

# Renewable Energies Strategies and Developments in France

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*France still rely on its Nuclear energy and presently the total Renewable energy (REN) still very limited in production but actions has been taken following the commitments by Kyoto Protocol in the EU and at National level, this text will present shortly the different Renewable Energies strategies and developments, regulations and supports forsm as well as the progress of the R&D in France and future priorities and steps toward sustainability and neutral carbon aura*

*Keywords :France Renewable Energies, EU(27) directives, National Action Plan, Production situation, Energy needs*

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## **Introduction**

*Looking at the near future, Humanity bears some challenges: How to keep growing with finite world resources, worsen polluting situations and raising demands of energy from emerging Economies, with fast increasing population and modification of the lifestyle in a globalised world. Our present system seems to have cumulated environmental discordance and Climate change evidences, that could threaten our future generations 'right to enjoy the Nature, its resources, ecological balance and biodiversity. The depletion of traditional fossil fuel pressure are conducting France and EU countries to a long term reflection to foresee which orientation and new forms of energy could bear timeless resources availability and at the same time bring clean energy, limit green house gas ( GHG) emissions in the atmosphere, and avoid health degradation. Pioneer to alert the World of evolutions and impacts of human activities, France has been sensitive to the security of supply, efficiency of processes as well as high quality control on its domestic market.*

*French Government observing Kyoto protocol, follows the following main goals:*

- Contribute to the reduction of GHG emissions and diminish their impact on the Environment and global Climate Change*
- Diminish the dependence to imported Fossil fuels by increasing supply source security in the long term and use of alternative energies clean energies (for indication France Importation for 2010 of fossil fuels consisting mainly of Oil and Gas, representing together 62.65% of Total available Energies in France)*
- Control Total consumption needs by improving the performance of main electricity*

*consumption sectors in France: the Buildings heating and lighting (about 40% of the total needs) in boosting the industries to offer new Green Building concepts, materials and skills. The other demanding sector is the transport sector, which energy demands would raise on a linear trend in the coming decades and could diminish the gasoline demand with blends of Biofuels. Two main goals :*

- Develop the rural areas activities and infrastructures with smaller Carbon footprint, and support new sectors jobs creation or qualification, tackle with higher efficiency in recycling and wastes usage.*
- Become a leader in Renewable Energies including maturing New Generation of solar, wind, marine, rivers, geothermic or wastes treatments technologies by financing Research and Development, encouraging pilot demonstrators, not disregarding any potential resource.*

#### D) France regulations and measures:

Orientation and roadmaps for a New Energy policy has been implemented by the “POPE” law 2005 in France to answer to the EU regulations on thermal source production. The Agricultural Law 2005-781 has on its side, fixed the agricultural productions orientation and was adopted on November 2006. The law was completed on one hand by the Multiannual Plan for Electricity production for the 2005- 2015 period and on the other hand by the Financial law incentives ( which is reviewed yearly), and that has fixed the target at twice the 2006 Renewable Energies production (2006 reference year). A National Action Plan for the Promotion of Renewable energies (NAP) promotion and regulations has been established, in accordance with EU Directive to boost Renewable Energies (REN) production in France and reach 20 M. ton of oil equivalent (Mtoe) in 2020 which compared to 2006, represent twice the REN production, a boost on production of 23%, which is more ambitious than the EU target of 20% at 2020. Moreover it is combined to a reduction of the consumption in electricity of 38% in France (which itself is more ambitious than the EU’s target reduction of 20% only)

EU Blue Print (2007 to 09) message confirmed the French measures taken before hand in 2000, 04, 05 and 06, to become a real National Program, and work against Climate Change, with regulations and actions implementation, to limit GreenHouseGas Emissions (and contribute to the respect of EU and France GHG quota). France Government has chosen to support Green building popularization a priority and main need in energy; 40 % of the energy is spent for heating or lighting of houses in France. Either transportation in lesser impact however shows fast growing

demands. New Generations of Hydrocarbons Biofuels with investments of large oil companies, or aviation companies for example could support the R&D and find an alternative solution with competitive costs to Fossil fuels for the future. These concepts have been readdressed in a New Plan 2010-14, with a new Roadmap that follows two Priorities: - Priority one is to establish the Supply Security, -Priority two to emphasize Renewable's Research and Development and Industrial projects supports.

Since 2007, Initiatives of France Ministry of "Ecology, Energy, Transport, Sustainable development and of the Sea marine" helped to bring together local stakeholders at National consultation level, Territorial collectivities, with interactive forum with Employers, Syndicates and Associations representatives, also called "Grenelle de l'Environnement ", has launched ambitious Development of Renewable Energies in France with priorities to master the consumption of Electricity and the promotion of Renewable energies. EU published a White Paper on the Future of Energy Policy and Strategy (2007, January 24) for a European Strategy for a Sustainable, Competitive and Secured Energy source within EU, and give birth to "Grenelle I and Grenelle II" regulations.

In particular, for Bioenergies, the Commission proposed a mid-term review in January 2008. The final version was adopted in December same year by the European Parliament; then approved by EU Council of Minister (on April 6, 2009) fixing an additional binding rate to the 10% goal of 2008, the prefixed binding rate of 40% will be a guaranty that the produced Biofuels will not be in direct competition with food or feed and could be classified in second generation Biofuels category for vehicles running on Green Electricity or Hydrogen (the binding rate might be raised at the pace of R&D progress and produce 100% from Non-food, Non-feed crops). French Bioenergies through C.E.A has defined Biofuels into 3 generations:

- First Generation using food crops like wheat, corn, sugar beet, colza.( Surplus of former Agriculture intensive production ), to become obsolete in the future.
- Second Generation using lignocelluloses from Non-Food crops, like straw, plant stalks, wood, leaves, showing a progress on former generation with no direct competition on food resources or water, land, and presenting a smaller ecological footprint
- Third Generation: using microorganisms, not occupying tillable lands, not in competition at all with food, water, or land. In France the research is particularly studying the Hydrogen biocells, and exploring microorganisms to optimize the production of hydrogen from sun, air and ocean sea water (-Enzymes like Hydrogenase, and parallel, develop catalysers via a

Biomimetics approach for photocatalytic hydrogen production using Solar, energy conversion with biocells).

