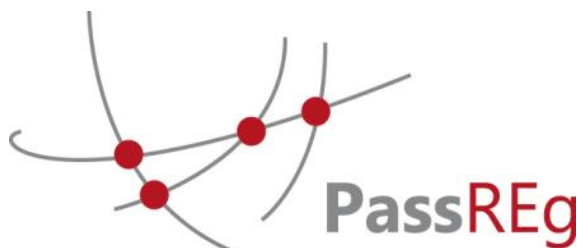




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IEE PassREg

PASSIVE HOUSE REGIONS WITH RENEWABLE ENERGY

Success Model

AQUITAINE Region

Contents by Nobatek

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1. ENERGY AND BUILDING POLICY

National framework

Baseline

After the French energy framework law of 13 July 2005 (Law 2005-781) setting out a framework of application for commitments made by France to the Kyoto Protocol (including the Factor 4 target for 2050, reduction of energy intensity by 2% per annum and promotion of renewable energies) and the 2004 and 2006 versions of the Climate Plan, in 2007 the Environment “Grenelle” (round tables with key stakeholders) appeared to be an original approach whereby, for the first time, all the stakeholders in France reached agreement on a shared diagnostic and action plan.

The Environment Grenelle set up sector-based work groups which continue to produce analyses and recommendations. In general terms as far as global warming is concerned, the Grenelle confirmed France’s ambitions in relation to the Kyoto and European commitments (notably Factor 4 by 2050 and 3x20 by 2020) and defined a series of specific measures for the building sector, placing it at the heart of the fight against GHG emissions.

The Grenelle strategy aims to achieve general application of positive energy buildings by 2020. For public buildings and commercial buildings: a) general application of low consumption (50 kW) from 2010, systematically integrating renewable energies and b) decision to undertake thermal refurbishment of public buildings within five years.

A Grenelle operational committee “refurbishment of existing buildings” was set up in December 2007. In its first report in 2008, the Committee outlined the expectations weighing on the sector:

“The building sector has the highest energy consumption – with half of final energy consumed – and is the second highest source of CO₂ emissions, just after transport, with nearly a quarter of emissions. With an annual renewal rate limited to 1%, the proportion represented by existing stock is preponderant. The corresponding three and a half billion square metres of heated surface area represent the main scope for savings, generally agreed in the sector to be potentially the most easily accessible.”¹

While the building sector’s share of CO₂ emissions is estimated at 24%, housing stock alone (31 million in 2006 in metropolitan France including 26 million main residences) represents 560 TWh per annum, i.e. 30% of final energy consumption in France. Housing and commercial buildings together account for a heated surface area of approximately 3.5 billion square metres, three quarters of it in housing and the remaining quarter in commercial buildings. Two thirds of energy is consumed in housing and one third in commercial buildings. CO₂ emissions are broken down in exactly the same way.

¹ 12 Operational Committee “refurbishment of existing buildings”, 2008, Rapport au ministre d’État, ministre de l’Écologie, du Développement et de l’Aménagement Durables, Section 1, 115 pp

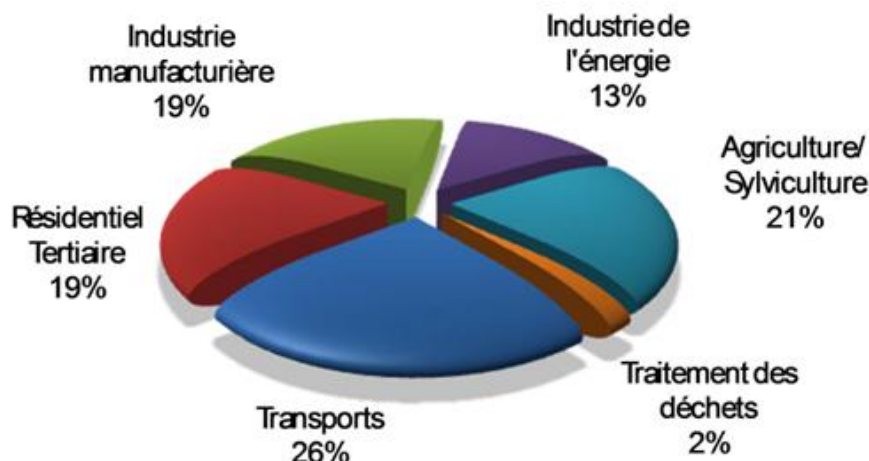


Figure above: GHG emission shares by sector, source CITEPA 2010

Out of the 16.1 million homes built before 1975, some 9 million were built before 1949 and the mass development of industrialised building. Their thermal performance, although still poorly documented, is in principle intrinsically of a high thermal standard (thermal performance and summer comfort). The Grenelle operational committee “refurbishment of existing buildings” recommended that this should be studied for better targeting of action on housing stock that is often of remarkable architectural and environmental quality.

Nevertheless, in statistical terms, this housing stock represents one the main potential sources of energy saving by refurbishment: individual houses built before 1949 account for a third in terms of numbers, but for 45% of heating consumption. In the same way, housing in apartment buildings constructed between 1949 and 1974 represents a significant share in terms of numbers (44%) but over half of heating consumption.

“General application, to all buildings constructed prior to 2001, of external thermal insulation rather than internal insulation where allowed by architectural characteristics, controlled ventilation units (with heat recovery from the air extracted if applicable) and multiple glazing, would reduce the needs of an individual house or apartment building by an average of 60%.”²

Finally, if the housing stock is characterised by almost zero renewal, from the point of view of lower population growth, it will nevertheless continue to grow due to the forecast effect of decreased household size, which could be reduced to 2 people on average by 2050. “This means that the sector would consist of just over 35 million main residences in 2050, 25 million of which are already built: the metropolitan city of 2050 was already 70% built on average in 2005. This highlights the importance of the housing stock and its energy upgrading.” (Traisnel et al., see footnotes).

² Translated from : Traisnel, JP et al., 2010, “Habitat Facteur 4, étude d'une réduction des émissions de CO2 liées au confort thermique dans l'habitat à l'horizon 2050”, *Cahiers du CLIP* No. 20, November 2010, 108 pp.

Focus on Grenelle round tables leading France towards positive energy buildings by 2020

The French energy framework law of 13 July 2005 (Law 2005-781) set out a framework of application for commitments made by France to the Kyoto Protocol (including the Factor 4 target for 2050, reduction of energy intensity by 2% per annum and promotion of renewable energies) and the 2004 and 2006 versions of the Climate Plan. In 2007, France organised the “Environment Grenelle” (round tables with key stakeholders to discuss environmental concerns). It appeared to be an original approach whereby, for the first time, all the stakeholders in France reached agreement on a shared diagnostic and action plan.

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These round tables lead to a law, called RT2012, a new thermal regulation for new residential buildings. This regulation is extended to all new buildings on 1 January 2013 (the date of filing an application for a building permit). As of that date, the labels corresponding to the old rules (including the label “low-energy building,” known as BBC) no longer exists.

3 Traisnel, JP et al., 2010, “Habitat Facteur 4, étude d'une réduction des émissions de CO2 liées au confort thermique dans l'habitat à l'horizon 2050”, *Cahiers du CLIP* No. 20, November 2010, 108 pp.

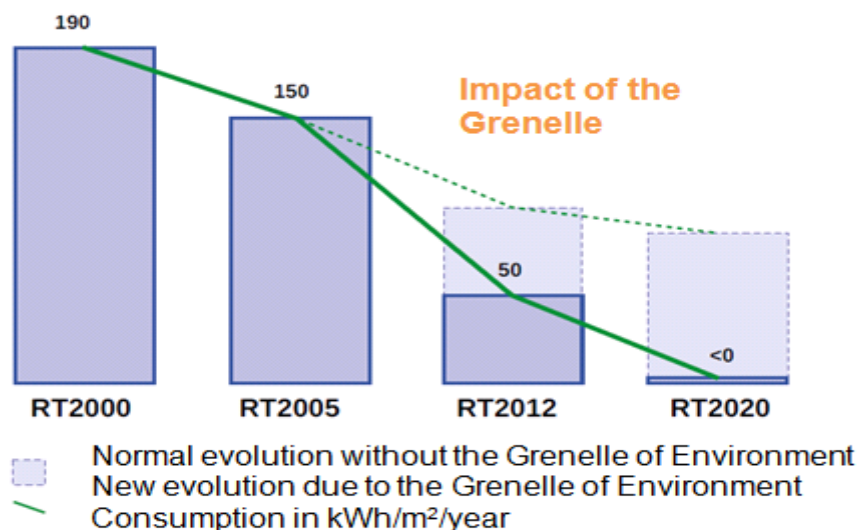


Figure 1 : Evolution of French new buildings thermal regulation⁴

The new thermal regulation foresees two levels of energy performance label: a "high energy performance" level (HPE) and a "very high energy performance" level (THPE). They provide for a reduction of primary energy consumption (10% for the former and 20% for the second) and the strengthening of some requirements.

