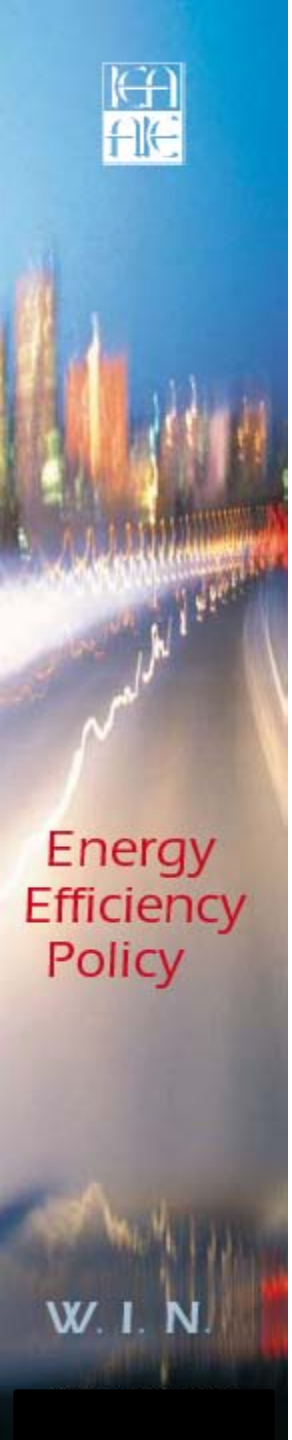


Buildings energy efficiency in global climate perspective

IEA Day at COP 16

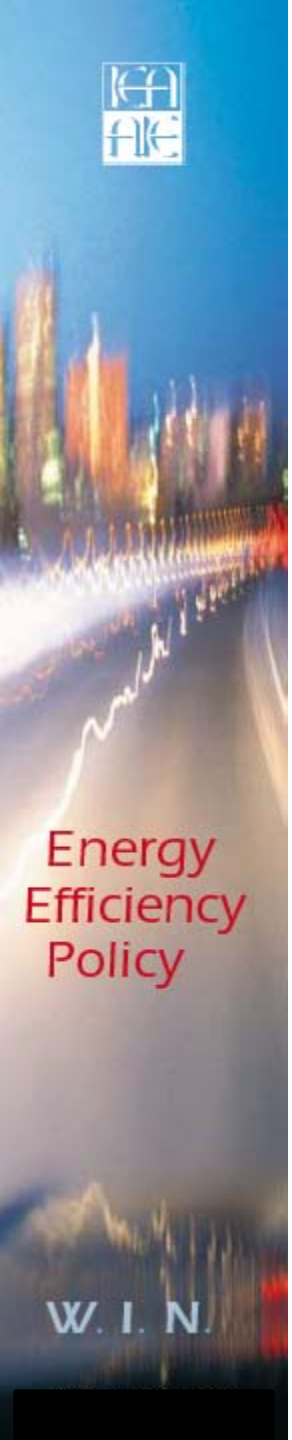
7 December 2010, Cancun

IEA, International Energy Agency,

Jens Laustsen

Senior Policy Analyst

(Efficiency in Buildings)



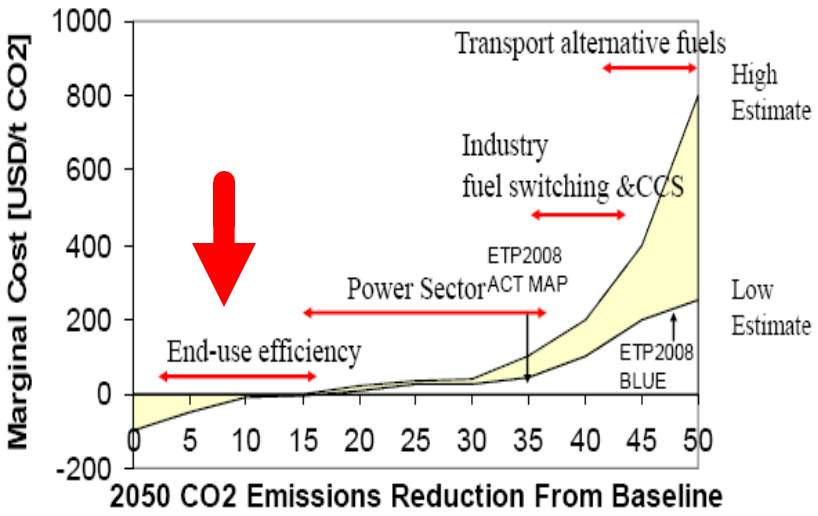
Content

- Energy efficient buildings in a global climate perspective
- Concepts are the answer
- Passive design in hot climates
- Driving buildings down to zero energy
- Recommendations and pathways
- SBN Sustainable buildings network

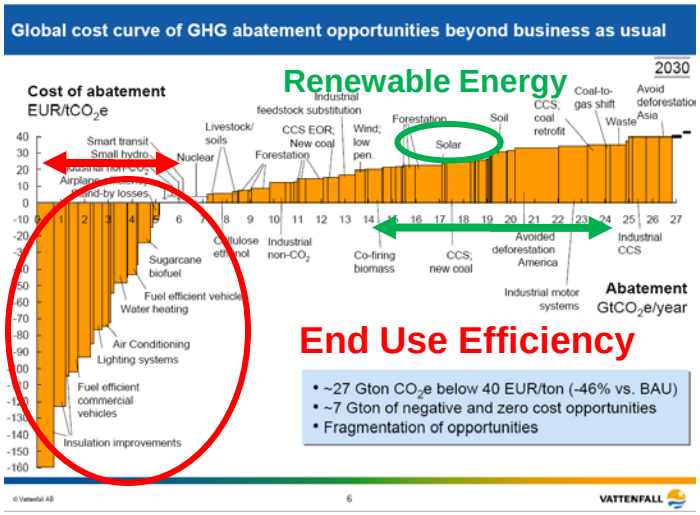
Energy efficiency in buildings is a critical part of sustainable energy future

Can deliver large reductions in CO_2 emissions at low costs

Climate change abatement at low costs



IEA: Energy technology perspective



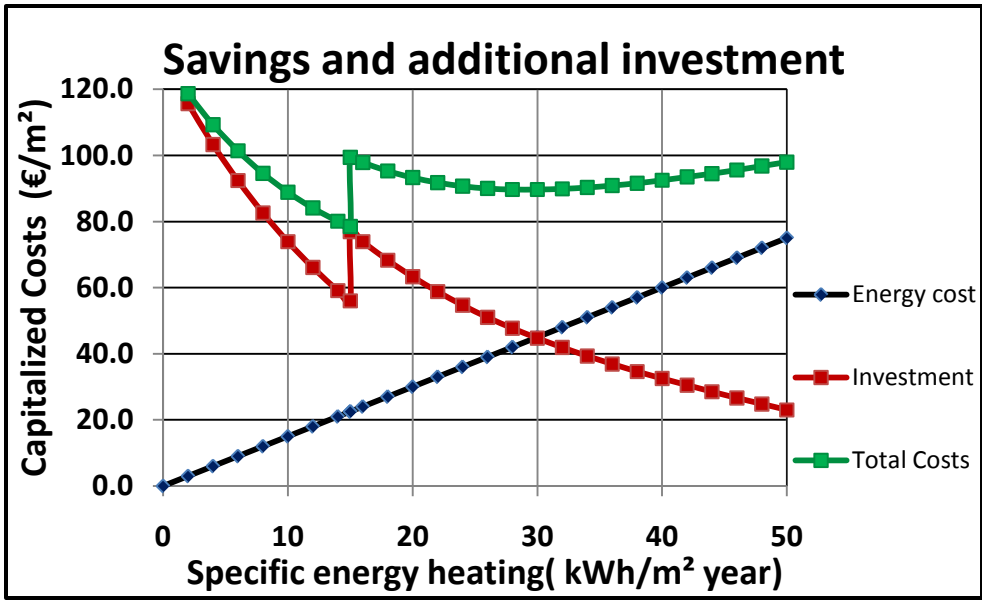
McKinsey institute: Climate reports 2007 - 2009

- Many other studies show the same trends !
- Buildings might even be able to deliver more if we look at these in a holistic way.
- The answer is concepts.

Best Practice Examples

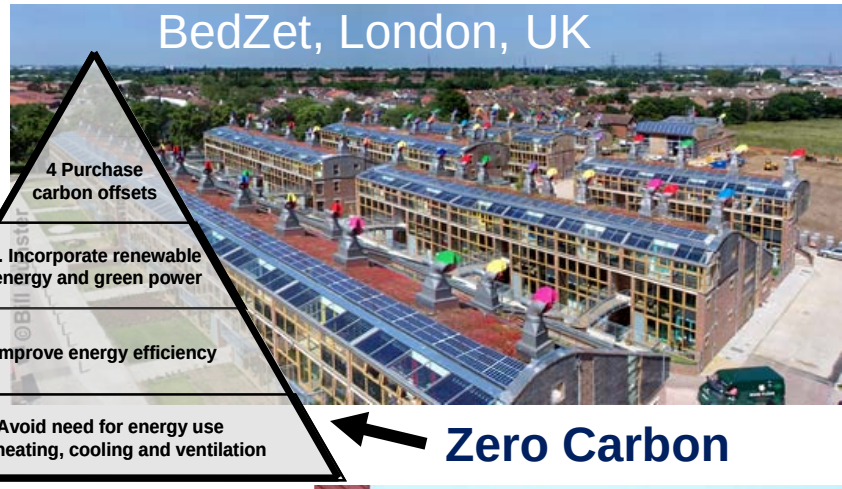
Concepts
Holistic approach

Concept 1: Passive House / Buildings

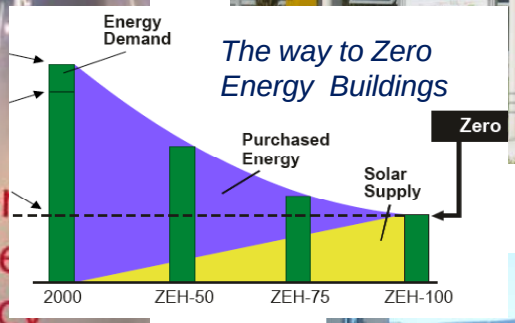


Sophienhof Frankfurt / Germany
15 kwh / m² per year
Extra costs = 3-5% of total costs
Payback = 9-10 years

