

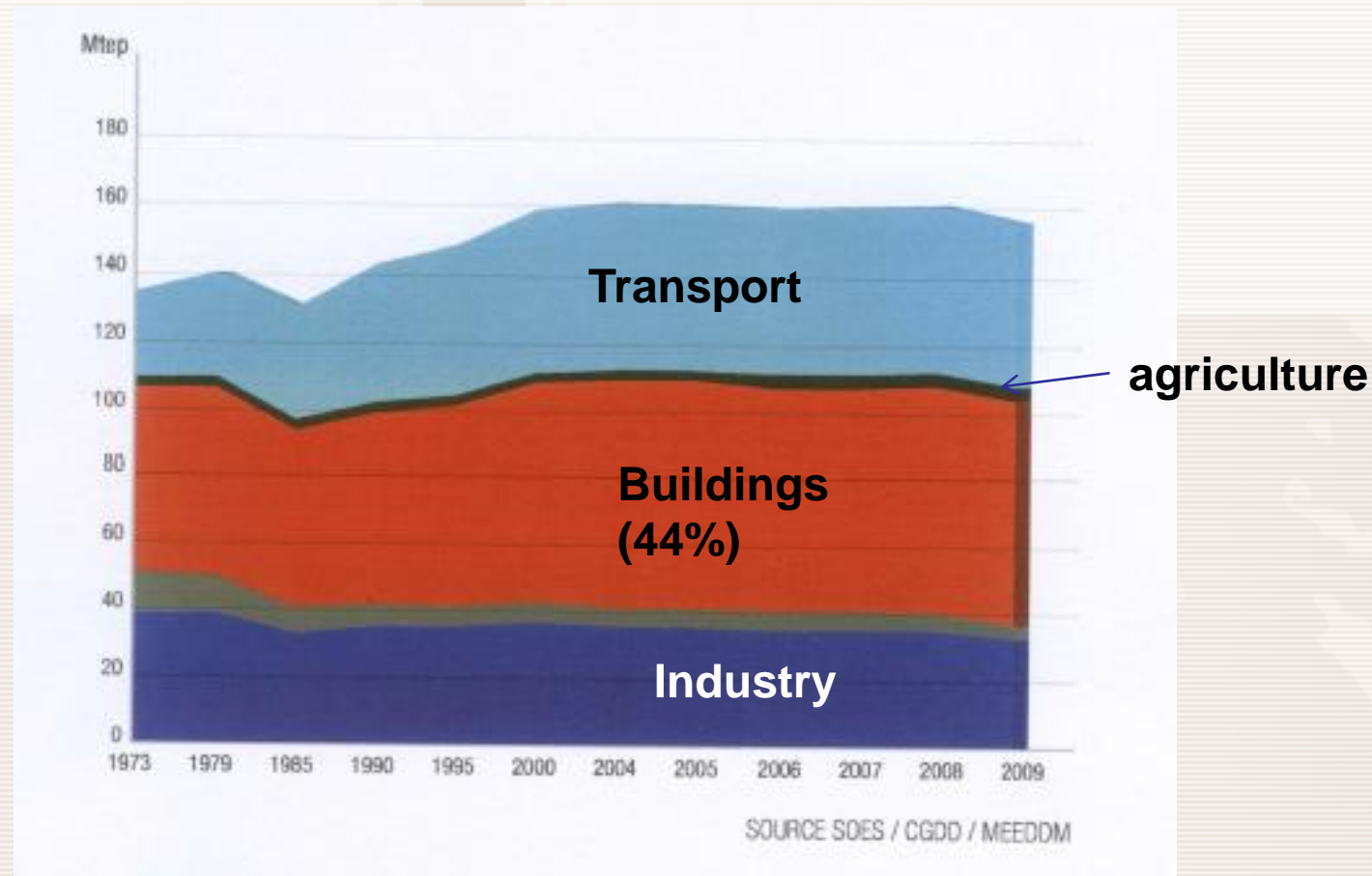
INNOVATIVE METHODS TO ENCOURAGE BUILDING ENERGY EFFICIENCY IN FRANCE

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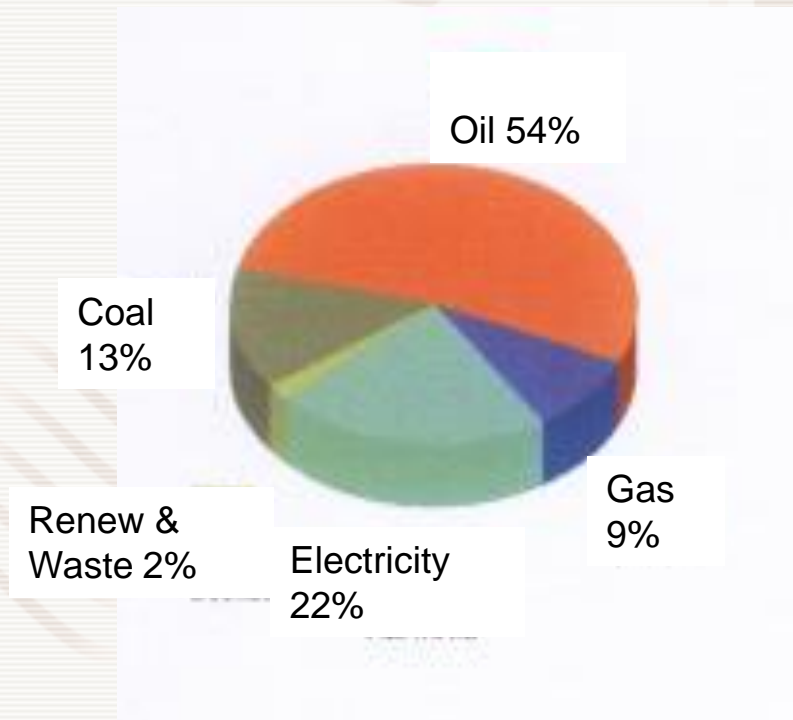
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Final Energy Use in France

