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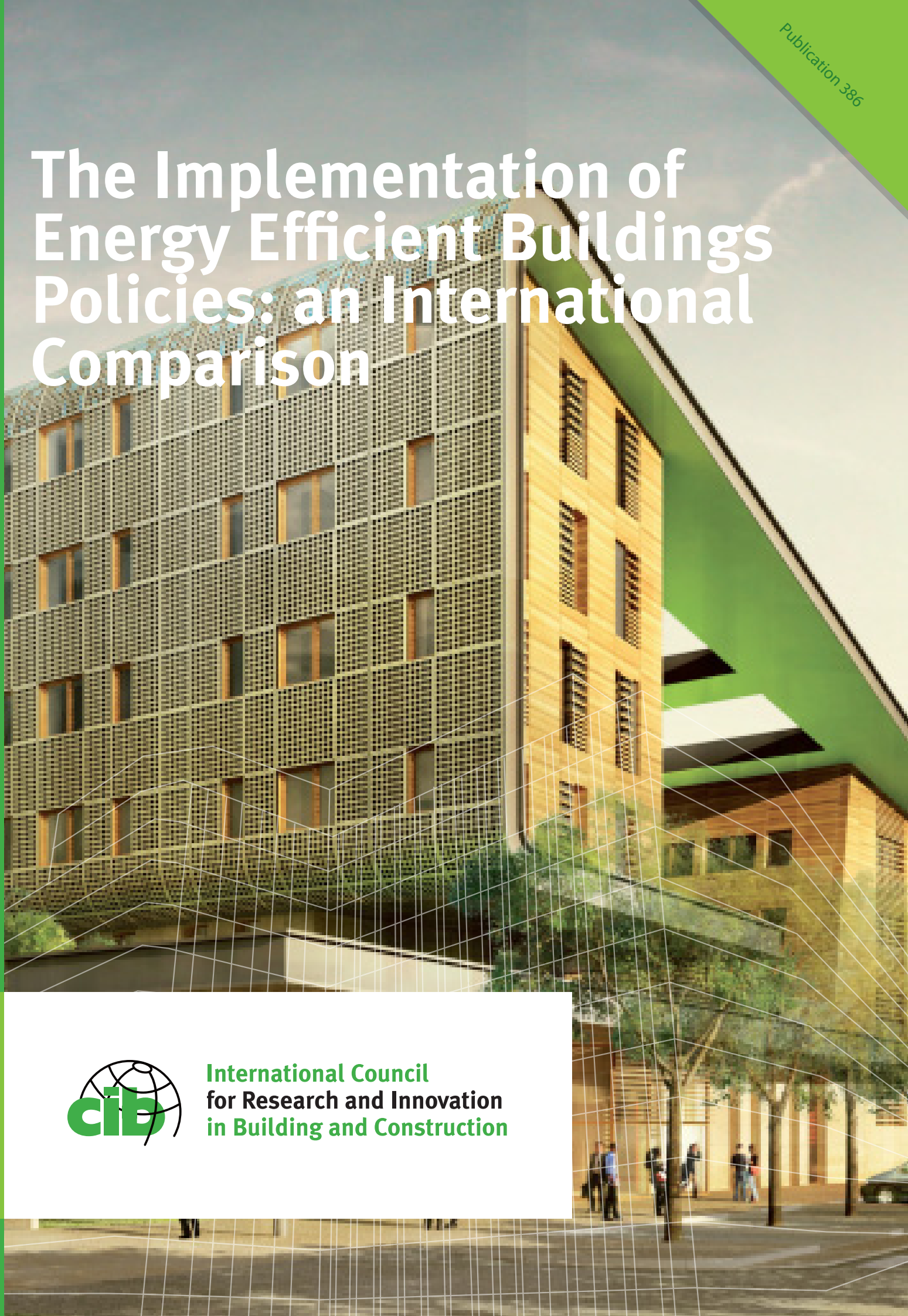
The Implementation of Energy Efficient Buildings Policies: an International Comparison



International Council
for Research and Innovation
in Building and Construction

THE IMPLEMENTATION OF ENERGY EFFICIENT BUILDINGS POLICIES : AN INTERNATIONAL COMPARISON

International Council for Research and Innovation in Building and Construction (CIB) Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012

FINAL REPORT

English version

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Fotograph on the cover:
« Zero Energy Coriolis Building for Ecole des Ponts ParisTech. France.
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The International Council for Research and Innovation in Building and Construction (CIB) was established in 1953. It brings together some 5 000 experts belonging to around 500 organisations. Its studies are conducted by Working Commissions or Task Groups.

The CSTB Carnot Institute is part of a network of 34 Carnot Institutes involved in a Research and Development programme with corporate partners in France. The Scientific and Technical Centre for Building (CSTB) is the Carnot Institute specialised in buildings.

Jean Carassus is professor and director of the Executive Master in Real Estate, Building & Energy at the Ecole Nationale des Ponts et Chaussées, which is part of the Paris Institute of Technology. He has founded and manages the bilingual sustainable real estate blog: www.immobilierdurable.eu

The CSTB Carnot Institute has provided financing for both the CIB Task Group 66 « Energy and the Built Environment » coordinator's work for the period 2009-2012 and the present report.

The report was put on line in two versions, English and French.

French > English translation: Marjorie Leach.

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FOREWORD

Since more than a decade and in particular given the increased concerns about climate change, the interest in energy and the built environment has substantially increased. Moreover, it has become a world-wide concern. Two typical features for energy issues in the built environment are:

- The very important role of the individual citizen in taking the appropriate actions AND
- The crucial roles of government in setting the scene, typically through legislative measures and/or stimuli.

The fact that these are world-wide challenges makes it a particular interesting topic for collaboration in the CIB context and it led to the creation of CIB Task Group TG 66 'Energy and the Built Environment'. This task group, very dynamically lead by Prof. Jean Carassus, who was mandated by CSTB, and with experts from more than twenty countries, has introduced in the context of CIB a new communication approach, whereby the organisation of four internet seminars was crucial and allowed to have a wide outreach. These webinars can still be watched on http://cib.sympraxis.eu/about.

With this task group coming to an end of its activities, this final report gives a structured overview and synthesis of the information gathered throughout the project.

The outcome of this task group clearly highlights that the energy challenges in buildings are an issue of concern in all countries involved in this study, but that the roadmaps and actions in the different continents vary widely. Therefore, further international collaboration in the context of CIB or in other networks is therefore surely needed.

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Centre Scientifique et Technique du Bâtiment (CSTB),
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EXECUTIVE SUMMARY

The Research and Development Department of the CSTB Carnot Institute was pursuing two goals in 2009 on deciding to support the CIB Task Group 66 « Energy and the Built Environment », whose mandate ended in December 2012.

The first goal was to support *an international benchmark on the implementation of energy efficient buildings policies* through the mobilisation of an international network of experts and the collection of relevant information on the subject.

The second was *to test new ways of working in an international context, more specifically by organising internet seminars (« Webinars »)* instead of the usual international conferences.

An international network of experts was mobilized to work on the implementation of energy efficient buildings policies at two different levels:

- An international 10-person project team,
- 30 experts who took part in five separate events: a kick-off seminar in Brussels and four webinars (Europe, North America, South America and India).

The 30 experts presented the experience of:

- three international organisations (International Energy Agency - IEA -, UN Environment Programme Sustainable Buildings and Climate Initiative – UNEP-SBCI - , World Business Council for Sustainable Development – WBCSD -),
- seven developed countries (United States, Canada, Germany, Belgium, France, the Netherlands and Poland),
- nine emerging countries (China, India, South Africa, Argentina, Brazil, Chile, Mexico, Uruguay and Venezuela).

All the presentations, talks and discussions can be found on the Task Group website: http://cib.sympraxis.eu/about.

The IEA's highly active policy includes running an online Sustainable Buildings Centre with a database on energy efficiency policies in 34, mainly developed, countries.

The UNEP-SBCI focuses on developing countries and provides assistance for the elaboration of their energy efficient buildings policies, especially in terms of methodology.

The WBCSD, under the auspices of ten or so large multinational groups, engages in lobbying aimed at large public and private real estate portfolio owners.

The European Union has the most structured approach, with set targets and a timetable for lower greenhouse gas emissions, better energy efficiency and the development of renewable energy.

One of the European Union Directives concerns the energy efficiency of buildings. The implementation of this directive is monitored by the European Union and a progress report is drawn up country by country every two years. Implementation is more advanced in Northern and Western Europe countries than in Southern and Eastern Europe.

North America has initiated a continental approach covering the United States, Canada and Mexico. However, the three countries each have different policies. The situation of Mexico, an emerging country, is radically different from the United States and Canada, both highly developed countries.

In the United States, there are stark contrasts in energy efficiency policies. Several Western (especially California) and North Eastern states have engaged in proactive policies whereas a number of central states have much less ambitious goals.

In South America, emerging countries have a relatively high GDP per capita. Several countries are initiating energy efficiency policies directed at the building envelope and energy use in buildings.

India and China are characterised by the massive and rapid growth of urban centres and new constructions. A policy of energy efficiency is being initiated. It concerns both the technical characteristics of buildings and energy use.

South Africa is in the process of defining a policy for energy efficient buildings.

The presentations related to the seven developed countries and the nine emerging countries do enable *a rough classification of energy efficient buildings policies into four types*, in spite of somewhat patchy information at times.

Two of these concern the developed countries and two the emerging countries.

The first type of policy is a well-structured energy efficient buildings policy which takes into account quantified and measured goals for greenhouse gas emissions, energy savings and the development of renewable energies.

It uses the usual five policy instruments, i.e. regulations on standards, informative regulations, economic and market-based instruments, fiscal instruments and incentives, information, education and voluntary actions.

This policy is pursued by several developed countries, and more particularly by the Northern and Western Europe countries and several Western and North Eastern states in the United States. Concerns for cost-effective investments are more pronounced in the USA than in Europe.

The second type of policy is *a less ambitious energy efficient buildings policy and considered to be of lower priority by the authorities in a number of developed countries. Quantified and measured goals are not highlighted. Not all the policy instruments mentioned above are used.*

Several Southern and Eastern Europe countries and several American states, and more especially some central states, seem to be in this situation.

In Southern and Eastern Europe, the European Union directives aim to progressively harmonize the energy efficient buildings policies in the same way as in the USA where federal actions and the dissemination of certifications such as Energy Star® and LEED® can counteract the less ambitious policies of several American states.