A National Law Renewable Energies Directive (RED) has been lastly adopted in France on September 2011 transposing and completing the former National Action Plan (NAP) into a National Law implementing the EU Renewable Energies Directive (RED) 2009/28 EU article 4. France contributes largely to EU REN production and consumption with 20% and 15% respectively, and aiming to raise total biofuels use for transport in France to 10% in 2020.

Important Pluriannual Programs of Investments (PPI) has been put in place to give to France a leader ranking position in the World for Research and Development (R&D) for Renewable Energies technologies in the future. The Energy Policy goals goes through the promotion of more ecological, low carbon supply sources, and spreading of the technologies from concrete projects of demonstrating industries and goes through the progress brought out by Research and Development teams and planning on all possible organic resource, including indeed, Non-Competing Resource with foods or feeds thanks to the REN target binding rate, (or source out from the sea for example like algae culture reducing land use and fresh water requirements). All Private and Public funding and means are combined to facilitate and overcome large scale production in a fast evolving environment.

Importation of Biofuels is also considered to catch up with the gap of production. as the blend rate for Biodiesel, was B30 (30% biodiesel) and E10 (10% Bioethanol), biofuels is growing so quick that a revision into 6.5% and 6% respectively will allow R&D to innovate with effective industrial sized productions sourced by local biomass rather, while USA can deliver at this time the lowest cost price as using Genetically modified crops (GMO) which has been not very popular in the EU for the past decades and not spread out at this moment.

The National Alliance for Coordination of Research in Energies (ANCRE) was created to meet the 2020 targets. It includes: France Atomic Energy Commission (CEA), National Center for Scientific Research (CNRS) and French Oil Institutions, and collaboration of the Universities, as well as 10 other Public Research Laboratories (each in its field of specialization : Environment, Nuclear wastes, Geology, Mining, Aerospace, Agronomy, Transportation and Sea marine). This organization ANCRE, helps to draw out the National roadmaps and priorities for each sector of research, from fundamental to demonstrative pilot units of production, to final industrial applications. ANCRE also care to promote and support partnerships and synergies with Public organization, Universities and or Private

companies. France equipped itself with a coordinated Energy research framework at the National, European and World scale, to be in the forefront of the Renewable's technologies, identify and coordinate the obstacles that may encounter Scientific researchers, Technologies, or Social considerations, that may limit potential industrial developments in Energy field.( Nuclear: clean energy, Sustainable like Solar, from biomass, or wind, sea, etc...).

The multiplication of applications and technologies relying on electricity as an energy source are playing a dynamic force. It helps to move toward new Concepts for Renewable's as presaid such as development of Sustainable and Low Energy Cities, to begin with Green Buildings, Electric or Hybrid vehicles and engines, use of New Materials to reduce aircraft fuels consumption and noise, raise vehicles number (10%) to be powered by biofuels, and 20% of all energies produced by Carbon neutral (like Solar, Wind and Nuclear and other any source not increasing the carbon in the atmosphere). On the other side, the decision to allow larger volume of coal fired to generate electricity, in a geopolitical strategic choice (France chose to burn EU 27: Polish and Romanian abundant coals at lower costs and diminish partially the rely on Russian oil and gas, since Russian –Ukraine incident, sudden interruption of gas supply from pipeline) combined with Carbon Capture Storage (CCS) (burying the captured carbon in outdated gas mines) to diminish total annual emissions of GHG in the atmosphere per country and fit in the Emission Trade System (ETS).

France National incentives on consumption and production of biofuels can be raised by fixing annually the blending rate of biofuels to Fossil fuel. Secondly Government imposed an environment tax (“TGAP”) on blenders, not implementing annual National blending target. Thirdly as per EU directive, 2003/30/CE, Government can rebate the General tax on oil products (ICT) to favor biofuels (but TIC declined in the recent years due to budget constraints and biofuels industries consolidation) (to give an idea in value: Incentive value for Biodiesel: 25Euro/hl from 2007 till this year, for Bioethanol and ETBE/Ethyl TertioButylEster: 33 euro/hectoliter, reduced to 14 euro /hectoliter).

The budget and France National support to the NAP characteristics and Targets: The importance of the budget and the increase in percent show the potential or promising developments. NAP proposes support schemes, certifications and monitoring Research and Developments (R&D) all azimuths from prototype to scale up industrial production size.

The difficulty and challenges have been layered in the time, stepping into new

generations of techniques but well oriented toward the prefixed Target. The budget in France as all over the world can help to go forward in their directions and meet the consensus of UNFCCC to preserve the Earth in all its landscapes, biodiversity and human developments, as sustainable as possible and preserving the resources and the future needs for markets propensity. For the EU and France Green high technologies will keep on exploring new limits of knowledge as well as futurist concerns for the humanity and maintain a leading role.