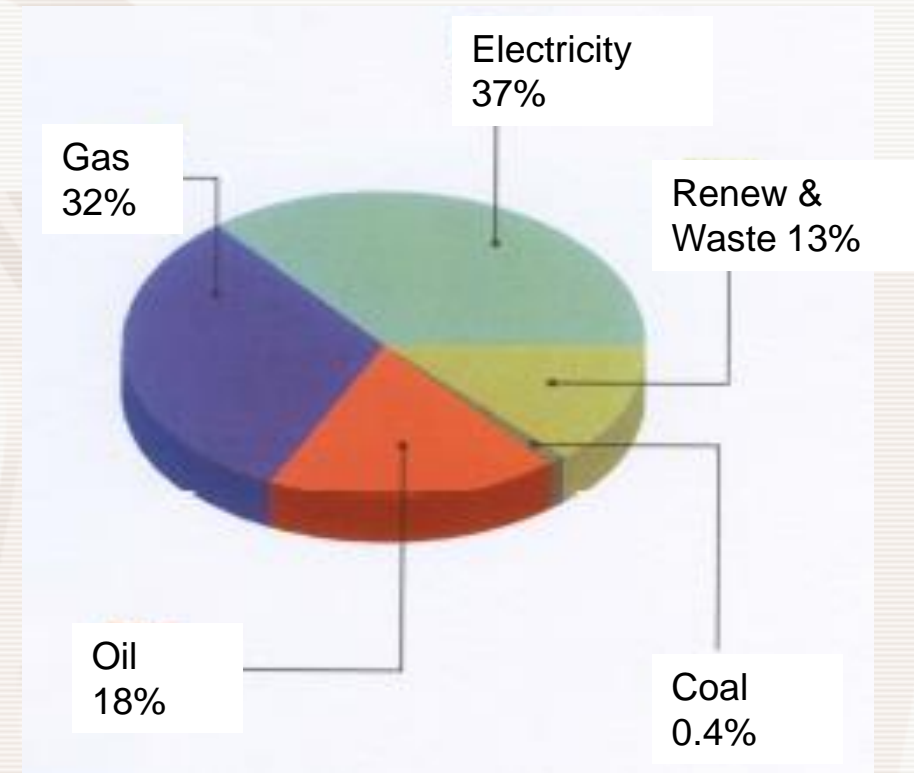


Final Energy Use in Buildings

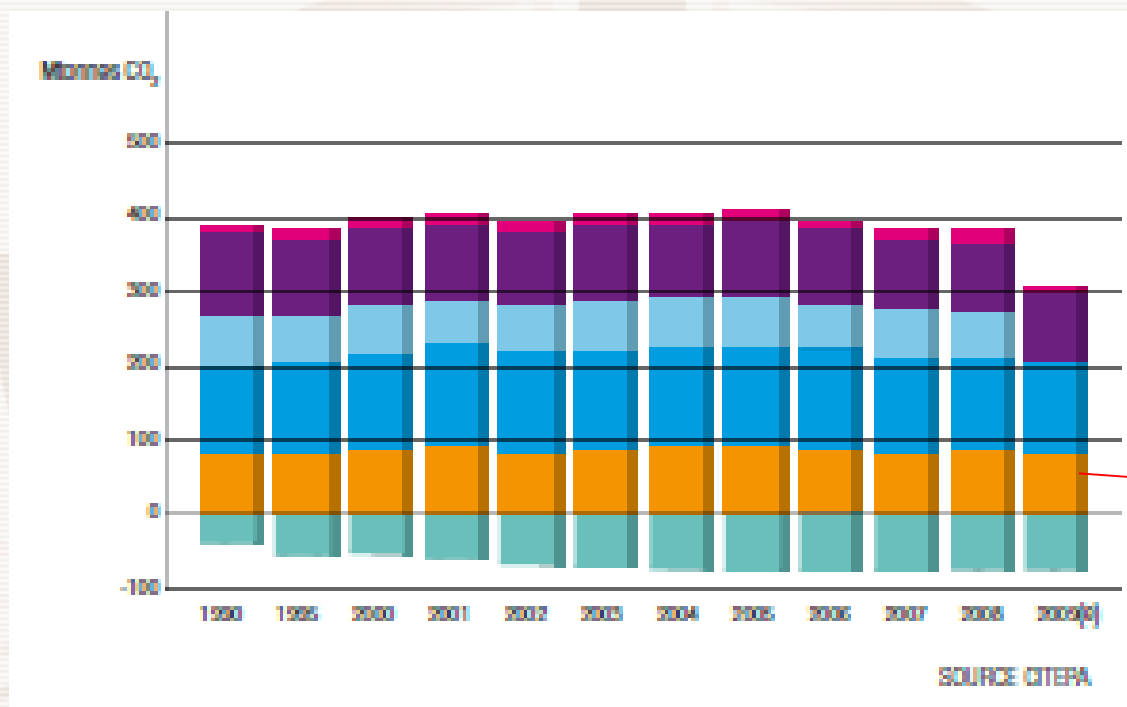
1973: 56.4 MTOE



2013: 68,7 MTOE



CO₂ Emissions in France



Agriculture
Industry
Energy transformation
Transport
Building Sector (23%)
Net Absorption of
Biomass

The Existing Building Stock



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Structure of the French building stock

• The housing sector

32,6 millions of residences (2.4 billions m²)

- ✓ 15,5 millions individual houses
- ✓ 12 millions multifamily buildings
- ✓ 3.2 millions secondary residences
- ✓ 1.9 millions vacant

• Tertiary buildings

➤ 904 millions m²

Sector	Heated surface (Mm ²)	Ratio
Commercial	203.749	22.5 %
Offices	198.765	22 %
Schools	180.584	20 %
Health	104,041	11.5 %
Sport	66.850	7.4 %
Hotel -restaurant	62.378	6,9 %
Community buildings	62.364	6.9 %
Transport	25.109	2.8 %
TOTAL	903.840	100 %

64,5%

The real challenge: existing stock

- **65% of this stock has been built before 1975** (First building energy regulation in France)
- **31% before 1949**, 34% between 1950 and 1974, 13% between 1975 and 1981 and 22% after 1982.
- The average new construction ratio is about 1%
- The average primary energy demand is **250-260 kWhpe /m² year**
- With the actual tendency, we will reach **160-180 kWhpe /m² year in 2050, the target is around 50 !!!!!**
- **55%** of individual houses have not been rehabilitated in the last 20 years

2007: A political issue

By 2012, all new buildings built in France should comply with the so-called "low-consumption" standards; and by 2020, all new buildings should be energy positive, that is, they should produce more energy than they consume.