Concept 2: Zero Energy Buildings



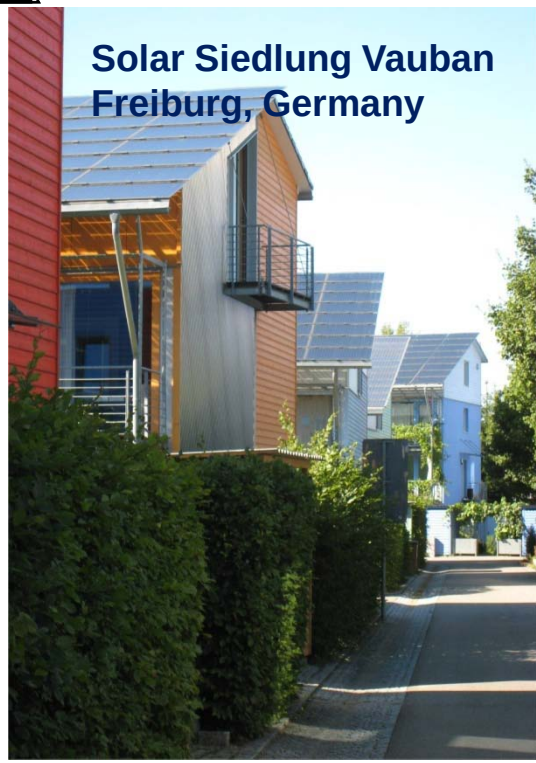
Zero Carbon



The way to Zero Energy Buildings

Zero Energy

Plus Energy



Zero Energy in Singapore

- High insulation levels
- Efficient Windows
- Shading / threes
- Greening facades
- Efficient Cooling, Vent.
- Solar PV

BCA - Academy Singapore

Concept 3: Intelligent Design

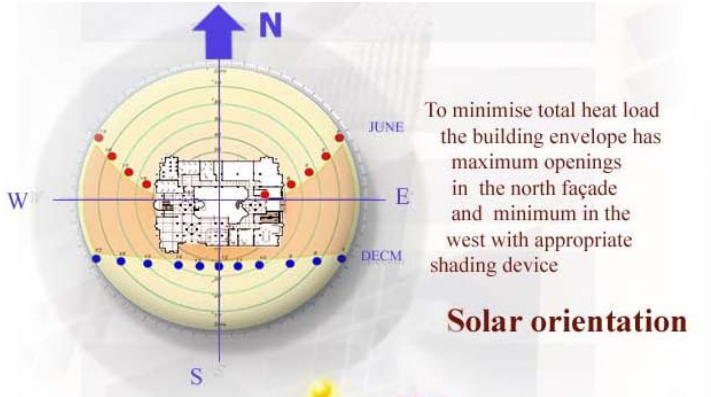
Energy Efficiency Policy

W. I. N.

Use integrated design and cultural heritage

The steps of Integrated Design Process:

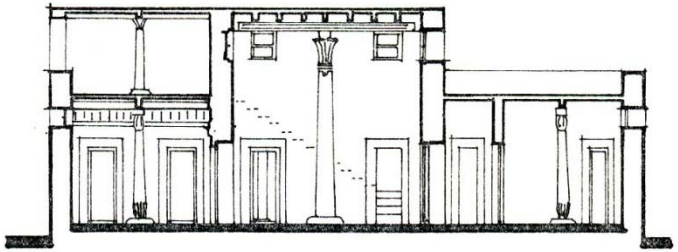
- consider right building size and use;
- consider orientation, form, thermal mass;
- high-performance building envelope;
- maximize passive heating, cooling, ventilation and use of day-light;
- install efficient systems to meet remaining loads;
- use renewable energy sources as much as possible;
- ensure that individual devices are as efficient as possible; and
- ensure proper commission of systems



15 degrees difference – sun / no sun – use of local heritage
MISR university Cairo

Generic Architecture

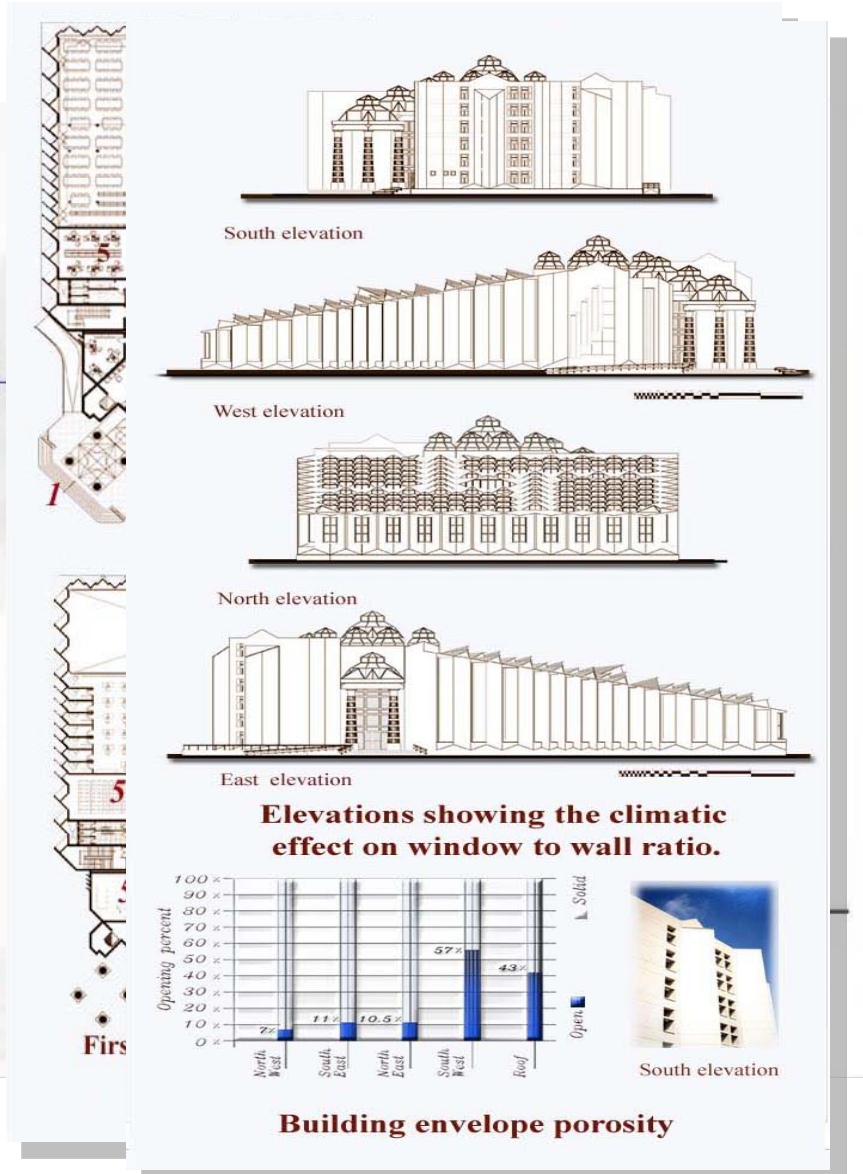
Misr University for Science and Technology, Cairo



Section through Amarna Villa

Source Professor Ahmed Abdin, Cairo Technical University

Old solutions – generic architecture used in new ways



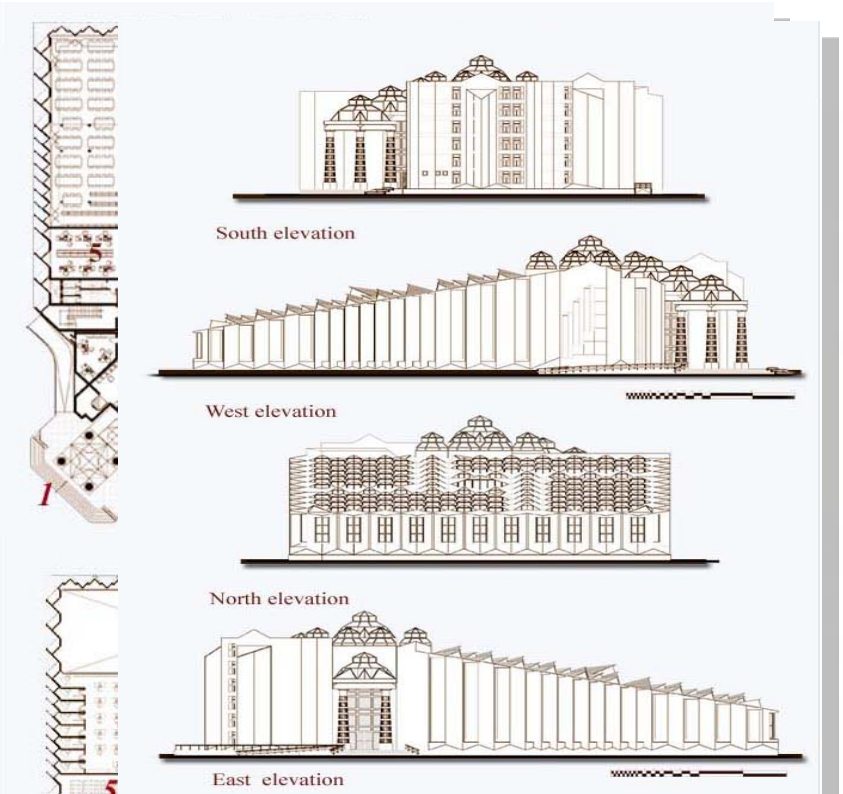
Generic Architecture

Protected against the sun !

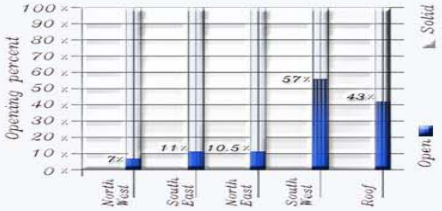
Misr University for Science and Technology, Cairo

Stepped domes of entrance roof

External envelope system.



Elevations showing the climatic effect on window to wall ratio.