The third type of policy is *the beginning of an energy efficient buildings policy in emerging countries applied both to buildings and energy use.*

This policy tends to differentiate:

- *Middle and high-income population housing and the commercial sector, using some of the five political instruments applied to developed countries, more particularly regulations on standards, informative regulations, incentives and information,*

- *Low-income housing where specific action plans are required for the « informal » construction sector, with a focus on energy use and the dissemination of efficient domestic appliances.*

China, India, Brazil, Chile and Uruguay seem to be moving in that direction.

The fourth type of policy seems to be *the start of an energy efficient buildings policy in emerging countries, principally focusing on energy use, with few or no regulations on buildings themselves.*

The emphasis is on energy use, and especially on certain appliances, such as light bulbs, refrigerators and cooking apparatus, etc., with little or no regulations on building envelopes.

South Africa, Argentina, Mexico and Venezuela seem to fall into this category.

It is worth noting that a number of emerging countries have stressed the importance of the socioeconomic aspect of the policies. In fact, it is also essential to take this dimension into account in developed countries, where a focus on only thermal regulations and technological progress could lead to disappointing results in actual energy consumption, especially in existing buildings.

Such analysis and classification may only be temporary. A more comprehensive analysis would be necessary to go further. It could be the topic of a permanent CIB Commission dedicated to Energy and the Built Environment, continuing the work initiated by the Task Group 66.

In terms of working methods, the usual international conference method bringing together participants in a given place was used for the presentation of 19 technical and socioeconomic research communications in Salford (United Kingdom). This conference comprised only researchers and doctoral students.

However, new working methods were successfully introduced.

This involved:

- top-down meetings on a precise subject submitted to the experts, rather than a bottom-up approach starting from their work,

- internet seminars (webinars), rather than conference venues,

- the participation, beyond the research and university world, of representatives from the private and public sectors and international organisations,

- information made rapidly available and freely accessible on line.

The report concludes with 5 proposals for a permanent « Energy and the Built Environment » Commission to be set up within the CIB.

The work of the Commission should be in line *with the perspective of the on-going third industrial revolution, according to the assumptions of the American economist Jeremy Rifkin*[1].

[1] *The third industrial revolution.* Jeremy Rifkin. Published by Palgrave Macmillan. 2011.

The « Energy and the Built Environment » Commission could deal with *the implementation, monitoring and evaluation of energy efficient buildings policies.*

It is suggested that the « Energy and the Built Environment » Commission *give priority to the dialogue between developed countries and emerging countries, the accent to be placed on the latter since developed countries already have organisations that are active in this field.*

The Commission would have *two target audiences* with a method adapted to each one:

- University and researcher target, through seminars in a physical location, or alternatively webinars,
- Representatives of the private and public sectors and international organisations, *exclusively through webinars.*

INTRODUCTION: TWO GOALS

In 2009, the Research and Development Department of the CSTB Carnot Institute decided to support the action of the CIB Task Group 66 « Energy and the Built Environment », with two goals.

The first goal was in line with the CIB's usual practices: elaborate an international benchmark on the implementation of energy efficient buildings policies by mobilising an international network of experts and putting together relevant information on the subject[2].

The second goal was innovative compared to the CIB's usual practices.

The International Council for Research and Innovation in Building and Construction (CIB) is an international organisation for cooperation on research and innovation in the building sector established in 1953. It brings together some 500 organisations and 5 000 experts working in around sixty working commissions and task groups.

The CSTB, a member of the CIB Board[3], was keen for CIB to renew its methods of work. After playing a leading role in international cooperation from the 1950's to the 1980's, the CIB had not sufficiently updated its *modus operandi* compared to other international organisations (European Commission, International Energy Agency and the UN Environment Programme, etc.).

The CIB usually organises bottom-up type international meetings on broad themes for participants from the research and university world: participants submit communications based on their own work, which are presented in a symposium giving rise to the publication of proceedings.

The CSTB and several other CIB board members wished to test new ways of working.

[2] Thee CSTB had directed the « Comparaison internationale Bâtiment et Energie » project in 2007 in the framework of the *Programme de Recherche et d'expérimentation sur l'Energie dans le Bâtiment* – PREBAT - (see final report in French on http://www.prebat.net/?Comparaison-internationale) and wished to pursue an international benchmark approach to these issues.

[3] The French acronym CIB is a reminder that the CSTB was particularly active among the founder members of the CIB.

The second goal was therefore to test top-down internet meetings where a precise topic was submitted to the participants, with the desire to make these conferences available to audiences beyond the research and university world: private sector, public sector (ministries, local authorities and public enterprises) and international organisations.

The innovation was four-dimensional around the organisation of meetings:

- a top-down approach, with a precise theme submitted to the experts, rather than bottom-up starting from their work,

- in the form of webinars on the internet, rather than gatherings in a conference centre,

- followed, beyond the research and university world, by representatives from the public and private sectors and international organisations,

- with information made rapidly available and freely accessible on line.

1. THE CIB TASK GROUP 66: CHOICES AND IMPLEMENTATION OF THE TWO GOALS

The CIB Task Group 66 was created in December 2006 on the theme of *« Energy and the Built Environment ».*

The Task Group held its inaugural meeting in May 2007 at the CIB Congress in Cape Town (South Africa) under the joint coordination of Jacques Rilling, former CSTB scientific director, and Sunil Vather, chief executive of Building Research New Zealand.

Three papers were presented : a presentation of the group's theme by its joint coordinators, a presentation of a sustainable development project in the UK construction sector by Chris Goodier (Loughborough University) and an update on PREBAT's on-going international benchmark by myself.

A second meeting took place in Barcelona in October 2007. Jiry Nieminen (VTT) presented a Finnish experience of the link between energy efficient buildings and local communities. Jacques Rilling presented the building section of the Intergovernmental Panel on Climate Change's (IPCC) on-going report and I presented the recent developments of the PREBAT benchmark.

The group was directing its efforts towards drawing up an international status report on the subject of Energy and buildings when the two coordinators had to abandon the project for personal reasons and leave the Task Group.

I was designated Task Group coordinator by the CIB in July 2008 with the support of CSTB management.

A think tank was formed with three members of the CIB to define the group's new action plan:

- Peter Wouters, Director Development and Valorisation with the Belgian Building Research Institute (BBRI),

- Dick Schmidt, Director of TNO (Built environment), the Netherlands,

- Rodney Milford, Programme Manager with the South African Construction Industry Development Board (CIDB).

The group strongly underlined the need to test a different approach from the one usually used by the CIB. As already indicated in the Introduction, the latter can be qualified as a *bottom-up approach on a broad theme:* researchers submit communications in a wide-ranging field, the papers are presented at a meeting where each participant rapidly presents his work and the communications are assembled in the conference proceedings. This was the approach used by the Task Group at the CIB Congress held in Salford in May 2010.

The group wished to test the *top-down approach on a specific subject* defined in advance.

The subject chosen was that of energy efficient buildings policies around the world.

It was decided that the group should base its methodology on the UNEP-SBCI (United Nations Environment Programme - Sustainable Building and Climate Initiative) study published in 2007 on policy instruments for reducing greenhouse gas emissions from buildings[4].

A typical kick-off seminar, based on presentations by speakers in a meeting room, was organised and the presentations and discussions recorded and made freely accessible to all on the internet.

The true innovation was adopted for the following seminars. They were *Web seminars or webinars,* i.e. seminars on the internet where several speakers address an audience scattered around their different work places in a large number of countries. The presentations and recorded talks and discussions were then made available free of charge on the internet. The technical system used was Webex, a product developed by CISCO.

An action plan was defined in May 2009 with a kick-off seminar scheduled for October 2009 in Brussels followed by several webinars to be organised per continent.

The action plan was implemented thanks to a close partnership between the Task Group coordinator and Peter Wouters, Director with the BBRI and President of the CIB Marketing and Communications Committee, who played a decisive role in the success of the operations, particularly with the Webex system.

[4] « Assessment of policy instruments for reducing greenhouse gas emissions from buildings ». UNEP-SBCI, Central European University, Budapest. 2007.

2. ENERGY EFFICIENT BUILDINGS POLICIES: CHOICE OF SUBJECT, STRATEGIC FRAMEWORK, METHODOLOGICAL FRAMEWORK

2.1 Choice of subject

The Task Group has taken stock of existing studies related to the energy efficiency of buildings.

The topic of the techniques used to improve the energy efficiency of new or renovated buildings is covered most, especially by technical building research centres, such as the work conducted by the 23 members of the ENBRI network – European Network of Building Research Institutes[5].

Another topic that has often been studied concerns recommendations for the definition of energy efficient buildings policies. These recommendations are formulated by international organisations, both public (UNEP – Sustainable Buildings and Climate Initiative, International Energy Agency) and private (World Business Council for Sustainable Development – WBCSD – Energy Efficient Buildings Project).

Policy cost-effectiveness is less often the subject of study[6].

All policies can be broken down into three components:

- definition and adoption,
- implementation,
- monitoring and evaluation.

The group decided that *priority should be given to the subject of the implementation of energy efficient buildings policies*, since the key issue today is not: « What should be done? » but « How to do it? » « With what instruments? ».

Insofar as the information exists, the group does of course explore policy monitoring and evaluation aspects, since the questions « How effective? », « What is the cost? » and « What are the results ? » are essential but unfortunately often neglected.

It should be pointed out that the subject of the implementation of policies came up against the dominant CIB culture, which is focused on techniques; indeed, the policy aspect is scarcely taken into account in the CIB Commissions and Task Groups.

[5] www.enbri.org/

[6] This is covered in the UNEP 2007 study already referred to and used for the methodological framework of the benchmark.

2.2 Strategic framework: two global issues, three quantifiable targets

The energy efficiency of buildings falls within the strategic framework of the two global challenges:

- climate change due to greenhouse gas emissions, CO2 in particular, and
- provision of fossil fuels.

In developed countries, buildings represent approximately 40% of CO2 emissions and 40% of energy consumption (in the European Union, 36% of CO2 and 40% of energy[7], and in the United States, 40% of CO2 and 40% of energy[8]).

These figures concern CO2 emissions and energy consumption from using the buildings. CO2 emissions and energy consumption related to the construction, renovation and destruction of buildings are placed under industry.

Transport-related CO2 emissions and energy consumption as a direct result of buildings, especially from private cars when blocks of flats or houses are not built on a public transport route, are placed under transport.

In all, buildings are directly or indirectly responsible for over half of total C02 emissions and energy consumption.

CO2 emissions and energy consumption by buildings are rising sharply in high-growth emerging countries, along with an improvement in comfort and rapid urban growth[9].