RT2012: Three main requirements

RT 2012 building regulation includes mainly three major requirements which must be respected simultaneously:

1. The **"Bbio" Factor (bioclimatic needs factor)** defines the impact of bio-climatic design on building energy performance. It deals with the intrinsic features of the structure and the envelope of the building without considering the HVAC system and other technical facilities. Bbio factor is a dimensionless number expressed by a number of points calculated. Its calculation takes into account the building's space heating, lighting, and air conditioning needs. The Bbio factor must be below a maximum value "Bbiomax" which is modulated by the use and the category (CE1 or CE2) of the building, the geographical location, the altitude location coefficient and the building floor surface.

⁴ Scheme from A. Jursik, "French Perspective: Thermal Regulation for New Residential Buildings", 2012 as from: <http://homeenergypros.lbl.gov/profiles/blogs/french-perspective-thermal-regulation-for-new-residential>, last access 28/02/2014.

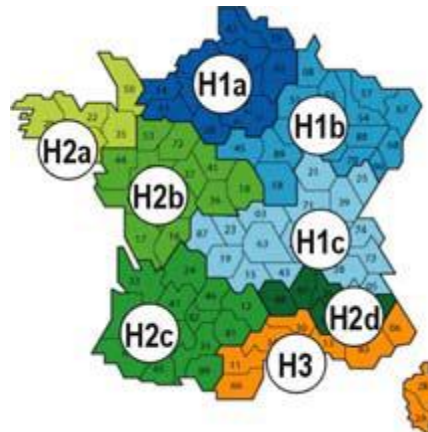


Figure 2: Geographical location division

2. The **“Cep” index (annual primary energy consumption)** defines the building's primary energy use taking into account performances of HVAC system, DHW production and, if any, artificial lighting and auxiliaries. The Cep index for the building in question must be below a maximum value "Cepmax" which is based on an average of 50 kWEP/(m².year). It is also modulated by the use and the category (CE1 or CE2) of the building, the geographical location, the altitude location coefficient, the building floor surface and the greenhouse potential of the fuel used. Only two primary energy factors are applied, for electricity 2.58, and for all other fuels 1.
3. The **“Tic” index (summer comfort)** defines the conventional interior temperature, which must be below a reference value "Ticref". This requirement is only requested for non air-conditioned buildings.

RT2012: not only a Cep + Bbio + Tic but also renewable, air tightness, and mean (monitoring) requirements

Besides the three main performances requirements described above some wherewithal exigencies are listed in RT2012. Some of them are given below as examples:

- **Thermal insulation of walls** : Albeit the thermal quality of the building envelope is already considered in the Bbio coefficient some complementary exigencies are intended:
 - **U-value of a wall separating** an unheated room and an heated room must not be higher than 0.36 W/m²K
 - **Overall linear thermal transmission ratio** (thermal bridges) of the whole building must be less than 0.28 W/(m²floor)
 - **Thermal bridges between** intermediate floors and facades less than 0.6 W/m K
- **Air tightness of the building envelope**: Airtightness of the building envelope measured according to EN 13829 measuring method (Blower door) must be lower than 0,6 m³/(h.m²) for individual or attached houses and than 1 m³/(h.m²) for collective housing buildings.

- **Natural lighting:** For housing buildings the total windows area must be more than 1/6 of the floor surface area of the flat.
- **Thermal comfort in summer:** In bedrooms Solar Heat Gain Coefficient of the windows is limited according to the orientation of the facade. Lower values of *SHGC* are required when the building is located in a noisy area.

Noteworthy differences between RT2012 and Passivhaus label

Significant differences exist between the thermal regulations in European countries. Particularly a brief comparison between RT2012 and Passivhaus label is done.

- Primary energy coefficients are different depending on the country context.

Tableau 1: Primary energy factors comparison between RT2012 and Passivhaus label

| Energy | | RT2012 | PassivHaus |
|------------------------|----------------|--------|------------|
| Primary energy factors | Electricity | 2.58 | 2.7 |
| | Fossil energy* | 1 | 1.1 |
| | Wood | 1 | 0.2 |
| | PV** | 2.58 | 0.7 |

- French legislation does not consider the domestic electricity consumption, unlike the PH label annual primary energy consumption. However in French legislation, maximum annual primary energy consumption is modulated according to context (for example the location). For PH label this threshold is fixed.
- Building areas are calculated and differently considered.
- Two different indicators are used to evaluate air tightness level:
 - The leakage flow under a pressure of 4 Pa divided by the area of cold walls (not the bottom floor). This indicator, called Q4Pasurf, is used in the thermal regulation RT 2012; For RT2012 in house, the maximum Q4Pasurf is set to 0.6 m³/h/m².
 - The flow of leakage at 50 Pa divided by the heated volume. This indicator, called n50 is used for labels Passivhaus with a maximum set at 0.6 vol/h, whether for new construction or renovation, for any type of use.

The conversion between the two indicators is complex because it involves the compactness of the building (the ratio of the volume on the surface of cold walls). But no matter what, the PH level is much more demanding.

Success Model

Currently, thermal regulation in force in France, RT2012 does not particularly support implementation of PH standard at any level. France has its own EE standard which includes target of NZEB positive energy buildings (produce more energy than they consume) for 2020.

The future thermal regulation, RT2020, is not clearly defined yet. It should be very near to the RT2012 definition by using similar requirements (Bbio, Cep and Tic). However these requirements could be inspired by the label Passivhaus by:

- Considering the domestic electricity consumption with a modulation of a Cepmax around 120 kWh/m². This amount should be adjusted according to building areas difference consideration between Passivhaus and RT2012.
- Reduce the air tightness level to be near to the n50.

RT2020 should require energy production systems in order for building or **district** to produce more energy than they consume. Indeed to have efficiency systems, energy balance should be sometimes considered at the district scale.

Concerning the impact of these policy regulations, several possibilities have already been mentioned for achieving a tenfold increase in the numbers of m² subject to thermal refurbishment, a necessary condition for meeting the Factor 4 target by 2050. Evidently any legal enforcement for energy works would be added to other constraints, already in existence (concerning termites, lead, asbestos, etc.), but the possibility was at least seriously considered for 2012/2013 by the Grenelle Operational Committee “refurbishment of existing buildings” in 2008.

Lastly, although it is not obligatory, the Grenelle set the goal of a 38% reduction in the energy consumption of existing buildings between now and 2020. To achieve these objectives, it will be essential to target the 20 million homes built before 1975, which are two to three times more “energy-guzzling” than the average (representing 58% of housing stock, they consume 75% of energy in the sector).

Going beyond these financial key factors, another important factor in any discussion of sector development is still the question of labour, which has been a sensitive issue for many years in the building industries (due to a structural lack of labour and training). The training requirement is estimated at 50,000 personnel per annum for France.

The French government has also recently taken several decisions and actions that will hopefully contribute to boost energy efficient refurbishments of buildings at high scale. Among these, the creation and financing of 4 new Institutes for Energy Transition in order to help innovation come to the key industrial sectors for reducing energy. Of these 4 institutes, 3 of them are somehow related to energy efficiency and ENR in buildings: Efficacy (focusing at the district and city level), INES2 (Renewable energies) and INEF4 (focusing on energy efficient refurbishment and construction). INEF4 is based in Aquitaine region and is managed by Nobatek. The new institute will allow to launch collaborative R&D projects aiming at improving technical, organisational and financial tools to launch massive-scale energy efficient refurbishment and structuring the market.

Additionally the French government has launched in 2013 a special ad-hoc stakeholder commission to pilot an “Energy efficient building renovation Plan”. This commission is led by two industrial representatives, from Point.P (construction materials distribution) and Delta Dore (ICT solutions for energy management of buildings). This commission is actively seeking

for solutions in a series of round tables and interviews with key stakeholders, their work is expected to underpin new policy measures for massive uptake of energy efficient refurbishment, specially targeting individual housing (12 million units to be refurbished out of 15 million total metropolitan France stock). Envisaged solutions are an “Energy Passport” for each building, including a diagnostic, decision-aid and management software tool “in the cloud”, that will allow optimisation of the EPBD implementation, follow up and coherence in step-by-step renovations, etc.