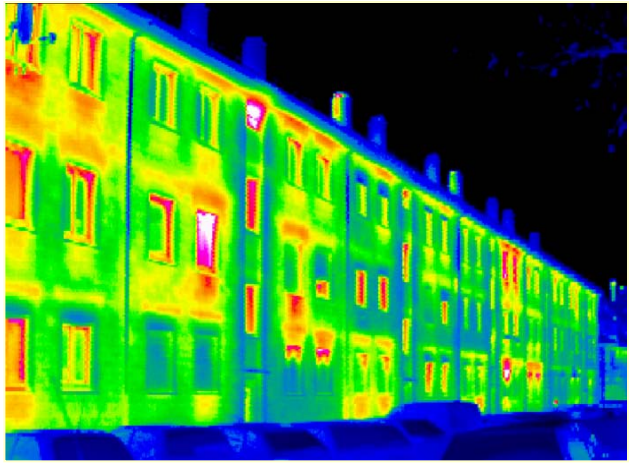


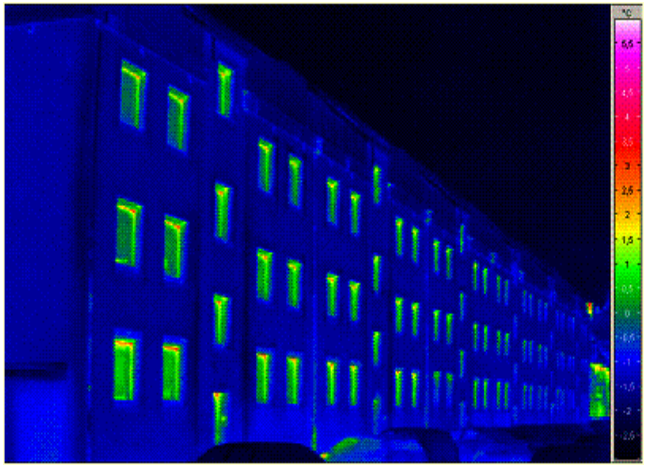
South elevation

Building envelope porosity

Concept 4: Factor 10 renovation

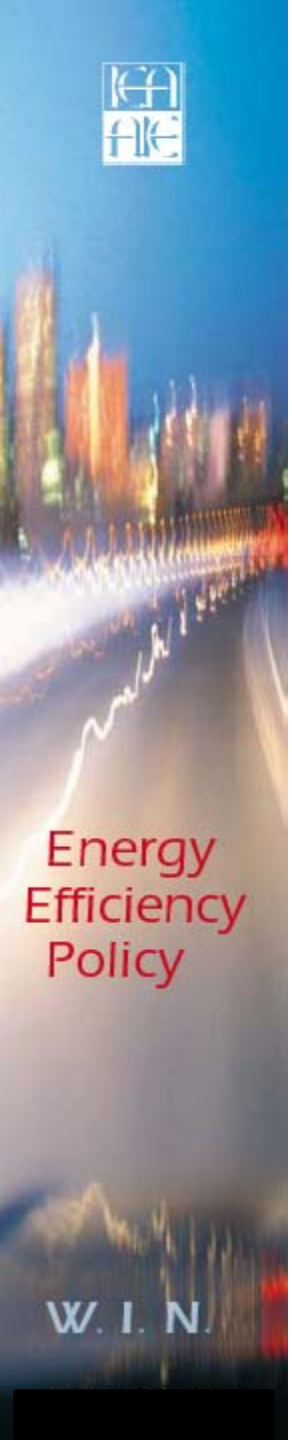
Frankfurt Teverstrasse, Refurbishment using Passive House Principles





Source: Passivehouse Institute / DENA

Expanding zero to all buildings

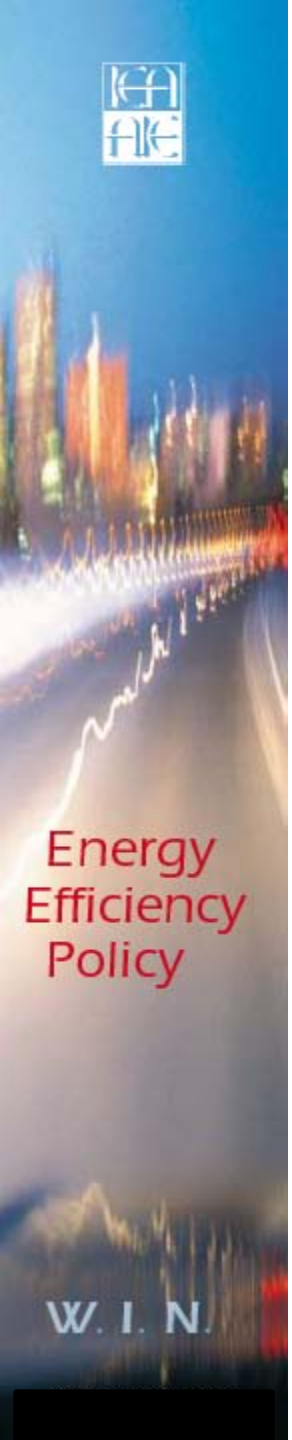


Zero Energy Buildings

- On longer term new buildings should use no energy

- But what is a zero energy building ?
- It seems a simple question, but in fact the answer is more complicated.
- A simple answer would be:

A (net) zero energy building is a building that can provide a normal indoor comfort and still use no energy, meaning that over time it produces as much (renewable) energy as it needs.

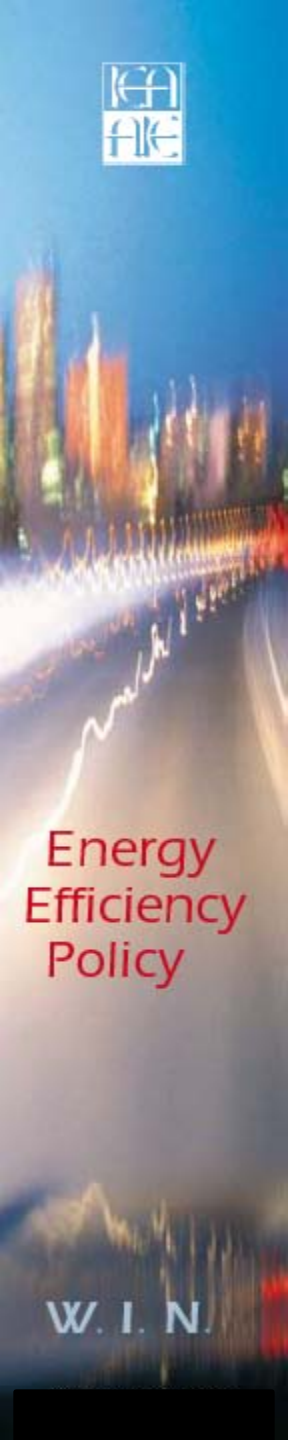


IEA G8 Recommendations Heiligendamm 2008

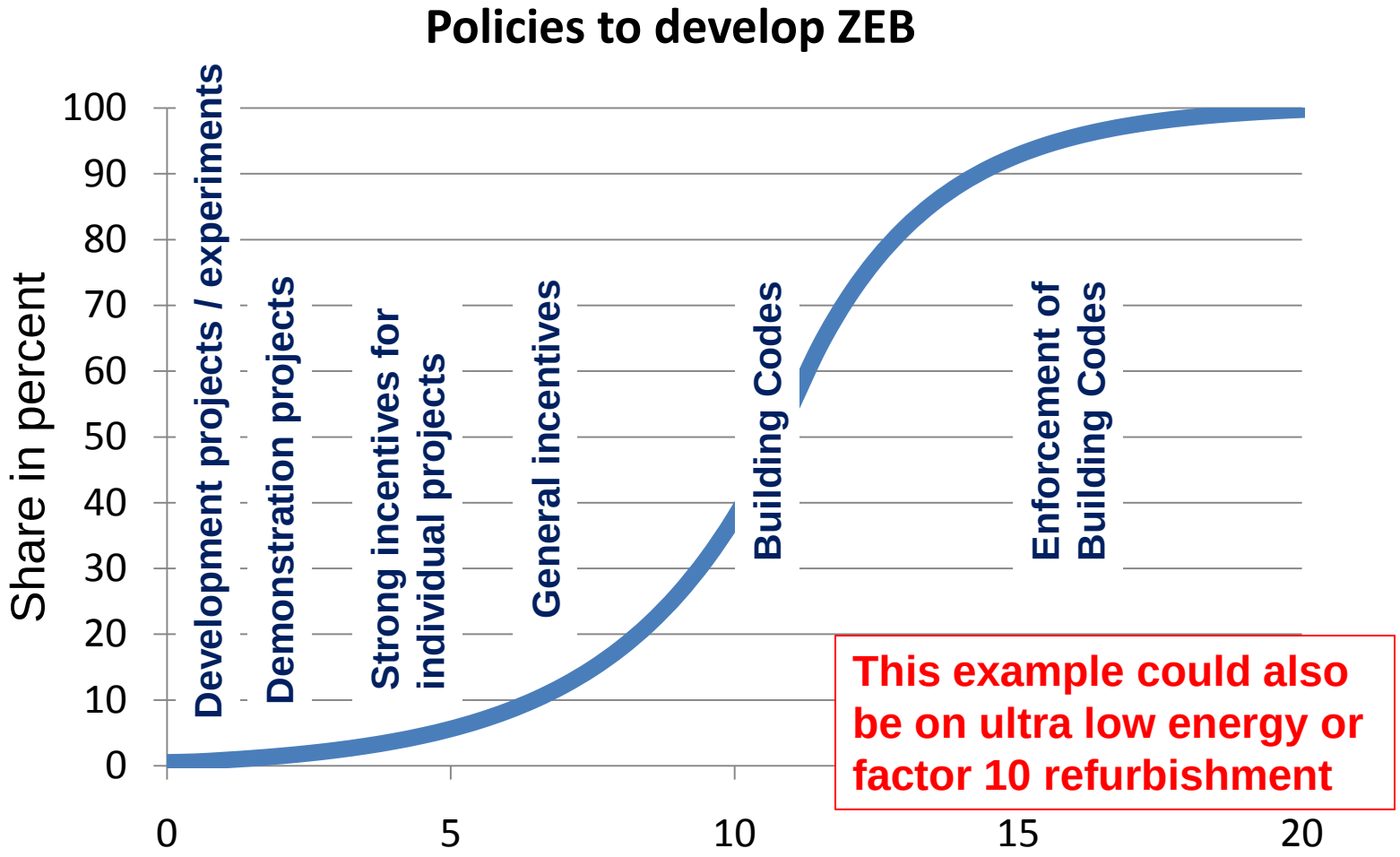
- *Countries that do not currently have mandatory energy efficiency standards for new buildings in Building Codes should urgently set, enforce and regularly update such standards. Those countries that currently have mandatory energy efficiency standards for new buildings should significantly strengthen those standards. Energy efficiency standards for new buildings should be set by national or state government and should aim to minimize total costs over a 30-year lifetime.*

- *Countries should support and encourage the construction of buildings with very low or no net energy consumption (Pa e Energy Houses and Zero Energy Buildings) and ensur se buildings are commonly available in the market. C should set objectives for PEH and ZEB market construction by 2020. Passive Energy Ho Buildings should be used as benchma standards in future updates of build*

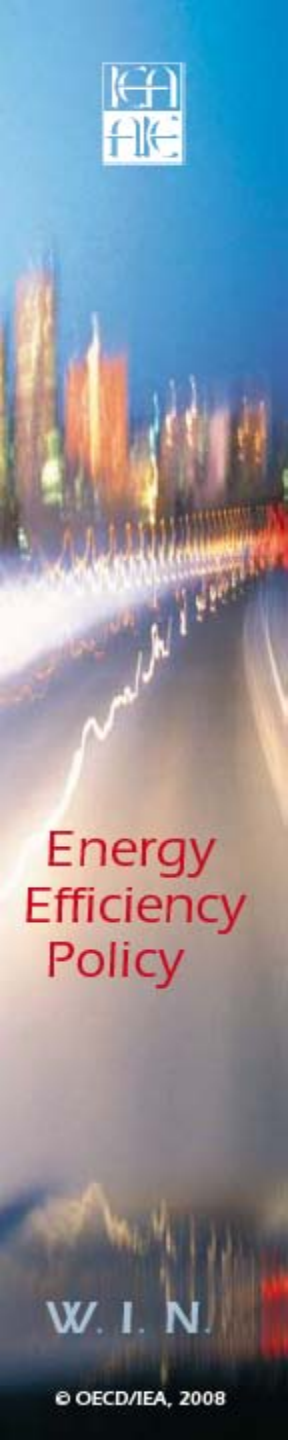
Endorsed by G8 leaders in 2007 Promised to implement in 2008