In developed countries, buildings represent the number One problem of the two geostrategic issues of climate change and energy provision, well before transport and far ahead of industry. The role of buildings is rising significantly in emerging countries along with rapid urban growth.

Three targets have been set in order to limit climate change and reduce dependence on fossil fuels:

- *reduce greenhouse gas emissions, especially CO2,*
- *increase energy efficiency, and even reduce energy consumption,*
- *step up the share of renewable energies[10].*

[7] Cf Appendix 1 - Michaela Holl's presentation

[8] Cf Appendix 1 - Shyam Sunder's presentation

[9] Cf Appendix 1 – Wang Wei and Fang Dong Ping's presentation for China, for example

[10] Cf – for example, the European Union's « 3x20 by 2020 policy » adopted in 2007 referred to in Michaela Holl's presentation op cit :

- A 20% reduction in EU greenhouse gas emissions by 2020 compared to 1990,

Energy efficient buildings policies are in line with these three quantifiable targets.

2.3 Methodological framework: classification and cost-effectiveness of policy instruments

The group has chosen to base its methodology on the study « Assessment of policy instruments for reducing greenhouse gas emissions from buildings » conducted in 2007 by the Central European University of Budapest for the UNEP-SBCI[11].

This study is based on a broad review of the international state of the art. It defines a *five-category classification* of policy instruments for improving the energy efficiency of buildings:

- *regulations on standards,*
- *informative regulations,*
- *economic and market-based instruments,*
- *fiscal instruments and incentives,*
- *information, education and voluntary actions.*

- A 20% reduction in EU energy consumption by 2020 compared to the the 2005 trend scenario,
- A 20% share of EU energy consumption produced from renewable resources by 2020.

[11] Access to the report: http://www.unep.org/sbci/pdfs/SBCI_CEU_Policy_Tool_Report.pdf

Table 1. *Classification of policy instruments for energy efficiency in buildings*

Control and regulatory instruments		*Economic and market-based instruments*	*Fiscal instruments and incentives*	*Support, information and voluntary action*
Normative : Appliance standards Building codes Procurement regulations Energy efficiency obligations and quotas	*Informative :* Mandatory audits Utility demand-side management programmes Mandatory labelling and certification programmes	Energy performance contracting Cooperative procurement Energy efficiency certificate schemes Kyoto Protocol Clean Development Mechanism (CDM) and Joint Implementation (JI)	Energy and carbon taxes Tax exemptions / reductions Public benefit charges Capital subsidies, grants, subsidised loans	Voluntary certification and labelling Voluntary and negotiated agreements Public leadership programmes Awareness raising, education, information campaigns Detailed billing and disclosure programmes

Source: UNEP Central European University 2007

We have adopted this classification and advised internet conference organisers and speakers to use it.

It has the merit of being virtually exhaustive. Some conference speakers have endeavoured to use the major part of it. However, those with such a global vision of the energy efficient buildings policy in their country are rare.

The vast majority of speakers have focused on only one part of the policy instrument classification, and even in some cases on one instrument.

One of the interesting points of the study is that it proposes, on the basis of existing studies in the different countries, the classification of policy instruments according to their cost-effectiveness and their effectiveness in terms of greenhouse gas reductions, taking into account a number of success factors.

One of the limitations of the approach is an appreciation of cost-effectiveness and of effectiveness in general, since the situation can vary considerably from one country to another depending upon the context. However, in the framework of an international benchmark, the trends indicated are useful and the qualitative assessment set out in the UNEP study (factors for success, strengths and weaknesses, possible collateral benefits) often more relevant than the ranking *stricto sensu*.

The following three tables present policy instruments which, according to the authors of the study, are of high, medium and low cost-effectiveness.

Table 2*. Policy instruments - high cost-effectiveness*

Policy instruments	*Cost-effectiveness*	*Effectiveness on greenhouse gas emissions*	*Factors for success, strengths and limitations, possible co-benefits*
Tax exemptions / reductions	High	High	If properly structured, stimulate introduction of highly energy-efficient equipment and new buildings
Energy efficiency obligations and quotas	High	High	Continuous improvements necessary: new energy efficiency measures, short term incentives to transform markets
Appliance standards	High	High	Periodic update of standards, independent control, information, communication and education
Utility demand-side management programmes	High	High	Seem more cost-effective in the commercial sector than in housing
Labelling and certification programmes	High	Medium / high	Mandatory certification more effective than voluntary. Effectiveness can be boosted by combination with other instrument, and regular updates
Building codes	High	Medium	Effective if enforced and controlled. No incentive to improve beyond target
Public benefit charges	High	Medium	Success factors : independent administration of funds, regular monitoring, evaluation and feedback, simple and clear programme design

Source: UNEP Central European University 2007

Tax reductions, energy efficiency obligations, appliance standards and utility demand-side management programmes tend to be more cost-effective and have a high impact, but conditions apply, such as appropriate structuring of tax incentives.

Labelling and certification programmes, thermal regulations and public benefit charges can have a high impact and tend to be very cost-effective, on condition, for example, that thermal regulations are actually enforced.

Table 3. *Policy instruments - medium cost-effectiveness*

Policy instruments	*Cost-effectiveness*	*Effectiveness on greenhouse gas emissions*	*Factors for success, strengths and limitations, possible co-benefits*
Public leadership programmes including new procurement rules	High / medium	Medium / High	Mandatory programmes have higher potential than voluntary ones. Need for labels and monitoring of ambitious energy efficiency. Can be used to demonstrate new technologies and practices
Energy efficiency / white certificate schemes	High / medium	Medium	No long-term experience yet. Institutional structures needed. Positive impact on employment. Interactions with other instruments. Transaction costs can be high
Cooperative procurement	Medium / High	High	To be combined with standards and labelling. Choose products with technical and market potential
Awareness raising, education, information campaigns	Medium / High	Low / medium	To be applied with other instruments. More effective in residential sector than in commercial sector
Energy performance contracting / ESCO support	Medium	High	Advantage: no need for public spending or market intervention, improved competitiveness
Mandatory Audit Programmes	Medium	High, but variable	Most effective if combined with other measures, such as financial incentives
Voluntary and negotiated agreements	Medium	Medium / high	Can be effective when regulations are difficult to enforce. To be combined with fiscal incentives and threat of regulation
Detailed billing and disclosure programmes	Medium	Medium	To be combined with other measures and periodic evaluation

Source: UNEP Central European University 2007

Public leadership including new procurement rules, energy efficiency certificates, cooperative procurement and education and information campaigns tend to be reasonably cost-effective. However, in most cases, they have to be combined with other measures.

Energy performance contracting, mandatory audit, voluntary and negotiated agreements and detailed billing tend to be less cost-effective but, there again, they can be very useful when combined with other instruments.

Table 4. *Policy instruments - low cost-effectiveness*

Policy instruments	*Cost-effectiveness*	*Effectiveness on greenhouse gas emissions*	*Factors for success, strengths and limitations, possible co-benefits*
Capital subsidies, grants, subsidised loans	Low	High	Positive for low-income households, risk of free-riders, may induce pioneering investments
Taxation on CO2 and fuel	Low	Low	Effect depends on price elasticity; revenues can be earmarked for further energy efficiency improvements. More effective when combined with other tools
Kyoto Protocol Clean Development Mechanism (CDM) and Joint Implementation (JI)	Low	Low	So far, a limited number of CDM and JI projects in buildings

Source: UNEP Central European University 2007

Capital subsidies, grants and subsidised loans can be very cost-effective, but can also be relatively costly.

It can seem surprising that taxation on CO2 and energy is in the category of low impact and low cost-effectiveness, even if the authors of the study do point out the fact that economists are very much in favour of this policy instrument.

In this respect, the Stern Review on the Economics of Climate Change suggests the creation of a global carbon price through the establishment of a global market for greenhouse gas emission quotas or the taxation of emissions[12].

The authors' assessment is based on measures related most often to the short-term effect of these taxes. The introduction of a carbon tax could be expected to contribute, in the medium to long term, to a modification in the behaviour of real estate investors.

As for the Kyoto Protocol mechanisms mentioned, they are indeed seldom applied in the building sector.

This analysis highlights above all that *it is not a question of finding the most cost-effective policy instrument(s) but of choosing the best policy instrument combinations for an overall high cost-effectiveness, depending on a country's context and specific situation.*

[12] Stern Review on the Economics on Climate Change. 2006. Access to the report : http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/sternreview_index.htm

The authors of the study give four examples of combinations which generally prove effective:

- appliance standards, product certification and financial incentives,
- voluntary or mandatory building certification and thermal regulations,
- thermal regulations and information campaigns to ensure more effective application of the regulations,
- public leadership programmes and energy performance contracts.

Finally, the authors point out the specificities of developing countries and the importance for the latter of technical assistance, training, demonstration projects, financing mechanisms, regulatory measures, institutionalisation of actions, monitoring and evaluation instruments, and adaptation to local conditions.

The Green Economy 2011 UNEP Report used the same policy instruments typology[13].

A 2011 Discussion Paper of International Energy Agency (Energy Conservation in Buildings and Community Systems Programme, Annex 51), edited by Andreas Koch and Jenny-Claire Kersting, EIFER, compared this typology with three other ones and suggested a more simplified classification: "sticks, carrots and tambourine"[14].

[13] Access to the report (see pages 362-366):
http://www.unep.org/greeneconomy/Portals/88/documents/ger/9.0_Buildings.pdf

[14] Access to the discussion paper (see page 86): http://www.annex51.org/home/subtask-a.html . Andreas Koch and Lioba Markl-Hummel used this typology in their presentation in the European Webinar (see link to their presentation in Appendix 2).

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

3. INTERNATIONAL NETWORK OF EXPERTS: A TWO-LEVEL DEVICE

3.1 Project team

The Task Group's strategy and action plan were defined by the initial core group formed, as already mentioned, by the coordinator and three members of the CIB Board:

- Peter Wouters, Director Development and Valorisation with the Belgian Building Research Institute (BBRI)[15],
- Dick Schmidt, Director of TNO (Built environment)[16], the Netherlands,
- Rodney Milford, programme manager with the South African Construction Industry Development Board (CIDB)[17].

A project team has gradually been built up by co-opting members to cover all continents.

At mid-2010, the project team included the four initial members and the following six members:

–Keith Hampson (Sustainable Built Environment National Research Center, Australia)[18],

–Hiroshi Ito (Building Research Institute, Japan)[19], CIB board member,

–Roberto Lamberts (Federal University of Santa Catarina, Brazil)[20],

–Barbara Lippiatt (National Institute of Standards and Technology, USA)[21],

–Mahua Mukherjee (Indian Institute of Technology Roorkee, India)[22],

–Yingxiu Zhu (Tsinghua University, Beijing, China)[23].

