Can we achieve NZEB goal

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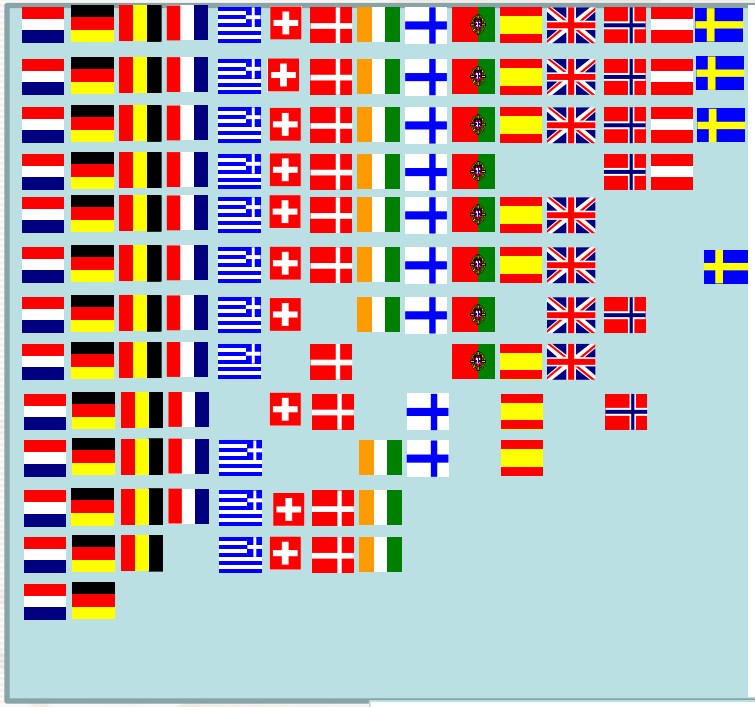
3 questions?

- What have been the main drivers of the evolution of the building sector in the last 12 years in Europe?
- What are the questions raised by the definition of NZEB?
- Have we the tools and technologies to overcome this challenge?


2001

Status of Building Codes and Regulations in Europe in 2001



heat transmission (U)
ventilation
solar gains
internal gains
heating system (building)
domestic hot water
lighting
cooling
fans and pumps
distribution loss
renewable thermal
renewable electrical
heating system (district)

(F. Allard, C.A. Roulet, CLIMA2001, Napoli)

Strengthening the Role of the Building Sector

- 40 % of EU's energy use
- 36 % of EU's CO2 emissions
- Cost-effective energy savings potential: ~30 % by 2020
- 9 % of GDP, 8 % of employment and 2 trillion € annual turnover

- Key EU legislation: Energy Performance of Buildings Directive (EPBD, 2002/91/EC)


2002

Energy Performance of Buildings Directive – EPBD (2002/91/EC)

- **Requirements for Member States to specify and implement:**
  - ✓ **An integrated methodology to rate the energy performance of buildings**
  - ✓ **Minimum energy performance standards for new and for existing buildings that undergo major renovation**
  - ✓ **Energy performance certificates for buildings**
  - ✓ **Regular inspections of heating and air-conditioning systems**

CEN Standards supporting the implementation of EPBD

- Originally 31 work items
- Resulting in about 40 draft standards
- Most of 40 approved in the final formal voting in May 2008, totally 1674 pages
  - ☑ **Heating systems**
  - ☑ **Ventilation and cooling**
  - ☑ **Energy performance calculation**
  - ☑ **Room temperature calculation**
  - ☑ **Heat losses , building physics**
  - ☑ **Inspections of A/C, ventilation and boilers**
- Standards available from national standardization organizations


2008

Climate Action: Energy for a Changing World

December 2008 adoption of the CLIMATE CHANGE PLAN

- **December 2008** adoption of the Directive on the Use of Renewable Energy Sources,
- **November 2008** adoption of proposal for "recast EPBD" by the commission
- **May 2008**, EPBD recast adopted by the European Parliament,
- **All these initiatives have a strong impact on the building sector**

Climate Action
Energy for a Changing World

The EU's CLIMATE CHANGE Initiative December 2008

20 % Less Green House Gases

20% More Renewable Energy

20% More Energy Efficiency


2010

EPBD RECAST 2010

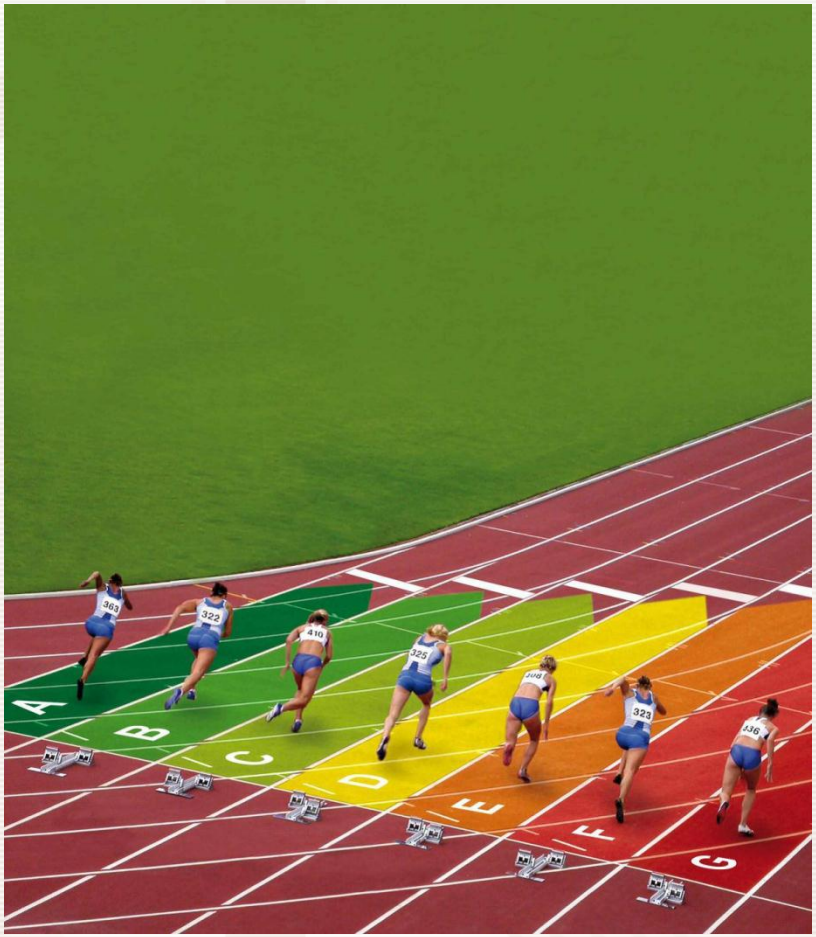
- Improve the quality and impact of energy certificates,
- Generalize the inspections of heating and cooling systems and the required heating/cooling demand,
- For the existing building, the floor area limit of 1000m² is omitted which means that the requirements for new buildings have to be applied,
- The measures to improve energy efficiency in each member country must be cost-optimal, minimizing the life cycle cost,
- New mandate for CEN for standard revision
- **Define a general road map towards Near Zero Energy Buildings in Europe**

A road map towards Near Zero Energy Buildings development in Europe

- An important element is that the directive also requests the Member States to make a plan (a road map) on how to increase the share of the very low energy buildings and zero energy buildings in the national building stock.
- This requirement shows the long term commitment of the commission in the programs for better energy efficiency of buildings.
- These plans have to be integrated in the national energy efficiency plans.