Market Penetration for ZEB's



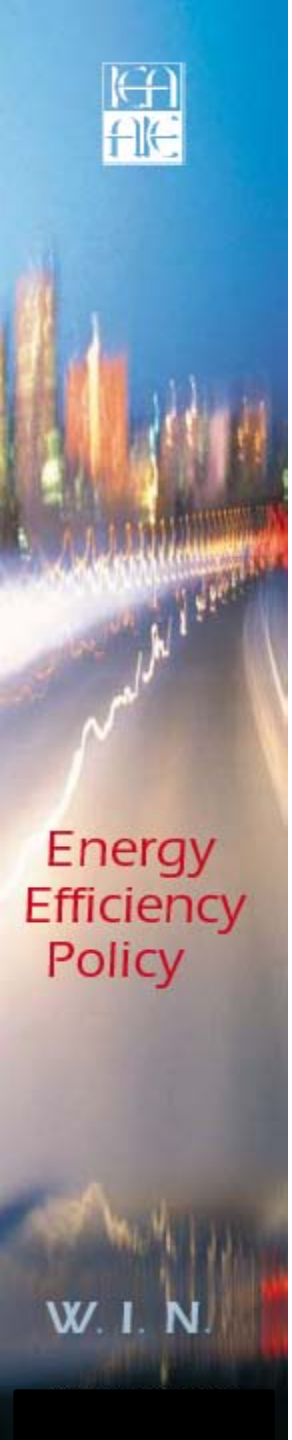
Implementation of EE in buildings takes time !



Mexican Example

Mexico has a very interesting development in this field.

- Starting from nothing they have developed almost 70 zero energy or close to zero energy buildings.
- Took less than 2 years !
- They are mostly low income or very low income housing.
- Supported by green mortgage – but else on normal market conditions.
- Builders very involved and competitive on this.
- Based on IEA recommendations and with support of Canada.
- Both governments and builders want to continue this process and upscale.

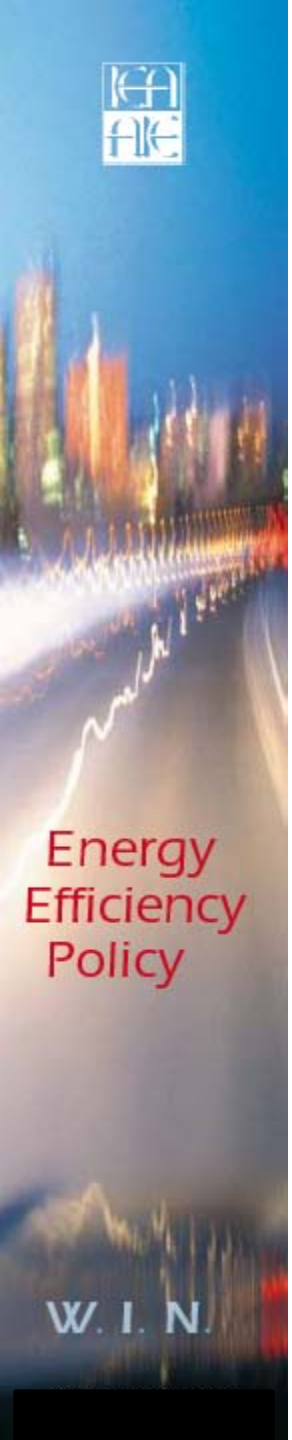


Progressive Building Codes

The other way to market penetration of zero energy:

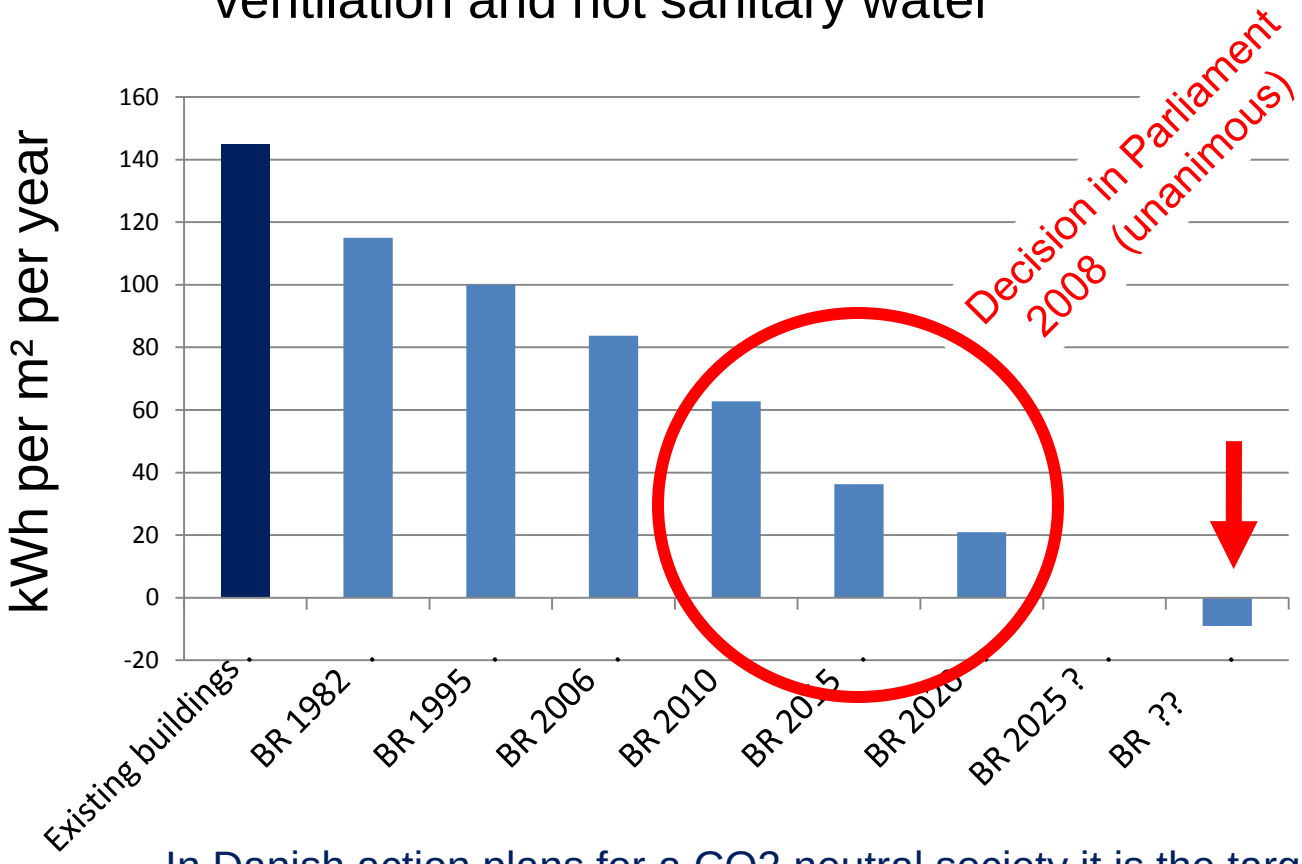
Some countries have set zero targets for building codes:

- UK: residential buildings zero carbon in 2016 and commercial / public buildings in 2018/19.
- France: all building public buildings plus in 2020.
- Denmark: all new buildings must be plus energy plus strict reductions of consumption in near future.
- European Union: all building codes must be close to zero in 2020 (EPBD directive).
- California energy commission: residential buildings zero in 2020 and commercial in 2030.
- Whole US will follow this pathway too.