## II) **Renewable energies production situation in France**

France is ranking Second producer of Renewable Energies (REN) in the EU, and is also second in REN needs (Mainly, REN from forest wood count for almost 45%, from biofuels: 11.34%, from Urban waste: 6.2%, from Wind energy 4.4%). France has taken commitments to double its former production in 2020 and reach the EU goals : 20,20,20 : the first 20 : is to replace 20% of fossils fuels by REN, France has fixed an even upper level : 23% of decarbonized energies from their total energy needs (The EU target is 20%, this means for France an additional 3% effort to boost the competitiveness of REN production), the second 20 is to diminish France emissions of GreenHouseGas (GHG), and the third 20 is to save 20% of their usual consumption of Fossil fuels in 2020. Certainly France has well developed Carbon capture system (CCS) and technologies to capture CO<sub>2</sub> to decrease by chemical way the total CO<sub>2</sub> emitted in the atmosphere from EU territory (so called Green chemistry), this method is receiving many critics, but it has the advantage to decrease under control the CO<sub>2</sub> emission, without binding for the industries and their production level, as the it allows to diminish the carbon level in the (ETS). From here, will be listed a review of all the REN present production in France, their respective share situation within the total REN production and their expected evolutions in the near future in respect of French National Action plan and policy goals, for the building of an Energy Infrastructure this coming decade, and evaluate the boosting of competitiveness of the traditional plants and innovative projects by industries and Small and Middle size Enterprises ( SME's) for domestic demands and at export.

### 1) **Wind energy** (5007 MW in June 2010)

It can develop an electricity production of 7891 GWH in 2009, which represents about 11.1% of the electricity produced in France. The potential and effort to equip marine and off-shore farm wind will help to reach very high level of electricity production: in 2012: 11500 MW and in 2020: 25000 MWH, this means fast spreading of effective sites in the coming 8 years.

These efforts will place France at the fourth rank of wind power in the EU with 198 GW, after Italy. It has generated 9585 employments and representing 2.8 Billion euro, (the estimation shows that Wind Power could create further 50,000 jobs with the support of French government). Present developments back up to 2006, while the “Grenelle I and II” has facilitated the simplification of the administrative procedures, and slowness, such as the classification, the definition of wind farm areas (“Zone de Developpement Eolienne/ZDE”), and regulations for installment not closer than 50 meters from residential houses. This has been often questioned by inhabitants or ecologist groups, making the installment difficult. New High technologies offer the choice to equip the seaside with off-shore in the Channel Sea, North Sea and Atlantic Ocean side, and avoid past considerations on Landscape impact, noise pollution and birds. Only one big company in this field, a french company “Areva”, quite original in its equipments but the figures show that EU wind power is dominated by German, Spanish and Danish companies, sharing a large market in France or at export with a few companies (“Enercon”, “Repower”, “Vesta” and “Nordex”).

## **2) Photovoltaic Power (511 MWcin 2009):**

It can develop 1100MWc and 8625 jobs with 1.4 Billion euro in 2009. The limited production till now is planned to be amplified to one solar central (of 300MWc production power) per region from 2010 year on to reach in 2020; the target of 5400 MWc. The market has been very developed by German and Japanese companies as well as Chinese with 9.5 Billion euro, therefore French companies, would look for the development of higher performance and more reliable equipments. French government encouraged the popularization of the photovoltaic equipments from 1997 to 2004 with tax credit of 50% for mostly individual houses of less than 3KWc, and representing about 44% of the total solar power in France, 20% would come from 50 larger Solar central (more than 250 KWc) and 28% of the powering of agricultural buildings of medium size: 3 to 120 KWc.this resulting an increase of 90% of the solar energy equipment. Since the good return of the credit tax, it has been cut to 25% on October 2010, and will be diminished to 10% in the future. On a same revision, the electricity rate price has been diminished on September first 2010, of 12%. France R& D has been developing a differentiated technology for the solar wafers.

## **3) Hydrolic power: (25557 MW)**

It can develop 61644 GWh and represent 87.1% of the Renewable energies in France, with a very long history of 150 years, ranking second sector in France and second producer in EU after Italy, with 10425 employments in 2009. Although these

bright figures this sector has been stagnant for the past years, then since efforts to diminish the carbon emission has been decided it has become more promising. Therefore the hydraulic power may evolve by 2020 with an additional powering of 3000 MW. In France the hydraulic power comes from large dams built in the past. The new hydrolic development is more disseminated in local regions as France is crossed by numerous rivers (East border: “Rheine river” region, central south: “Rhône river” region, and South-West : “Garonne river” region) with decentralized smaller hydraulic central power plants. “Alstom Power Hydraulic” is a World leader company, and has, near Grenoble (France) 450 persons dedicated to R.& D. and constitute a total in France of 1620 employments exporting high tech equipments design and installment, amounting 67.3 M. euro in 2008.

#### **4) Solid Biomass: (1642 GWh)**

It represents 265 MW offering 1280 jobs in 2009 or 189 Million euro. Solid biomass is principally constituted by wood incineration, and production of biogas. France territory count with 15.71 M. ha of forest (namely 28.5% of total territory surface), the third in size in the EU (27), but it is ranking second for wood energy after Germany, and Sweden. This low energy productivity comes from the French government supporting policy which is not showing effect since 2003 and moreover Paper mills and panel’s plants have reluctance to the use of wood for energy as sharing the wood resources. While the revision of electricity power in Germany has been quite effective for biomass power developments, if the price of the electricity could be revised, it may help to raise interest in solid biomass energy. In France, there is now one very large central that needs 500,000 tons of wood waste to produce 69 MWc. The logistical collection has yet to be organized due the volume of the biomass to be daily delivered to the incinerators even of moderate size. Yet local needs in electricity could generate at the same time, new jobs and a smaller carbon foot for biomass from forests or fields. However not all the biomass are designated to electricity production, it is also used for heating purpose, separately or in cogeneration (heat and electricity production), that explains the low electricity yield of these incinerators.

Major people are defending the forest as environmental island among megacities and ecological zones to preserve biodiversity, since evidence of CO<sub>2</sub> emissions from fossil fuels these past decades. The particular situation for the forest in France is also an added difficulty, as French forest are in a good proportion; private, and disseminated, which add to the difficulty to enter into these private forest to collect their natural dry wood on the ground or pruning products the year round.

