Improving energetic performances and mass balance of existing biomass transformation processes.
- Designing integrated systems (biorefineries) for the optimal use of biomass, by combining conventional chemistry and biotechnologies
- Improve combustion processes to reduce polluting emissions of wood-fuel

It funds **collaborative projects coordinated by industrials (**consortia of two or more of the following entities: companies, research centers, technical centers, national laboratories, universities. An industrial leadership of the project is requested).

Since the launch of the BIP programme, 3 calls have been carried out:

- **2008:** 7 projects selected and funded by the ADEME
  - Total cost: : 3.1 M€
  - Total fund from ADEME: 1.6 M€
- **2009 :** 8 projects accepted for funding
  - Total cost : 4.2 M€
  - Total fund from ADEME : 1.8 M€
- **2010:** 9 projects accepted for funding
  - Total cost : 5.7 M€
  - Total fund from ADEME : 1.6 M€ (provisional, need to be confirmed)

  - **"Bioenergies" program**

This program is managed by the ANR (National Research Agency). It funds **basic and applied research** projects in the following fields: resource inventory, 2nd and 3rd generation biofuels, biorefinery and LCA.

Results for the 3 last calls:

- **2008:** 13 projects selected, including 63 partners. Total grant (ANR): 10.6 M€
- **2009:** 7 projects selected, including 39 partners. Total grant (ANR): 6.5 M€
- **2010:** 7 projects selected, including 36 partners. Total grant (ANR): 7 M€ (total cost: 18 M€)

- **"Green Chemistry and Processes for a sustainable development" program (CD2I)**

This program is funded by the ANR (National Research Agency). It funds mostly **basic research** projects in the area of green chemistry.
One part of this programme is dedicated to bio-based chemistry (production of new building blocks or substitution of petro-based ones…). Here are the results concerning the projects funded in this specific field:

- **2007:** 4 projects selected. Total grant (ANR): 2.2 M€
- **2008:** 3 projects selected. Total grant (ANR): 1.2 M€
- **2009:** 10 projects selected. Total grant (ANR): 6.1 M€

Running demonstration programs

- **Research demonstration fund**

Created in 2008 as a measure of the "Grenelle de l'environnement" (large stakeholder consultation carried out in 2007, see introduction), the "research demonstration fund" is managed by ADEME and funds research demonstration plant projects in the field of the new energy technologies (renewable energy, low-energy transport systems, CO_2 capture and storage, smart grids, etc.). This fund has a budget of 325 million euros for the 2009-2012 period. In 2009, a total budget of 175 M€ was committed under the Demonstration Fund.

Two projects for the development of a second-generation biofuels (thermochemical routes) have been accepted:

- **the GAYA project:** Gasification of lignocellulosic biomass to produce Synthetic Natural Gas (SNG). This 7-year duration project was launched in June 2010 and includes 11 partners. The aim is to reach an available offer of bio-SNG from gasification, reliable, with high efficiency in 2015.
  - Total cost: 46.5 M€
  - Fund from ADEME: 18.9 M€

- **the BioTFuel project:** B-XTL route: Gasification of torrified lignocellulosic biomass (and possibly petrol coke, coal as complementary charge materials) followed by a Fischer-Tropsch synthesis process to convert FT-fuels (diesel and kerosene). This 7-year duration project was launched in January 2010 and includes 5 French partners and 1 German partner (Uhde).
  - Total cost: 112.7 M€
  - Fund from ADEME: 30.1 M€ (+3.2 M€ from other structures)

Running development programs

- **"Renewable heat fund" program**

This funding programme, managed by the ADEME, aims at fostering the **development** of the renewable heat (biomass, geothermal, solar) by inciting the replacement of old heating plants or the creation of new ones. The objective is to produce a supplement of 5.47 Mtoe of renewable heat (estimated breakdown: 69.5% biomass, 10.5% geothermal, 2% solar, 18% biogas and wastes).