2012

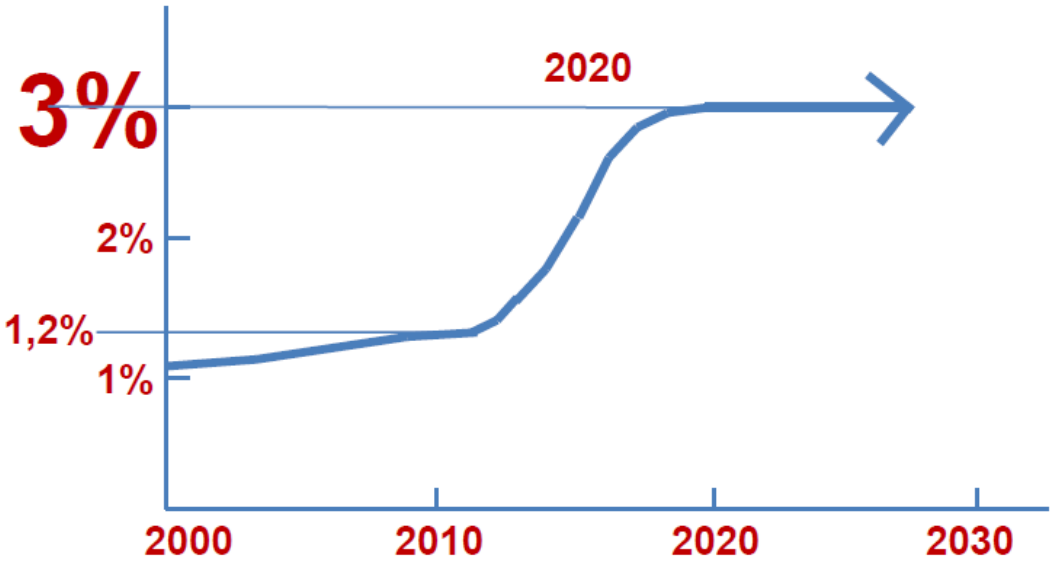
A new directive EED (10/ 2012)



EED 2012:
Focus on building renovation

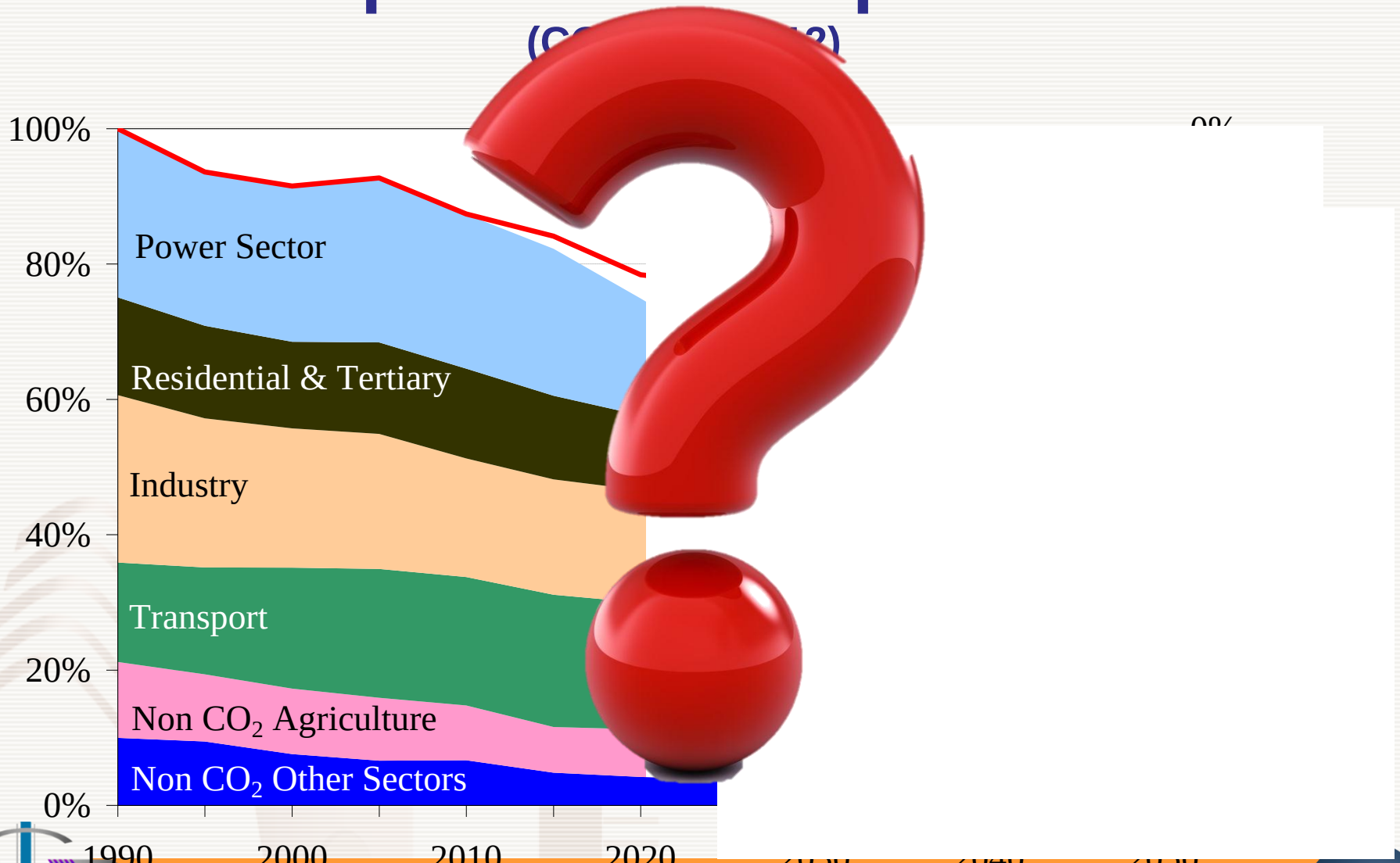
- Member States shall establish a long-term strategy for mobilizing investment in the **renovation of the national stock of residential and commercial buildings, both public and private.**"
- "[…] each Member State shall ensure that, **as from 1 January 2014, 3 % of the total floor area** of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU."
- The same approach applicable at lower administrative levels on a voluntary basis.

Building stock retrofitting



European road map for retrofitting

European Roadmap to 2050



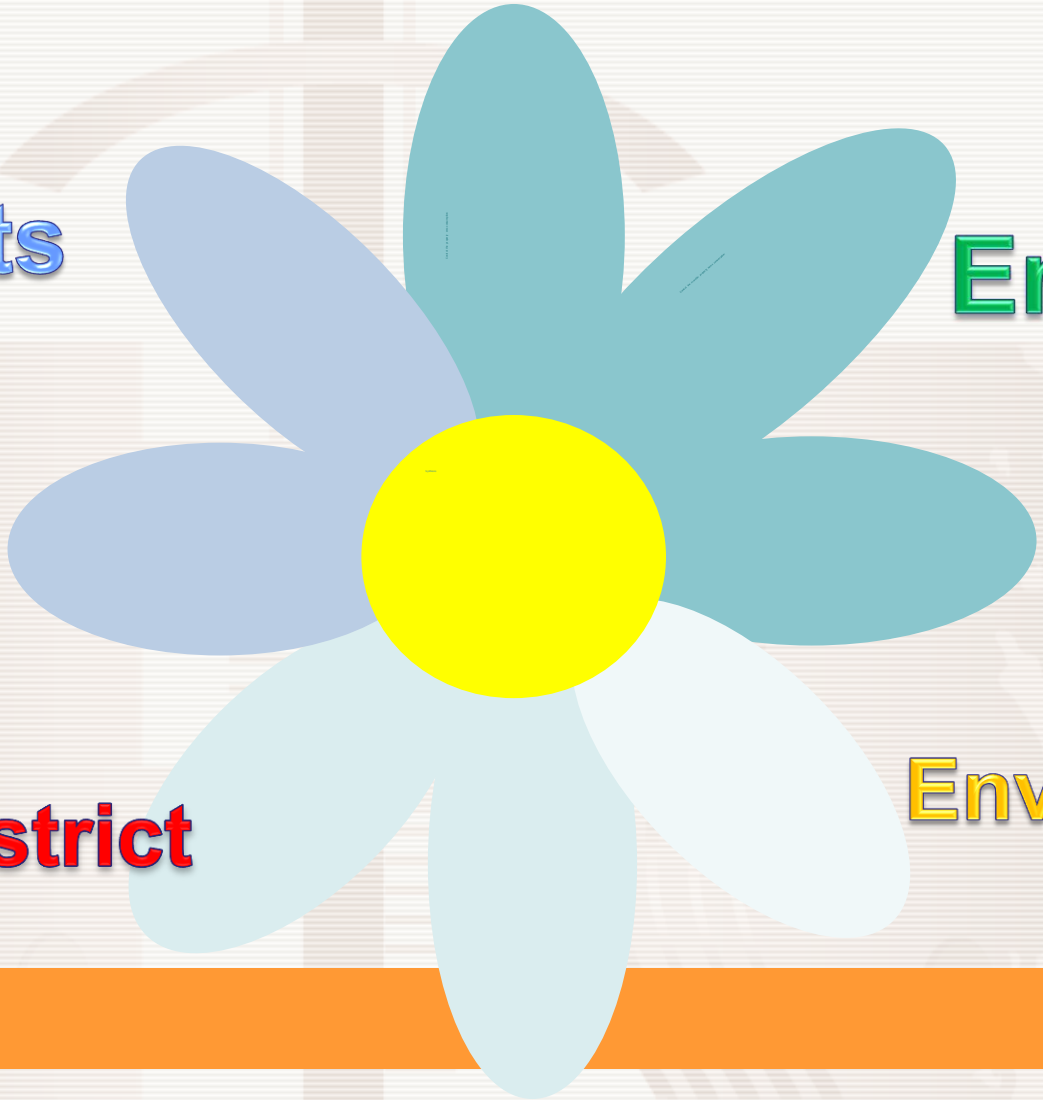
NZEB Definition

Article 2 of the recast EPBD:

"*a building that has a* ***very high energy performance... .***

The ***nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources,*** *including energy from renewable sources produced on-site or nearby".*

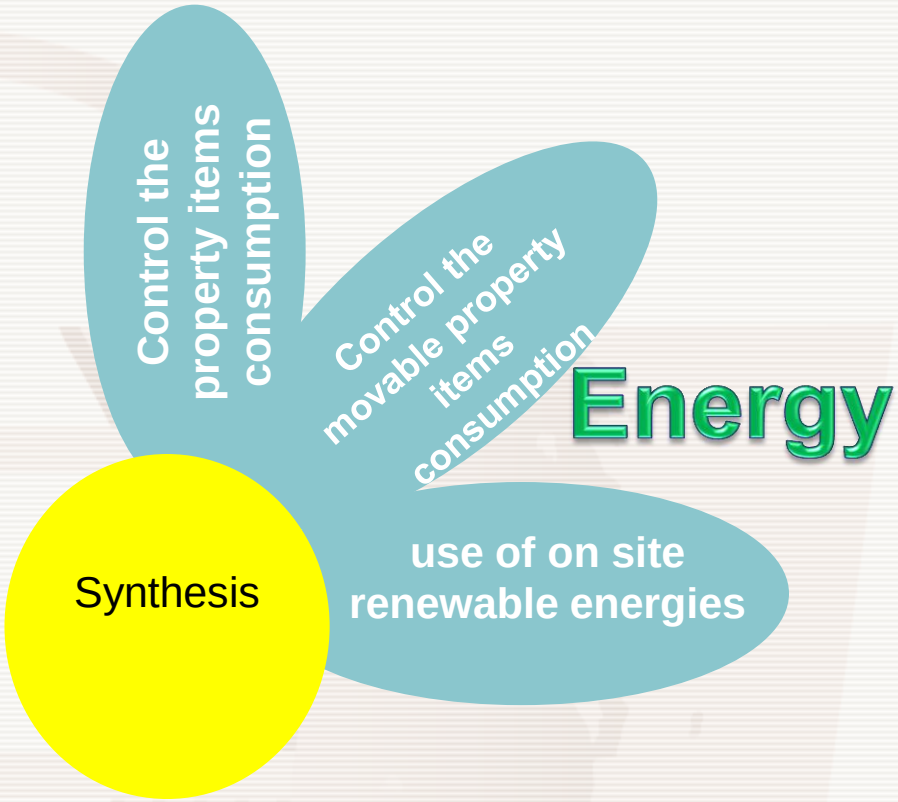
Questions raised by Zero Energy Buildings Definition



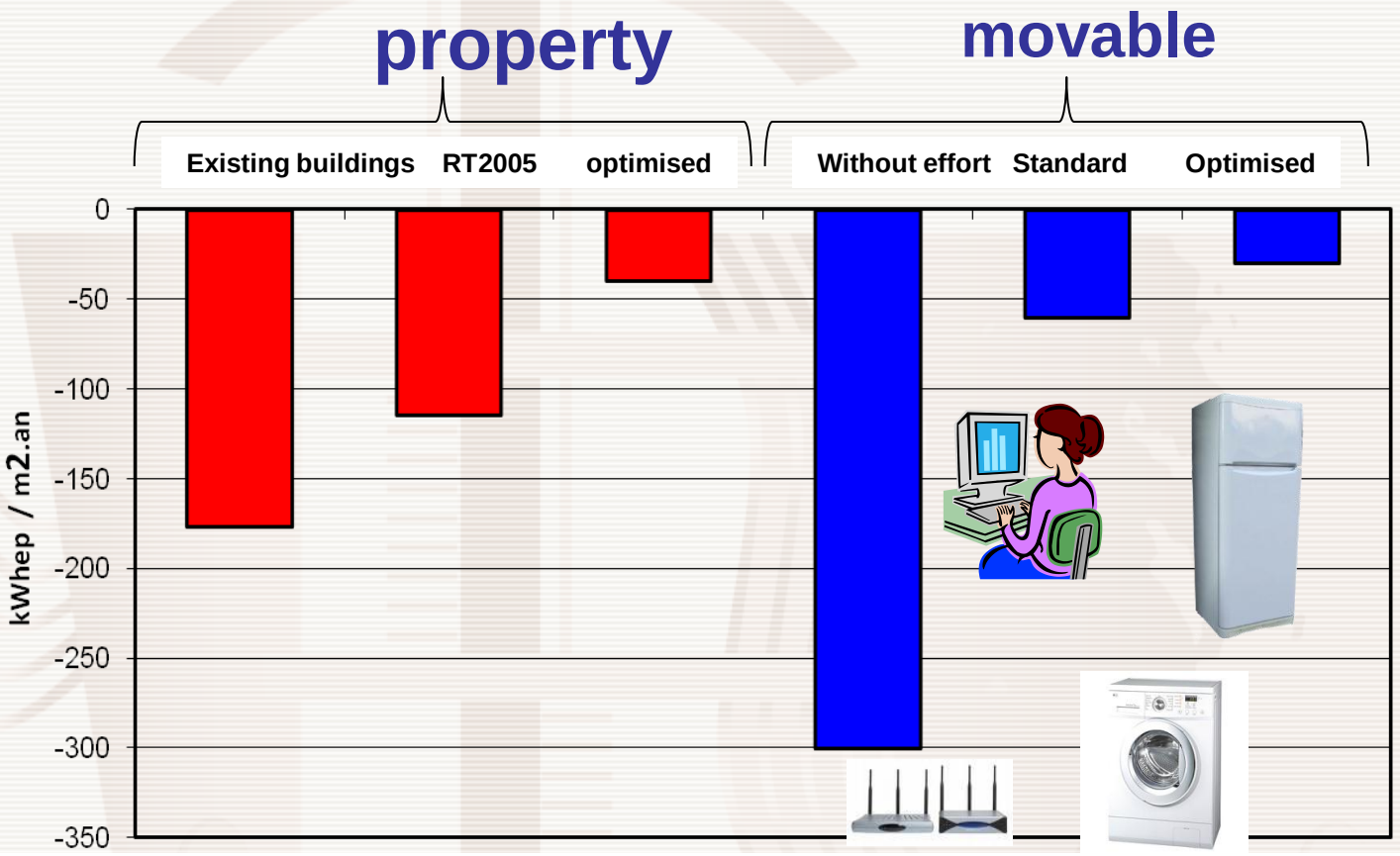
Courtesy
J. C. Visier 2011

Questions raised by Zero Energy Buildings : Energy aspect

“A sober building giving value to local renewable energies”