Political will at the local level

Baseline

Aquitaine Region shows a political will to go forward, generally speaking, into a “more greener and sustainable economy”, which should include energy efficiency in buildings as one of its majors assets.

For the moment, and very recently (last September 2013) the region has engaged the first regional *Circular Economy Plan* in France.

The greening of the production system as a completely circular economy will be based on principles such as industrial ecology, eco-design, and the “functional economy” (preferring to use goods than possess them). In addition to being extremely beneficial to the environment, this approach can be a tremendous economic asset with competitive advantages to companies, dramatically lowering production costs. To do this, Aquitaine has committed to integrate the concept into its regional scheme of economic development, which will pursue the following objectives:

- to boost economic performance while using fewer resources
- to identify and create new opportunities for economic growth
- to ensure security of supply of essential resources
- to limit the impacts of resource use on the environment.

In all this shows a favourable environment to engage in energy efficiency reforms, although in general, the tendency for this sector is to follow national roadmaps rather than to engage in pioneering work as would be the NZEB challenge today.

Success Model

In France, regional authorities have competence in terms of decisions related to energy efficient buildings and renewable energies, but it is limited given the national context of regulation, which evolved greatly over the last and which will evolve more before 2020.

At regional level, more efforts should be dedicated to the cooperation between existing services in a transversal and interdisciplinary approach. To develop this approach working groups must be proposed, driven and animated, in order to make the most of synergies in terms of political will related to NZEB and RES. The process proposed for the drawing up of the *Bilan Carbone “patrimoine et services”* could be an inspiring initiative for this approach.

Local climate and sustainable energy policy

Baseline

The *Climate Plan* has been implemented in France since 2006 as a policy framework to be declined at the local level, with the objective of improving policies and practices towards climate change fight. Of course Aquitaine Region has its own version of the Climate Plan, and defined several work groups following social and economic sectors of activity.

The “Social housing for low-energy” project group of the Local Climate Plan aims to refine the implementation of the Climate Action Plan in its point 3.2: “Energy saving in social housing.” In Aquitaine there are nearly 130,000 public rental housing managed by housing agencies, with about 250 000 inhabitants.

The total portfolio represents 10 % of the main homes in Aquitaine region. 52 % of the park was built before 1977. The objective of this group has been to integrate and support energy efficiency and renewable energies integration in refurbishment programs implemented by public SHO offices including defining guidelines based on a technical assessment of opportunities including the establishment of thermal performance criteria appropriate to Aquitaine region, a hierarchy of actions to be taken, and identifying the conditions for convergence of actions between the local communities and the French government.

More recently in 2012 the French State and the Aquitaine Region have approved the Regional Plan for Climate, Air and Energy (SRCAE). Since November 15, 2012, Aquitaine has a shared strategic document which delivers to all Aquitaine players a coherent framework “Climate, Air, Energy” including communities levels of implementation. The SRCAE defines the main regional orientations and objectives in the fight against climate change, energy efficiency, development of renewable energy and land management to improve air quality.

The objectives of the baseline scenario SRCAE Aquitaine are:

- A reduction of 28.5% of final energy consumption by 2020 compared to 2008
- Production of renewable energy equivalent to 25.4% of final energy consumption in 2020
- A 20 % reduction in greenhouse gas (GHG) emissions by 2020 compared to 1990
- A reduction in emissions of air pollutants, including nitrogen oxides and diesel particulates.

Aquitaine is positioning itself on a path to achieve a division by factor 4 of GHG emissions by 2050, compared to those recorded in 1990. The baseline report presents the regional situation in terms of energy consumption and production, climate vulnerability and air quality, as well as potential and targets for 2020 to reduce greenhouse gas emissions, energy consumption and renewable energy production.

The PLAN OF REGIONAL TERRITORY AND SUSTAINABLE DEVELOPMENT (SRADDT) named “Aquitaine 2020”, indicates that the regional energy policy for 2020 must count in terms of consumption with an increase in energy consumption by 2020. In fact, given the demographic trends, it will be higher than the national average growth, with 20% for Electricity alone.

Thus energy savings are particularly needed in three areas:

- 1) Transport by promoting modal shift to limit impacts the environment and to deal with the rising price of oil.
- 2) The collective and individual housing sector by making progress on insulation and the choice of materials, especially considering that the high dispersion of homes in Aquitaine generates an energy consumption proportionately more important. Gains on the order of 35% are possible, which implies taking into account the savings in regional projects.
- 3) Industrial activities by developing innovative processes.

S u c c e s s M o d e l

Aquitaine is one of the first regions to adopt its climate plan in 2007 while the year 2011 was marked by the adoption of two major texts aiming to mitigate and adapt to the impacts of climate change: SRCAE (Regional Scheme Plan for Climate, Air and Energy) and the new regional Climate-Energy Plan entitled "Climate Challenge Aquitaine", adopted in November 2012. SRCAE helped define the effort required over the period 2008 / 2020 to reach a level of cutting emission by 20% compared to the reference year 1990 (EU target adopted in the climate and energy package). These goals are called *Grenelle + scenario*.

The goals of energy and renewable energy (RE) from the SRCAE for the Aquitaine region are shown in the table below:

| | Tendanciel | Scénario Grenelle + |
|--|------------|---------------------|
| 1- Efficacité énergétique (2008/2020) | - 13.5 % | - 28.5 % |
| Consommation d'énergie (2008/2020) | 5.6 % | - 12.7 % |
| 2- Part des EnR dans la consommation d'énergie | 15.6 % | 25.4 % |
| 3- Emission de gaz à effet de serre (Evolution par rapport à 1990) | 7.1% | -20 % |

Tableau 2 : Objectifs SRCAE Aquitaine

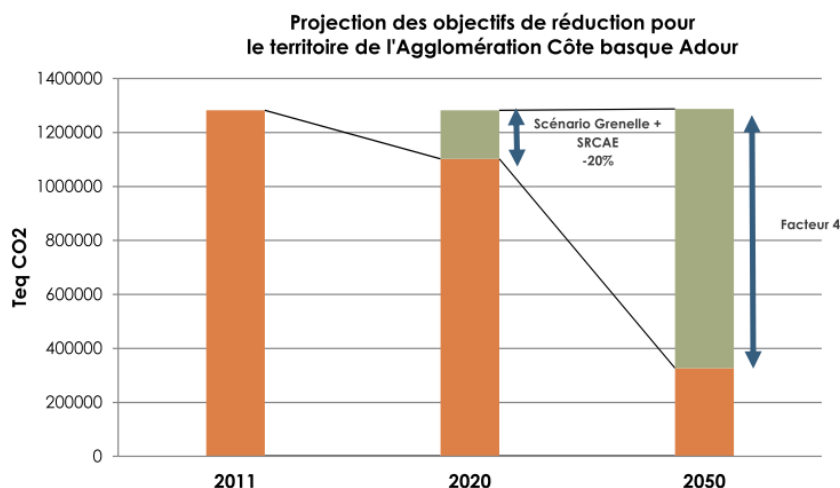
At the local level we work in Côte Basque Adour Urban Agglomeration (ACBA) which counts about 150 000 inhabitants and comprises 5 municipalities: Bayonne, Anglet, Biarritz, Boucau and Bidart. The ACBA starts, meanwhile, in 2007 a process of Territorial Climate Plan, one of the first territories of France. Today as part of its evaluation policy and continuous improvement, the Community took the opportunity to develop a Climate Action Plan of second generation.

This community approach is an additional level of local policies to fight against climate change. This new Territorial Climate Plan will be made consistent and necessarily incorporate the supra regional initiatives. Indeed, SRCAE of Aquitaine is to propose a framework for local action (across all players in the area) to counteract the tendency to increase GHG emissions.

Some of the members of the Community, the towns of Anglet, Biarritz and Bayonne have developed since 2009 a local Agenda 21 adapted to each of the territories which deals with the consideration of climate and energy issues in their public policy and the cities of Bidart

and Boucau developed a balance of greenhouse gases emissions related to their own activities in 2011 to initiate action on their internal practices.