New supports of the Government and demand for wood Biomass will help to increase an estimated 20 M. cubic meter yearly, through complementary electricity power punctually supplied by the Paper Mills or Wood plants.

#### **5) Biogas (165 MW):**

The production of biomethane is limited to 850 GWh and under operated, in 2009; it generated 905 employments with 210 M. euro, at this period. The potential of Biogas is large, the target for example for 2020 is to double the production 2012: 5930 GWh and reach 16,750 GWh. Aids given from 2006 on, helped to increase past trends, sustained by higher electricity purchase price rate (instituted by “Grenelle” directives) boosting the development of biogas as renewable energy. The biogas is issued from fermentation of wastes, processed foods wastes, household wastes and are methanized in gazifier. Recycling of waste shows high potential and France is willing to enhance the urban waste collection and sorting. AT this moment only a small share can be recycled; more actions are taken to improve the performance and high-valued byproducts from waste such as biogas and usage for heating or other applications.

France has also developed few industrial companies (“ Degremont”, “Vinci environment”, “OTV”) that are covering France regional demands with Power plants, Combined heat power, or Centralized district heating system, while a smaller company “Rhodia” expecting potential development with projects into Vietnam and China.

#### **6) Wastes incineration (1980 GWh):**

There are 28% (13 M. of Tons of wastes) of the total wastes in France that are incinerated in 112 plants all over France, one third of the waste are originated in Paris, the capital city count on itself 18 incinerators. It constitutes the third source of renewable energy in France, with 90% for heating. This source has been reviewed, and the target for 2020 is to double the production for heating. On another hand few plants are generating electricity only, while a few more are co generators. The yield of incineration has been promoted with new techniques of pyrogazeification of the wastes to increase the heat production.

Due the polluting smoke and environmental hormones they may create, the regulation are strict and following EU 2000/76/CE, it has been modified on December 28 2005 more severely by the Ministry of Ecology, Sustainability, Transports and Accommodations, to limit the dioxin emission to 0.1ng/cubic meter, and diminish the heavy metals (mercury 7 times, the lead 14 times). Under this consideration, “Grenelle I”, article 46 prefixed maximum incineration volume in

2006, and it cut the production to 55%, by shifting the waste into Biogas as described above.

### **7) Tidal Power (240 MW):**

It is an original way to produce electricity that France has inaugurated in “La Rance”, a bay side in the north west of France, 40 years ago that can retain the seawater after tides, that can activate turbines to back to the sea. But since that time no other predisposed place could be developed. A few projects will try to take advantage of geographical sites, and aim to help to double the present production of electricity in 2020.

### **8) Geothermic Power ( 18 MW) :**

It is mainly used in French Overseas DOM Islands, by La Martinique , la Guadeloupe (“la Souffriere volcano”), La Reunion, more than in the Metropole (Mainland France). A good reason for this is because will need not to dig so deeply in the islands. At about 300 to 1000 meters temperatures reaching already 200 degree Celsius, while in France to get the same temperature need to dig till 5000 meters deep. The only place in France to use geothermic power is in the South of Alsace, where natural fractures occurred at 5000 meters. These natural fractures have been used to evaporate water into steam vapors and produce electricity; the residual heat can be salvaged and used in agricultural applications, such as cereals drying or greenhouse heating.

### **9) Marine Offshore stream energy ( 240 MW) :**

The largest Marine Offshore Stream energy of the World are in France where 24 turbines of 10 MW, reach 240 MW, and will be emphasized in the future: The target in 2020 is 6000 MW and mainly operated by France National “Electricite de France / EDF” company (that control 86% of French total Power production). There are many forms of marine energy that are exploited, among which; streams power converting into 5- 14 TWh per year. Tides, swell, waves power also are captured and converted. Even temperature gradient of 20 degrees Celsius occurring in Tropical areas can generate electricity thanks to the difference of temperature in between surface sea water and deep sea water. There are more innovating projects and original prototypes designed with floating wheel, propellers or vertical axe that find ways to use natural potential power and store the electricity generated.

### **10) Heliothermodynamic: Concentrating Solar Thermal Power (CSP):(540 MW)**

It has been well developed in desert areas where solar energy are concentrated by

mirrors, and collected by reflection on to a central tower. The sunshine rays are concentrated and help to evaporate a fluid, to propels turbines and produce electricity.

The target for 2020 is 10 KW. Presently EU CSP is mainly produced in Germany and Spain totalizing 740 MW between 2007 and 2010. This technique has been developed in USA and Spain. The South of France benefiting of more regular daytime sunshine has begun to bear some developments. Few French companies can offer their Know-How at export (in Middle East, North of Africa, Soudan and Korea).

### **11) Biofuels: Bioethanol and Biodiesel:**

Boosted from 2007 on, Biofuels represented in France only 2.7% of total road transport fuel in 2010 for the whole EU, while USA has gain first ranking for exportation of Bioethanol before Brazil that is producing from different biomass source (both production added represent 88% of World exports) hounding EU, remaining, yet, first exporter for biodiesel production which has slowed down the time been. The main resource for first generation biofuels is wheat, sugar beet and rapeseed. Then by November 6<sup>th</sup>, 2010 at The Hague, EU (27) adopted Sustainable Production Scheme (SPS), which have imposing to future generations of biofuels to be produced from neither Non-crop nor tillable Land resource. France government new renewable energy investment program is providing an important support with two low interest loans totalizing 1.35 billion euro dedicated for Renewable Energy and Green Chemistry Demonstration (from 2010 to 2014) for private investment; such as solar, marine, biofuels, carbon capture and geothermal high technologies developments.