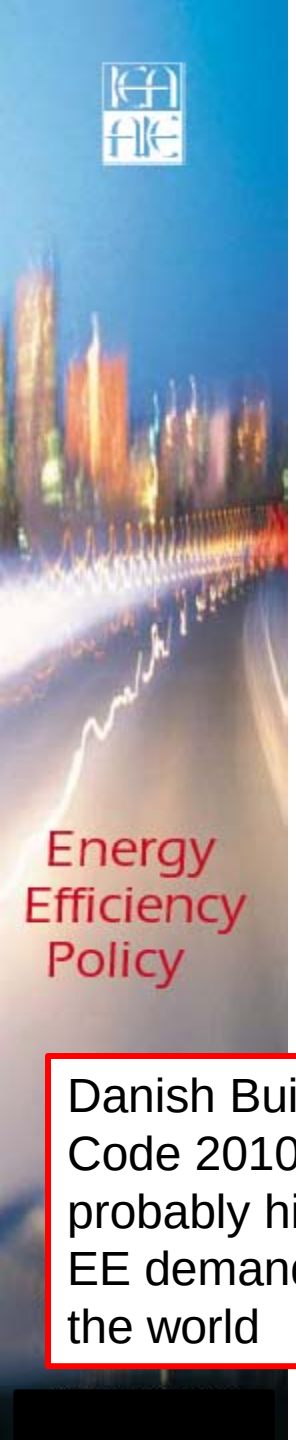


Danish Building Codes

Gross energy including heating, cooling, ventilation and hot sanitary water

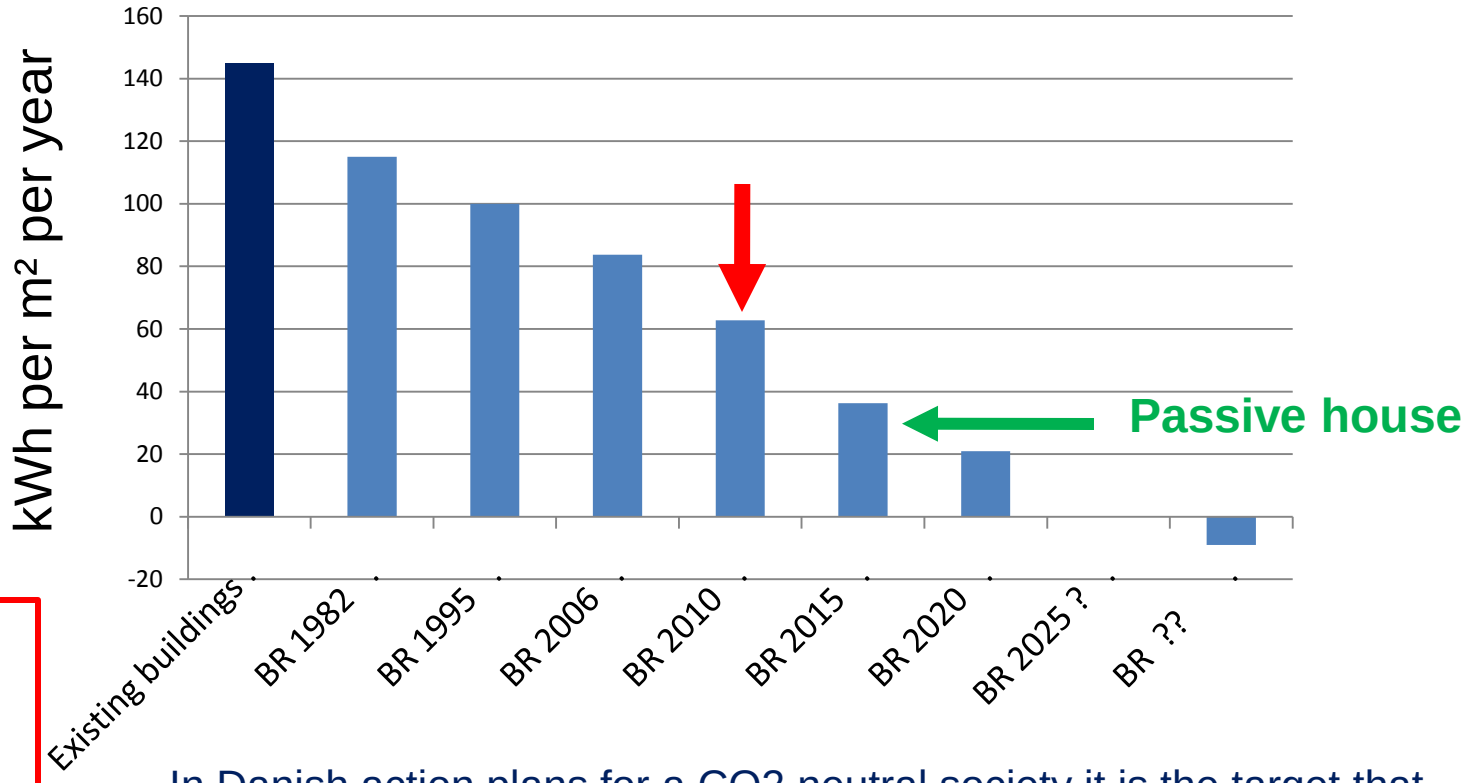


In Danish action plans for a CO2 neutral society it is the target that all building will be positive in the future (year still to be decided)



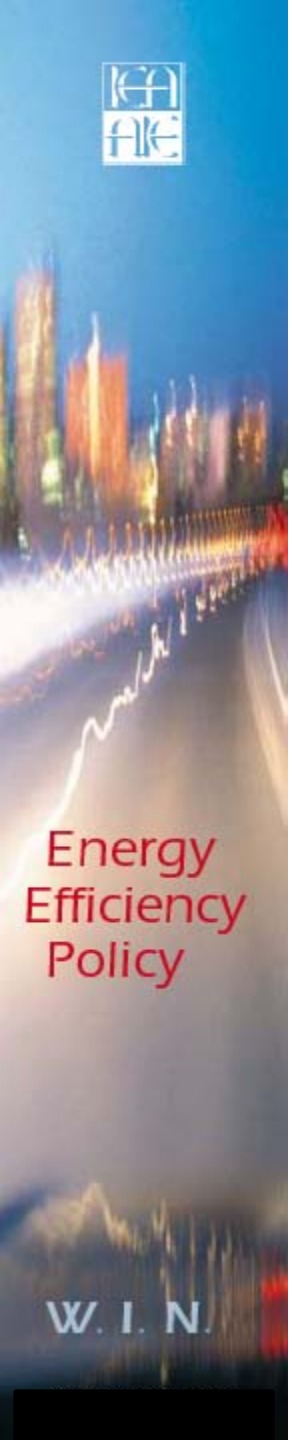
Danish Building Codes

Gross energy including heating, cooling, ventilation and hot sanitary water



Danish Building Code 2010 - probably highest EE demands in the world

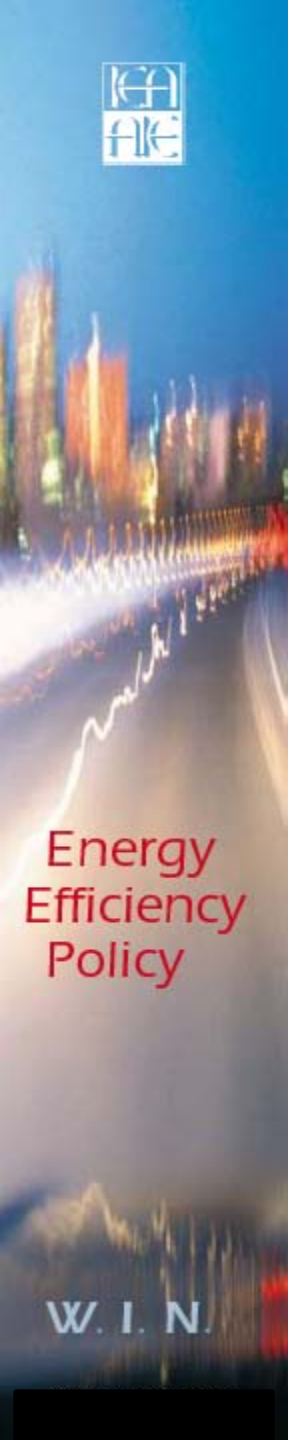
In Danish action plans for a CO2 neutral society it is the target that all building will be positive in the future (year still to be decided)



Costs for improvements of building codes

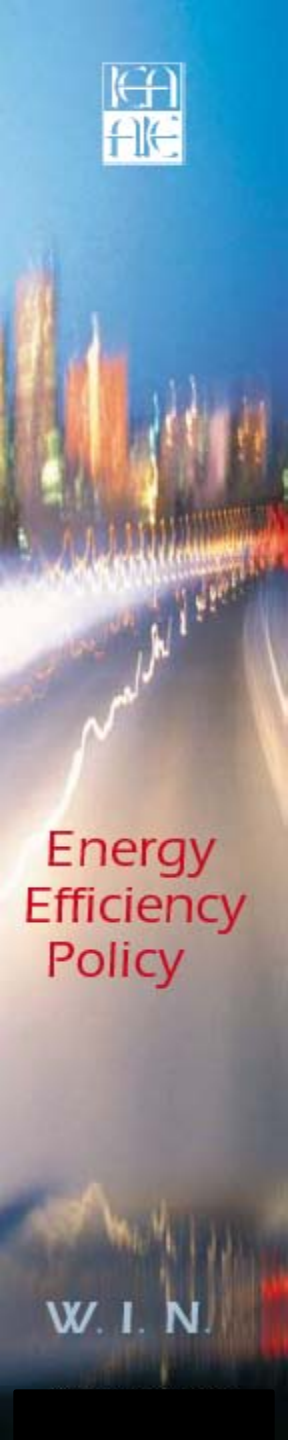
- Danish Building Research Institute calculated additional costs by reduction of 25 % in 2010 to be 5%.
- A reduction on 50 % would have 10 % additional construction cost.
- Over few years these additional costs will drop to 3 % versus 6 %.
- Simple calculations based on these examples shows that both the improvement of building codes in 2010 and a further reduction 2015 are cost neutral for uses and owners of new buildings as such.
- These improvements have no costs or negative costs seen over 30 year lifetime – even without a basic change of design which would be natural with such strong demands.

- Similar calculations in France show that a 50 % reduction of energy consumption in building codes can be obtained in 2013 with negative costs for owners and users if based on performance.



European Policy (EPBD)

- New European Directive forces all 28 member states of European Union will have to follow the examples above.
- A recast EPBD (Energy Performance in Buildings Directive)
- Claims that all member states must implement:
  - Innovative Building Codes new buildings must be close to zero energy in 2020.
  - Recast EPBD directive was adopted 19 May 2010.
- Although final level to be defined, it is expected to be similar to passive house.
- Most European countries expected to follow.



Recommendations

- Passive design and zero energy buildings must play central role in the work to realize the large potentials.
- Such buildings must be supported by active policies.
- Innovative building code is a central policy.
- Front runner buildings showing the way.
- Up scaling markets and provide right incentives at right time.
- Move fast because the buildings we construct now will last also after 2050 !

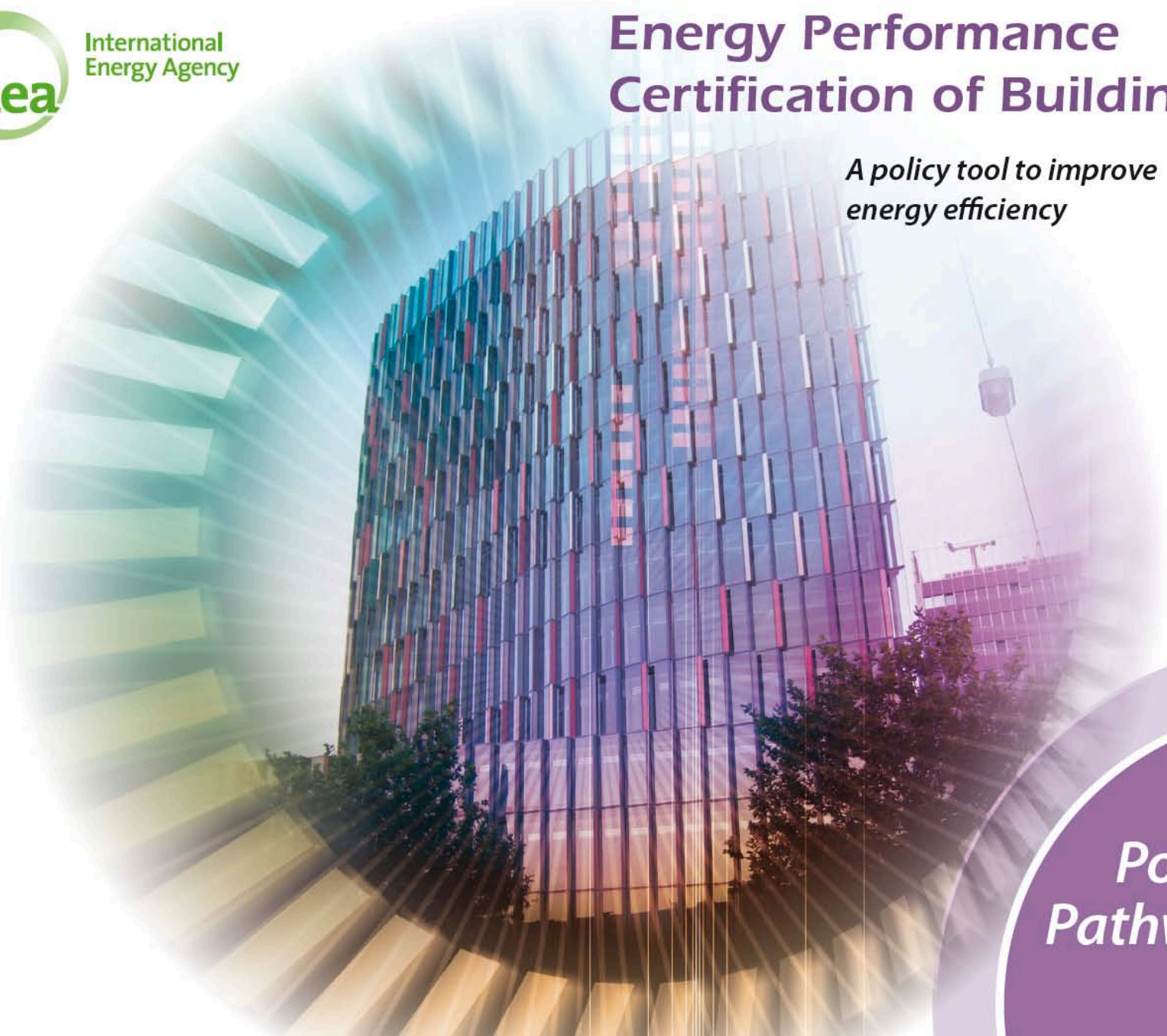
What can IEA do to help countries ?