Public actors are stakeholders in this community project that is the Climate Action Plan, they engage and mobilize on the subject. However, it remains yet to establish the necessary synergy and coherent articulation between these Agenda 21, Carbon Footprints and Territorial Climate Plan of the urban agglomeration.



After the completion of carbon balances for having a diagnosis for each institution and for the whole territory, the Agglomeration (by then Urban Community of Bayonne, Anglet and Biarritz) adopted by decision of 30 June 2009 a Territorial Climate Plan on its program consistent with national and international legal framework. Targeting a factor 4 for 2050 with two dates matched to those of France and Europe.

- Reduced GHG emissions by 20% over the territory in 2020 ,
- A 75% reduction of GHG emissions in the territory for 2050.

The diagnosis of GHG emissions established in 2008 identified room for improvement and set targets for reducing GHG emissions adapted to the local and territorial context.

To achieve its objectives, the Community in connection with the municipalities has initiated a Climate Action Plan which features 3 levels:

1. At the institutional level, public building must be exemplary in terms of energy management of its assets and its activities. This line of work is shared with the municipalities of Bayonne, Anglet and Biarritz,
2. At policy level the of its Climate Plan will be included in sectoral policies
3. Towards its territory of influence, ACBA wants to encourage stakeholders to engage alongside the agglomeration to fight against climate change.

Achieving the diagnosis of GHG emissions in 2006 has allowed the realization of a 2009-2013 action plan featuring a 5 axis program to enable an overall reduction of 20% in 2020 of greenhouse gas emissions associated with the activities of the Community. The axes are:

Axis # 1 - Travel:

Implement a travel policy rational and sober energy

Axis # 2 - Management:

Engage the administration in an environmentally responsible public procurement policy and economic management of resources

Axis 3 - Heritage:

Improve the energy performance of the built heritage and existing infrastructure and build new equipment to minimize the use of conventional energy and adapting to future climate change. In managing its built heritage, ACBA scored its commitment to sustainable development and reductions of greenhouse gas emissions. Part of the investment is devoted to reducing energy consumption and are realized by improving the insulation of various public buildings (notably the roofs), improved heating systems, and the implementation of energy efficient public lighting.

Axis 4 - Energy:

Embark on the path of production and consumption of renewable and locally produced energy

Axis 5 - Monitoring and reporting:

Coordinate with the Cities Climate Plan, evaluate and communicate

This internal action plan is now advanced to about 60% with axes Travel, Heritage and energy are the most advanced. There is still room for improvement, notably by convincing local authorities to go further in the renovation of public buildings, to consider envelope upgrading to NZEB or PH standards.

Local policy instruments for energy efficiency in buildings

Baseline

The *Aliénor* program, built over several years, is a series of calls for projects initiated and supported by the Aquitaine region and the regional delegation of the French Environment and Energy Management Agency (ADEME) for the realisation of buildings with high energy and environmental efficiency.

For the first session, which was launched in March 2007, the call for proposals focused on social housing operations. Subsequent calls have opened the range of buildings suitable as candidates. Performance targets set for candidates in the call for proposals are:

- Consumption of primary energy $\leq 45 \text{ kWh} / (\text{m}^2 \text{ year})$ For heating, hot water and ventilation.
- Emissions of greenhouse gases $\text{KgCO}_2 \leq 10 / (\text{m}^2 \cdot \text{year})$
- The summer comfort (no need for air conditioning) and visual comfort (natural light) are also taken into account.

This program wants to build very low energy buildings in order to optimize energy and comfort criteria adapted to Atlantic climate of Aquitaine region. Especially, concerning summer comfort, this program limits the Tic (RT2005 / RT2012) to a maximum value of 28°C during occupation period and defines a thermal discomfort limited to 8% which is the number of hours when temperature should not comply with adaptive comfort conditions [Brager 2005]⁵ [Ecocampus 2007]⁶. These criteria are a pillar to develop new systems for summer comfort management and innovative design methods [Guiavarch 2007]⁷. Arroussets buildings are a good example issued from this program.

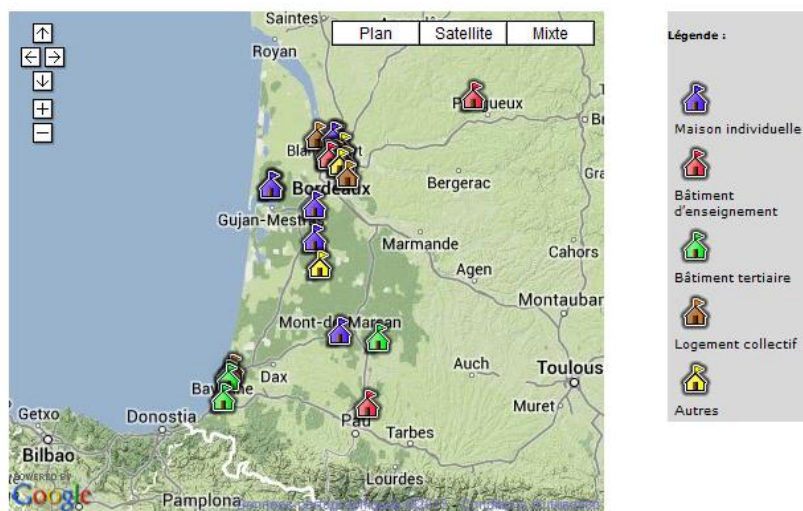
Aliénor program has a website which primary goal is to promote the dissemination of technical solutions implemented by the winning teams in order to reach players in the construction sectors with a return of valuable experience and effectively encourage the reproduction of this type of operation. For each call to Aliénor projects, one can find all the specifications of the winners as well as the monitoring of ongoing projects teams (in a "blog" section).

<http://www.ecocampus.net/alienor/>

Aliénor website complements with another resource and dissemination oriented website with support from the regional government, which is managed by CREAHD, a cluster of building sector companies and is technically driven by Nobatek.

<http://constructionsdurablesaquitaine.com/>

This websites presents a database of front-runner buildings in the region, either from Aliénor competition or specially selected operations.



Interactive map of front-runner operations in Aquitaine

Another initiative concerns the management and new projects for high schools (which are under responsibility of the regional government). The region has decided to apply French

5 G. Brager, R. de Dear, Thermal adaptation in the built environment: a literature review, Energy & Buildings, 27 (1), 1998

6 Cellule Ecocampus, Etude préalable: démarche de performance pour les constructions soumises au climat ouest atlantique, Aliénor, 2007 www.ecocampus.net/alienor/

7 A. Guiavarch, F. Clottes, P. Lagièrre, Démarche de conception de bâtiments passifs à usage tertiaire. Application à la construction bois en région Aquitaine, Actes des 25e rencontres de l'AUGC, (2007)

environmental certification HQE standard for these operations. Regarding schools, the HQE standard is particularly suitable for:

- Buildings: integration of buildings in their environment, choice of materials ...
- Management of energy, water, and maintenance.
- Health and comfort for users: acoustic, thermal, air and water quality.

The Blanquefort Technical School in Bordeaux is the first institution to receive this HQE certification for its extension and restructuring works. Since 2010 the Region is actually working to develop HQE guidelines for further new build, restructuring or rehabilitation of schools in Aquitaine.

At the request of the Regional Council, the Ecocampus⁸ service at University of Bordeaux 1 has developed ECOWEB, a software suite that monitors water and energy consumption and waste management in Aquitaine high schools.

This tool will identify overconsumptions or management problems, giving baselines for the negotiations of facility management contracts. In addition, it will serve as a pedagogic tool for teachers to raise practical environmental awareness among students and staff.

S u c c e s s M o d e l

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More visibility of the ALIENOR initiatives should be given through communication actions and feedback from monitoring results. These projects may then appear as references for the region, in order to inspire other project.

Further initiatives similar to ALIENOR, but proposed at larger scale (district) could be useful to show the perspectives in terms of impact of implementing NZEB to larger areas.

2. ECONOMICS AND FINANCE

Economic objectives and indicators

B a s e l i n e

The Energy Efficiency market in France is potentially enormous, key challenges include the refurbishment of 30 million dwellings (2.2 billion square meters) and 0.9 billion square meters of industrial and commercial buildings. Overall, the French government hopes that

8 From 2009 Ecocampus is integrated in Nobatek.

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400,000 homes will be renovated each year between 2013 and 2020, which would require € 208 billion of private and public investment.