This fund has a budget of 1 billion euros for the 2009-2011 period, and 160 M€ have yet been allocated in 2009.
Specific budget allocated for renewable heat from biomass:

- **in 2009:**
    - 1st national call for biomass boilers: for companies providing at least 1000 toe/year in industrial, agricultural and residential sectors:
        - 31 projects accepted for funding
        - Total investment: 164 M€
        - Total requested support from ADEME: 63 M€
        - 147 ktoe / 314 MW
    - Regional funding scheme: for companies providing less than 1000 toe/year in industrial, agricultural and residential sectors, and also local authorities.
        - 96 projects funded
        - Total investment: 145 M€
        - Total requested support from ADEME: 34 M€
        - 37 ktoe / 113 MW

- **2010:** 2nd national call for biomass boilers closed: more than 60 projects received ;
    - expertise in progress

In addition to the renewable heat fund, ADEME also funds projects producing renewable heat from biomass for installations producing less than 100 toe/year. Results for 2009:

- 431 projects funded
- Total investment: 100 M€
- Total fund from ADEME: 11 M€
- 25 ktoe / 114 MW

- **National tender for bioenergy CHP production plants (CRE)**

Four calls were carried out so far:

- **2003 and 2005:** call for heat production plants from biomass
- **2006:** call for CHP production plants from biomass
- **2009:** call for CHP production plants from biomass
    - 32 projects selected
    - total of 250 MWe, electricity sold at 145 €/MWh on average

- **2010:** 4th call under preparation for CHP production plants > 12MWe

New programs in preparation: the “Investments for the Future” fund

In December 2009, the French government launched the “Investments for the Future” fund, granted with a € 35 billion budget. This fund is a strategic investment plan to boost the nation's scientific and technological competitiveness.

In August 2010, ADEME has been assigned a € 1.35 billion budget for a 4 years period, to boost the development of renewable energies (solar power, marine energy, geothermal energy and carbon capture and storage) and green chemistry, with a special attention for the bio-based chemistry (biofuels, biomolecules, building blocks...).

This program will fund mainly pilot and demonstration projects. Among others, ADEME is currently working on two strategic roadmaps on advanced biofuels and bio-based chemistry, which aimed at determining the research priorities and funding needs. When these strategic roadmaps will be finalized, ADEME will launch several calls for expressions of interests, in order to fund demonstration projects in the prior areas definited in the strategic roadmaps.

ADEME will hand out € 190 million for the projects resulting from this programme in 2010, and then € 290 million every year until 2014. Two thirds of this will take the form of loans, with the remaining third being grants, and the government expects to attract over € 2 billion in extra investment from private institutions. Even if the breakdown of the fund is not defined between the five technologies yet, the fund allocated to green chemistry will probably exceed € 200 million'.

The ANR (National Research Agency) has also been assigned a € 1 billion budget for a 5 years period, to boost the creation of “excellence institutes” in the field of non CO2-emitting energies. 5 to 10 institutes will be selected via calls for proposals between 2010 and 2014. To fund this programme, ANR will hand out a € 300 million budget in 2010, followed by a €400 million budget in 2012 and a€400 million budget in 2014.

Running commercial biorefineries

Table FR7. Examples of the most representative existing biorefineries – preferable not conventional biofuel production facilities or traditional use of biomass (e.g. pulp and paper):

Company	Feedstock	Products	Description	Size
Pomacle Bazancourt biorefinery: ARD, IAR, Cristal Union, Chamtor, Cristanol, Champagne-cereales, Soliance, BioAmber, CIMV	Wheat, sugar beet	Food, feed, ethanol, succinic acid, cosmetics, other bioproducts...	Several industries / partners are located in the Pomacle Bazancourt biorefinery, working on physical, chemical and fermentation processes. **BioAmber:** joint venture between France-based ARD and US-based DNP Green Technology, producing acid succinic. **Soliance**: production and marketing of plant-based cosmetic active ingredients. **Other agro-industries:** Cristal Union (Sugar beat in ethanol), Cristanol (sugar beet, wheat / subsidiary of Cristal Union and Blétanol), Chamtor (wheat): production of sugar for ethanol / food / feed.	**BioAmber** (succinic acid): Initial annual capacity of 2,000 metric tons (industrial production started in Dec. 2009).
Novance (Prolea - Sofiproteol)	Vegetable oil	Oleochemistry for non-food markets	Subsidiary of Diester Industrie (which is a subsidiary of Sofiproteol). Production of different oleochemical products: solvents, lubricants, coating (paints, inks), plant protection, biomaterials	
DRT	pine tree (paper and pulp by-products)	Resins, gum rosin, fine chemicals, tall oil derivatives, surfactants	250 different products. Applications: adhesives, inks, rubber, perfumes et aroma, pharmaceuticals, cosmetics, surfactants, industrial oils …	
Roquette	Wheat, potato, maize, pea	Starch, food, feed, bulk and fine chemicals, succinic acid, ethanol… Major production: diester isosorbid / isosorbid (building blocks)	Physical, chemical and fermentation processes**.** 650 products from starch for food, feed and industry (paper, pharmacy, chemicals, cosmetics…) Consumption of 6 Mt/y of feedstock	Isosorbid / Diester isosorbid: production > 1,1 ktons/y
Solvay	Rapeseed-oil derived glycerin	epichlorhydrin	Production of epichlorohydrin from glycerin, major rapeseed biodiesel by-product. Epichlorhydrine is mainly used for producing epoxy resins, paper reinforcement and water.	43ktons/year