So the team includes three representatives from general research institutes, five from research institutes specialised in building and two University representatives.

[15] http://www.cstc.be/homepage/index.cfm?cat=bbri&sub=presentation
[16] http://www.tno.nl/content.cfm?context=thema&content=thema_hoofd&laag1=896&item_id=896&Taal=2
[17] http://www.cidb.org.za/default.aspx
[18] Keith has taken over from Peter Scuderi, http://www.sbenrc.com.au/
[19] http://www.kenken.go.jp/english/introduction.html
[20] http://en.ufsc.br/
[21] http://www.nist.gov/index.html
[22] http://www.iitr.ac.in/
[23] http://www.tsinghua.edu.cn/publish/then/5768/index.html

The method adopted for organising the kick-off seminar and the internet seminars involves one or two members of the project team taking responsibility for the organisation of each seminar, including the formation of, and responsibility for, a group of speakers for each seminar.

Jean Carassus and Peter Wouters were in charge of organising the kick-off seminar held on 14 October 2009 and the first internet seminar, dedicated to Europe, which took place on 24 February 2010.

Barbara Lippiatt, in coordination with Daren B. Meyers (International Code Council), was in charge of the internet seminar dedicated to North America held on 12 October 2010.

Roberto Lamberts was in charge of the internet seminar dedicated to South America held on 4 November 2010.

Mahua Mukherjee, in coordination with Priyanka Kochar (Energy and Resources Institute New Delhi), was in charge of the internet seminar dedicated to India held on 28 June 2012.

Jean Carassus and Peter Wouters were also responsible for the organisation of the Task Group research seminar held on 11 May 2010 during the CIB World Building Congress.

3.2 International network of experts

The international kick-off seminar held in October 2009 in Brussels brought together three types of experts:

- four European experts who presented different aspects of the European energy efficient buildings policy,

- three experts representing three public and private international organisations active in this area,

- four national experts who presented the policies implemented in their respective countries, one developed country and three emerging countries.

The four European experts were:

- Michaela Holl from Unit D4 – Energy Efficiency, Directorate-General for Energy and Transport (DGTREN), European Commission,

- Peter Wouters, as coordinator of the European internet portal BUILD UP,

- Eduardo Maldonado, coordinator of the European Concerted Action Energy Performance of Buildings Directive (EPBD),

- Luc Bourdeau, Secretary General of the European Construction Technology Platform (ECTP), which brings together the European building and real estate private sector.

The three experts representing the three international organisations were:

- Jens Laustsen, Energy Policy Analyst for buildings with the International Energy Agency (IEA),

- Rodney Milford, representing the UN Environment Programme Sustainable Buildings and Climate Initiative (UNEP-SBCI),

- Dorien van der Weele, Director of Energy Efficient Solutions, Philips, and representative of the World Business Council for Sustainable Development (WBCSD) Energy Efficiency in Buildings project.

The national experts were:

- Shyam Sunder, Director of the Building and Fire Research Laboratory, National Institute of Standards and Technology, US Department of Commerce,

- Wang We, Shanghai Research Institute of Building Sciences (SRIBS) and Fang Dong Ping, Tsinghua University, Beijing,

- Vahan Agopyan, Polytechnic School of the University of Sao Paulo and Roberto Lamberts, Laboratory for Energy Efficiency in Buildings, Federal University of Santa Catarina,

- Rodney Milford, Programme Manager with the South African Construction Industry Development Board (CIDB).

The internet seminar dedicated to Europe brought together:

- Marleen Spiekman, TNO, the Netherlands,

- Frédéric Bougrain, CSTB and Jean Carassus, Ecole des Ponts ParisTech, Task Group coordinator, France,

- Peter Wouters, BBRI, Belgium,

- Andreas Koch and Lioba Markl-Hummel, European Institute for Energy Research (EIFER), Germany,

- Krzysztof Kasperkiewicz, Building Research Institute, Poland.

The internet seminar dedicated to North America brought together:

- Jonathan Westeinde, Chair, Green Building Advisory Group, North American Commission for Environmental Cooperation,

- Darren B Meyers, Technical Director, Energy Programs, International Code Council, USA

- James Clark, Buildings Division, Office of Energy Efficiency, Natural Resources Canada,

- Evangelina Hirata, Consultant on Energy Efficiency in Housing, Mexico,

- Joshua Kneifel, economist, National Institute of Standards and Technology, USA.

The internet seminar devoted to South America brought together:

- Nastia Almao A., Professor, University of Zulia, Venezuela,
- Gautam Dutt, MGM Innova, Argentina,
- Alfonso Blanco, Director, Energy Efficiency Project, Uruguay,
- Waldo Bustamante G., Professor, School of Architecture, Catholic University of Chile,
- Roberto Lamberts, Professor, Federal University of Santa Catarina, Brazil.

Le *seminar dedicated to India* brought together two experts:

- Priyanka Kochar, Programme Manager, Sustainable Habitats Division, The Energy and Resources Institute, New Delhi,

- Mahua Mukherjee, Assistant Professor, Department of Architecture & Planning, Indian Institute of Technology, Roorkee.

30 experts took part in the five seminars.

The experts are from a variety of backgrounds: 11 from research centres, 6 from universities, 6 from national public institutions, 4 from international organisations and 3 from the private sector.

They hail from 18 countries (13 from Europe, 6 from North America, 6 from South America, 4 from Asia and 1 from Africa).

The experts who took part in the kick-off seminar in Brussels are from a variety of backgrounds, those in the European internet seminar primarily from research centres, those in the North America internet seminar mainly from national or international public institutions, those in the South America internet

seminar predominantly from a university background, whereas those in the Indian seminar are members of a research centre and a public institution.

4. METHODS OF INTERNATIONAL EXCHANGE: THE TWO MODELS USED

4.1 The usual bottom-up method: a broad theme and seminars

The Task Group used this method, largely dominant in the CIB, for its research seminar on 11 May 2010 at the CIB World Congress in Salford.

For the preparation phase of the Congress, which brought together numerous CIB Commissions and Task Groups, the organisers had defined a general calendar to be respected by the authors for the submission of their abstracts and communications.

In the absence of a call for specific abstracts by the Task Group, 19 abstracts followed by contributions were submitted.

This is a bottom-up approach on a broad theme: the researchers and doctoral students choose the subject of their communication, with only one constraint; it must be related to the field of « Energy and the Built Environment ».

Indeed, the communications were particularly diverse. Two directions were defined for the meeting:

- Technically-oriented communications were presented in the first part of the meeting run by Peter Wouters,

- Communications with a socioeconomic and internet bias were presented in the second part of the meeting run by the Task Group coordinator.

From the 8 technically-oriented communications[24] :

- One was on the subject of building envelope and the relationship between tall office building envelope technologies and comfort and energy consumption in hot, arid climates. It was presented by two doctoral students from the Polytechnic of Milan University.

- Two dealt with Phase Change Material-treated natural stone, one by a research team from the Alicante Technological Institute of Construction (Spain) and the other by the same team in partnership with three researchers from the National Technical University of Athens.

[24] The list and internet links for the 19 communications are to be found in Appendix 6.

- Three communications dealt with solar energy: one concerned building-integrated photovoltaic for roofs and a case study in Turkey, by two researchers from the Technical University of Istanbul; one the effectiveness of several models of photovoltaic/thermal air collectors by a doctoral student from the University of Nottingham; and one the performance of solar hot water systems in retrofitted social housing, by a group of doctoral students from Northumbria University.

- Two communications dealt with embodied energy and life cycle assessment: one compared, from a maintenance point of view, the use of passive or mechanical solutions in zero carbon commercial buildings, by two doctoral students from Manchester University; the other dealt with the embodied energy measurement of building materials, by two doctoral students from Texas A&M University.

From the 11 socioeconomic and internet-biased communications:

- Two concerned the use of internet: one the use of a web platform for energy performance diagnosis, by three researchers from the Italian National Research Council, and one the automated generation of display energy certificates, by doctoral students from the Universities of Manchester and Hertfordshire.

- Three dealt with rehabilitation: one on the rehabilitation of the Coimbra Baixinha historical centre, Portugal, by researchers from Coimbra University; one on the low energy retrofit of houses by a doctoral student from Delft University of Technology; and one on the rehabilitation of public buildings in Hungary, by a doctoral student from Széchenyi István University.

- Two dealt with commercial buildings: one the cost-effectiveness of energy efficiency measures in new commercial buildings, by an economist from the National Institute of Standards and Technology (USA)[25] and one a survey of energy consumption in commercial buildings in New Zealand, by two researchers from Branz Ltd.

- Three dealt with energy efficiency and user behaviour: two dealt with the influence of occupant behaviour in houses in New Zealand, by researchers from Brantz Ltd, and one with pupil behaviour in schools in Scotland, by two researchers from Heriot Watt University.

[25] Joshua Kneifel, who participated in the webinar dedicated to North America.

- One communication dealt with the up scaling of innovations for energy efficient buildings, by two researchers from TNO.

The communications provided the opportunity for rapid discussion at the seminar and were then posted on the Task Group coordinator's blog[26], before being put on the CIB website along with the overall CIB Salford Congress proceedings[27].

This type of research seminar clearly addresses the needs of researchers and future researchers to communicate work to their peers.

The work is more attractive when available on line: details of the seminar, along with the communications, were consulted by over 1 800 people on the coordinator's blog in the first 30 months, not to mention the researchers who consulted the proceedings on the CIB website.

However, *this device is adapted primarily to researchers and future researchers and not to other groups interested in energy efficient buildings, such as the private sector, public institutions and international organisations etc.*

4.2 The new top-down method: a specific topic and webinars

Following the kick-off seminar in Brussels, which set the scene by presenting the European framework, the position of three international organisations and the policy pursued by four important countries, four internet seminars or webinars were organised.

The first three centred on the implementation of energy efficiency policies in several countries on the same continent: Europe, North America and South America.

The method of organisation is the same in all three cases. One person or a team of two is in charge of organising the conference.

The organiser(s) coopt 5 or 6 speakers who prepare a presentation and back-up materials.

A Webinar on Asia was projected for 2011 with the participation of China, India and Japan. While Europe and America are used to cooperation and exchange on a continental scale, this is not the case for Asia which is made up of very large, or important and independent, countries.

It was therefore decided to limit ambitions for Asia. A Webinar was organised in June 2012 focusing on India with the participation of two experts.