A “Grenelle” operational committee “refurbishment of existing buildings” was set up in December 2007. In its first report in 2008, the Committee outlined the expectations weighing on the sector:

“The building sector has the highest energy consumption – with half of final energy consumed – and is the second highest source of CO₂ emissions, just after transport, with nearly a quarter of emissions. With an annual renewal rate limited to 1%, the proportion represented by existing stock is preponderant. The corresponding three and a half billion square metres of heated surface area represent the main scope for savings, generally agreed in the sector to be potentially the most easily accessible.”¹⁰

While the building sector’s share of CO₂ emissions is estimated at 24%, housing stock alone (31 million in 2006 in metropolitan France including 26 million main residences) represents 560 TWh per annum, i.e. 30% of final energy consumption in France. Housing and commercial buildings together account for a heated surface area of approximately 3.5 billion square metres, three quarters of it in housing and the remaining quarter in commercial buildings. Two thirds of energy is consumed in housing and one third in commercial buildings. CO₂ emissions are broken down in exactly the same way.¹¹

Out of the 16.1 million homes built before 1975, some 9 million were built before 1949 and the mass development of industrialised building. Their thermal performance, although still poorly documented, is in principle intrinsically of a high thermal standard (thermal performance and summer comfort). The Grenelle operational committee “refurbishment of existing buildings” recommended that this should be studied for better targeting of action on housing stock that is often of remarkable architectural and environmental quality.

S u c c e s s M o d e l

Nevertheless, in statistical terms, the aforementioned housing stock represents one the main potential sources of energy savings by refurbishment: individual houses built before 1949 account for a third in terms of numbers, but for 45% of heating consumption. In the same way, housing in apartment buildings constructed between 1949 and 1974 represents a significant share in terms of numbers (44%) but over half of heating consumption.

“General application, to all buildings constructed prior to 2001, of external thermal insulation rather than internal insulation where allowed by architectural characteristics, controlled ventilation units (with heat recovery from the air extracted if applicable) and multiple glazing, would reduce the needs of an individual house or apartment building by an average of 60%.”¹²

10 Operational Committee “refurbishment of existing buildings”, 2008, *Rapport au ministre d’État, ministre de l’Écologie, du Développement et de l’Aménagement Durables*, Section 1, 115 pp.

11 Operational committee “refurbishment of existing buildings”, op. cit. supra.

12 Translated from Traisnel, JP et al., 2010, “Habitat Facteur 4, étude d’une réduction des émissions de CO₂ liées au confort thermique dans l’habitat à l’horizon 2050”, *Cahiers du CLIP* No. 20, November 2010, 108 pp.

Economic levers

Baseline

The main determining factors of success concern public action to trigger economic levers. Legislation and fiscal tools have a great impact on change in the sector.

For instance 200 000 “zero-interest eco-loans” (maximum amount €30 000) were granted in 2010 (covering insulation of walls and glazed areas and heating and hot water installations based on renewable energies or with particularly high performance. Control systems are also included). However there are some unfavourable signs, such as abandonment of the provision granting 40% of mortgage interest for seven years to low consumption buildings (“bâtiments basse consommation” - BBC), or the 10% reduction in the sustainable development tax credit.

For social housing, the eco-loan at 0 % rate of €9 000 to €16 000 per building finished in December 2013. Available data from 2009-10, says the total budget for that, managed by the *Caisse des Dépôts et Consignations*, was €1.2 billion.

The main lever applied by the State in the short term is the RT 2012 (French thermal building regulations) in force from 1st January 2013... but this solely applies to new buildings, which only represent 1% of the building stock per annum. These regulations, together with the NOME law governing new organisation of electricity markets, will have a certain impact on development of the energy efficient building market.

In France without fiscal incentives, private companies and households are traditionally reluctant to engage in energy saving measures. Nevertheless the implementation of *white certificates*, notably concerning energy providers, have recently encouraged “top-down” energy saving measures from main market actors towards their clients (EDF, GDF, Poweo, Altergaz and Direct Energie, among others, are concerned).

Projects implemented by ESCOs (*Société de services d'Efficacité Energétique*) are mostly HVAC system operations, public lighting, and Combined Heat and Power and facility management, notably public or tertiary buildings oriented. French ESCOs mostly provide complex solutions, in contrast to ESCOs in other European countries. In France the price of energy is still not high enough to seriously encourage savings in energy consumption (cheap energy from nuclear plants). The social housing sector (and in general, rented houses) are still in need of special treatment to overcome split incentives.

The EE market in France is potentially enormous, key challenges include the refurbishment of 30 million dwellings (2.2 billion square meters) and 0.9 billion square meters of industrial and commercial buildings. Overall, the French government hopes that 400,000 homes will be renovated each year between 2013 and 2020, which would require € 208 billion of private and public investment.

Success Model

Although the conditions are very stiff for bank loans to communities, the Aquitaine Region, proving its financial health, will be able in 2013-2014 to invest in energy efficient aid loans and operations.

For the 2013 budget the European Investment Bank (EIB) has been committed to deliver € 800 million. A major undertaking, being one of the largest sums for the EIB within a French region), it will benefit schools, training organizations, and small and medium enterprises in their projects of renewable energy production.

500 million euros of EIB loans will be signposted to finance expansion, upgrading and improving the energy efficiency of schools and training organizations. Among the selected projects: the construction of a "positive energy" school in Bergerac or the installation of photovoltaic panels on the roofs of many regional schools. A first credit of € 150 million was signed in late 2012.

In addition, the region, the EIB, alongside Crédit Agricole and Banque Populaire banks and Caisse d'Epargne, have engaged to support small and micro businesses in their projects of renewable energy production and energy renovation of buildings. Funded jointly by the EIB for € 150 million and the two banking partners who will bring an overall additional funding of € 150 million, this is a total overall budget of € 300 million which will be allocated to energy efficiency projects, in the form of loans at favourable rates. Moreover, the regional guarantee fund, in partnership with OSEO, will also be mobilized to support the initiatives of small and micro businesses.

Forms of funding

Baseline

On 22 November 2012 the European Investment Bank (EIB) granted a loan of 800 million euros for Aquitaine region for sustainable development and energy efficiency in the region. This is one of the most important loans from the EIB a French region.

This loan will allow investments in high schools, SMEs and Very Small Enterprises.

A budget of 500 million is being dedicated to high schools and training organizations. It will improve the energy efficiency of these institutions, and achieve compliance with standards. Photovoltaic panels are being installed on buildings of these institutions.

The loan will finance the construction of a high professional school at Bergerac (Dordogne) which will meet the criteria for a "positive energy building."

€ 300 million will be spent on business envelope to help companies, supplemented by a contribution of € 150 million granted by Crédit Agricole and Banque Populaire / Caisse d'Epargne.

A regional guarantee fund in partnership with OSEO also supports small business investments, including farms.

Tax Incentives and loans in France available for households to finance works for Energy Efficiency

Tax credits are available for heating and energy saving works in households. This is called *crédit d'impôt développement durable*.

With the introduction of stricter energy performance standards (RT 2012) in new dwellings from 1st January 2013, only new properties completed by 1st January 2011 are eligible for the tax credit. Since 2014 landlords are not eligible from the tax credit.

The eligible works include many types of home energy conservation measures, including wood burners, provided the installation meets agreed performance standards. The works for which a tax credit is payable are:

- Condensing boiler
- Double glazing
- Insulating shutters
- Wall insulation
- Hot water insulation
- Central heating controls
- Equipment for renewable energy for heating and/or hot water
- Combined heat and power

Since 2014, the installation of solar panels and rainwater harvesting systems no longer qualify for a tax credit. Neither are heat pumps, other than air/air, eligible. Also new simplification has been done with the rates: from 10 different levels of tax credit previously available now they have been replaced by two rates.

The first lower rate of 15% is only available to those on a maximum income threshold, which is related to household size. For a single person this is around €25 000 pa, for a couple around €35 000 pa and for a couple with a child around €40 000 pa.

The second higher rate of 25% is not subject to a test of resources, but is conditional on at least two elements of energy conservation works - *bouquet de travaux* - being carried out, this is to encourage complementary works aiming at coherent actions and more efficiency. The works can be carried out over two years.

There are **maximum limits** on the level of the tax credit that can be granted, the maximum for one person is €8000, and €16 000 for a couple, which is increased by €400 for each additional person in the household. The allowance can be received over a five year period. No means testing is carried out.