- Policy Pathways
- Sustainable Buildings Network

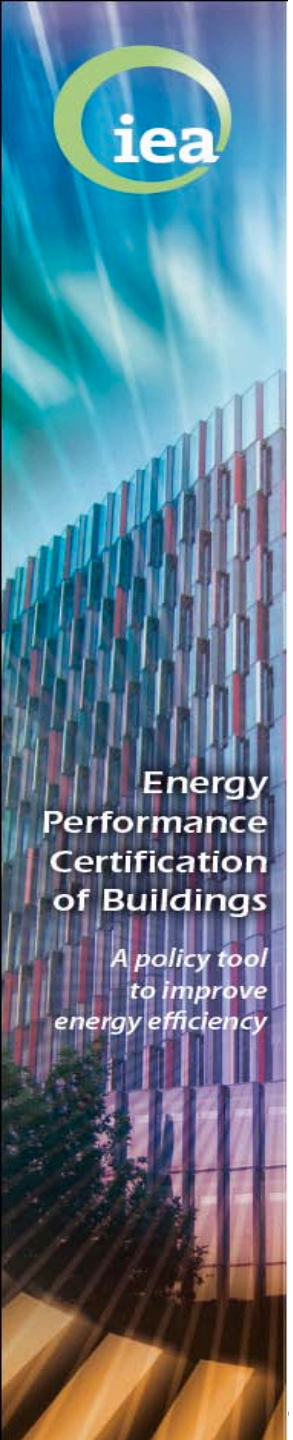
International Energy Agency

Energy Performance Certification of Buildings

A policy tool to improve energy efficiency

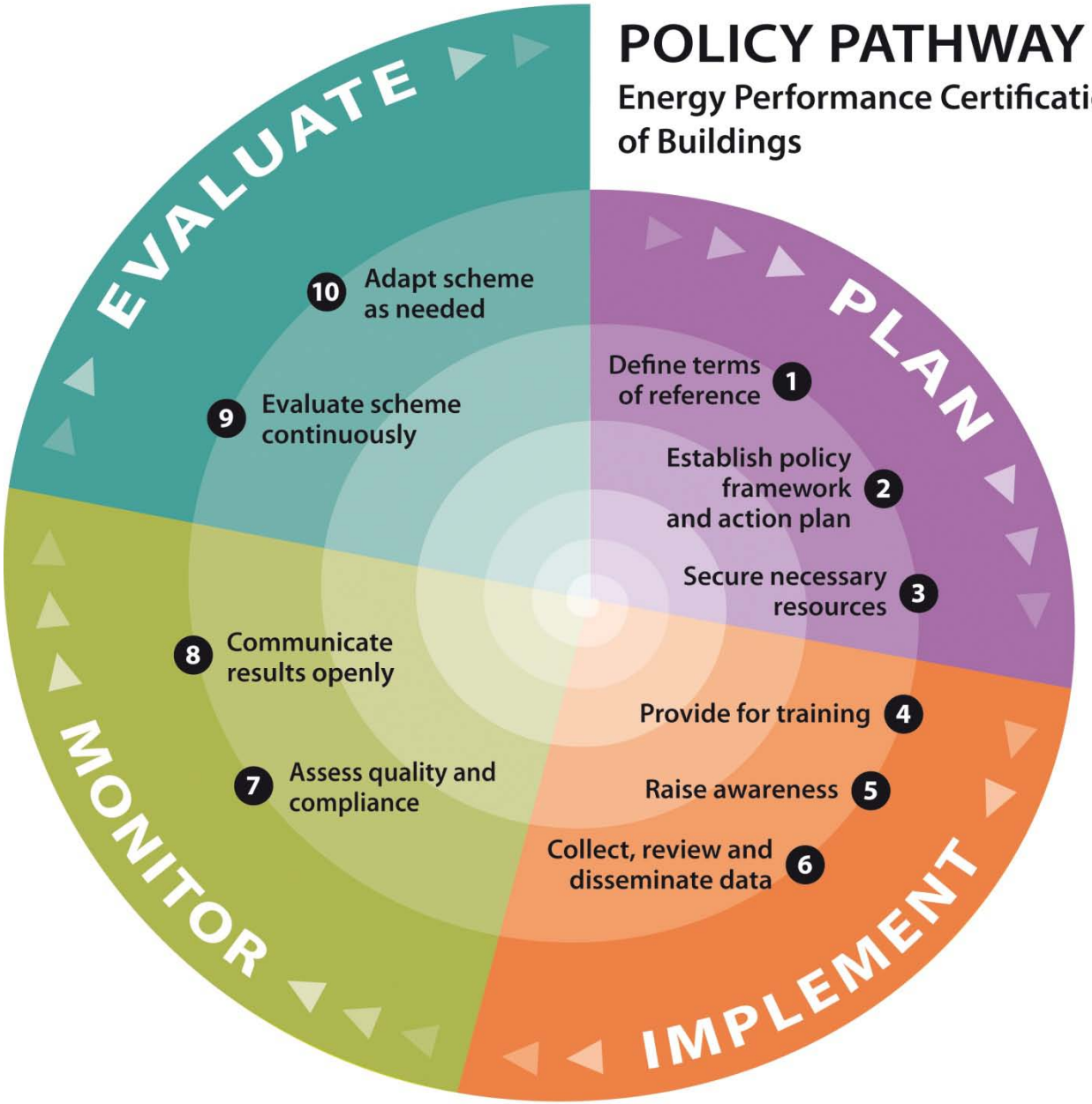


Policy Pathway

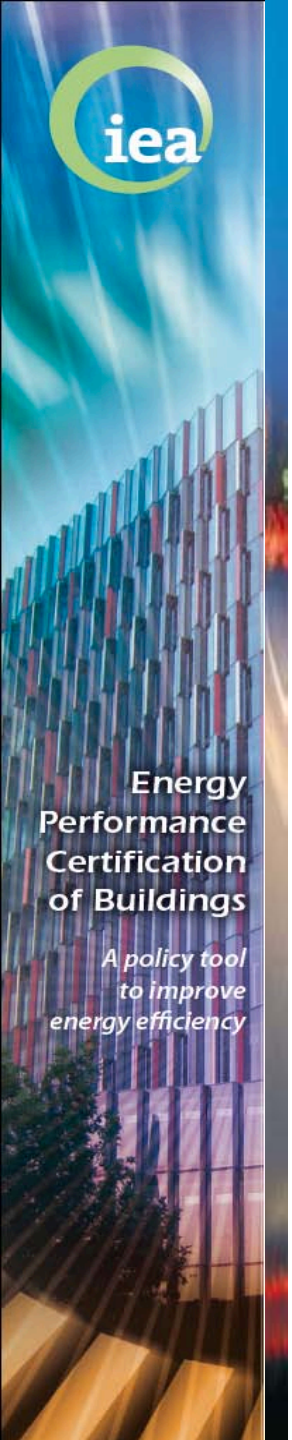


POLICY PATHWAY

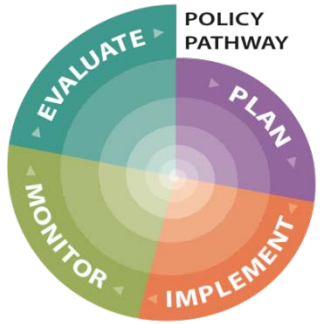
Energy Performance Certification of Buildings