[26] http://jeancarassus.zumablog.com/index.php?sujet_id=14240
[27] http://www.irbnet.de/daten/iconda/CIB19150.pdf

For the seminar on Europe, the idea was not to commission a presentation of the policy for each country. One of the specificities of Europe is the continental nature of its policy, which is set out in the form of directives.

Each participant was requested to handle a « horizontal » theme related to policy implementation:

- The Netherlands : a comparison of the requirements defined by national regulations,
- France : the relationship between innovation and regulations,
- Belgium : the compliance and control of policies,
- Germany : the renovation of existing building stock,
- Poland: the specificity of policy implementation in Eastern Europe.

For the North America seminar, a North American vision was presented followed by different policy elements for the United States, Canada and Mexico.

For the South America seminar, different policy aspects were presented for five countries: Argentina, Brazil, Chile, Uruguay and Venezuela.

For the India seminar, one presentation focused on energy efficient policies in buildings and the other expanded the analysis to district and city level.

As already indicated, the overall organisation was the fruit of a close partnership between the Task Group Coordinator and Peter Wouters, Director with BBRI and President of the CIB Marketing and Communications Committee, without whom the undertaking would not have been possible.

A Greek technical team run by Alexander Deliyannis (Sympraxis Team) played an important role in preparing the seminars (prior testing is essential), recording and managing the conference with the inevitable minor technical problems (telephone links, internet), and putting the recordings (sound and pdf) on line on the Task Group's website.

This kind of technical assistance is essential to ensure that the webinars are successful.

The technical system used was Webex, a product developed by CISCO. It enables an internet and telephone connection between speakers and an internet audience of up to 200 participants.

Each speaker needs a computer with an internet connection, with or without a webcam, and a telephone (used for a local call). From their place of work, the speakers control the smooth running of their presentation and comment it orally.

The audience, at their workplace, need a computer with an internet connection. They watch the presentation and listen to the speaker. They do not take part orally but can ask written questions from their keyboard. The speaker answers the question orally.

A satisfaction survey was used for the European seminar to enable analysis of the audience.

34 listeners from a total of 93, i.e. 37%, completed the questionnaire. The results are to be found below:

Question	Very good	Good	Neutral	Poor	Very Poor	Score
What is your opinion of the seminar content?	9	16	8	1	0	4.0
What is your opinion of the quality of the device used (aside from audio quality)?	14	14	3	2	1	4.1
What is your opinion of the audio quality of the device used?	7	15	4	8	0	3.6

Listeners indicated a good level of satisfaction for the content and quality of the device. Almost a quarter of listeners experienced problems with the audio quality. This is generally due to a problem with their own internet connection.

When asked if they would like to be informed of the next CIB internet events, 33 gave a positive response and one a negative response.

Audience characteristics were quite different compared to the bottom-up meeting in Salford, which was attended primarily by researchers from Universities and research centres.

Out of the 93 participants (not including speakers) in the Europe webinar, 41% were from the private sector, 39% from University and research centres, and 20% from public institutions and international organisations.

83% were European (almost half from the two countries, France and Belgium, organising the event and the others from a wide variety of European countries, since 19 were represented); 17% were from other parts of the world (United States, Latin America and Asia).

Among the 89 participants in the North America webinar, proportions were very similar to the Europe seminar in terms of profiles: 39% were from the private sector, 37% from University and research centres and 24% from public institutions and international organisations.

60% were American, 11% Canadian, 15% European, 10% from Asia and 4% from South America.

Among the 71 people who participated in the India webinar, 55% were from India, 31% were Europeans, 7% were from North and South America and 7% from Asia[28].

The detailed information available for the Europe and North America webinars highlight the capacity of this method to embrace the private sector and significantly open up to public institutions and international organisations, which contrasts with the usual CIB participation profile.

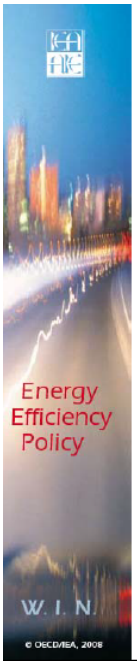
Being able to attend the conference in one's office, for an event lasting two hours at the most, clearly makes CIB conferences accessible to a new public and private audience.

[28] We are not in possession of this information for the South America webinar due to a technical problem.

5. THE VISIONS OF THREE INTERNATIONAL ORGANISATIONS

5.1 The International Energy Agency

Buildings are at the heart of IEA concerns[29]. Jens Laustsen, Energy Policy Analyst for Buildings with the IEA[30], went over the key messages:



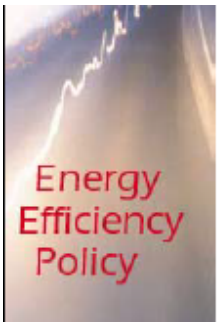
Key messages

- IEA 25 recommendations provide direction – high emphasis on buildings
- **W.I.N = W**orld-wide **I**mplementation **N**ow
- Energy efficiency is a critical part of a sustainable energy future
- Buildings energy use can be reduced dramatically alone with existing solutions
- A reduction to ¼ of BAU in 2050 is rational and economic reasonable (Factor 4)
- SBN - Sustainable Buildings Network

© OECD/IEA, 2009

Connected to the OECD and therefore mainly to developed countries, the IEA is developing an ever more global vision.

Five of the 25 IEA energy efficiency recommendations approved by the G8 in June 2007 are related to buildings:



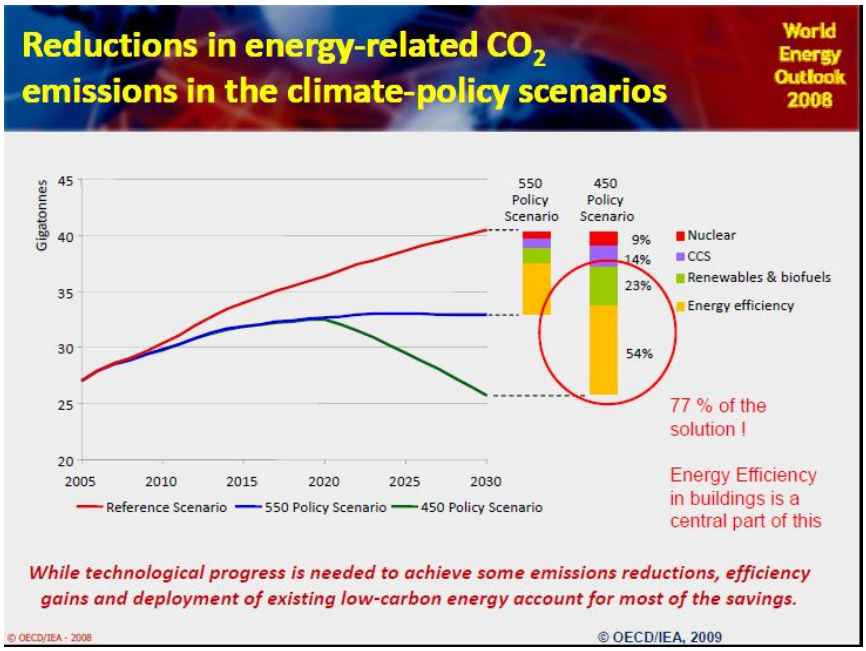
2. Buildings

2.1 Building codes for new buildings;
2.2 Passive Energy Houses and Zero Energy Buildings;
2.3 Policy packages to promote energy efficiency in existing buildings;
2.4 Building certification schemes;
2.5 Energy efficiency improvements in glazed areas.

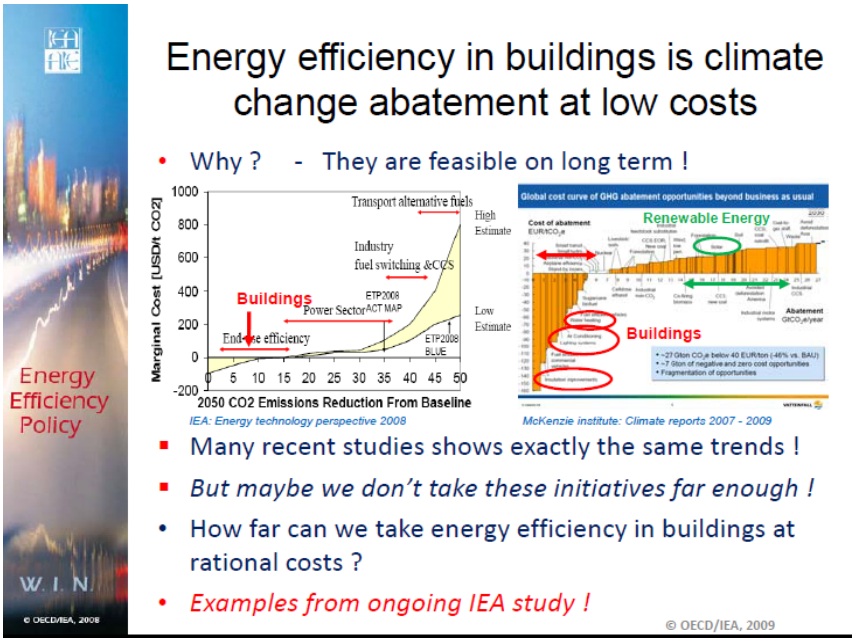
[29] www.iea.org. Jens Laustsen published in 2008 an IEA Information paper dedicated to *Energy efficiency requirements in buildings codes, energy efficiency policies for new buildings*, access to the paper: http://www.iea.org/publications/freepublications/publication/name,3780,en.html

[30] Cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=08_Laustsen_222_Building_research_on_5_continents_IEA.pdf&lang=en

Energy efficiency is the policy cornerstone:



According to the IEA, improving energy efficiency in buildings is one of the most cost-effective solutions:



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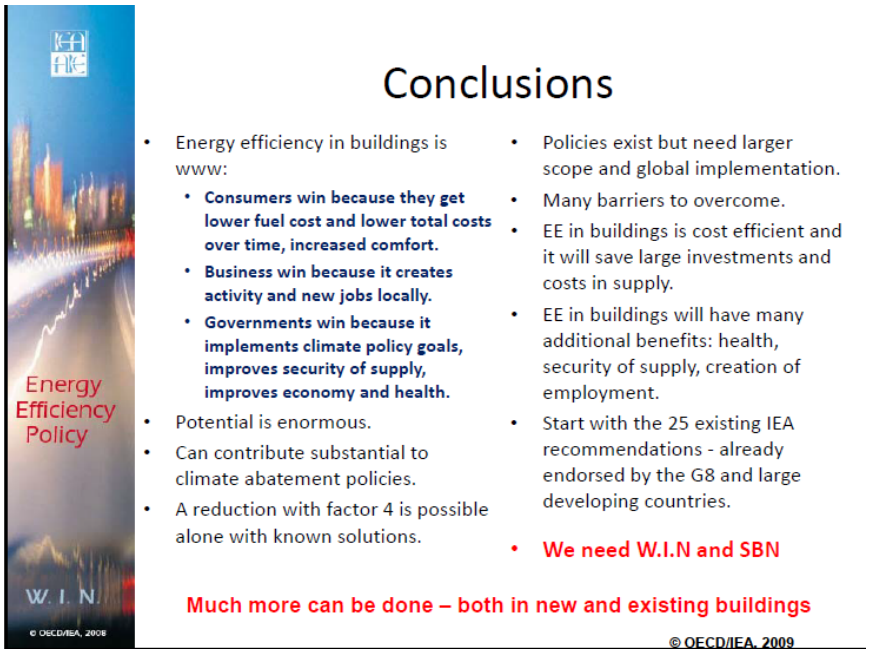
The IEA presentation highlighted best practices (Germany and Denmark, etc.) and concluded on a proactive note:



Since then, the IEA has created the Sustainable Buildings Centre, « the online voice for low energy buildings »[31].