In most cases the tax credit is only available for the costs of the materials, except in relation to the installation of **roof and wall thermal insulation** where the tax credit can cover the same percentage of the labour cost. The project must be undertaken in its entirety by a registered builder. Even more from 1st July 2014, these companies must have the qualification label *RGE – Reconnu Grenelle de l'Environnement* which is intended to ensure quality of the works and final energy efficiency of the improved envelope.

In addition to tax credits, there are two small grants that are available on a means tested basis.

Covering several works such as insulation and improved heating, the government states that around two-thirds of all households should be eligible for at least one of the grants. The conditions of eligibility are not quite the same for each grant, with different income thresholds and works.

A 3000 € grant (*Prime à la rénovation*) is available for the poorest households. It complements the aid of the National Housing Agency (Anah) and replaces the previous renewal grant (FART) of €1 600. The grant work must improve the energy performance of the property by at least 25%. (a specialist must perform an energy assessment to decide the most suitable work). The work should not be started before the application is submitted.

A second 1 350 € grant is attributed to households whose annual income does not exceed the maximum ceiling of €35 000 euros and who do not benefit from the *prime à la*

rénovation of €3 000. To qualify for the grant, a *bouquet de travaux* involving at least two of the following must be realised:

- Thermal insulation work of all of the roof;
- Thermal insulation of at least half of the external facing walls;
- Thermal insulation of at least half exterior facing glazing;
- Installation of a condensing boiler or combined heat and power boiler, or heat pumps other than air/air;
- Space heating or heating hot water by wood or other biomass;
- Heating of hot water by a renewable energy source.

Both grants are only available if carried out by a certified tradesman.

An interest free loan (*l'éco-prêt à taux zéro*) for the cost of works of home energy conservation is also available, without resource condition. The duration of the loan is normally 10 years, but it can be up to 15 years where at least three elements of work are undertaken.

Eligible works include loft insulation and other types of work as listed above for tax credits, as well as renewal of a septic tank system.

The amount of the loan is up to €20,000 for two elements of energy conservation, and up to €30,000 for three or more. It is up to €10,000 for a septic tank alone, but this sum must be included within the maximum of €30,000. Eligible properties are those constructed before 1st January 1990.

White certificates

In France a part from limited fiscal incentives, private companies and households are traditionally reluctant to engage in energy saving measures. Nevertheless the implementation of white certificates, notably concerning energy providers, have recently encouraged “top-down” energy saving measures from main market actors towards their clients (EDF, GDF, Poweo, Altergaz and Direct Energie, among others, are concerned).

Projects implemented by ESCOs (*Société de services d'Efficacité Energétique*) are mostly HVAC system operations, public lighting, and Combined Heat and Power and facility management, notably public or tertiary buildings oriented. French ESCOs mostly provide complex solutions, in contrast to ESCOs in other European countries. In France the price of energy is still not high enough to seriously encourage savings in energy consumption, (cheap energy from nuclear plants). The social housing sector (and in general, rented houses) are still in need of special treatment to overcome split incentives.

Success Model

The government must keep the logic of “bouquet de travaux” (coordinated and complementary works for energy efficiency) and also keep the RGE label compulsory for the enterprises. This will ensure the quality of the builds that obtain fiscal incentives or zero interest loans.

The government has recently created a special commission on “Energy Refurbishment of buildings” which is led by industrial actors. They are currently working on ideas to fuel massive energy efficient refurbishment specially considering housing, as a strategic target.

One of the ideas is to launch an “Energy Passport” which will be established for each house, where after a first energy assessment, a list of suitable works will be introduced, allowing follow-up, communication between different actors, step-by-step renovations keeping coherence of interventions, and also in case of property transfer, this will stay with the building and help new owner to keep on with the energy efficiency measures.

A digital management tool is envisaged to complement the Energy Passport, in order to help all stakeholders involved in the process to act more efficiently and exchange more, possibly both on a cloud based platform and featuring BIM compliance.

Of course energy efficiency standards are expected to comply to NZEB or at least have it as a suitable target, as it is well known that renovation works are generally envisaged by cycles of 30 years, so the idea is to achieve a good performance from the start.

White certificates are already being used as a complement for financing energy saving works as big actors that need to certify actions are offering the system to households: for instance big retail chains that sell gasoline (Carrefour, Leclerc supermarkets) will reverse money to clients that certificate their works via a dedicated platform and service.

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3. KEY ACTORS

Departments of regional and local administrations

Baseline

DREAL *Direction Régionale de l’Environnement, de l’Aménagement et du Logement d’Aquitaine* (Aquitaine Regional Directorate of Environment, Urban Planning and Housing)

DREAL Aquitaine's mission is to implement at the regional level, state policies driven by the Ministry of Ecology, Sustainable Development and Energy and the Ministry of Gender, Territories and Housing. The DREALs is organized in five thematic services and five territorial units, supported by 4 missions, a general secretariat and an integrated support pole. Its scope of action promotes a transversal approach to issues and greater consistency of advice. DREAL's mission is to “bring to knowledge and action” issues from state policies to regional level and allows departmental services to conduct a partnership reflection on the choices that will engage Aquitaine territories in the path of sustainable development.

Climate and Energy Service of the DREAL: SCE Climate and Energy works closely with ADEME¹³ services on energy production, savings and transport, and for the promotion of

13 ADEME is the French National Energy Agency.

Aquitaine significant potential for renewable energy (including solar, biomass and geothermal). It is also in charge of sustainable construction and energy efficiency.

S u c c e s s M o d e l

In sustainable construction depending from SCE Climate and Energy from DREAL, two initiatives are worth noting and developing:

1. **The Observatory of Building Materials** (natural aggregates or substitution) which are the indispensable raw material for all activity of Building, Civil Engineering and Public Works. As such, their efficient and effective management is one of the essential elements of the planning and development of the regional territory. Since several years, the Aquitaine region presents an increasing reduction in the supply capacity of local materials. Indeed, regardless of the type of natural resource (loose rock or solid rock), the potential for exploitation is restricted due to the depletion of certain deposits, changes in regulatory constraints and conflicts of use (environmental conservation, protection of natural areas, increasing urbanisation, infrastructure...). At the same time, the need for raw building materials has grown steadily. This is why the Aquitaine region is now a net importer with all the environmental consequences induced, particularly in terms of transport. The Observatory of Building Materials is an effective and dynamic regional tool, capable of responding to a comprehensive and efficient supply and use of building materials in Aquitaine.
2. **The Observatory of the Construction Sector** is a permanent information tool that gathers and processes all economic and social information in the field of construction. Its funding is contracted through a multi-year agreement and subject to funding from the State and the Regional Council. It is managed by the CEBATRAMA (Economic Unit of Building, Public Works and Building Materials Aquitaine) which is a non-profit organisation. The observatory is meant to be a place for dialogue, information and forecasting that includes at the regional level, all partners in the building sector, including Public Works and Quarries and Building Materials.

Other stakeholders

B a s e l i n e

There are some interesting initiatives like “poles of competitiveness” who works like associations of complementary actors of the building sector, who can work together on improving the methods and habits, and promote novel solutions in energy efficient design and construction of NZEB. The CREAHD is one good example of this kind of initiatives: it is an association dedicated to Construction, Resources, Environment, and Development of Sustainable Residential Buildings in the Aquitaine Region.

S u c c e s s M o d e l

There is already an important network of actors like regional and local energy agencies, educational institutions, and industry organizations.

The most important step will be to convince all of them of the interest of the NZEB approach proposed in the PassREg project, in comparison with existing and planned regulation context, existing labels/certifications, and sustainable construction concepts already applied.

Once these key actors are convinced and have available all the necessary information, and sets of solutions, they will be able to disseminate the idea and convince the other stakeholders (local legal entities, civil associations, financial institutions, media). The networks, and information dissemination channels already exist: the key to success in establishing an appropriate regional roadmap will be to use them efficiently.

4 CAPACITY FOR PLANNING, DESIGN AND CONSTRUCTION

Training of local authorities

Baseline

The number of opportunities for vocational training in France's building sector has exploded. A very large number of firms and professionals are involved. In addition, quality demands in terms of the performance and technical standard of new products are increasingly high.