Policy Pathway

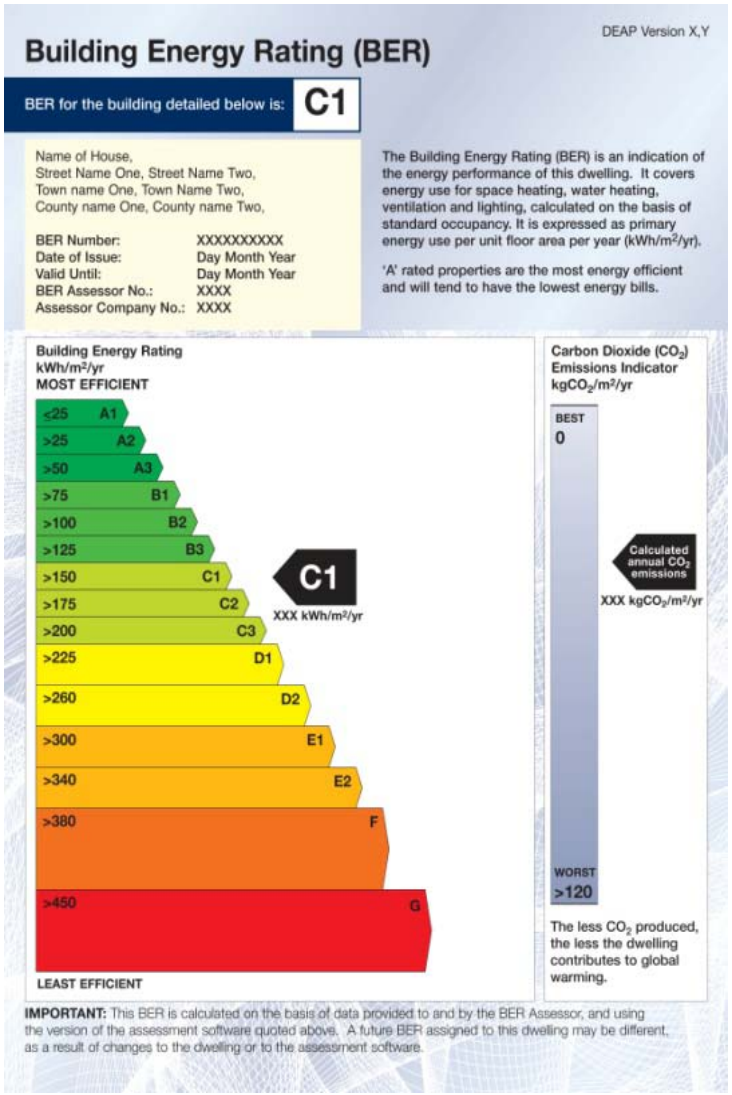


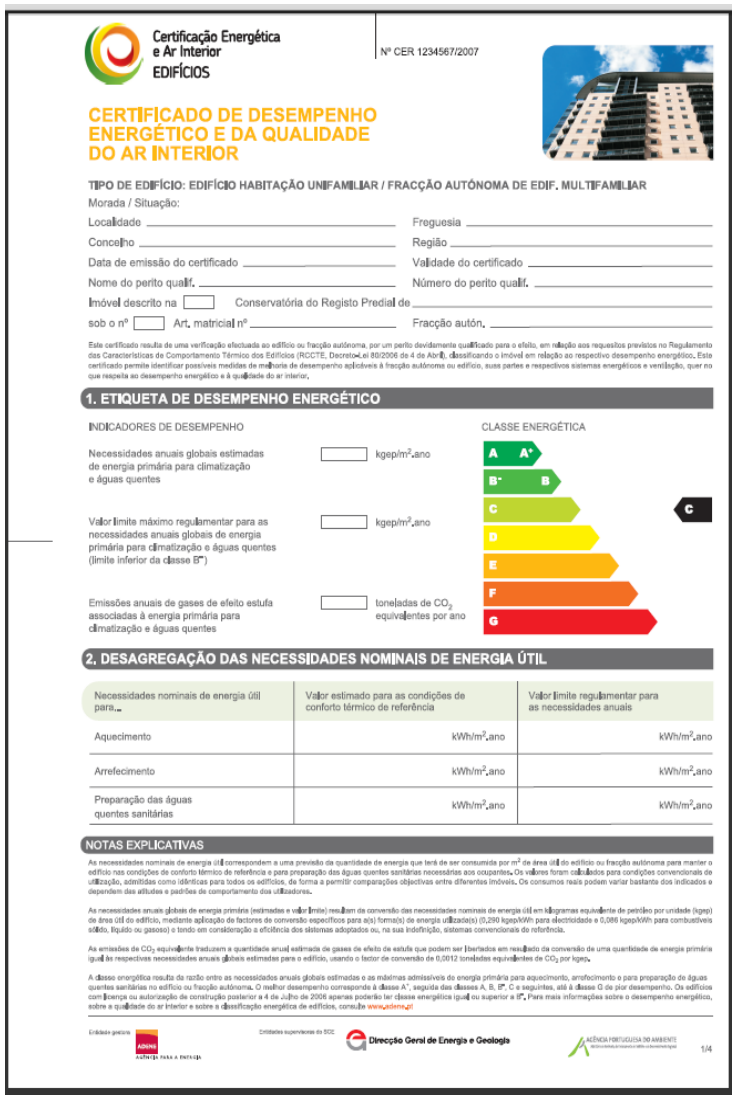
A guide base on best practice around the world

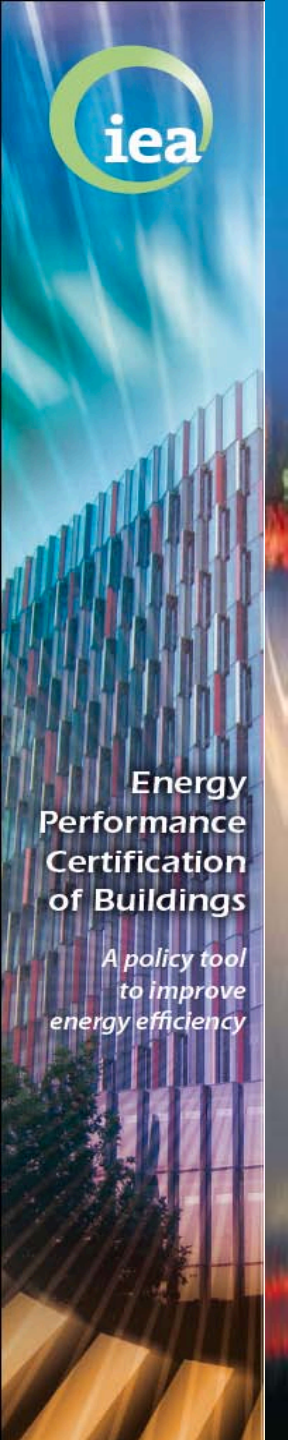


- The policy pathway is drawn up based on world wide best practices in certification
- The policy pathway itself includes
  - 2 main examples (Portugal and Ireland) that illustrate the whole process
  - Mandatory certification by construction, sale and rent. (EPBD)
  - and many other examples to illustrate individual elements in the process
- Just a few examples

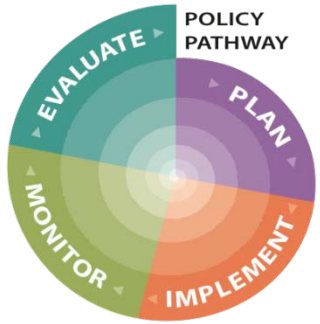
Ireland and Portugal



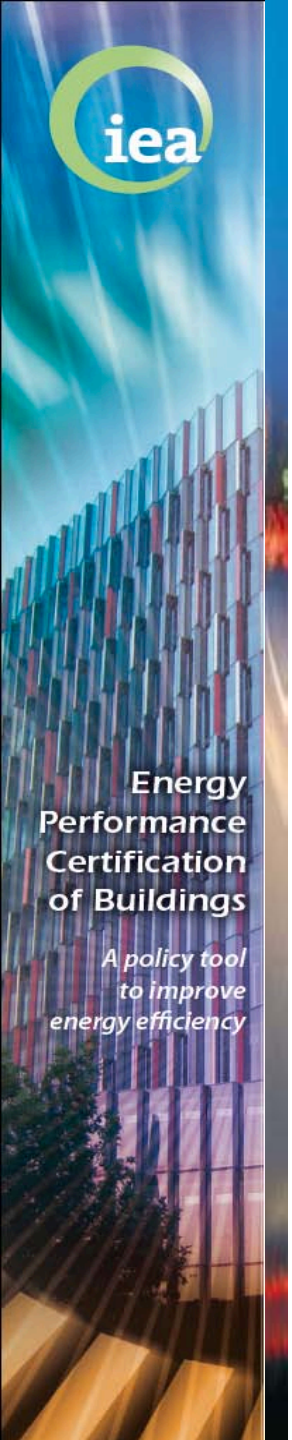




Voluntary certification



- Most certification around the world is voluntary and often used to highlight the buildings that are better than average.
- Positive certification and labeling
- Owners or constructors of such buildings can use certification to document good energy or environmental performance
  - This can increase the market price
  - Or it give other benefits, such as access to subsidy
- In Singapore there are two good examples



Singapore and US

ENERGY SMART HOTEL

ENERGY SMART OFFICE

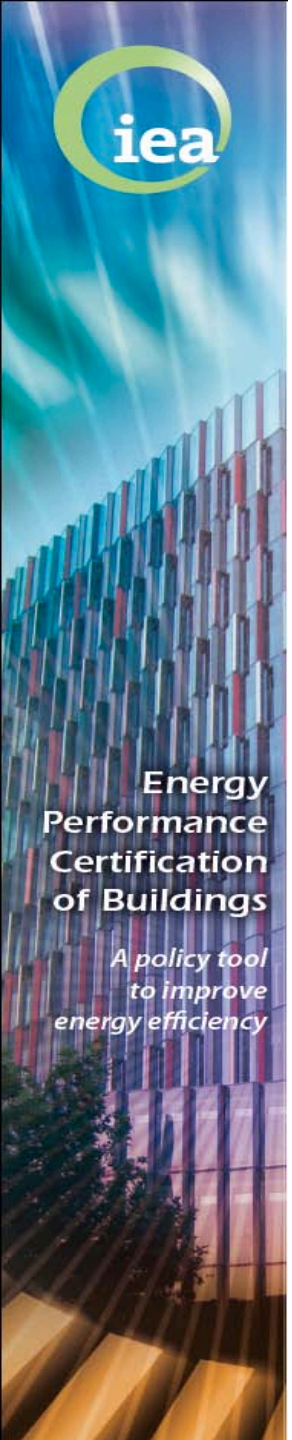
ENERGY SMART RETAIL MALL

BCA GREEN MARK

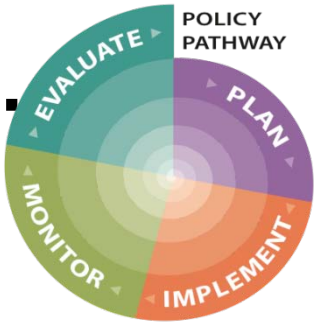
Energy Smart and Green Mark in Singapore

US Energy Star

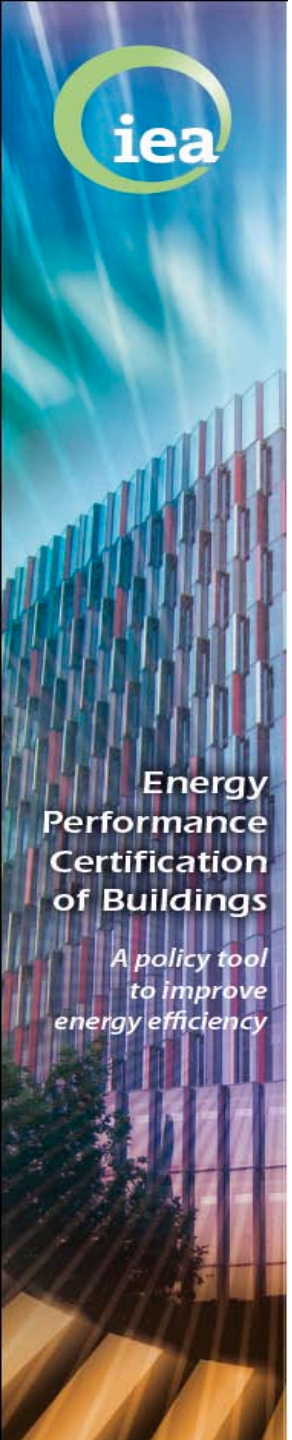
ENERGY STAR



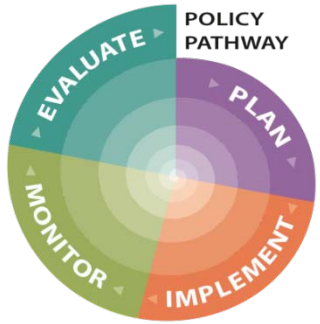
Buildings policy pathway: Key steps to implementation



- Lessons learned four phases of ten critical elements are broken into 38 steps or recommendations for countries implementing such a policy
- Key points:
  - Solve the many questions very early in the process
  - Communicate results openly in all stages
  - Involve the main stakeholders in planning
  - Plan training of assessors carefully and early in the process
  - Leave sufficient time for key processes such as training
  - Most impact if certification is combined with other policies
- Clear process to set up schemes - Plan, Implement, Monitor, Evaluate and Improve!