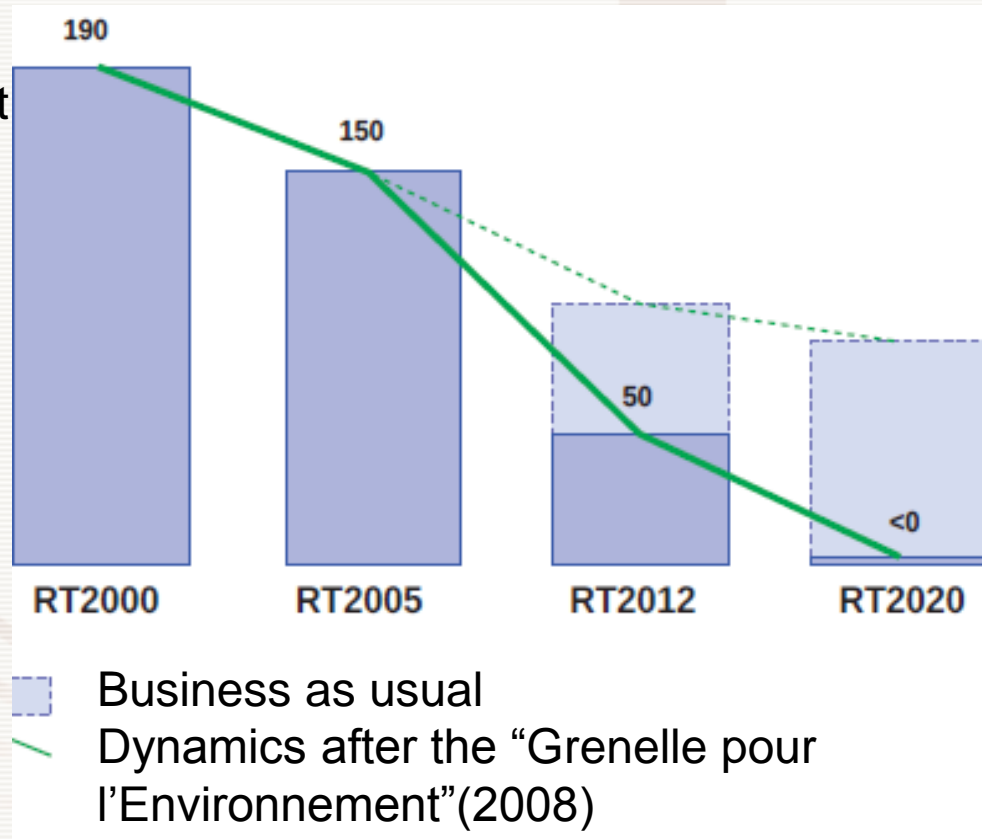


● Factor 4:

France has to divide by 4 its CO₂ emissions before 2050

Transition to NZEB, a long process speeding up now in France

Energy consumption target ($\text{kWh}_{\text{pe}}/\text{m}^2 \text{ Year}$) for Heating, Cooling, Ventilation, Domestic Hot Water, Lighting & Auxiliaries



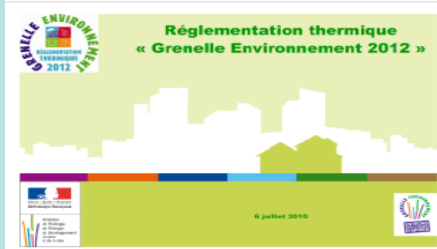
Houses Heating Consumption ($\text{kWh}_{\text{pe}}/\text{m}^2 \text{ Y}$)		
Building period	Fossil energy	Electricity
avant 1975	400	650
1975-1982	200	300
1983-1988	170	220
1989-2000	145	175
2001-2005	125	150
2006-2010	106	125

The main steps

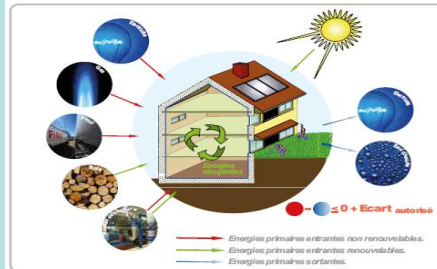
2008: Effinergie association creates « **BBC** » Label for new and renovated buildings



2013: New building regulation RT2012



2013: 2 New voluntary labels: **EFFINERGIE+** & **BEPOS Effinergie**



17/08/2015: new law « **Energy Transition & Green Growth** »



Main target : 50 kWh pe/m² Year for Heating, Cooling, Ventilation, Domestic Hot Water, Lighting and Auxiliaries. Control of Airtightness .6 m³/h.m² at 4 Pa