France has already carried out consistent work to determine training needs of building sector's workforce at national but also regional and local levels. Different initiatives have also already been undertaken to train these workers.¹⁴

- BUILD UP SKILLS is an EU programme, In order to meet the general objective of lifelong skills improvement among all construction industry professionals (particularly between now and 2020), proposed different methods to build up the skills of construction personnel (information, awareness-raising, training, support) based on the extent of knowledge or skill required.

The programme aim to train about 12000 trainer and instructors¹⁵, excluding the higher education sector, at the national level. Half of them, including national education and apprenticeships, with initial training, while the other half with continuing training, this section includes "non-certifying training organization", AFPA (National association for adult vocational training), GRETA (Consortium of public educational institution), FCMB (Building trades training companion) and other certifying training body.

However, it becomes clear that in order to meet the objectives of improving the ambitious energy efficiency set by the Europe and France, skills must be improved massively and quickly.

The training of construction professionals is a major challenge for the implementation of energy efficiency policies in the region of Aquitaine. The quantitative and qualitative leap to be made in the performance level of buildings being built or renovated necessitates a

¹⁴ <http://www.buildupskills.eu/en/national-project/france>

¹⁵ http://www.buildupskills.eu/sites/default/files/BUS%20FRANCE_Roadmap%20ENDORSED%20VERSION%20-%2026Nov.pdf

change in practices and a significant increase in the skills of all those involved in the construction industry.

To meet these needs, state agencies offer high quality consultancy and training services. Hundreds of consulting firms and design offices also offer their services in France and worldwide.

S u c c e s s M o d e l

Various national studies show the Insufficient level of training in France in relation to Europe's requirements; lack of mastering new skills (heat exchange in the building, control measurement tools, poses new insulation, air tightness, etc.), only 30% of the trainers feel competence enough, the offers of training are not very legible and finally, the number of qualified trainer and the TOT is insufficient.

The needs for targeted training are:

- Instructional design: promoting development situation on educational platforms and continues training in work sites, case studies, new teaching methods, etc.
- Raising difficulties access to training provision (the image of the construction trades, continuous training : developing of eco-conditionality supports, access to public procurement, state aid and competition issues, etc., promote access to training, require mandatory induction training).
- Training of trainers TOT: better define of pedagogical framework, innovative new tools, qualifying training of trainers, disseminating technical and pedagogical intelligence to support trainers.
- recognition of training: a lot of communication, driven by demand;
- Financing: support entrepreneurs in terms of training and good signs specific funding.

Training of designers and builders

B a s e l i n e

Certified European Passive House Designer (CEPH):

Based on the teaching material developed in collaboration between the CEPH project partners, the CEPH training courses are designed as a 80 hours intensive programme to cover all relevant topics and issues, it includes nine modules providing all the elements necessary for a good design of a passive building in the 10-day-training-course.



In France, the Passive House certified center for training and examination in Paris is “La Maison Passive Service Sarl”. Nowadays there is no training center in Aquitaine region. However, from 244 persons graduated CEPH in France, seven persons graduates CEPH at regional level.

BATIR 2050, training Agreed *Effinergie*:

Founded in 2006, the association Effinergie has set a goal to develop the market for new and refurbished construction, a genuine dynamic to generate comfortable and efficient buildings from an energy point of view. PASSIVE HOUSE BIOCLIMATIC “Effinergie certified center” offers a training programme “**Bâtir 2050**” to help professionals of building to manage the BBC and RT 2012 labels, Effinergie and passive building. The training programme is set up in collaboration with FFACB (French Federation of Building artisan-cooperators), FFB (French Building Federation), CAPEB (Confederation of Crafts and Small Business Building) and SYNAMOBB (combination of professional project management and architectural designers). More than 600 designers and building developers already formed “**Bâtir 2050**” from 2009 to 2012 ¹⁶.

FEE Bat, Training in energy saving of professional in building, companies and craftsmen. Until 2012, more than 48,000 participants in energy savings with training deployment in all regions



The FEE Bat provides five training modules are open to all entrepreneurs, artisans and craftsmen work in buildings. The modules are about the energy improvements to existing buildings, efficient technologies and NZEB. There is many certified centers in the Aquitaine region for the FEE Bat training, ARFAB (Organization of training for building artisans), GRETA (Group of institutions of national Education), NOBATEK (Technical center), IFRB (Institute for Training and Research Building), CDPEA (Sustainable Building and Energy Performance in Aquitaine), AFPA Aquitaine (National Association for Adult Vocational Training). FEE Bat program is supported by a large majority of leader organizations, associations and enterprises (atee, CAPEB, FFB, SCOP BTP EDF and ADEME).

Regional Level

The vast majority of French Regions support Effinergie®, Today 20 out of 22 mainland regions have joined the association including the region of Aquitaine. Created in March 2006, this association’s objective is to create a supportive dynamic within the construction market that makes it conducive to building comfortable and energy efficient buildings. It has forged the ability to:

- develop building references and tools,
- unite all the players in the sector,
- promote a regional dynamic among the players in the construction sector,
- ensure coordination between governmental authorities and regional initiatives,
- show the technico-economic feasibility of low energy construction, highlighting results from real experience.

S u c c e s s M o d e l

¹⁶<http://effinergie.org/web/index.php/effinergie-en-region/informations-de-la-region/185-formation-pratique-a-la-construction-basse-consommation-rt-2012-effinergie>

CFAA (Centre Formation Architects Aquitaine) proposes a continuous training for the architect in Aquitaine region about the sustainable building management. At June 2014, CFAA achieved a training about “ Positive Energy Building” BIPOS in collaboration with NOBATEK “technical center in Aquitaine region”.

CFAA proposes many other training primarily intended for architects, BBC (Low energy buildings), BBC et santé (Low energy buildings & health care), RT2012, Air quality in the buildings ... etc.

The number of architect follow these trainings is not mentioned by the center (for more information see: <http://www.cfaa.fr/>)

5 MARKET FOR PASSIVE BUILDINGS

At present, The French labels meet the need of the market to the low energy consumption buildings. The Effinergie® association, in partnership with the Ministry has developed energy performance labels for the new and renovated buildings in residential and non-residential sectors. These labels are delivered by accredited organizations of certification (Promotelec, Cequami, Cerqual, Prestaterra and Certivéa). BBC-Effinergie label, also used by the Grenelle environmental agreement as the 2012 objective for new buildings, the consumption goal of this label is 50 kWh_{ep}/m²/year for new residences, and 80 kWh_{ep}/m²/year for renovation projects.

To prepare the construction sector to NZEB, Effinergie offers its labels “BPASS-Effinergie” and “BEPOS-Effinergie 2013”. The general principle of “BEPOS-Effinergie 2013” is to reduce the consumption of non-renewable primary energy used in the project, it demonstrates the foundations of what must be a positive energy building, and therefore proposes a developed protocol to be shared by all stakeholders in the building sector from 2013, It involves individual or collective residential and non-residential buildings in France (excluding overseas territories). This label will allow for evolution of the requirements and prepare for further steps before the generalization of BEPOS provided by future thermal regulation RT 2020.

Effinergie’s strength comes from bringing together French regional, city governments and a wide range of actors and experts, from research laboratories to manufacturers, training centers, architects, engineering consultants, research departments, non-profit organizations, etc.

In France, between 2007 and 2014, the Construction with BBC Effinergie label is 306.810 housing, 87% for apartment housing and 13% for single housing. The graphs below show the evolution of the number of requests for the BBC label Effinergie cumulatively, since 2007.

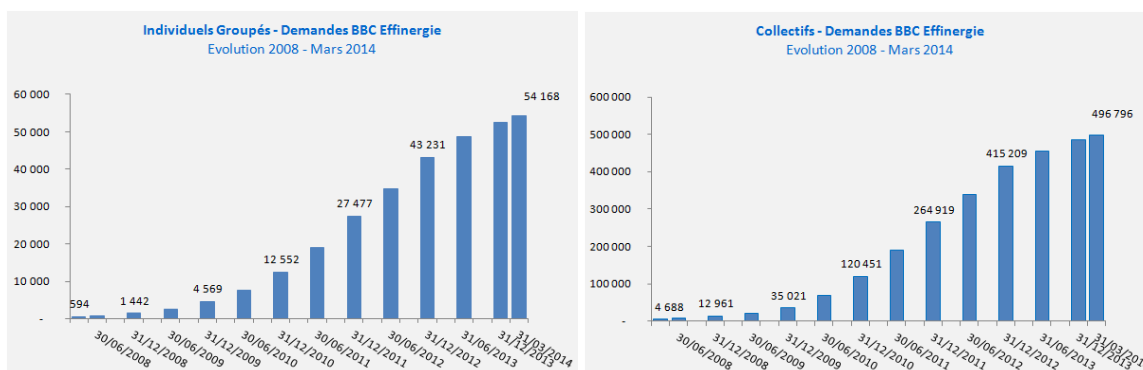


Figure above: Evolution of the number of requests for the BBC label Effinergie cumulatively, since 2007

In March 2014, more than 51% of applications were certified Effinergie BBC, this percentage achieved 62% in single houses. In the first quarter of 2014, the pace of Certified BBC Effinergie housing is always supported and comparable to the average in 2013. Indeed, more than 12,000 houses are certified by month.