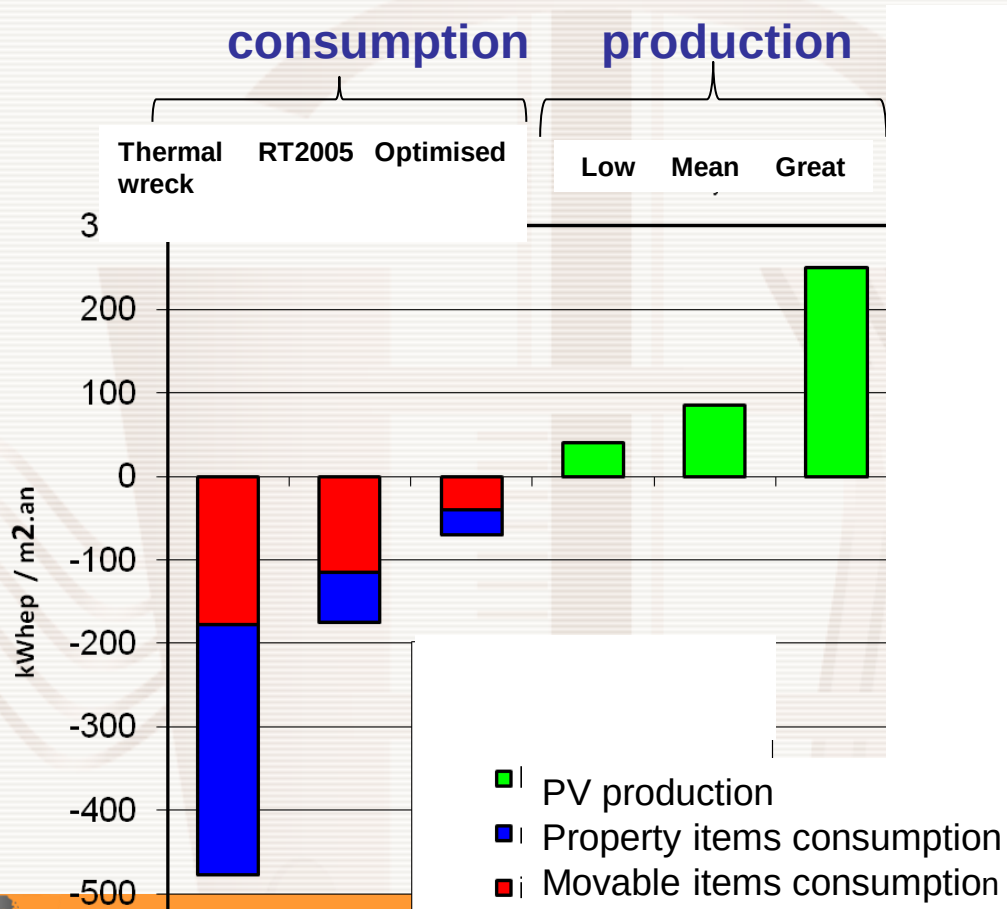


Include all energy consuming items…



Rough estimate of building's consumption in kWh pe/m² Year

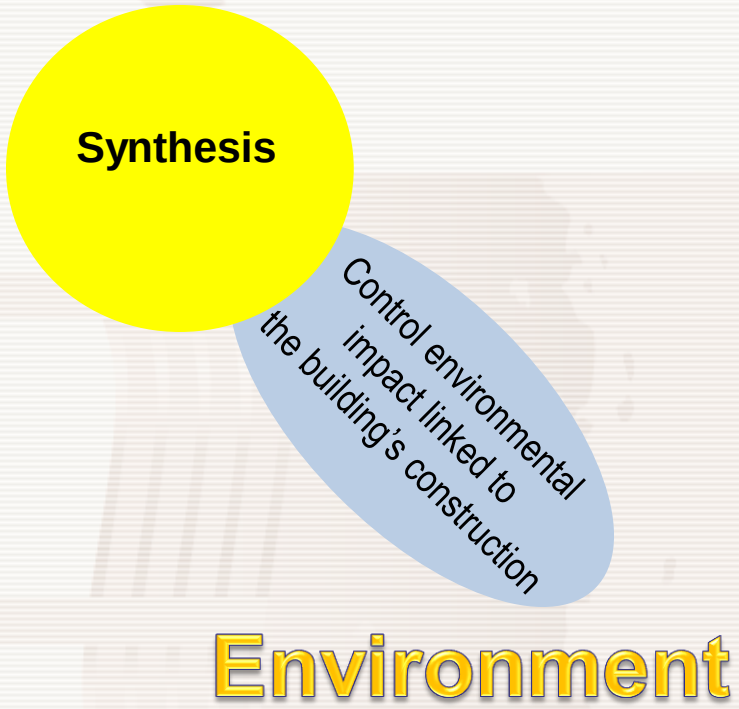
Assess the potential of renewables in different urban contexts



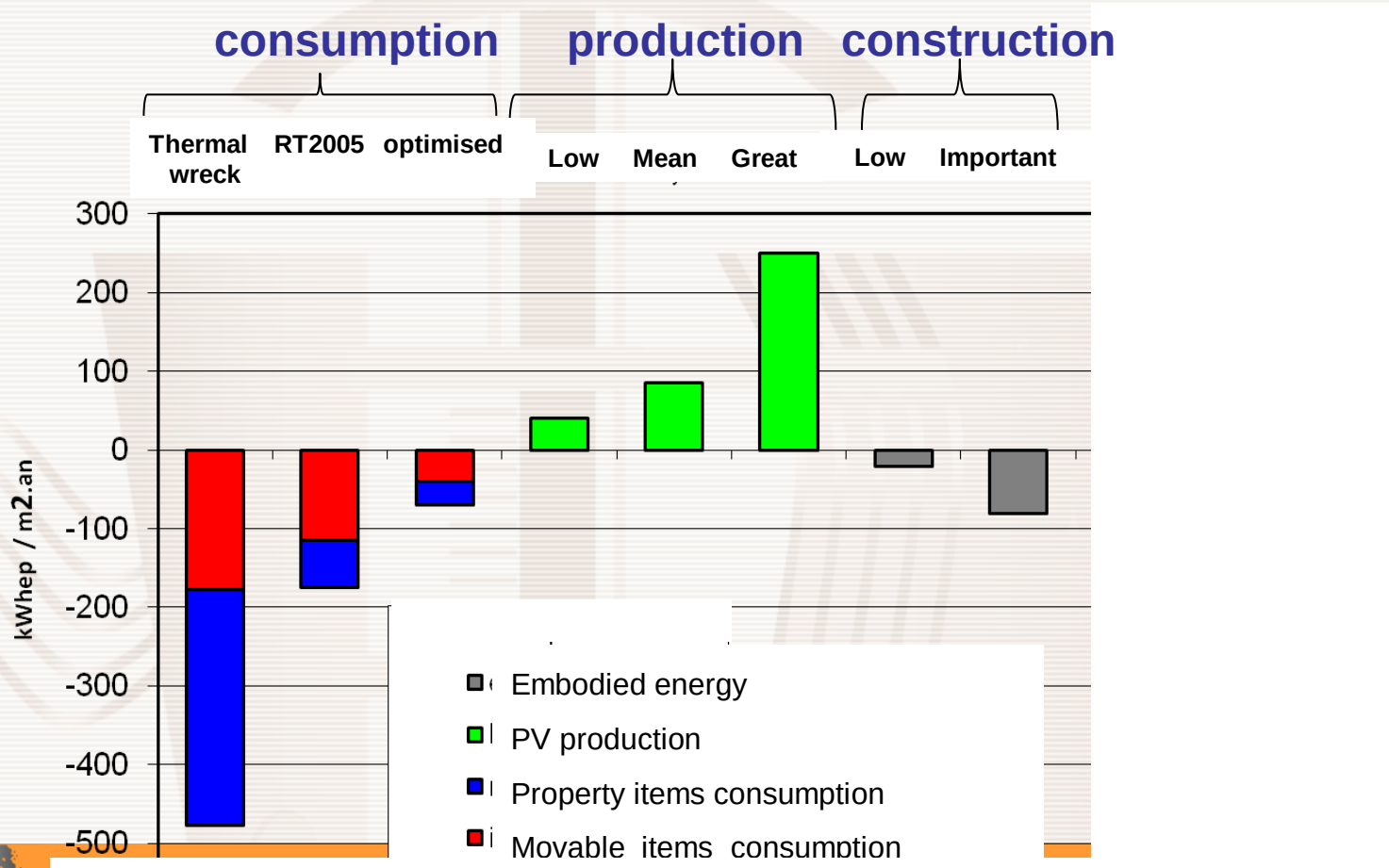
Rough estimate of building's consumption in kWh pe/m² Year