Policy Pathway series – Schedule of work



Policy Pathways

- Appliances monitoring, verification and enforcement (Oct 2010)
- Buildings certification (November 2010)
- Public-private partnerships for energy efficiency finance (June 2011)
- Policies for advanced buildings - Cool buildings for hot climates (September 2011)
- Industrial energy management (December 2011)

New Energy Efficiency Roadmaps:

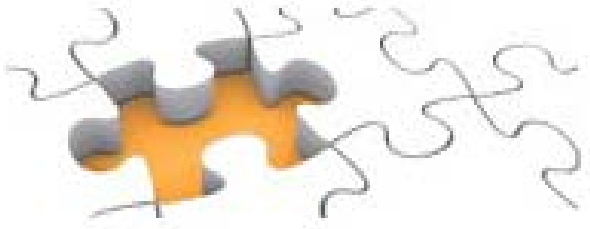
- Solid state lighting (2011)

Sustainable Buildings Network

A global network of networks

Sustainable Buildings Network

- Mobilise existing stakeholders and networks towards common approaches.
- Collect and disseminate information; becoming a reference portal for information and policy-related issues.
- Link technical and political levels of decision-making.
- Share experiences and lessons learned, between local, national and international levels.
- Provide informal coordination of political action at international level.
- Engaging national bodies, networks, organizations and even individual experts when appropriate.
- SBN started by IPEEC countries, but will have a global scope.



SBN a network of networks

Some central key activities will be:

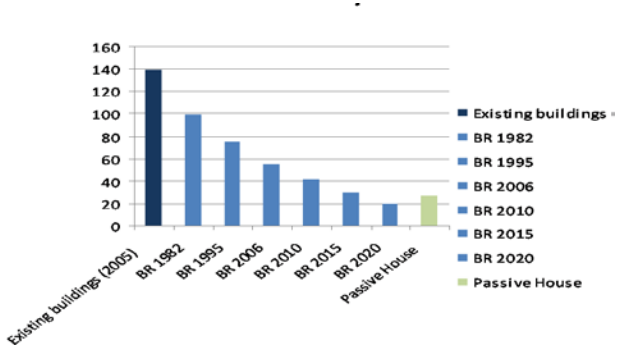
- **Preparation of evidence based information and policy advice**, nationally, regionally and globally.
- **Support clarification and information exchange on definitions and standards**, collection of information, areas needing research.
- **Support for capacity building** in particular in developing countries, assistance to national authorities and organisations

A set of enabling activities will be set up including:

- **Global collaboration between different stakeholders** in energy efficient and sustainable buildings.
- **Establishment of a data bank** with information; dissemination of good results and best practices, policy advice.
- **Dissemination of experience on best practices,** on demonstration projects, public private partnerships, cost, feasibility and results.

1. Building Codes

- **Building Codes is a central element in development of EE policies**
- **Many projects is running, (APERC, CA EPBD, REEEP, APP, Bilateral etc.)**
- **All countries face challenges**
- **Need for help to develop first Building Code and make it mandatory.**
- **Enforcement.**

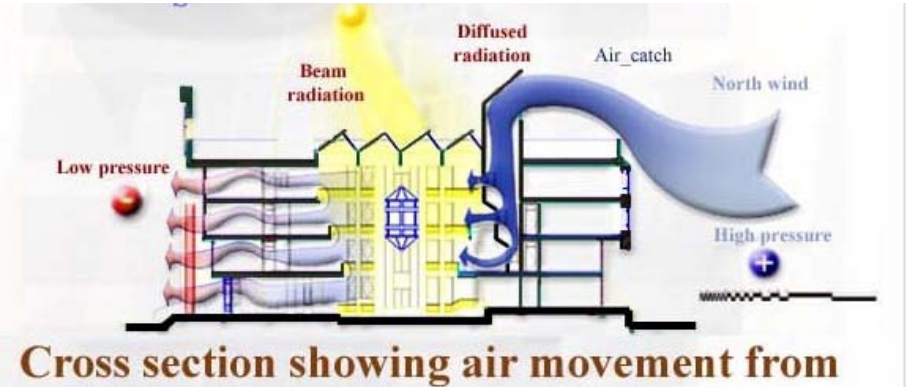


2. Zero Energy Buildings

- **Zero energy and zero carbon buildings.**
- **Many national initiatives, regional initiatives or research, development and deployment projects, but also legislation.**
- **Recommendations on definition and methods as well as sharing of experiences could be key elements.**

3. Intelligent Tropical Architecture

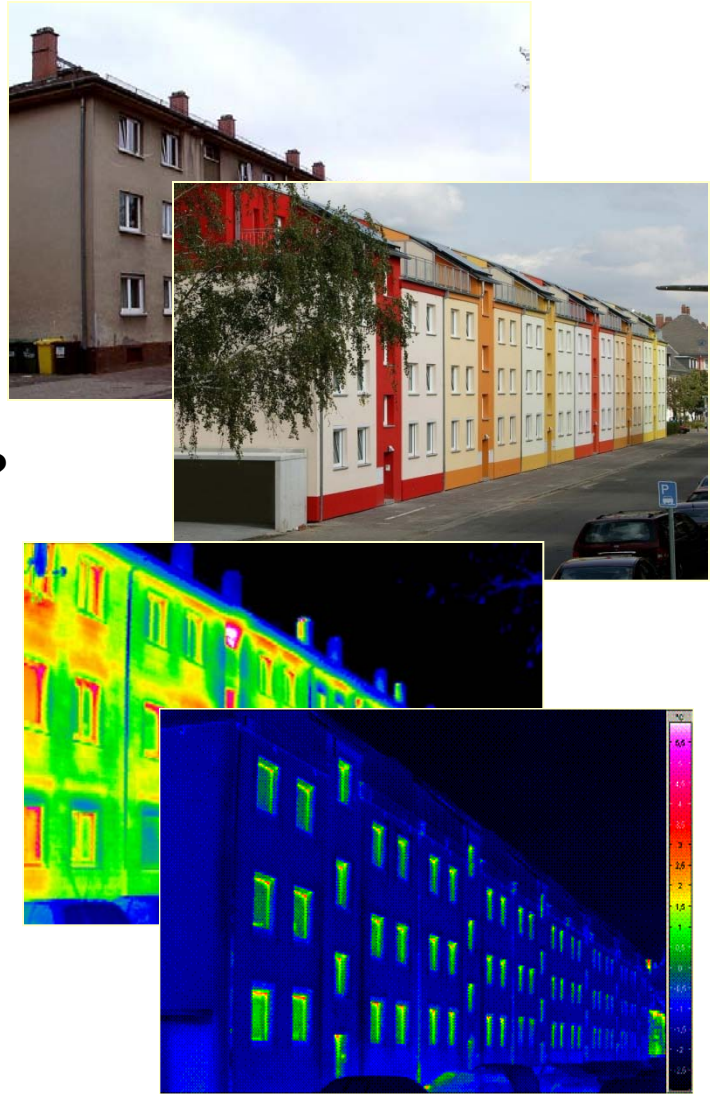
- **Examples of intelligent architecture for tropic and for very hot climates.**
- **Low cost design options, national or local traditions for energy efficient architecture; control of humidity or ventilation with simple solutions**
- **Transfer of knowledge between countries in hot humid and hot dry climates.**

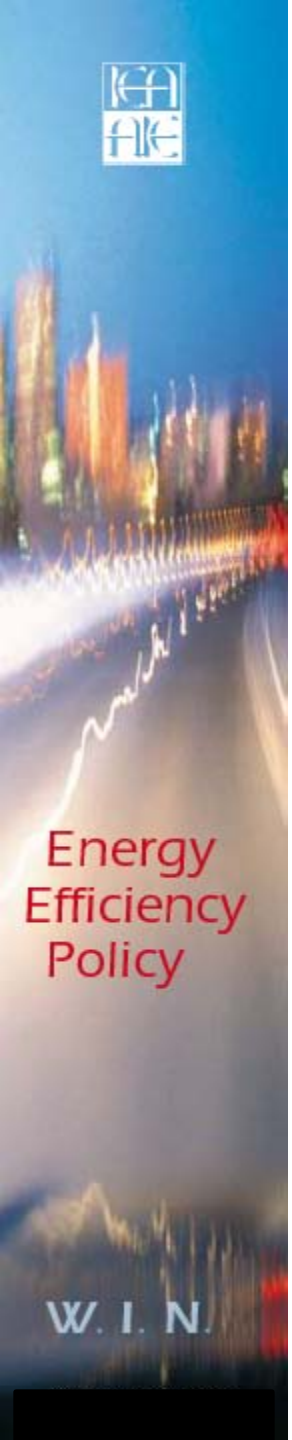


Cross section showing air movement from

4. Package for Existing Buildings

- **Policy packages for existing buildings**
- **Assessment of different policy packages for improving energy efficiency in existing buildings.**
- **What works and what doesn't work?**
- **Collection of information on impact of policies and in particular combinations of policies. Looking at very best practices.**
- **Training and capacity building issues.**
- **To be further defined !**



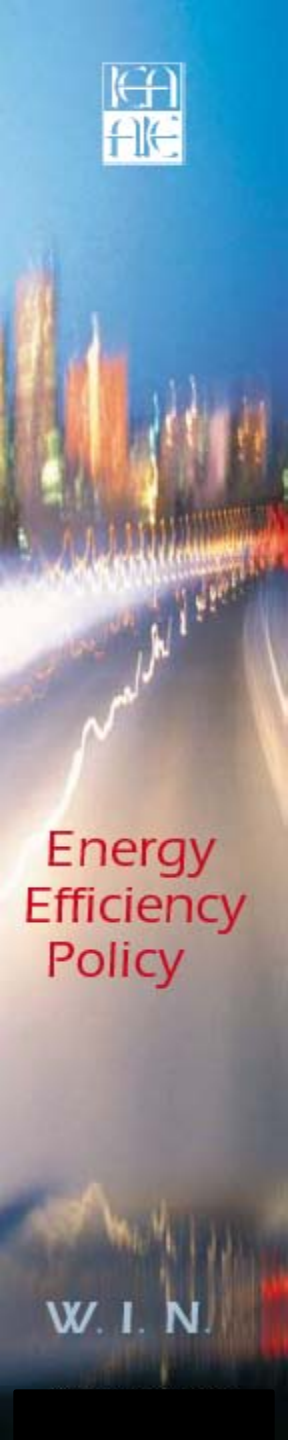


Conclusions

- Buildings must play a substantial role in climate change abatement.
- Improvements should be based on holistic approaches.
- Passive design is a key to implementation.
- Development of passive design for hot climates is a major challenge.
- Many examples exist in traditional architecture.

New IEA work:

- Policy Pathways:
  - Energy Performance Certification,
  - Cool Buildings in Hot Climates,
  - Windows
- Sustainable Buildings Network (SBN).
- Four Times Better Buildings on the way.
- *People around passive buildings must be active !*



Thanks

You can find more information on:

www.iea.org

And for SBN:

http://www.iea.org/sbn/