This Centre posts publications, events, a glossary, a blog on low energy buildings and above all *an international database on policies related to the energy efficiency of buildings* (Building Energy Efficiency Policies - BEEP Data Base[32] -).

Policy content is listed in three areas:

- regulations (Building Codes),
- energy performance and environment labels (Labelling Schemes),
- incentives (Incentive Schemes): loans, grants, taxes, tax reductions and energy economy certificates, etc.

In January 2013, data had been collected for 34 countries including 6 emerging countries: China, India, Turkey, Brazil, South Africa and Tunisia.

[31] http://www.sustainablebuildingscentre.org/pages/home
[32] http://www.sustainablebuildingscentre.org/pages/beep

The following links provide access to information related to the energy efficient buildings policy adopted by each country:

 Australia

 Austria

 Belgium

 Brazil

 Canada

 China

 Czech Republic

 Denmark

 Finland

 France

 Germany

 Greece

 Hungary

 India

 Ireland

 Italy

 Japan

 Korea

 Luxembourg

 Netherlands

 New Zealand

 Norway

 Poland

 Portugal

 Russia

 Slovak Republic

 South Africa

 Spain

 Sweden

 Switzerland

 Tunisia

 Turkey

 United Kingdom

 United States

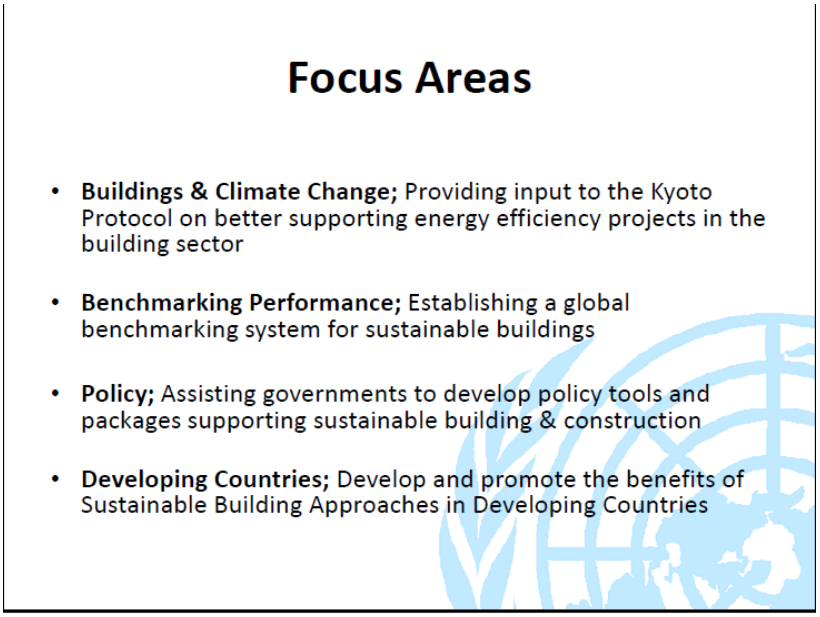
In 2013, IEA published, with UNDP, an interesting report dedicated to the modernisation of the building energy codes[33].

[33] IAE-UNDP « Modernising Building Energy Codes », 2013, access to the report : http://www.iea.org/publications/freepublications/publication/PP7_Building_Codes_2013_WEB.pdf

5.2 The United Nations Environment Program – Sustainable Buildings and Climate Initiative (UNEP-SBCI)

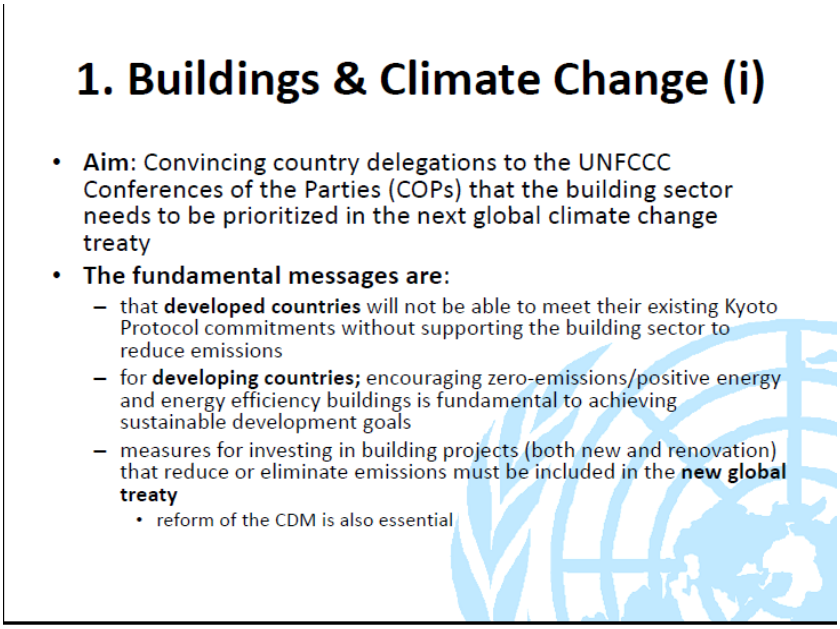
The United Nations Environment Program (UNEP) Sustainable Buildings and Climate Initiative (SBCI)[34], presented by Rodney Milford (South Africa)[35], has the following mandate[36] :

The initiative focuses on four main areas:

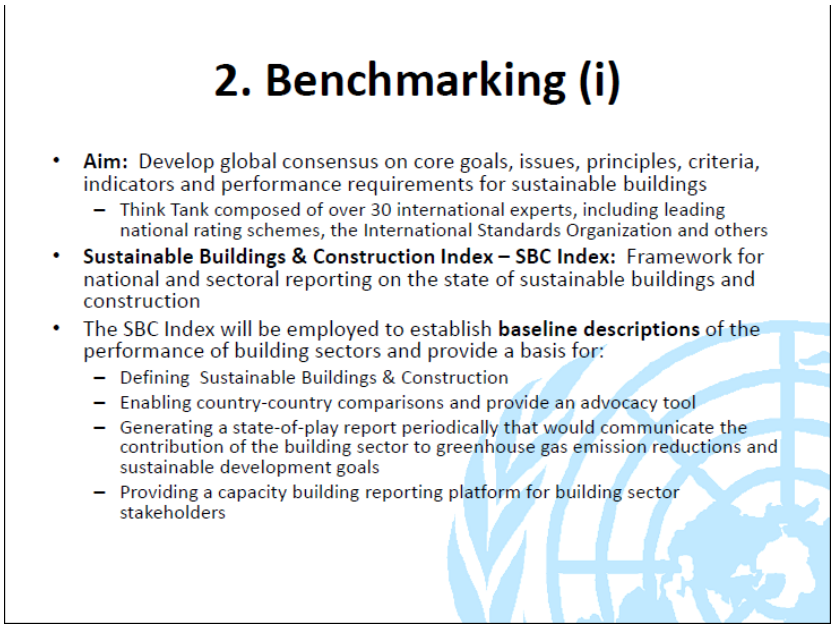


[34] http://www.unep.org/sbci/
[35] Cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=09_Milford_SB_SBCI_UNEP_2009_10_16.pdf&lang=en
[36] Summary of UNEP-SBCI missions : http://www.unep.org/SBCI/pdfs/SBCI_2pager_280112_english_web.pdf

In the first focus area, it plays an influential role in international negotiations on climate change:



In the second area, it aims at fostering a global consensus on the indicators used for building environmental certification:



The UNEP-SBCI published the « Common Carbon Metric »[37] report on this subject in 2010.

[37] Available on http://www.unep.org/sbci/pdfs/Common-Carbon-Metric-for_Pilot_Testing_220410.pdf

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In the third and fourth areas, it organises Think Tanks which publish reports on energy efficiency policies[38] and supports initiatives in developing countries which, as we shall see later, are much less well equipped than developed countries in the field of energy efficiency in buildings.

In this respect, the UNEP-SBCI has launched the interesting SPoD project (Sustainable Building Policies in Developing Countries)[39]. It intends to provide a methodological framework to countries and local authorities in developing countries who wish to define and set up an energy efficient buildings policy.

It has elaborated a 4-step Quick Scan tool for such a policy: goals, barriers, content and system of authorities[40].