Questions raised by NZEB
Environmental aspect

Performances analyzed on the entire life cycle of the building

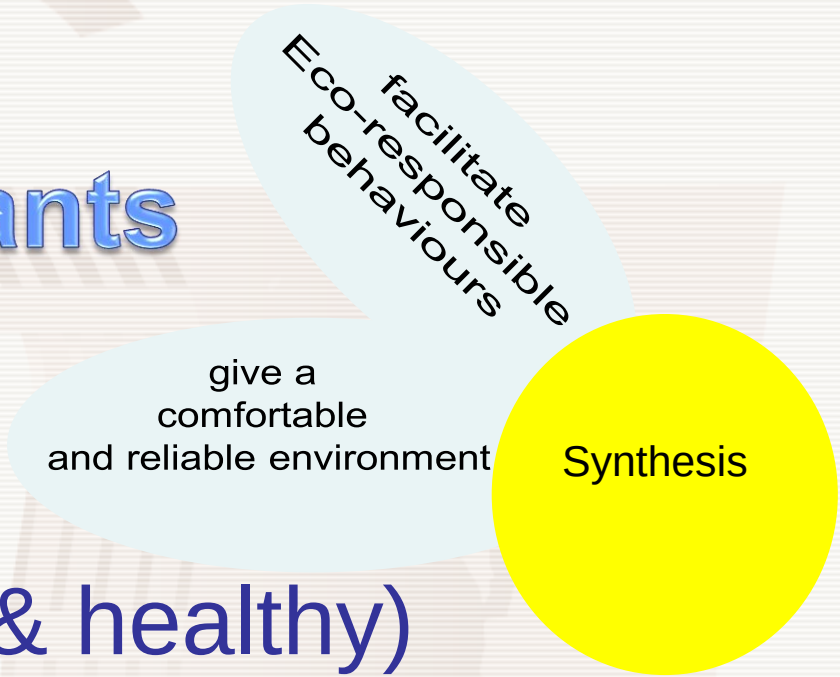


Consider the embodied energy



Rough estimate of building's consumption in kWh pe/m² Year

Questions raised by NZEB Occupants



A comfortable and reliable building (safe & healthy) facilitating eco-responsible behaviours

Questions raised by NZEB Occupants

Facilitate eco-responsible behaviours

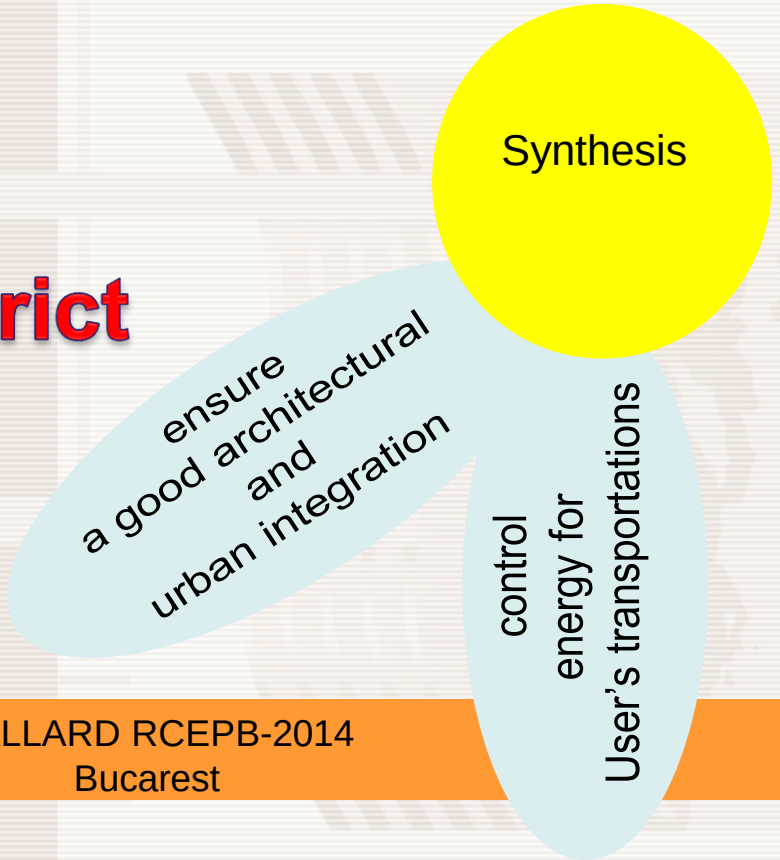
- Evaluate
  - Tools to assess the **impact of occupants on consumption** (rather unknow, may be important with low energy buildings)

- Make behaviours change
  - Via building's conception
  - Via occupants 's information

Questions raised by NZEB City &District

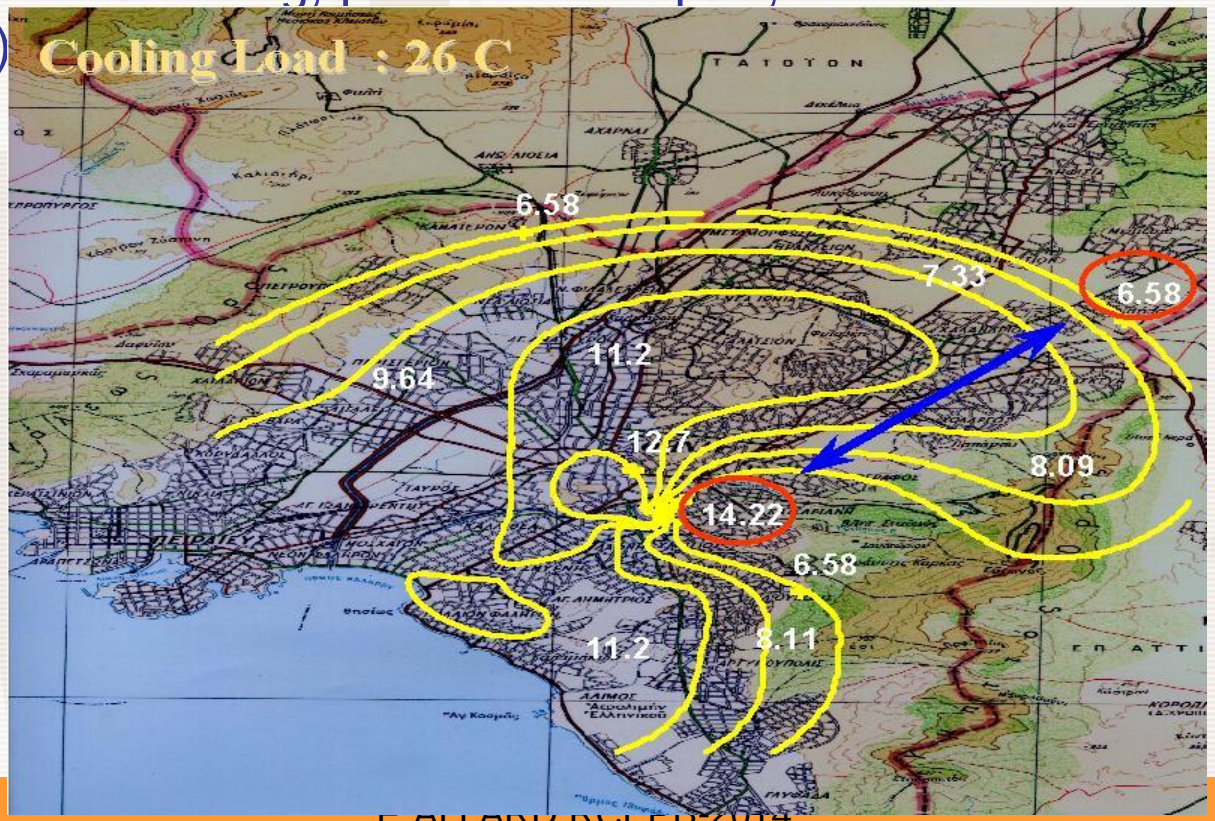
Positive energy buildings into sustainable cities and district