Biofuels represent a small share among other Renewable Energies resources but biomass will be the bulk supply for the electricity from Renewable Energies and will play its crucial contribution to the target of 23% for France. Also smooth development of the biomass production could be achieved by French farmers as need no more to face to uncertainty of their eligibility of National support from past year on.

*(NB: as per French EU report on Bioenergies: National resources allocated to the production of biomass for energy uses other than Transport. Biomass energy recovery must help to contribute to the ambitious targets set by the "Programme Law" laying out the energy policy guidelines with regard to the development of renewable energies by 2020, namely, in addition to transport fuels:*

- *an increase in the production of renewable electricity to 27 % of domestic electricity consumption;*

• *an increase of almost 50% in renewable heat production.*

*In 2008 biomass (including waste incineration and biogas) produced 4.3 TWh of electricity and 9.284 Mtep of heat within the framework of Directive 2009/28/EC).*

The natural resources are limited and controlled. For wood supply despite the fact that French forests surface is very large, representing EU largest forests, but two third are private and disseminated on the territory. Measures to increase the resource availability and its efficiency in production of electricity have been planned for coming terms: 2012, 2015 and 2020. Either environmental consideration in the control and regulation of resources for a more sustainable supply is adopted as well as for the control of possible pollution of the air, water, soil or in the materials occurring from these activities. As well, the promising Biofuels production stands for Biodiesel, Bioethanol and derived chemicals from biomass liquid or solid. At the image of the EU, second generation Biofuels in France are produced from Non-food agricultural vegetal, mainly Biodiesel and for transportation ends (lignocelluloses or fast growing wood varieties superficies that are limited to 193,000 ha and from urban waste water or industrial sewage).

Like most EU countries France is producing mainly Biodiesel or Fatty Acid Methyl Ester (FAME) : 570,000 tons and producing also some other biofuels: such as Glycerin: 57,000 tons, Ethanol: 70,000 tons is produced from wheat by-product (dried distillers grains with soluble:88,000 tons) and 165,000 tons Ethanol from sugar beet (115,000 feed by-products and 74,000 tons of liquid by-products), constituting a total of 1.76% of Total Fuel Consumption and Transport (2006) with now in France the blending of Biofuels at 6.5% for Biodiesel, and 6% for Bioethanol, respectively. French cars park traditionally are in majority burning diesel, for their lower cost and explain the larger production of biodiesel compared to Bioethanol (about 10 folds).

The energy supply situation in France of Renewable Energies :

A look at these figures showed that in France, the Renewable Energies are still very relying on the traditional renewable Hydropower. The raising Energy extraction from the Biomass, Feedstocks (liquid or solid biowastes) developed lighter contribution till now, as often the production at research estate or prototype demonstration while local collecting and market systems not yet organized with local successful examples. But promising Biofuels or Biogas energies are gaining supports as constituting a Carbon neutral source ( Biomass capturing the CO<sub>2</sub> from the atmosphere through the photosynthesis process, when burnt will restitute to the atmosphere, at the difference of the Fossil fuels, which increase the CO<sub>2</sub> in atmosphere as burning accumulated carbons chains from millenaries). Certainly the

Photovoltaic and Wind have their share particularly the Marine off-shore wave and streams energy in the future composition of renewable energies in France and in the World.

## **Conclusion :**

Our needs in electricity with electric appliances profusion and increase of population and standard of living, the dependence on imported Fossil fuels and coals are at pick. Nuclear energies and is main clean Energy form, up to about one fourth of the energy supply in France, it has been implemented long ago, when first oil crisis broke out by 1973 and became world first nuclear production in the world. The pattern adopted for Nuclear energy production in France has been reshaped, since past decade, in terms of capacity of production of energy, on one hand, (some Nuclear plants were closed or have to modulate their running or capacities), and on the other hand, Nuclear energy very contested and had to bear from the beginning, higher security risks, associated to nuclear plants and radioactive wastes, since the different incidents that happened around the World the past years( the recent Japan catastrophe has bring to a turn point for many other EU member states (Germany, Italy,...) to close all their plants in response and face their nuclear waste levels). In the future the evolution of prevision of energy share will be changed under these considerations as well as economic costs, risks and the progress of science for renewable energies R&D. (this last one is not sustainable, due to limited resource of Uranium) and will go on with electricity supply to their neighboring countries, that decided to stop their nuclear plant operating this year.

For the long term hot fission project (ITER) with global largest economies under experimentation may become next step evolution for at least they will not present radioactivity problems and find new large and powerful source of energy but not without threats.

- French government has equipped its action plan with several laws, Environmental, agricultural, financial , in respect of EU community directives, and created certifications, as well as a commission to control and regulate the constant situation, while the research is under coordinated alliance of all the official and specialized research units in France, to orient future research, progress or obstacles,

- Financial support are large investments to help the laboratories to overcome pilot unit size, into Demonstration units, to give the example and promote at the same time, under private or combined contracts with the State, and can beneficiate funds from the EU.
- The priorities for France and Europe is not only the environmental view but also the security and stability of price, the main consumptions become their priorities: Heating. Lighting and Transport have kept on promoting these new sectors new concepts and industrial revolution to increase employment offers and stabilize the rural areas in regards to cities concentrations of population, pollution and source of larger Footprint, and biodiversity lose

#### Conclusions on Renewable energies in France Strategies and Developments:

France has been among EU leading countries in High technologies in the Research of new systems of Energy sources, able to replace, partially, or diminish the prominent share of energy dependency on depleting fossils oils, gas or coal. Also, France adopted new strategies, targets and laws to reduce energy consumption increase the efficiency of energy use and secure the energy supply for the future generations, in respect of EU 2009/28 EC Directive and laws in accordance with the Kyoto protocol emission reduction.