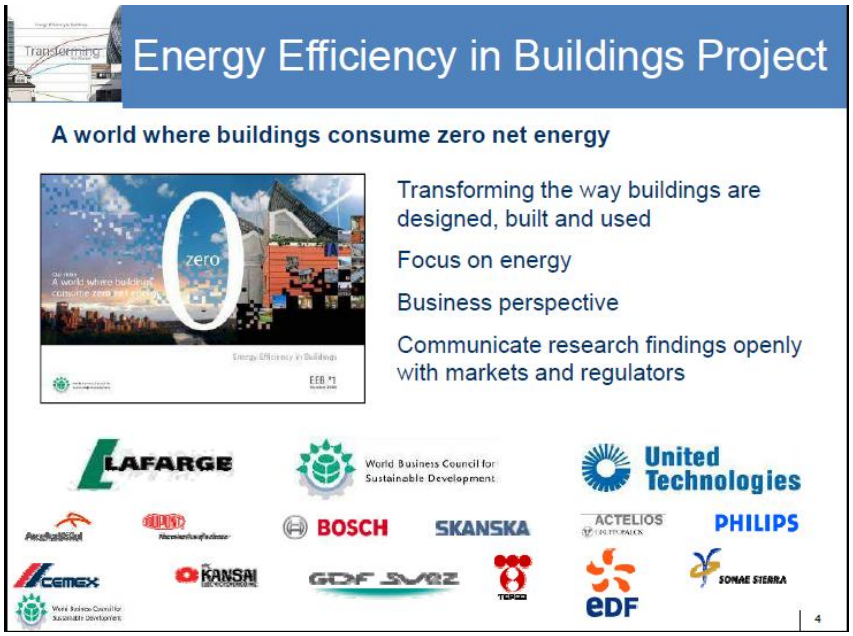
It should be noted that the UNEP has also set up an initiative in the field of sustainable finance (UNEP Finance Initiative). Within the framework of this initiative, the Property Working Group has published several reports on responsible property investment[41]. The French entities playing an active role in this group are Caisse des Dépôts and AXA.

5.3 The World Business Council for Sustainable Development

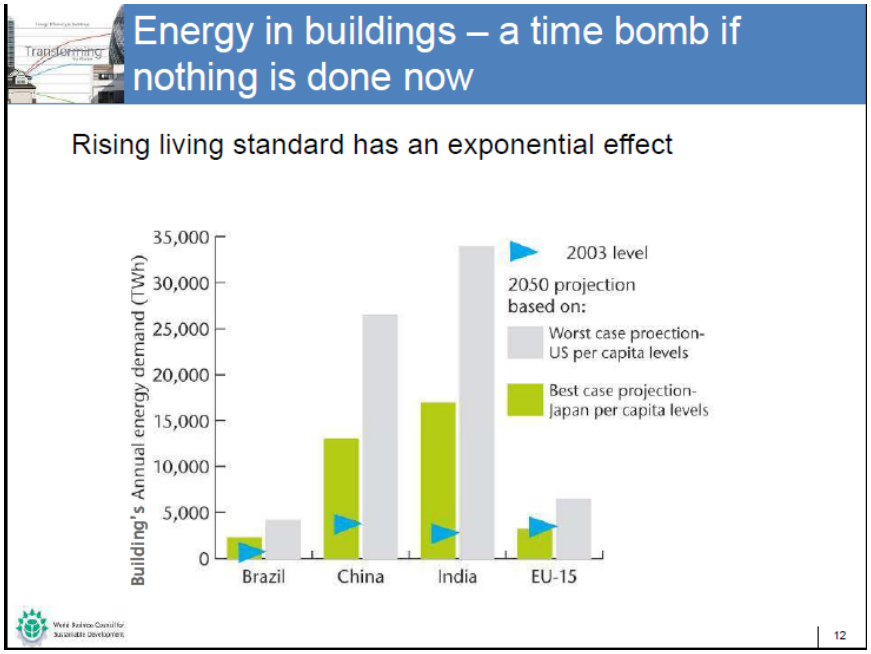
The World Business Council for Sustainable Development Energy Efficiency in Buildings project[42] was initiated by a group of large multinational corporations led by Lafarge and United Technologies.

[38] Such as the one presented in Chapter 2 on the assessment of policy instruments for reducing greenhouse gas emissions from buildings
[39] Project summary : http://www.unep.org/sbci/pdfs/SPoD_2pager_english_220812.pdf
[40] « Policy Quick Scan Tool » : http://www.unep.org/SBCI/QuickScanTool/index.html
[41] http://www.unepfi.org/work_streams/property/index.html
[42] http://www.wbcsd.org/buildings.aspx

The project was presented by Dorien Van der Weele (Philips)[43] :



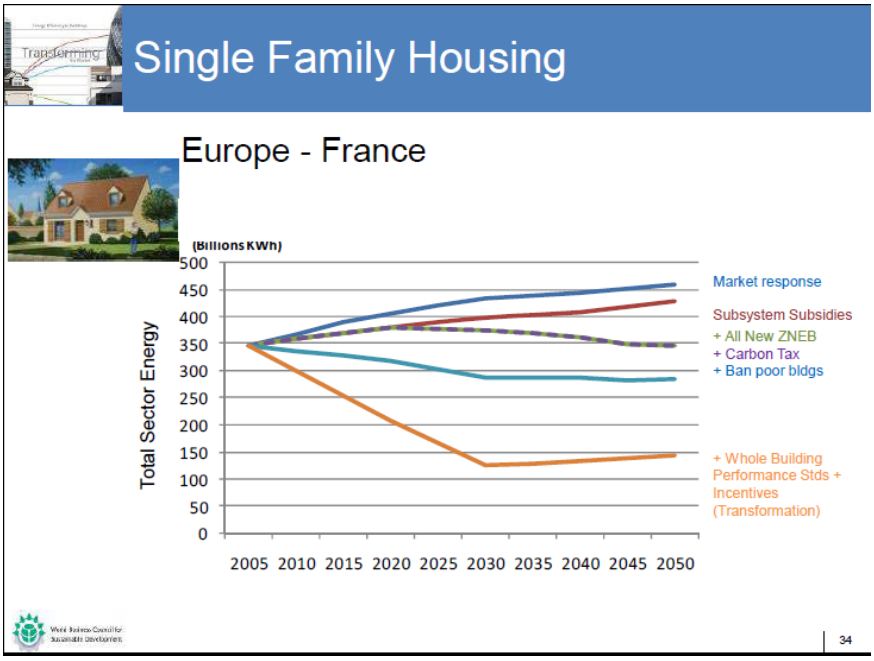
It was recalled that if emerging countries adopt the American building model, the planet is heading for disaster:

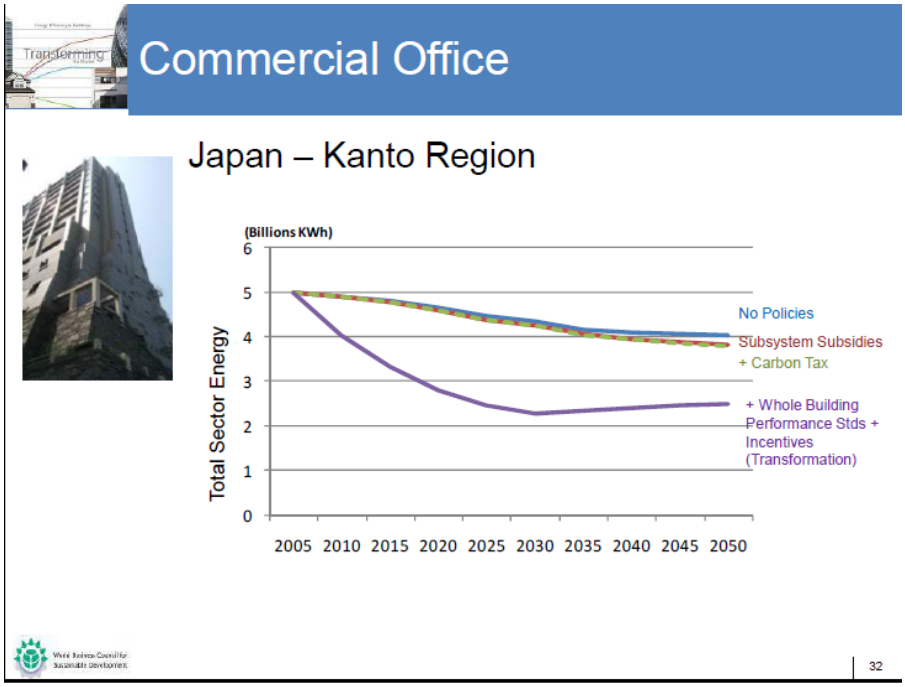


[43] Cf Appendix 1, access to the presentation :
http://www.cstc.be/homepage/download.cfm?dtype=services&doc=10_van_der_Weele_091014_EE_Buildings_CIB_Brussels_Oct_14_2009_FINAL.pdf&lang=en

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

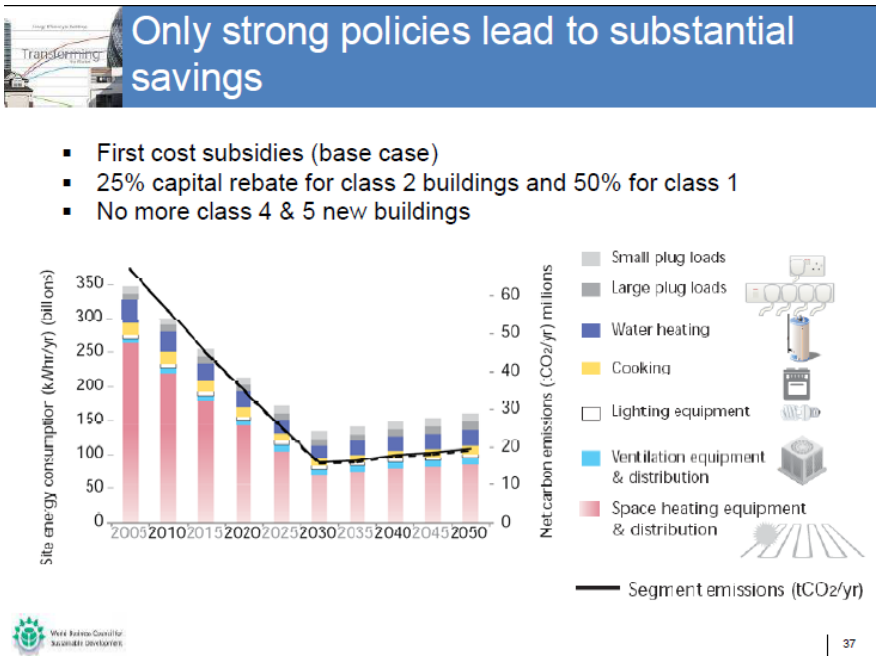
In order to take the logic of regional actor systems into account, the project has developed energy consumption models by sub-sector and region, to the 2050 horizon, with different policy scenarios:





CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The conclusion is that a simple change of market orientation would be ineffective and that there is a need for transformative change through a proactive policy:



For the housing sector, this translates into 1000 renovations of existing stock per day over a period of 40 years! This analysis is in line with the French Grenelle Environnement which has defined a goal of 400 000 housing renovations per year in France. The present government hopes to raise this figure to 500 000 renovations per year by 2017.

In conclusion, the project defined a six-fold action plan:

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Since then, the project has come up with a manifesto for energy efficiency in buildings signed by 118 companies in October 2012. These companies undertake to:

1. Create a baseline for company's commercial buildings and set time-based energy and/or CO2 reduction targets in line with transformative change.