City and district



Coupling with urban environment

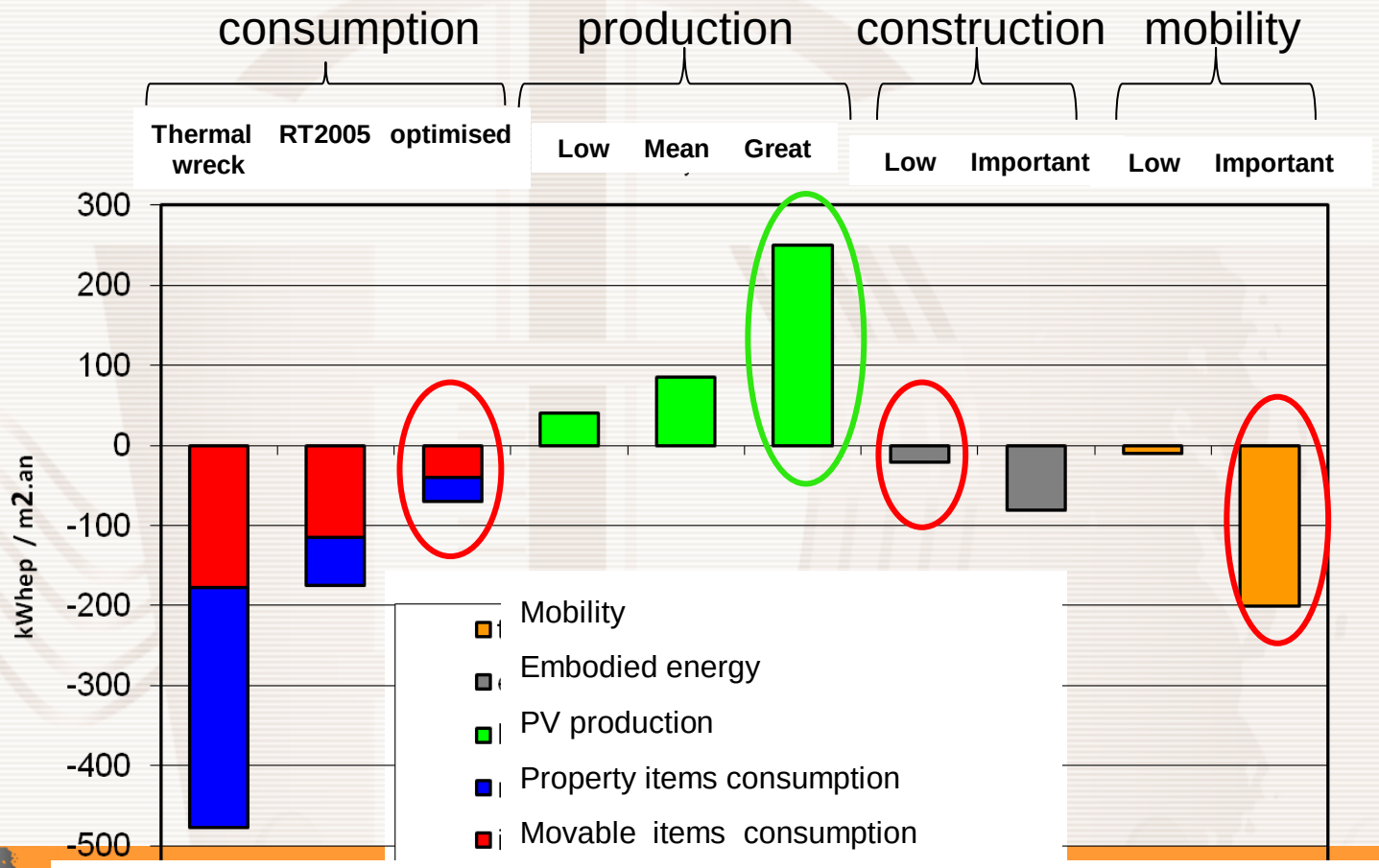
In most cases, it is no more possible to consider that buildings are isolated and do not interact with their environment.(use of renewable energy, ventilation cooling, pollutant transport, Heat Island reduction strategies,…)



Distribution of cooling load [kWh/m^3] in Athens for a set point of 26°C, (Santamouris et al,2004)