The consumption of buildings has been identified as main component in the consumption a heavy residential and tertiary building (such as heating-cooling systems and lighting main purposes with 40% of total energy consumed in France. While the rest of the electricity used goes for transports and other activities.

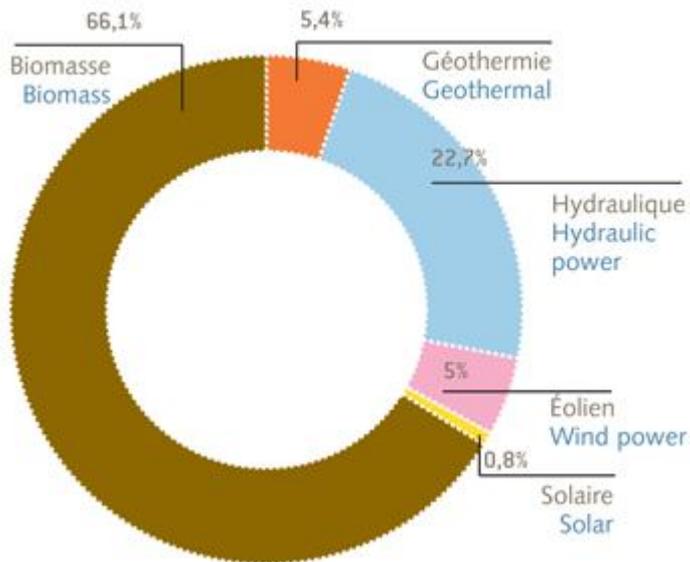
In this sense France opted for “Grenelle” Strategies financial support to tackle with the new energy challenge and the promotion of Green Technologies applications in the Building Sector or growing Transport Sector.

On another hand, the applications for Building sector has been detected as a source of economic activities, jobs creation for Small and Medium size Enterprises (SME) or local authorities as well. In the National Action Plan (NAP) Promotion of Renewable Energies 2009-2010, stands in accordance with the decentralization of the services, through Territorial and Regional and Communities Authorities that could give the example with construction of projects for all purpose type Public Buildings. Also, NAP has encouraged through promotional campaigns, financial and tax supports, the residential buildings equipments with heat pumps, wood-fired heating, solar heating and Photovoltaic energy at household or at SME’s level.

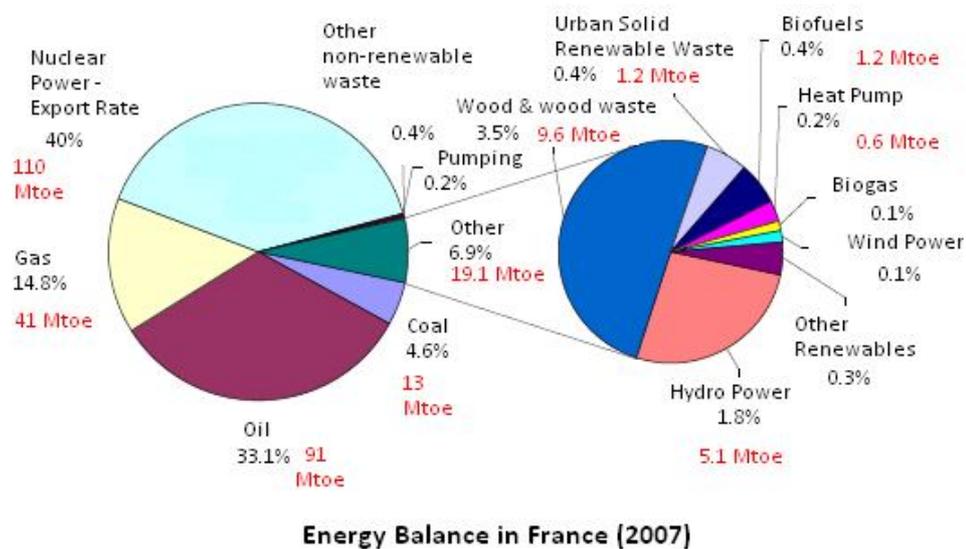
After this review, it appears clearly the strategic development planning to discard energies import dependency and the remodeling of the energetic supply, as well the building of a regulation infrastructure at National level in respect of Kyoto protocol and the emissions limitation for a more sustainable environment, without limiting the economic development, with simple principle, such as economy of energy, recycling waste, using new techniques ( biotechnology or green chemistry) and move to a sustainable electricity source and heating system from next first decade already.

Remarks from the round table discussion on France and Taiwan Renewable energies Strategies and development :

- Both countries are energy dependant and relying on importation of Fossil fuels for their energy needs ( more coals for Taiwan than gas, but oil in the both case),
- Taiwan waste collection and recycling is quite efficient , as for example the PE bottles are recycled at 96% and can become new varied materials ( for textile, packaging , building)
- Both countries have agreed to meet with Climate change GHG emissions limitation and challenge Economical development and sustainable electricity supply and apply ETS on their emission regulation systems and the use of Carbon capture (CCS).
- Both countries High Technologies efforts and large investments will go on and help determinate all possible Bioenergies resources available in a way to play a leading role in the research and the industrial production and export in the future



Tab1: Barometer Renewable energies in France per share (Observer)  
[http://www.energies-renouvelables.org/add\\_member.asp](http://www.energies-renouvelables.org/add_member.asp) ( av. Dec 2011)