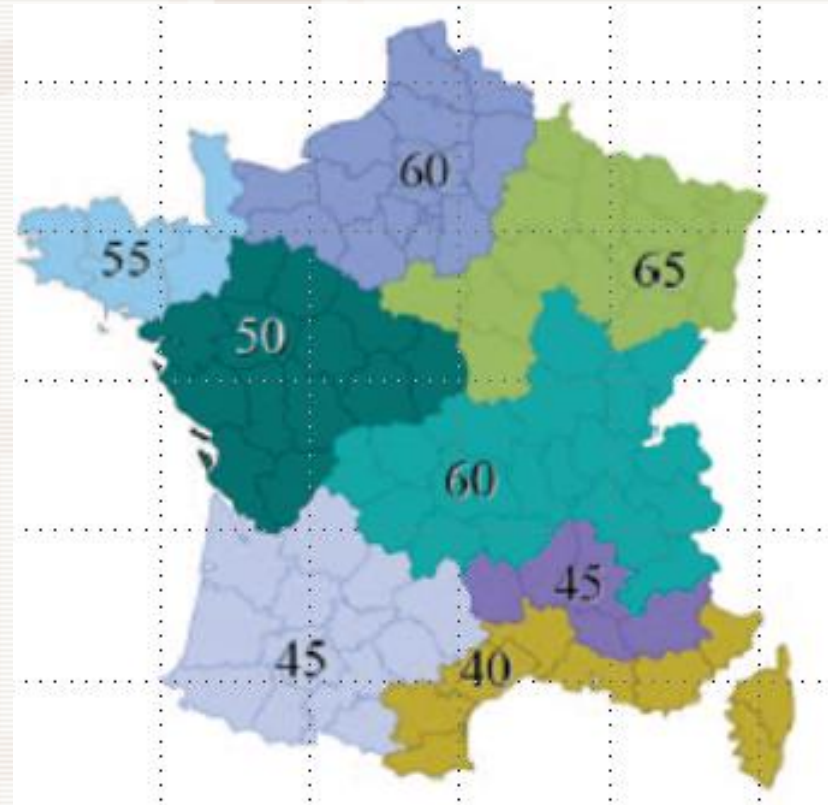
Main target : mandatory extension of BBC label to all new buildings from January 2013

Main target: -20%/ RT2012 & positive energy balance associated with PV integration

Main target:

- 1million buildings (new or renovated) with high energy standards each year from 2017
- Nearly Zero Energy Building Sector by 2050

A new EPB regulation RT-2012

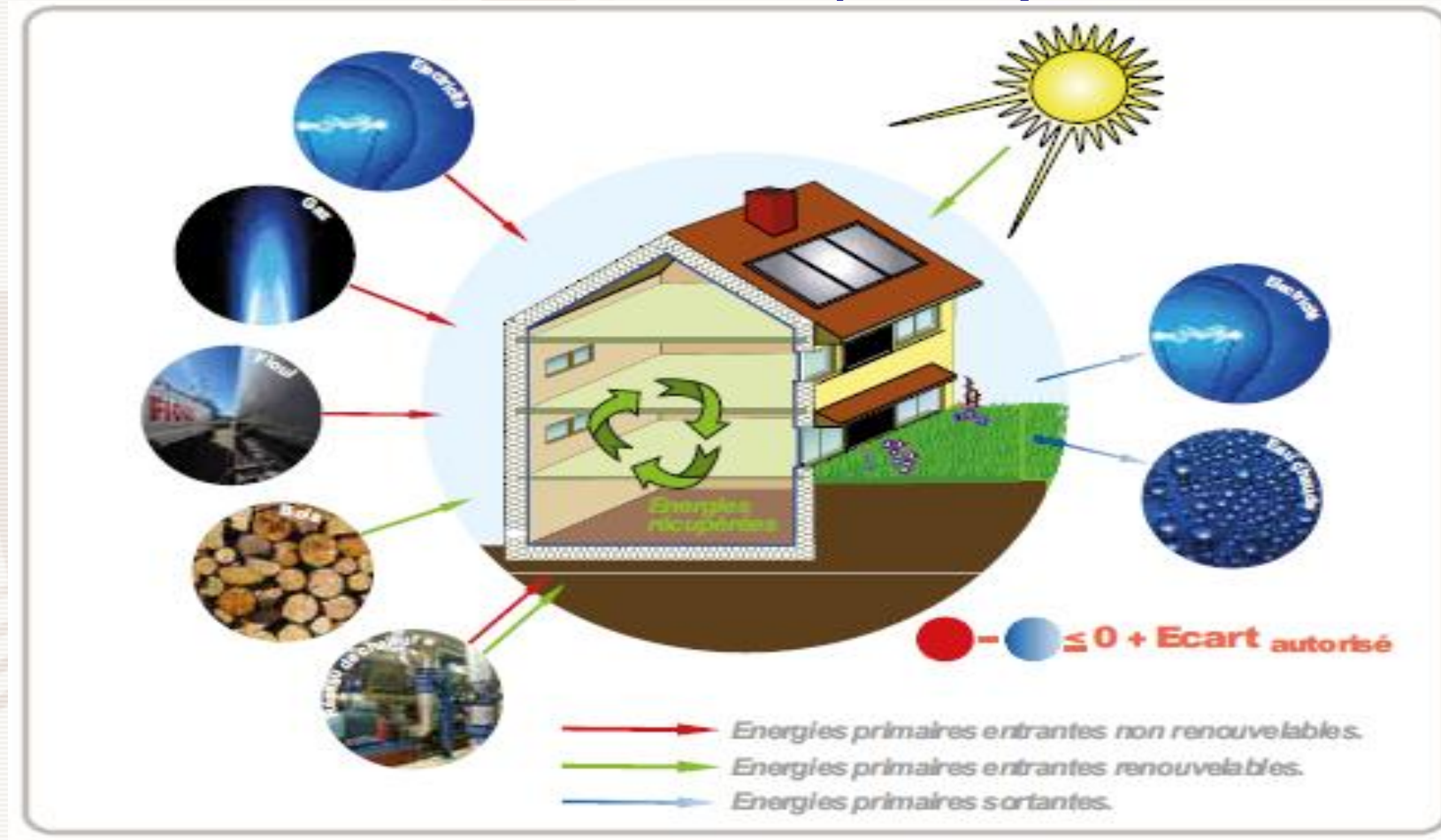


**Maximum Primary Energy
Consumption (**50 kWh pe/m²**
Year) for**

- Heating,
- Cooling,
- Ventilation,
- Domestic Hot Water,
- Lighting
- Auxiliaries.