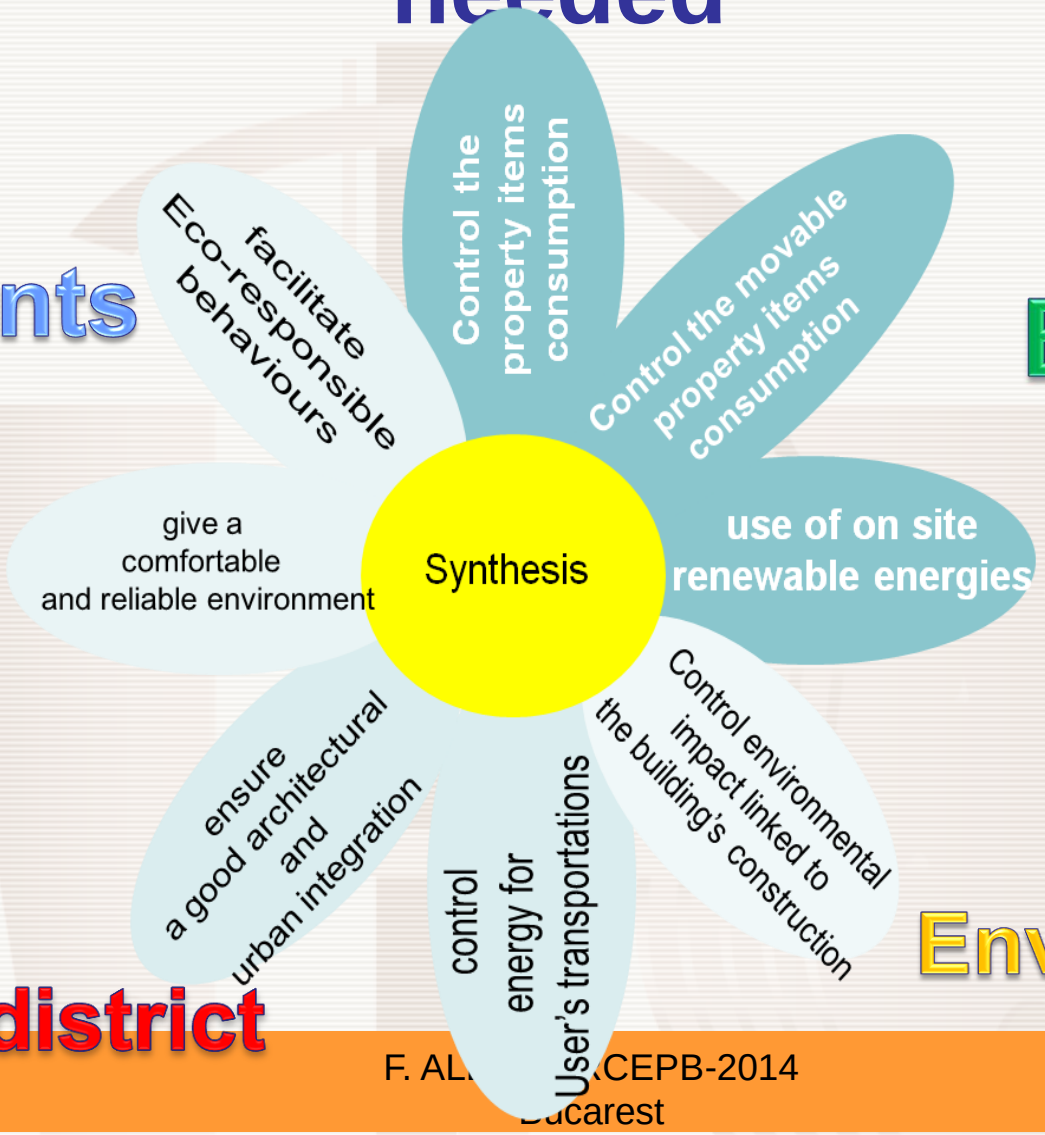
Consider energy for mobility

How to associate local production and small consumptions for my mobility



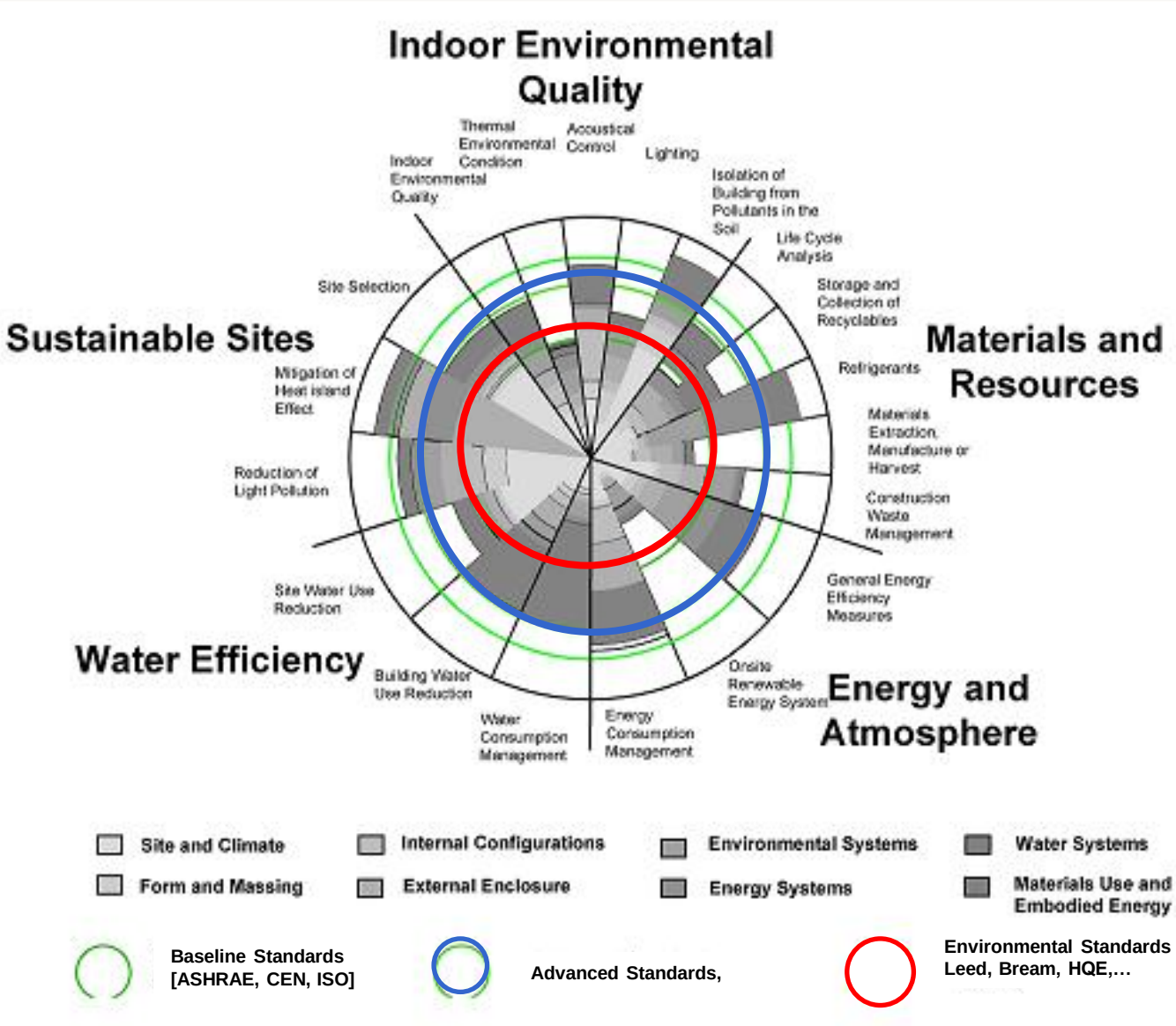
Rough estimate of building's consumption in kWh pe/m² Year

Global approach is absolutely needed



Multi-Performances:

How to evaluate the overall performance? Which metrics to be use?

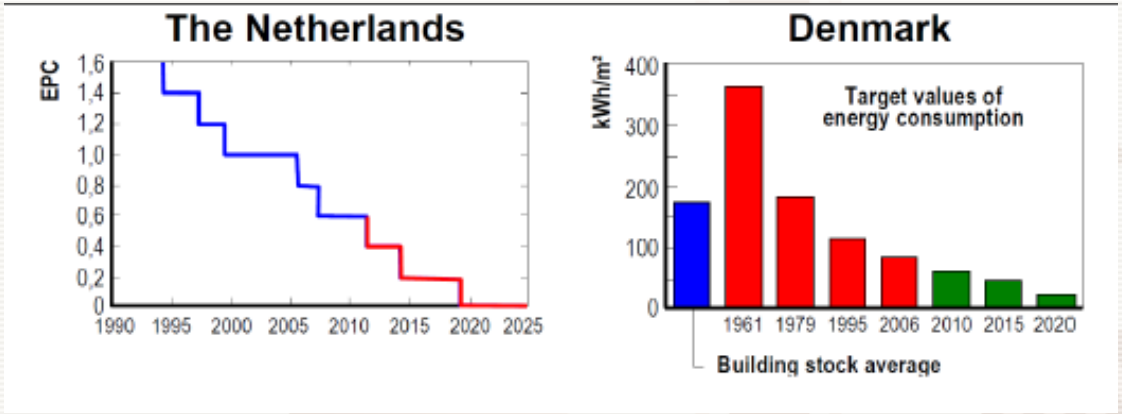


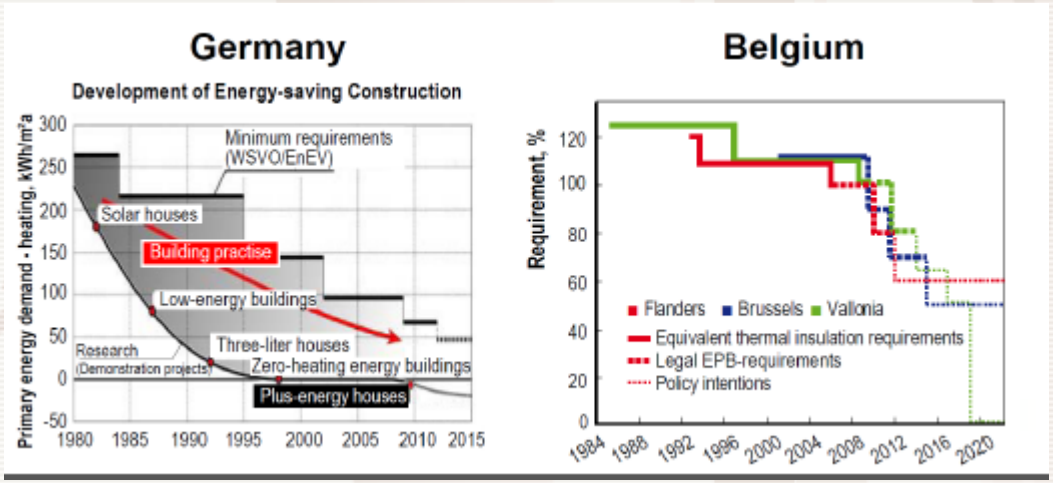
What is the status of NZEB in Europe in 2013?
Best practice examples do exist!!!!

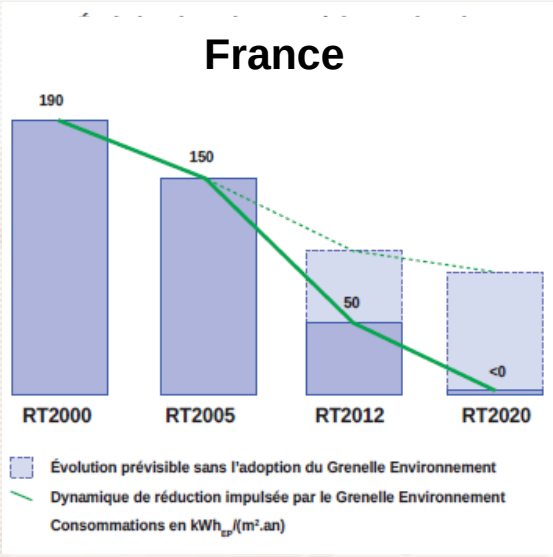
o of a prefabricated zero-heating energy house in Germany