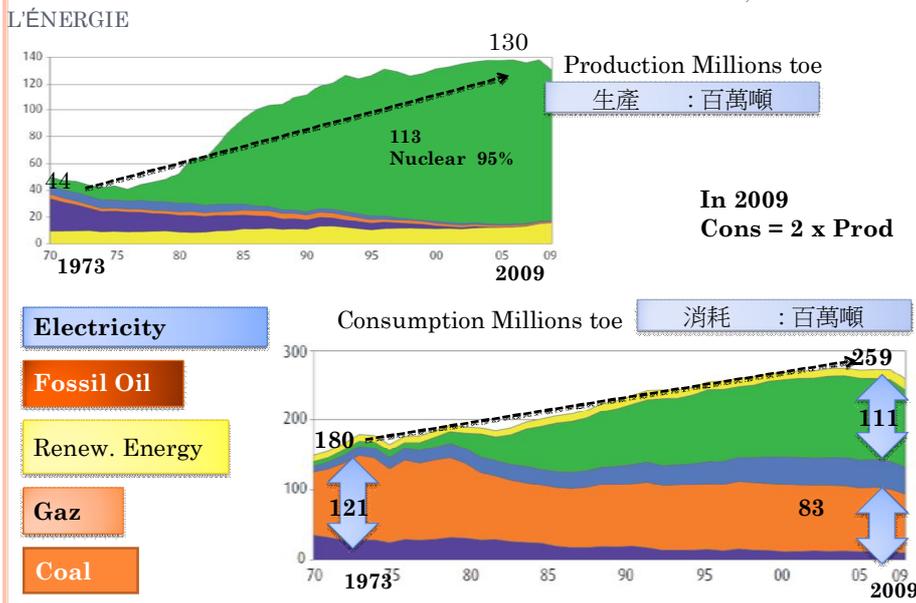


Tab 2: Energy balance in France  
 (Source :[http://www.erec.org/fileadmin/erec\\_docs/Project\\_Documents/RES2020/FRA\\_NCE\\_RES\\_Policy\\_Review\\_09\\_Final.pdf](http://www.erec.org/fileadmin/erec_docs/Project_Documents/RES2020/FRA_NCE_RES_Policy_Review_09_Final.pdf) av. dec 20110)

# 能源生產及消耗

## ENERGY PRODUCTION AND ENERGY CONSUMPTION

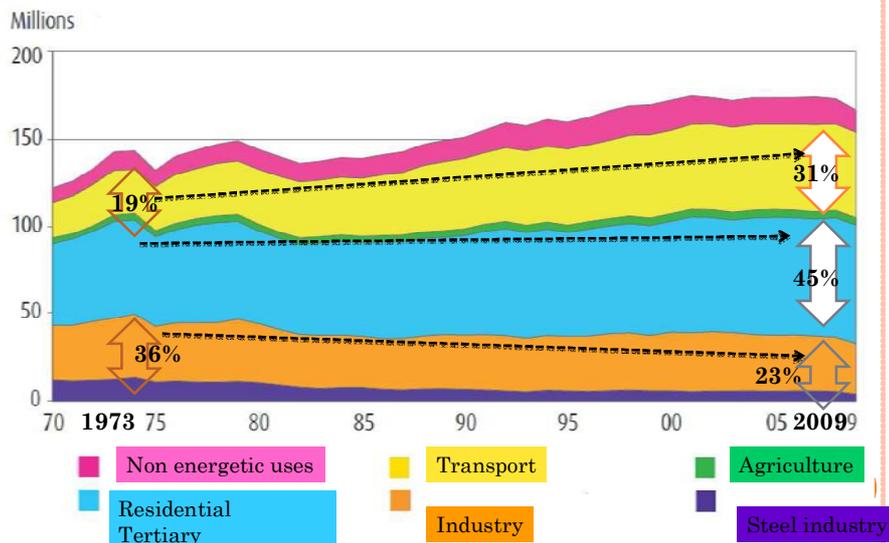
SOURCE : SOES, BILAN DE



Tab3: Energy Production and Consumption, (source SOES 2009)

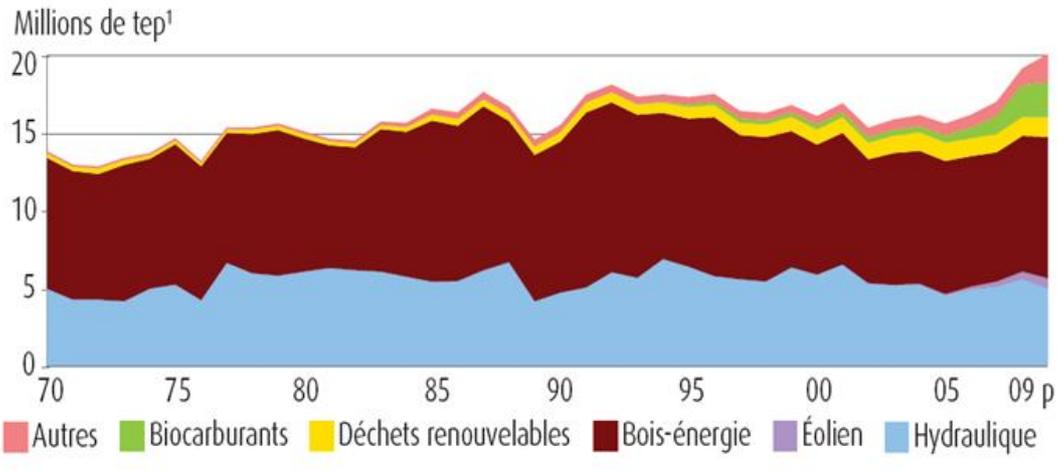
## ENERGY CONSUMPTION BY ACTIVITY

SOURCE : SOES, BILAN DE L'ÉNERGIE



Tab4: Energy consumption by activity ( Source :SOES 2009)

## Production totale d'énergies renouvelables



(Autres : Others, Biocarburants : Biofuels, Déchets renouvelables : renewable wastes  
Bois-énergie : wood waste, Éolien : Wind Power, Hydraulique : Hydrolic power)  
Equivalence for Electricity : 086 toe/MTWh for Geothermic and 0.086 toe/MTWh for the  
other sources origin