CONTROL OF AIRTIGHTNESS

Development of Positive Energy Buildings Label (BEPOS EFFINERGIE, 2013)



National Observatory For Low Energy Buildings




Created in October 2009

Objectives: Promote Low Energy Buildings in France



- Analyzing good practices
- Evaluating technical and economical solutions
- Documenting a large sample of buildings
- Preparing the next regulations (NZEB)

<http://www.observatoirebbc.org/>

Observatoire **BBC** | L'OBSERVATOIRE DES BÂTIMENTS BASSE CONSOMMATION

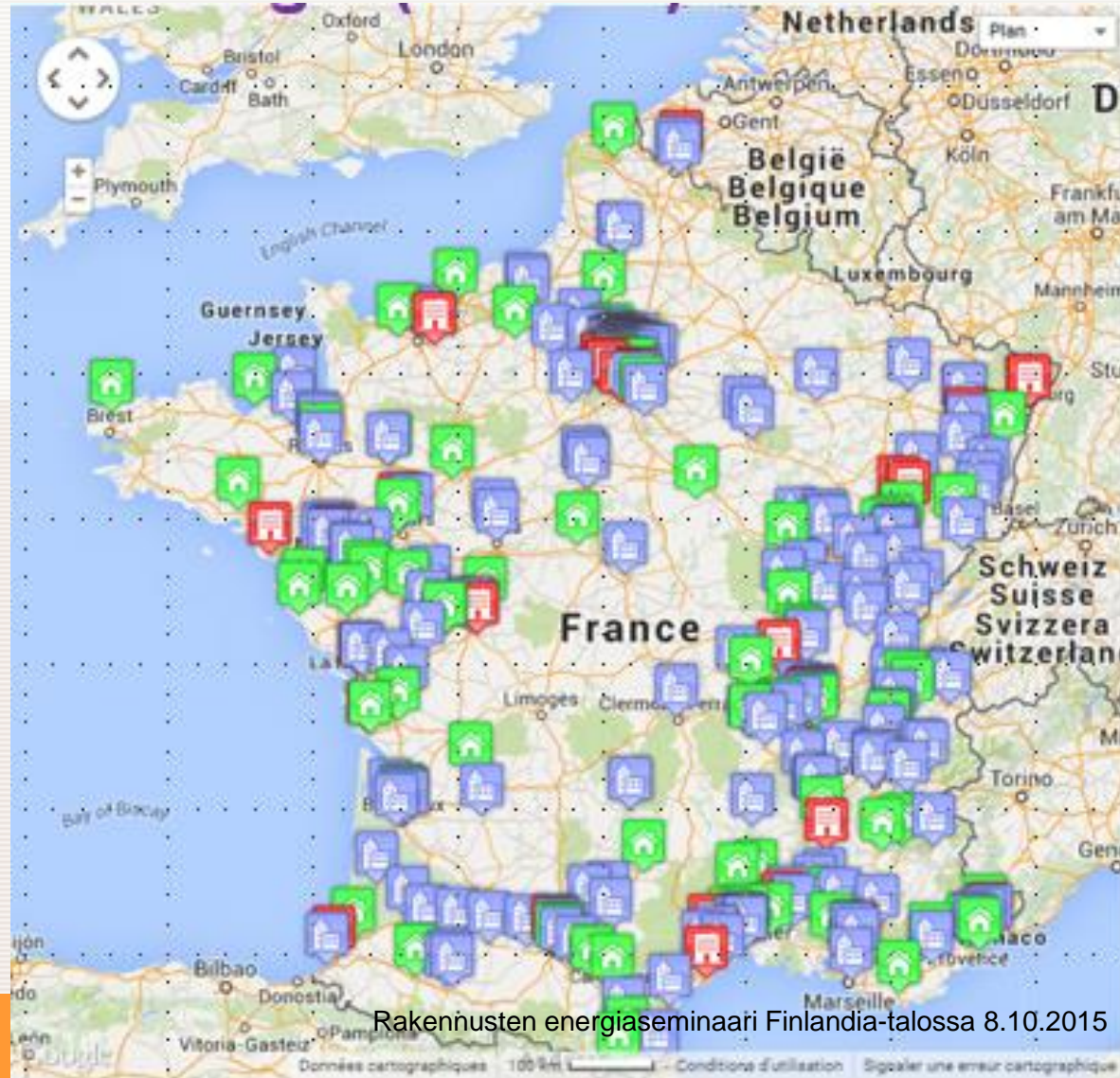
  




ACCUEIL CONSTRUCTION RÉNOVATION BEPOS EN RÉGION

894 351 333

333 projects of positive energy buildings (BEPOS) in 2015, 69 fully documented



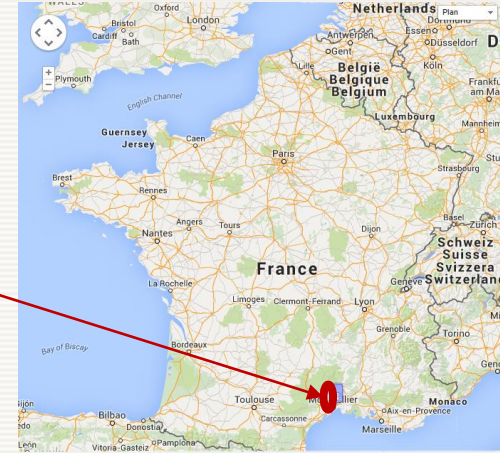
-  Family houses
-  Multifamily buildings
-  Tertiary buildings