Photo of a net zero energy office building in Portugal

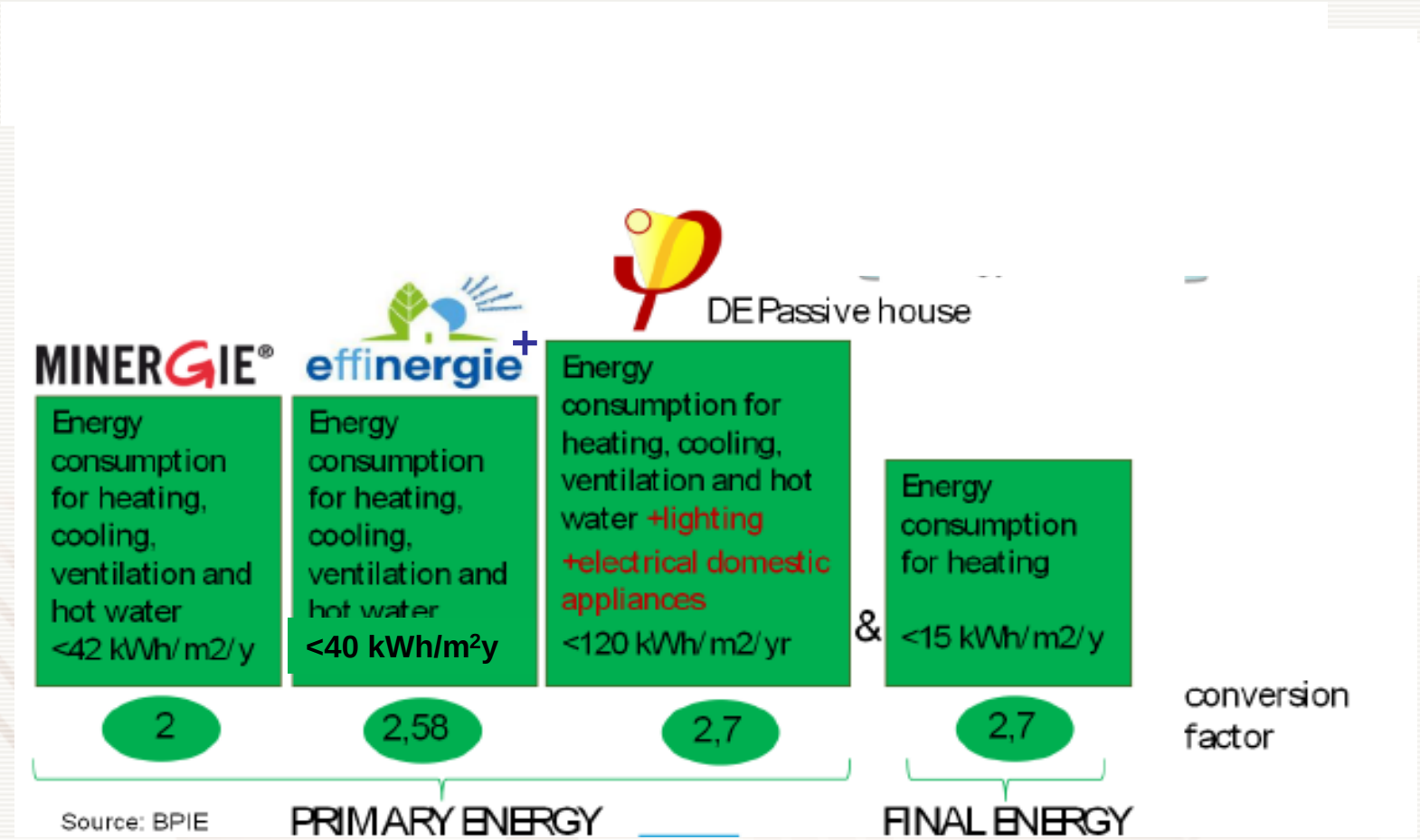
Every country is contributing



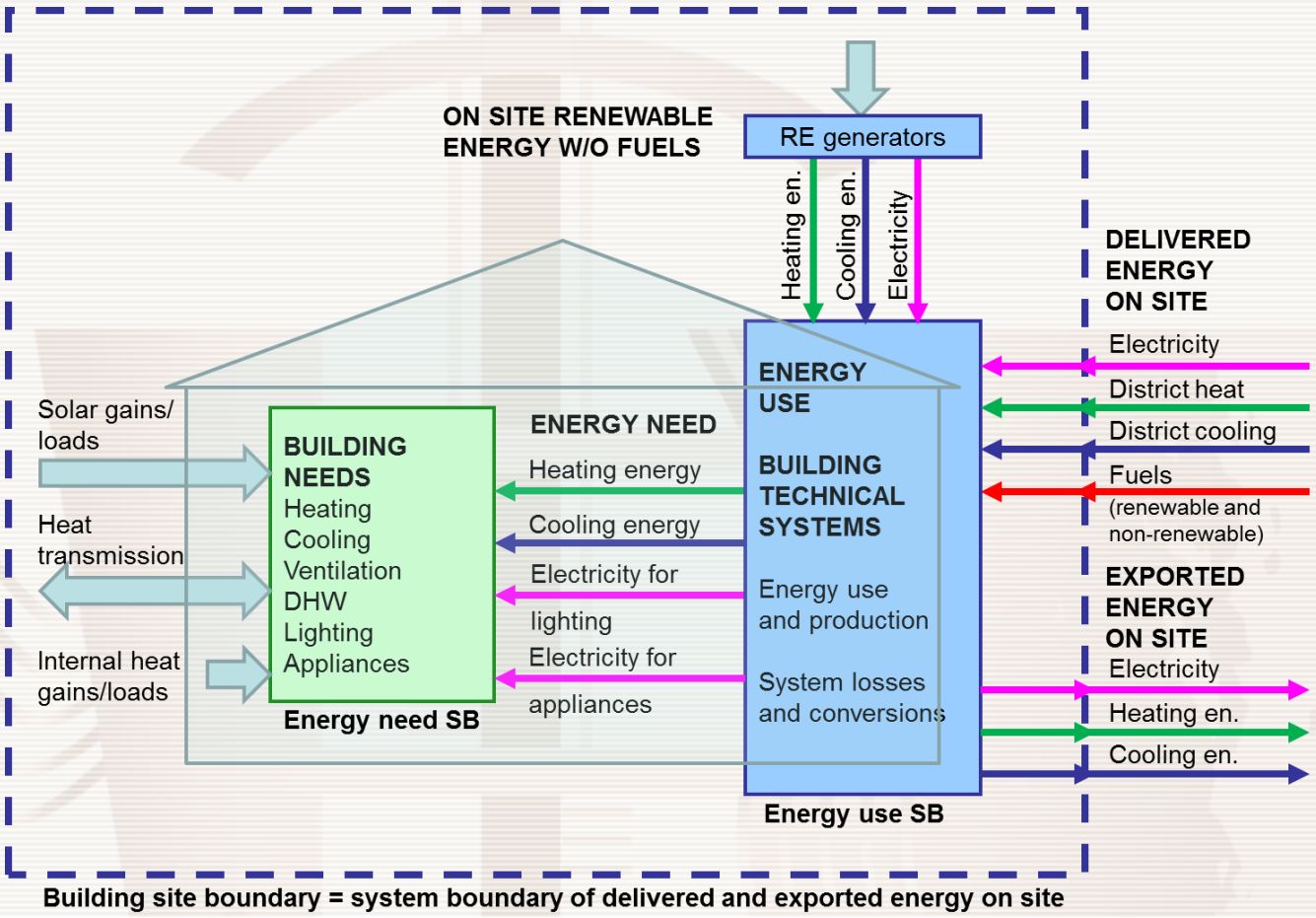




Existing voluntary labels



REHVA/CEN contribution



Rehva proposal for a detailed system boundary for energy calculation and nZEB definition

Conclusion

- **We certainly can achieve the nZEB target for new buildings** as we achieved the building performance evolution of the last 12 years in Europe.
- **Boundary conditions** definition of the global performance evaluation needs still some work and common consensus
- **Ecolabels need to be standardized**
- **Costs have to be severly controled** (integrated design)
- The major challenge still to come is the massive development of **nZERB**: **near Zero Energy Retrofitted Buildings**

Conclusion

- **A strong effort in model development is still needed**
  - MORE CONFIDENCE IN OUR PREDICTION
  - INTEGRATION OF THE SURROUNDING ENVIRONNEMENT
- **New metrics are necessary:** Performance based overall evaluation means index definition and multidimensional evaluation.
- **Technology developments are necessary**: from components to systems
- **Conceptual evolution is needed, the Occupant should be at the center of the performance evaluation : (Lagrangian/Eulerian approach)**

Thank you for your attention