Tab 5: Total Renewable energies productions from 1970-2009

Fig 1 : Increase of 20Mtoe of renewable energy production by 2020, shared as follows:

Source : Idem as above Tab 2

RES	Target by 2020 Mtoe <i>Grenelle environnement</i>	
Wind	5Mtoe	60TWh
PV	0,5Mtoe	5400MWc
Hydro	0,6Mtoe	
Biogas, renewable waste & other	1,2Mtoe	
<b>Total R Elec</b>	<b>7,2Mtoe</b>	
Thermal solar	0,9Mtoe	15 to 20 millions m <sup>2</sup> installed
Wood	7,2Mtoe	
Geothermal & heat pump	2Mtoe	
<b>Total R Heat</b>	<b>10Mtoe/y</b>	

Fig 2 : Tariffs electricity ( Hydro, Wind and Biomass)

Tariffs are guaranteed on 15 to 20 years. Tariffs were revised in 2006 and 2007 to take account of the investment and managing costs together with a premium taking into consideration improvements of air quality and reduction of greenhouse gases.	Technology	Support level *€cents/ kWh+	Feed-in tariff or premium?	Start year	Duration [years that an investor is entitled to support]
Resource hydro	small	6,07 c€/kWh + premium between 0,5 and 2,5 for small installations + premium between 0 and 1,68 c€/kWh in winter according to the production's regularity	feed-in tariff	2007	20 years

wind	onshore	8,2 c€/kWh during 10 years, then between 2,8 et 8,2 c€/kWh during 5 years depending on the location's productivity.	feed-in tariff	2006	15 years
wind	offshore	13 c€/kWh during 10 years, then between 3 and 13 c€/kWh during 10 years depending on the location's productivity.	feed-in tariff	2006	20 years
biomass	Solid combustion	4,9 c€/kWh + premium for energy efficiency between 0 and 1,2 c€/kWh	feed-in tariff	2002	15 years

**Publications :**

- National Action plan for the Promotion of Renewable Energies ( 2009-2020), in accordance with Art. 4 of EU Directive 2008/28/EC, ( Present for the avenir, 2010 by the French Republic :

« Ministere de l'Ecologie de l'Energie, du Developpement durable et de la Mer »

- Beurkens, L.W.M., Hekkenberg W., Sept. 10 2010, “ *Renewable Energy Projects as published in the National Renewable Energy Action Plan of the European Member States ( 19 countries* ”), by the European Environment Agency, ECN-E-10-069

- OECD dec 2009 , « Politiques de Soutien Des Biocarburants: Une Valuation Economique”

2.

- **OECD June 2008**, « Tables Rondes Fit Ptrole Et Transports: La Fin Des Carburants Prix Abordable ? « »

**Document on the web (December 2011)**

REN France: subventions, taxes in force

<http://www.iea.org/textbase/pm/?mode=re&action=view&country=France>

REN France :

[http://www.erec.org/fileadmin/erec\\_docs/Projcet\\_Documents/RES2020/FRANCE\\_RES\\_Policy\\_Review\\_09\\_Final.pdf](http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES2020/FRANCE_RES_Policy_Review_09_Final.pdf)

EU REN:

[http://ec.europa.eu/energy/publications/doc/2011\\_energy\\_infrastructure\\_en.pdf](http://ec.europa.eu/energy/publications/doc/2011_energy_infrastructure_en.pdf)

[http://ec.europa.eu/energy/res/index\\_en.htm](http://ec.europa.eu/energy/res/index_en.htm)

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[http://ec.europa.eu/energy/intelligent/index\\_en.html](http://ec.europa.eu/energy/intelligent/index_en.html)

[http://ec.europa.eu/energy/res/legislation/electricity\\_member\\_states\\_en.htm](http://ec.europa.eu/energy/res/legislation/electricity_member_states_en.htm)

[http://ec.europa.eu/energy/res/legislation/share\\_res\\_eu\\_en.htm](http://ec.europa.eu/energy/res/legislation/share_res_eu_en.htm)

To find out more about support measures,

[http://ec.europa.eu/energy/res/legislation/support\\_electricity\\_en.htm](http://ec.europa.eu/energy/res/legislation/support_electricity_en.htm)

projects or contacts in local region

<http://www.managenergy.net/emap/maphome.html>

Further fact sheets on France and other Member States :

[http://ec.europa.eu/energy/energy\\_policy/facts\\_en.htm](http://ec.europa.eu/energy/energy_policy/facts_en.htm)

2008 REN evaluation and targets for France

<http://www.renewableenergyworld.com/rea/news/article/2008/01/france-sets-ambitious-renewable-energy-targets-5097>

2008 facts sheet

[http://www.energy.eu/renewables/factsheets/2008\\_res\\_sheet\\_france\\_en.pdf](http://www.energy.eu/renewables/factsheets/2008_res_sheet_france_en.pdf)

France energy issues ( 2008)

<http://www.geni.org/globalenergy/library/energy-issues/france/index.shtml>

solar electricity

[http://www.renewableenergyfrance.com/selling\\_electricity.html](http://www.renewableenergyfrance.com/selling_electricity.html)

info heat pumps,...

<http://normandy.angloinfo.com/countries/france/renewable.asp>

barometer REN in France

[http://www.energies-renouvelables.org/observ-er/html/energie\\_renouvelable\\_france/BAROELEC\\_Integral.pdf](http://www.energies-renouvelables.org/observ-er/html/energie_renouvelable_france/BAROELEC_Integral.pdf)

REN sources in France per sector

[http://www.energies-renouvelables.org/add\\_member.asp](http://www.energies-renouvelables.org/add_member.asp)