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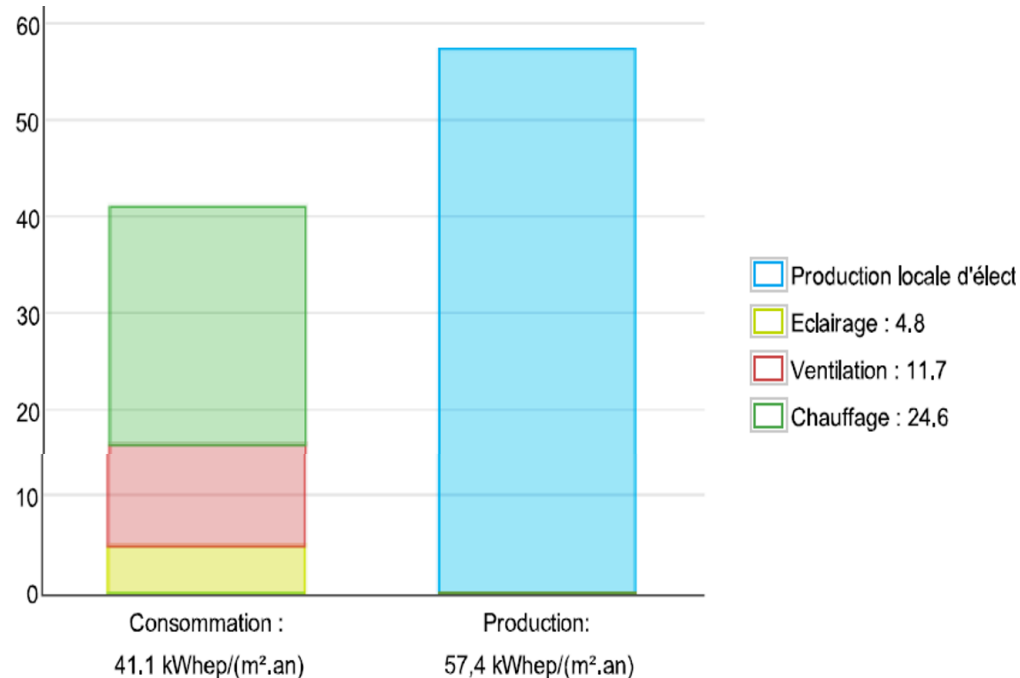
Few Examples: Mediterranean Region



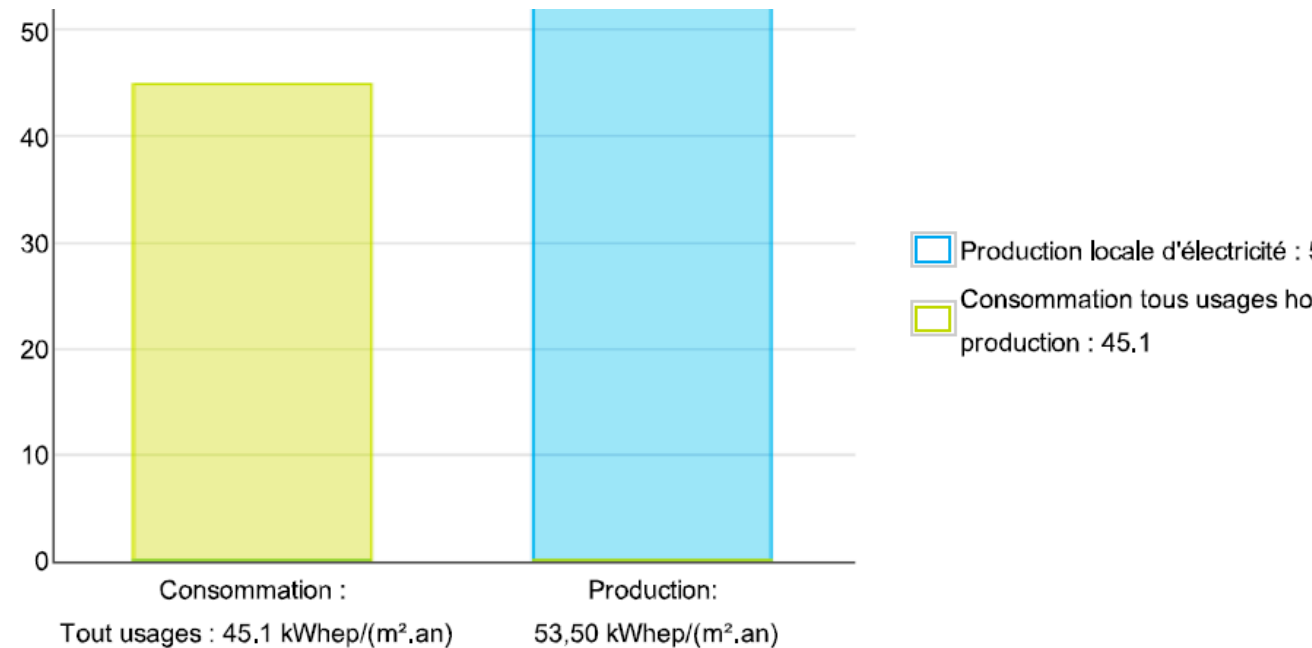
School building F. Mitterrand in Montpellier
2 buildings, 3558 m².
Cost: 1545 €/ m²



Predicted consumption: -16,3 kWh pe/m².Y



Measured consumption: -8,3 kWh pe/m².Y



Main Characteristics



External walls

Concrete-external insulation (20cm of rock wool)



Roof

Terrace, 24 cm of polyurethane



Floor:

on ground, 10cm Polyurethane



Windows:

Low emissivity double glazing with Argon, aluminium frame, movable solar protection

Air tightness

0,52 m³/h.m² at 4 Pa



Heating

Condensing gas boilers(2X70 W)
Radiators



Ventilation

Mechanical extraction with humidity control + Natural ventilation



DHW

Gas+ accumulation for restaurant and sanitary rooms



Lighting

High efficiency lamps (T5) 8W/m² in classrooms



Renewable energy:

PV: 400 m² directly injected in the network

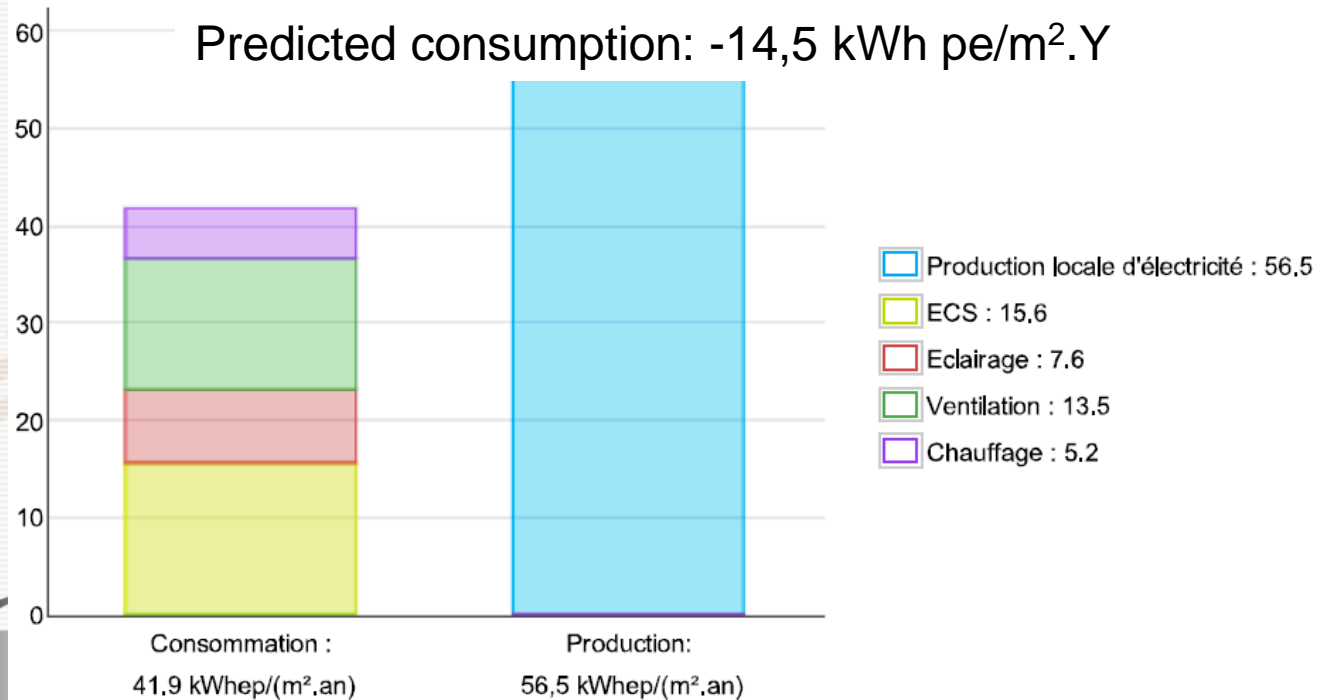
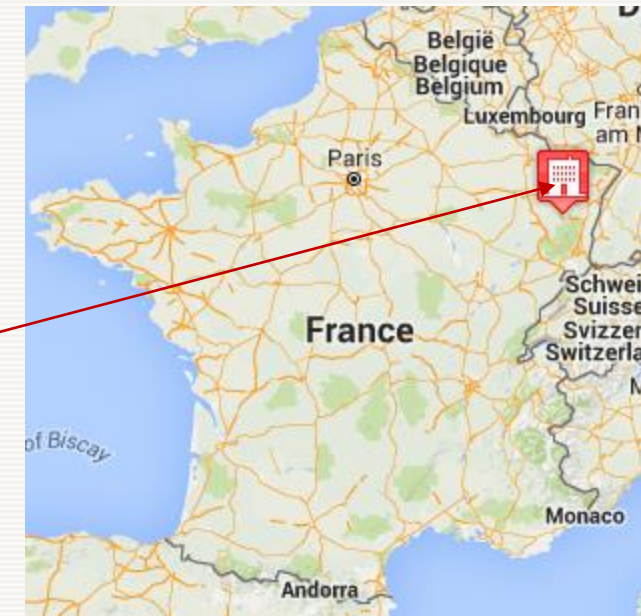
Few Examples: North-East Region



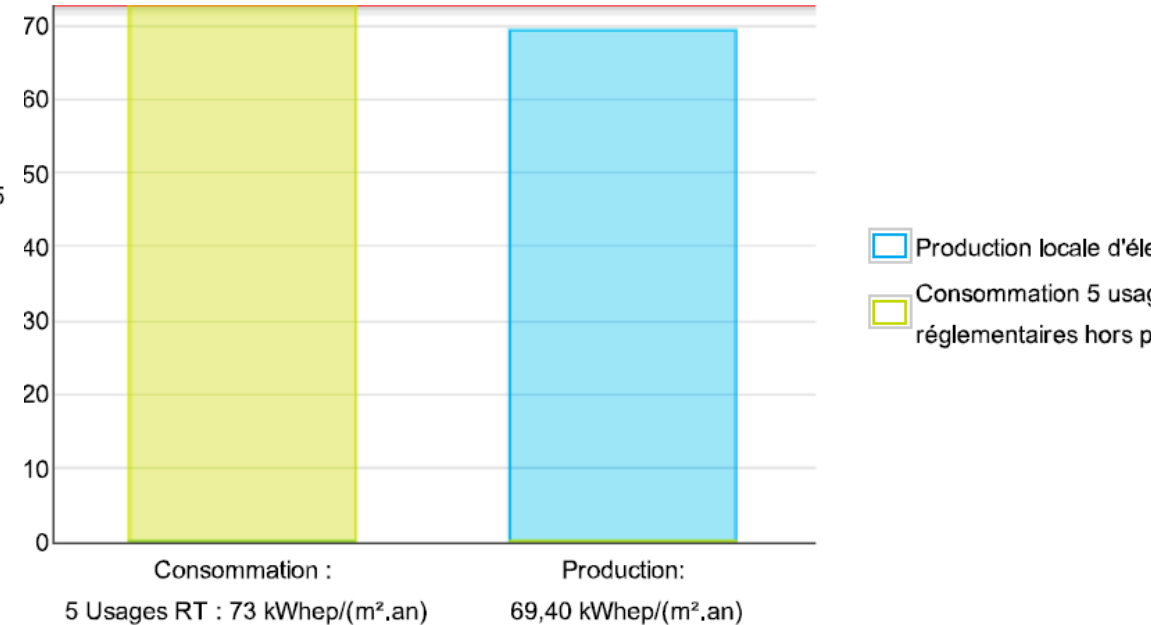
Residential building “Héliades”, St Dié (Vosges)

2 buildings, 2230 m². 17 apartments

Cost: 1834€/ m² (including PV system)



Measured consumption: +3,6 kWh pe/m².Y



Main Characteristics



External walls

Wooden frame, 30cm glass wood



Roof

40cm glass wood



Floor:

Wooden Floor, 40 cm glass wood



Windows:

triple glazing

Air tightness

0,28 m³/h.m² at 4 Pa



Heating

Direct electric heating + radiant panels



Ventilation

Double flux Mechanical ventilation+ heat recovery



DHW

Solar DHW +Gas cogeneration with condensing boiler.