The number of housing certified Effinergie+ in France was 204 housing in 2014, 2 housing only had the label BEBOS Effinergie 2013 at the same period.

In the region of Aquitaine...

In the region of Aquitaine, the number of a new housing certified BBC Effinergie (Houses Detached group, Collective Housing in the region of Aquitaine is about 22500 housings in addition to 60,000 m² of tertiary buildings. Nowadays, 38500 Housings and 204000 m² of tertiary buildings are demanded the certification.

The graphs below show evolution of the number of housing certified BBC-Effinergie in the region.

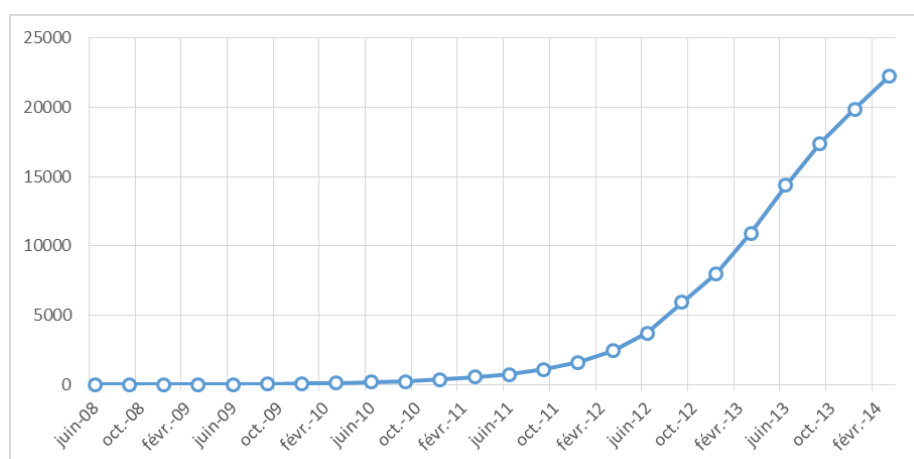


Figure above: Evolution of the number of housing obtained BBC in Aquitaine region

There is no housing labeled Effinergie+ or Bepos Effinergie yet in the region of Aquitaine, even though there is about 550 demand for the label Effinergie+.

The statistics show that although the market for passive house building has not yet matured, but there is a great trend among decision-makers and end-users to move toward this type of construction. The number of designed and built passive buildings is very limited in the region of Aquitaine particularly and across France Generally.

6 SUCCESSFUL PRACTICES

Baseline

Buildings built in Aquitaine region and designed with high energy performance are currently listed on the Aquitaine Area Sustainable Building website:

(www.constructionsdurablesaquitaine.com).

This website is supported from the regional government, and managed by CREAHD, a cluster of building sector companies and technically driven by Nobatek.

The screenshot displays the website's interface. At the top, there is a navigation bar with links: ACCUEIL, ACTUALITÉS, AGENDA, OPÉRATIONS (highlighted), DOCUMENTS, and CONTACT. Below this, a sidebar on the left contains a menu with items like 'Opérations en Aquitaine', 'Opérations Aliénor', 'Appel à projets Aliénor', 'Newsletter', 'Ressources', 'Démarches Construction', 'Démarches Aménagement', and 'Autres démarches en Europe et dans le monde'. The main content area is titled 'Réalizations en Aquitaine' and includes a search filter with dropdowns for 'Département', 'Domaines', 'Type', and 'Mot-clé'. Below the filter is a map of Aquitaine with various colored icons representing different types of buildings. A legend on the right side of the map identifies these icons: 'Maison individuelle' (blue house), 'Bâtiment d'enseignement' (red school), 'Bâtiment tertiaire' (green office), 'Logement collectif' (orange apartment), and 'Autres' (yellow house). The bottom of the page features logos for 'Région Aquitaine', 'ABRÉS', and 'Nobatek', along with text indicating 'Conception - Réalisation : Novaldi' and 'Plan du site | Mentions légales'.

Fig. 1 - Aquitaine Area Sustainable Building website- Interactive map of front-runner operations in Aquitaine

Thermal Regulation in force in France, RT2012 does not particularly support implementation of PH standard at any level. France has its own EE standard which includes target of NZEB

positive energy buildings (produce more energy than they consume) for 2020. Currently only one house have been certified in Aquitaine. This house is briefly described on a next section.

Focus on monitored wooden buildings with high-energy performance and adapted summer comfort design

In order to consider largely sustainable development issues, two adjoining apartments in Taillan-Medoc (Fig. 2), social housing buildings of the urban development zone of Arrousets (Fig. 3), and two energy-plus-house, called Napevomo (Solar Decathlon Madrid 2010, Fig. 4) and Sumbiosi (Solar Decathlon Madrid 2012, Fig. 5), have been developed with a global reflection of life cycle assessment. The massive use of wood ensued from these studies.

These projects, through regional economic development request, aim to reduce energy loads in winter while maintaining optimum summer comfort conditions. However, one of the main and common issues to these buildings is the management of summer comfort for the Atlantic climate which is warm and humid. Indeed use of lightweight constructive principles in wood requires a particular attention to compensate for thermal inertia and mass losses compared with traditional masonry buildings.

From this perspective, these buildings and their systems were designed, built and instrumented to provide experience feedbacks.

As for winter strategy, bioclimatic architecture is required to manage summer comfort. The use of wide overhangs to protect south-facing windows from the sun or dense insulation (like wood fiber and cellulose wadding) to slow down heat penetration into the walls is examples applied in three projects. Also Napevomo and SUMBIOSI have self-irrigated vegetal areas which enable to protect the house from the solar gains by refreshing green areas through by evapo-transpiration process.



Fig. 2 - South façade of Taillan-Medoc building



Fig. 3 - South façade of Arrousets buildings



Fig. 4 - South façade of Napevomo



Fig. 5 - South façade of SUMBIOSI

However, in hot climate these strategies are not enough, especially for wood frame buildings where the inertia is not enough. Different systems and strategies have been applied to compensate this lack of inertia (**Table 2**).

Table 2 – Cooling systems resume

| Additional thermal inertia | Cooling ventilation systems |
|----------------------------|-----------------------------|
|----------------------------|-----------------------------|

| | | |
|----------------------|--|---|
| Arrousset | - Dense insulation - PCM intermediate floor | - Mechanical over ventilation |
| Taillan-Medoc | - Dense insulation - Massive wood intermediate floor | - Natural over ventilation - Ground coupled heat exchanger |
| Napevomo | - Dense insulation - Raw clay - Self-irrigated vegetal areas | - Natural over ventilation - PCM exchanger |
| Sumbiosi | - Dense insulation - Concrete - Self-irrigated vegetal areas | - Natural over ventilation - PCM exchanger |

All these buildings have been or are currently monitored. Generally they have given very positive feedbacks for both, winter and summer behaviors. These projects and their monitoring relieved three main axes to work and develop:

- Training of trade construction works is necessary to avoid manufacturing defects (for instance : air tightness)
- Detailed dynamic studies are necessary to design summer comfort in Aquitaine
- User has to be entirely integrated during design phase in order to avoid dysfunctional systems

Studied and developed solutions for timber frame building in Atlantic climate enable to maintain an acceptable summer comfort. They require detailed dynamic studies; a reasonably high level of insulation, a compact architecture, an inertia insertion and innovative systems such as PCM based systems. In addition it is important to develop architectural integration through a collaborative work between architect and engineer. Other points are to develop solutions compatible with social housing, that is to say: economic, simple, prefabricated and easy to use. Indeed, user has to be entirely integrated during the design phase.

The first certified Passivhaus house in Aquitaine : The Rospide house



Fig. 6 : Maison passive Pays Basque © IdeA