Demo and pilot plants

Table FR8. Give examples of the most representative demo and pilot plants:

Company	Feedstock	Products	Description	Status (demo/pilot)
BioTFuel	Lignocellulosic biomass (and also fossil charges)	FT-fuels (diesel and kerosene)	B-XTL route: Gasification of torrified woody biomass (and possibly petrol coke, coal as complementary charge materials) followed by a Fischer-Tropsch synthesis process to convert FT-fuels (diesel and kerosene). This 7-year duration project was launched in January 2010 and includes 5 French partners and 1 German partner. Total cost: 112.7 M€ / Fund from ADEME: 30.1 M€ (+3.2 M€ from other structures)	Demo plant
GAYA	Lignocellulosic biomass	Synthetic Natural Gas (SNG).	Gasification of lignocellulosic biomass to produce SNG. This 7-year duration project was launched in June 2010 and includes 11 partners. The aim is to reach an available offer of bio-SNG from gasification, reliable, with high efficiency in 2015. Total cost: 46.5 M€ / Fund from ADEME: 18.9 M€	Demo plant
Procethol 2G (Futurol project)	Wheat straw	Bioethanol	Production of cellulosic ethanol on the existing sugar-beet and wheat biorefining site of Pomacle – Bazancourt Expected outputs (2016): 2 700 t/year	Demo plant
Roquette / Metabolic Explorer	Starch from wheat, potato, maize, pea	Glycolic Acid / L-methionin / 1.2 Propanediol	In the framework of the BioHub programme.	Pilot plant
Roquette (in association with DSM)		Succinic acid	In the framework of the BioHub programme. Fermentation with E. Coli bacteria. several hundred metric tons of succinic acid per year After successful demonstration of the technology, the company expects to begin large-scale production by 2011.	Demo plant (500 tons/y)
Innovation hub B.R.I. (Biorefinery Research and Innovation)	Wheat, sugar beet	Food, feed, ethanol, succinic acid, cosmetics	ARD *(Agro-industrie Recherches et Développements)* has signed an agreement with the French Ministry for Industry in December 2009 to create the hub B.R.I., which is an open technological platform for the industrial scaling-up of biotechnology processes. This platform aims at boasting laboratory equipment, pilot installations and an industrial demonstration unit (BioDémo). B.R.I. brings together the biorefineries of Bazancourt-Pomacle (Cristal Union, Cristanol, Chamtor, etc.), the R&D centre ARD, as well as French engineering schools.	Technological platform, including a demo plant (BioDémo).

Major RTD activities

Table FR9. major RTD activities:

Name of project	Type of project	National coordinator	Description	Duration	Size (€s, US$)
EUROBIOREF	EU (FP7)	**CNRS**, Arkema, Metabolic Explorer, Alma CG, Novance	European multilevel integrated biorefinery design for sustainable biomass processing. 28 European partners. http://eurobioref.org/	4 years (beginning in 2010)	**37 M€** (23 M€ funded by the FP7)
BIOCORE	EU (FP7)	**INRA**, Arkema, CIMV, Syral, Solagro	This project will study the industrial feasibility of a biorefinery concept that will allow the conversion of lignocellulosic biomass (cereal by-products, forestry residues…) into ethanol and polymer building blocks, designed to the production of thermoplastics. http://www.biocore-europe.org/	4 years (beginning in 2010)	**20,3 M€** (2/3 funded by the FP7)
BioProChemBB	EU (ERA-Net IB)	University Paris-Sud, ENSAIA	Objective: developing *Corynebacterium glutamicum* as a platform organism for new and efficient bioprocesses, such as the production of chemical building blocks.	3 years (beginning in 2009)	**2.7 M€** (345 000 funded by ADEME)
EPOS	EU (ERA Net IB)	University Paris-Sud, Institut Pasteur	Objective: building a new production platform (Streptomyces as fermentation host) capable of industrial level protein production (xylanase as a model).	3 years (beginning in 2009)	**1.1 M€** (200 000 funded by ADEME)
BioHub	National	**Roquette**	The program aims at developing new cereal based biorefineries by developing new chemical and biochemical processes to synthesize chemical products from sorbitol and isosorbide: polymers, solvents, building blocks, plasticisers and lubricants... 13 Industrial and research partners ((DSM, Metabolic Explorer, Cognis, Solvay, Eurovia, Insa…)	6 years (beginning in 2006)	**88 M€** (public funding (OSEO): 42 M€)
Osiris	National	**Soufflet**	Development of biofuels, food, feed and biological crops protection products from cereals	8 years (beginning in 2007)	**77 M€** (public funding (OSEO): 31.2 M€)
AlgoHub	National	**Roquette**	This programme aims at developing the industrial exploitation of micro-algae. Market targets: food, feed, health and cosmetics. 15 partner involved.	5 years (2008-2013)	**28.3 M€** (Public fund: 10 M€ (OSEO))
Deinol	National	**DEINOVE**, Tereos, CNRS, INSA	Fermentation of cellulose (fodder cereals) into ethanol, utilizing the Deinococcus bacteria. This project will be carried out with the cooperation of the VTT Technical Research Center (Finland).	4 years (beginning in 2010)	**21,4 M€** (Public fund (OSEO): 8,9 M€)
Regional	National	**Arkema**,	The programme aims at developing an industrial process of conversion of	3 years	**11 M€**

research programme on biobased acrylics.		Regional Council of Lorraine	glycerol into acrylic acid.	(beginning in 2010)	
BIO2CHEM programme	National	**Metabolic Explorer**, INSA Toulouse, SpecialChem	Objective: to manufacture chemical compounds from renewable resources (2,2 propanediol especially), looking at the same time at the end-used markets (new marketing approaches to meet the needs of chemicals processors). One of the targeted product: MPG (1,2 propanediol), used to manufacture personal hygiene products and furnishings.	Beginning in 2010	**9.6 M€** of public funding (OSEO)
FINATHER	National	**FDR (Fibres recherche Développement)**, ARD…	This project aims at developing the production of innovative thermoset composite materials for the transport sector (rail and car industries). Petro-based resins will be substituted by linseed oil based resins and fibreglasses will be replaced by flawen and hemp fibres.	4 years (beginning in 2010)	**Public fund: 3.6 M€**
Delta 3	National	**Rhodia,** Novance, DRT,	Developing a pilot of production of biosolvents from glycerine. Capacity Objective: 15 000 tons/year	(beginning in 2010)	**3.6 M€** (Public fund: 1.3 M€)
GaïaHub	National	**Roquette**	Functionalization bio-based chemistry: plastics in particular, and to replace oil-derived polymers in general (in adhesives, paint, ink and varnish, building materials, water treatment, etc.). 23 partner business firms and research centers	n.a.	n.a.
SALINALGUE	National	**Biocar** (subsidiary of GDF SUEZ) – other partners (12 in total)	This project aims at developing a large-scale production of micro-algae in salt open ponds (salines) and using them to produce and market several high-value products: biodiesel, biogas, health products, feed products... This project includes a demo plant of 10 hectares, in order to validate the technical and economical feasibility for future industrial development.	(beginning in oct. 2009)	**7.45 M€** (Public fund: 3.9 M€ (OSEO))

Stakeholders

Table FR10. Major stakeholders in France:

Name	Short Description
Industry	
Chemical companies	Arkema, Total, Solvay, ARD, BASF – France, Cognis, Rhodia, Seppic (Air liquide),
Biomass refiner / Agro-industries	Roquette (mainly wheat / corn starch), Syral (m. wheat / corn starch), Soufflet (cereals), DRT (pine tree), Cristal Union (sugar beet), Tembec (pine tree), Tereos (sugar beet, sugar cane, cereals), Chamtor (wheat)
Feedstock producers unions	CGB (sugar beet), Proléa - Sofiproteol (oil seeds), AGPM (Maïze), AGPB (wheat)
Biotechnology companies	Proteus (engineering and manufacturing of proteins of industrial interest, and developing protein-based processes)**,** Metabolic Explorer (SME that develops and patents fermentation-based industrial processes).
Research Institutes	
CNRS	National center for scientific research (public status)
INRA	National Institute for agronomic research (public status)
IFP	French petroleum institute (public status)
CEA	French Atomic Energy Commission (public status)
Universities	
INSA-Toulouse (Engineering school) - LISBP	The Laboratory of Biosystems and Process Engineering (LISBP) is located in the Engineering School INSA-Toulouse and recognised by 2 French research institutes (INRA and CNRS). The laboratory is structured around five complementary research groups ("Biocatalysis", "Physiology and Microbial Metabolism", "Microbial Systems and Bioprocess", "Transfer, Interface and Mixing", "Separation, oxidation and Hybrid Process") and three platforms ("High Throughput Screening platform for Directed Evolution of Enzymes", "Biochips Platform" and "Metabolome-Fluxome Analytical Platform").
ENSIACET – LCA (Toulouse)	Associated to a French research institute (INRA), the Laboratory of Agro-Industrial Chemistry (LCA) performs a multi-disciplinary research in partnership with the agricultural and industrial sectors. Basic and applied research fields: chemical structures and properties of agro-molecules as well as the study of their reactivity. Final research objective: the non-food utilization of products and byproducts from agriculture, forestry and agro-industries.
Governmental Organisations	
French Environment and Energy Management Agency (ADEME)	ADEME is a public body with industrial and commercial nature (EPIC), under the joint supervision of the French ministry of ecology, energy, sustainable development and sea and the French ministry of higher education and research. ADEME is a governmental funding agency mandated to accompany and assist actors in the society and the economy in the process of reducing their environmental impacts and managing energy, in the 4 following domains: waste and soil, energy, air quality and noise pollution and cross-sectorial actions.
French National Research Agency (ANR)	ANR is a governmental funding agency. Its main objective is to stimulate French basic and applied research by increasing the number of funded projects, in all scientific areas. Cross disciplinary projects,

	bringing together industrial and academic research partners are encouraged.
SME Innovation Agency (OSEO)	Its mission is to provide assistance and financial support to French SMEs and VSEs over the different phases of their life cycle : start up, innovation, development, business transfer / buy out. In particular, it support innovative technology-based projects with marketing prospects.
Inter-ministerial Committee for Regional Planning and Competitiveness (DGCIS)	DGCIS is a department of the French ministry of Economy, Industry and Employment. Its objective is to increase the competitiveness and the growth of the industrial and service sector companies.
Non-governmental Organizations (NGOs)	
ACDV (Association Chimie du végétal)	Biobased chemistry association that brings together companies from 2 sectors: the chemical and agro industries. Common activities are carried out to integrate these new value chains (from biomass to chemicals and materials) in the fields of certification, lifecycle assessments, technico-economic watch, strategic analyses, regulations and incitement…
Others	
ARD (Agro-industrie Recherches et Développements)	ARD is a mutualised private research structure, owned by major players in French agribusiness (Cristal Union, Chamtor…) as well as regional farming cooperatives. It is located in the Bazancourt-Pomacle biorefinery and part of the IAR (Industries and agro-resources) competitiveness cluster. It was created in 1989 to fin new opportunities for creating value from its shareholders' produce (cereals, sugar beet, alfafa, oilseeds, etc.). ARD has developed expertise in plant fractionation and biorefining, white (industrial) biotechnology and bio-based chemistry and agro-materials. ARD is one ARD has created several subsidiaries, in order to market its new bio-based products: **Soliance** (cosmetics), **Bioamber** (succinic acid – joint venture with DNP Green technology), **WheatOleo** (surfactants - joint venture with Oleon).
Competitiveness clusters	The Inter-ministerial Committee for Regional Planning and Competitiveness (DGCIS) supports industrial R&D projects submitted by clusters. There are 71 clusters in France, in which at least 12 have activities related to biobased products and micro-algae: IAR – Industries and agro-resources (world class cluster), Agrimip, Axelera, Fibres Grand Est, MAUD, Xylofutur, Cereales Vallée, Plastipolis, Trimatec, Mer PACA, Mer Bretagne and Capénergies.