Lighting

High efficiency lamps (fluo compacts)



Renewable energy:

PV: 465 m² directly injected in the network
+ 33 m² water solar collectors .

National Survey of IAQ in Low Energy Buildings (2015-2017)



Objectives:

- ❑ **Building a state of the art of existing Low Energy Buildings/Comfort & IAQ:**
 - Use and working of the buildings, equipment and systems
 - IAQ levels
 - Comfort evaluation (thermal, visual, acoustic)
- ❑ **Identifying improvement strategies for the design, construction and management of Low Energy Buildings**
- ❑ **Since 2013, 150 buildings are being collected: 132 residential, 9 schools and 8 office buildings**
- ❑ **In 2015 the interpretation of results is still going on. However the first results are encouraging.**

A strong support by incentive measures



■ Tax reduction:

- Insulation, efficient systems (condensation boiler, heat pumps, heat & power generation, connection to district heating, PV, solar DHW,.....)
- Certified Company (RGE)
- 30% of the investment up to 16 000 € in reduction of the income tax
- Reduced VAT (5%) on the total cost

■ Zero rate loan

- For new owners (new or existing building)
- Up to 50 000 € depending on the location
- Income conditions modulate the duration and volume of the loan

A strong initiative in certifying the professionals



- **RGE Label :**
 - Certified qualification after one week individual formation
 - Certified Company (RGE)
 - Applies to a large spectrum of activities (building works, electricity, plumbing, integration of renewables, design,)
 - RGE Label is mandatory for any company to get tax reductions or zero rate loan

Development of third party investor



- **ARTEE Initiative in Poitou Charentes Region :**
 - Regional Agency for Technical and Financial Support of building renovation
 - Mixt Economy Society (Private & public funds)
 - Third party investor as well as technical consulting and confidence third party
 - **Targets:**
 - Identify a unique partner to owners in order to speed up the renovation process
 - Improve the access to incentive measures for individual owners,
 - Secure the owners decision to invest.

A strong support to innovation

- **Tax reduction for research**
 - A bonus when collaborating with a public laboratory (University or Technical research centers up to 60% in tax reduction)
 - 50% support for a company hiring a PhD Student (Cifre grant)
- **National and regional research programs launched by ANR, ADEME or within the objective contract between the regions and the state supported by FEDER.**
- **A specific target on buildings : Building Technology Platforms development**

Building Technology Platforms

- OPECST report (2009)
- Scientific Committee for Sustainable Building Development report (2011)
- Need for innovation development in the building sector
- Need for improving the technical assessment of innovations.
- Call for technology platforms
 - 9 projects,
 - 5 projects in development



Tipee Platform project in La Rochelle

Technology & Innovation Platform for Environmental Efficiency



- Granted in 2012 as “Investment for future” (19,3 M€)
- A group of industrial partners
- Incubated at LaSIE (University of La Rochelle)
- Independent company in 2016.
- High performance renovation of an industrial Hall in a Zero Carbon Urban project
- Final delivery, April 2016



Tipee Platform in La Rochelle



New Test Facilities:

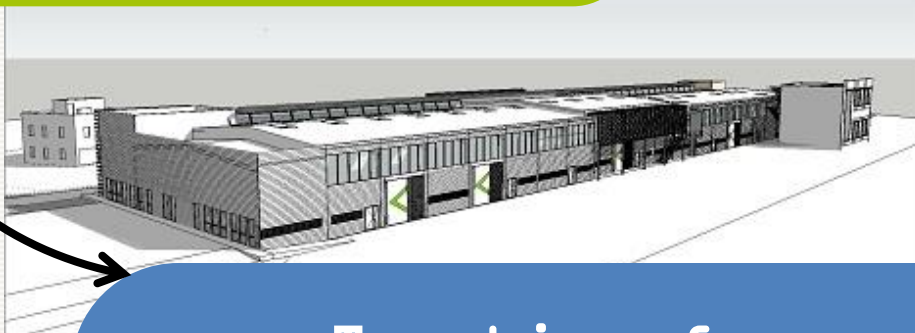
- Materials
- Components
- Systems
- On Site Measurements

Research & Engineering

- Innovation partnership
- Innovation evaluation
- Assistance to project developers
- Expertise in IEQ, Green building development, NZEB

Teaching for Professional

- Development of teaching platforms (simulation, BIME, techniques....)
- Partnership with building federation and existing centers

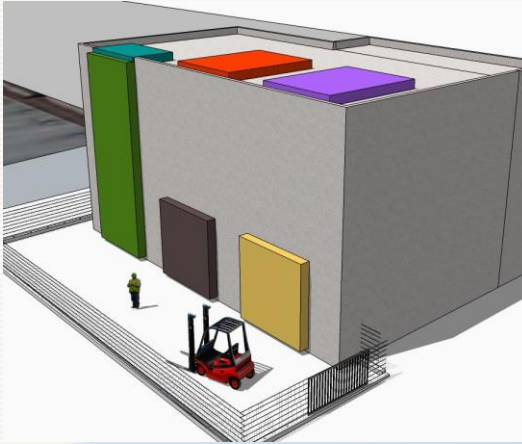


Test facilities



Envelope Test Facility

Five Cells
Façade tests
Roof tests



From material to component laboratory tests

- Thermal characteristics,
- Radiative properties,
- Humidity transfer



IEQ Laboratory :

- comfort,
- IAQ, pollutant transfer (ground, ambient air,)
- Conditioning systems



Delivery April
2016

Delivery April
2016

Delivery
November
2015

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Conclusion

- ❑ The building sector appears as “the” strategic sector for the Green Growth Strategy in France,
- ❑ The overall objective is to reach a nearly zero carbon emission building sector by 2050,
- ❑ Innovation development appears to be strategic in this domain,
- ❑ For new buildings, incentive measures combined with regulation evolution and voluntary labels will do the job,
- ❑ For building renovation, the main problem is to convince the owners to make the renovation decision,
- ❑ Incentive measures, third party investors and qualification of the professionals are the first targets.