2. Publish a company policy for minimum energy performance levels in the company's commercial buildings.

3. Define and carry out the company's audit program and implementation strategy to meet energy targets for its commercial buildings.

4. Publish buildings' energy use, CO2 emissions and progress against reduction targets annually in the company's corporate social responsibility or other report.

5. To further promote building energy efficiency among suppliers, employees and other stakeholders through advocacy, marketing activity, R&D, education and training.

As of October 2012, 15 French companies had signed the manifesto : Air France, AXA, BeCitizen, BNP Paribas, Caisse des Dépôts, Dassault Systèmes, EDF, Eiffage, GDF Suez, Lafarge, La Poste, RATP, Saint Gobain, Schneider Electric and Société Générale.

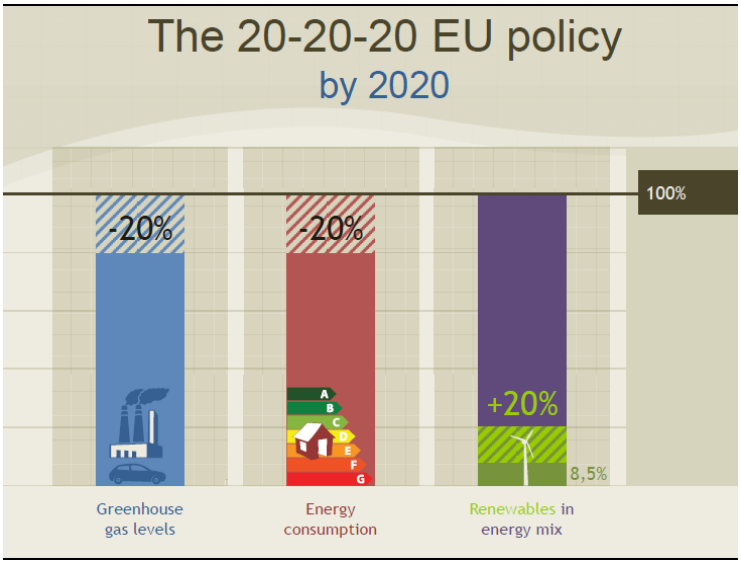
A new project « Energy Efficiency in Buildings 2.0 » steered by 9 multinationals, of which 5 are French (EDF, GDF Suez, Lafarge, Schneider Electric and Saint Gobain), aims to conduct lobbying activities with large public and private building portfolio owners worldwide.

6. THE EUROPEAN APPROACH

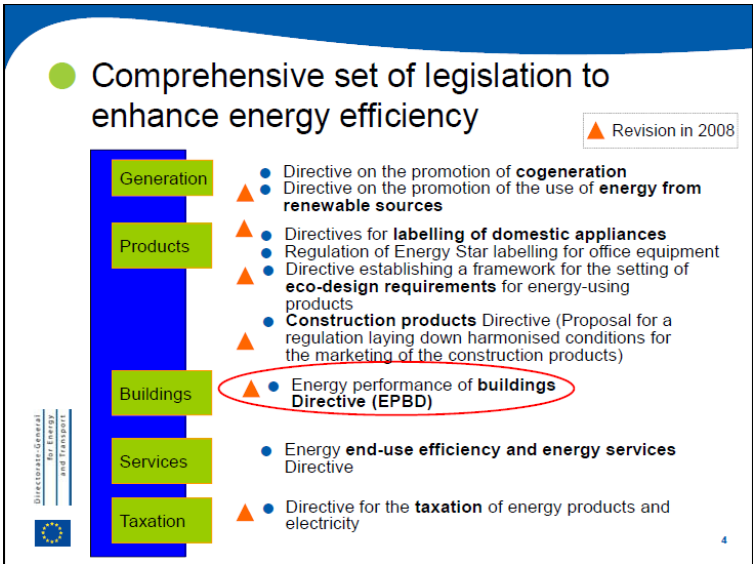
6.1 The community project

Although often the subject of intense internal debate, the European policy is, from a continental stand, the most structured and well organised.

Michaela Holl[44] went over the 3X20 by 2020 policy, adopted in 2007, with the following averages for all member country activities:



The European Union operates with directives adopted by the Commission, Parliament and the Council of Heads of State and Government:



[44] Cf Appendix 1, access to the presentation :
http://www.cstc.be/homepage/download.cfm?dtype=services&doc=04_Holl_BBRI_seminar_on_EE_buildings_in_5_continents_pw.pdf&lang=en

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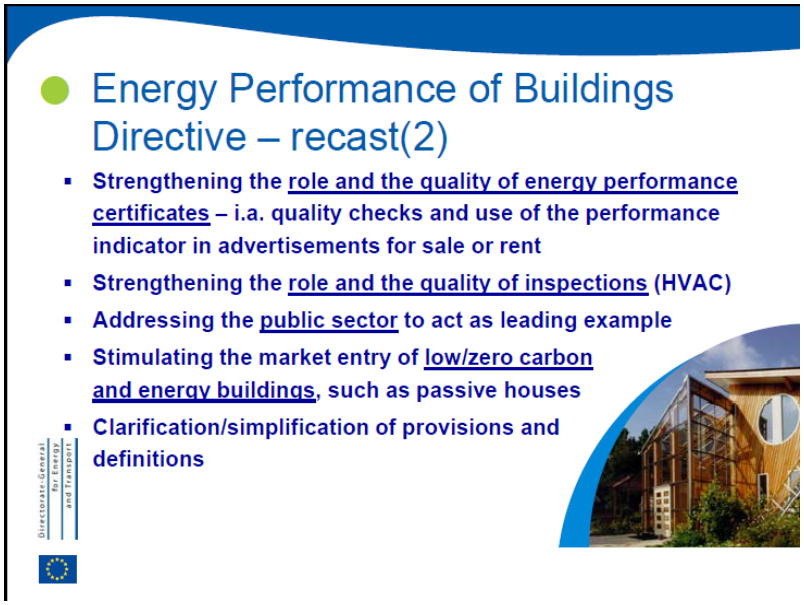
The latest directive on the energy performance of buildings (EPBD) is directive n°2010/31/UE dated 19 May 2010 which replaces the previous 2002 directive:



The directive states that in 2020 all new buildings will be nearly zero energy in the European Union member states[45].

[45] This objective is being prepared by several European labels, especially the German Passivhaus® one, the Swiss Minergie® one and the French Effinergie® one, see: http://www.buildup.eu/sites/default/files/content/Overview%20article%20Market%20trends%20towards%20NZEBs%2018012013_0.pdf

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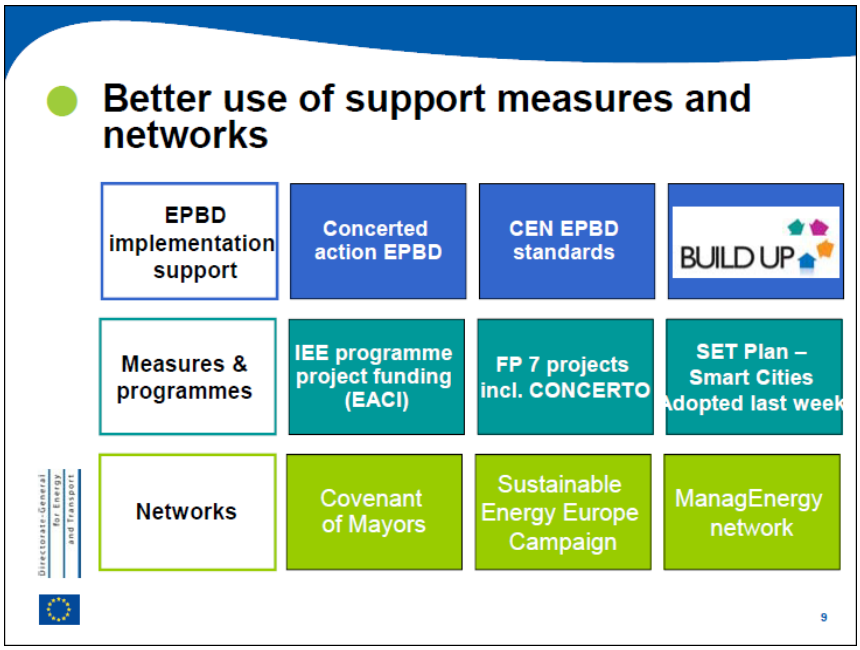
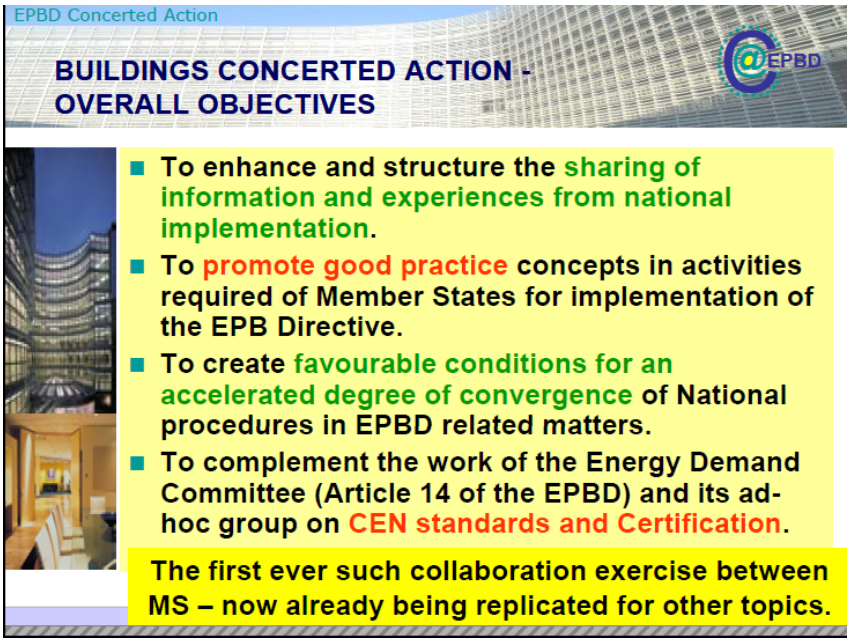
The European Union has set up a well-structured action plan taking into account the directive, programmes of action and the activity of several networks:



Eduardo Maldonado[46] is coordinator of the Concerted Action Energy Performance of Buildings Directive, which has the following goals:



[46] Cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=06_Maldonado_BBRI_Brussels_MALDONADO_CA_14Oct2009.pdf&lang=en

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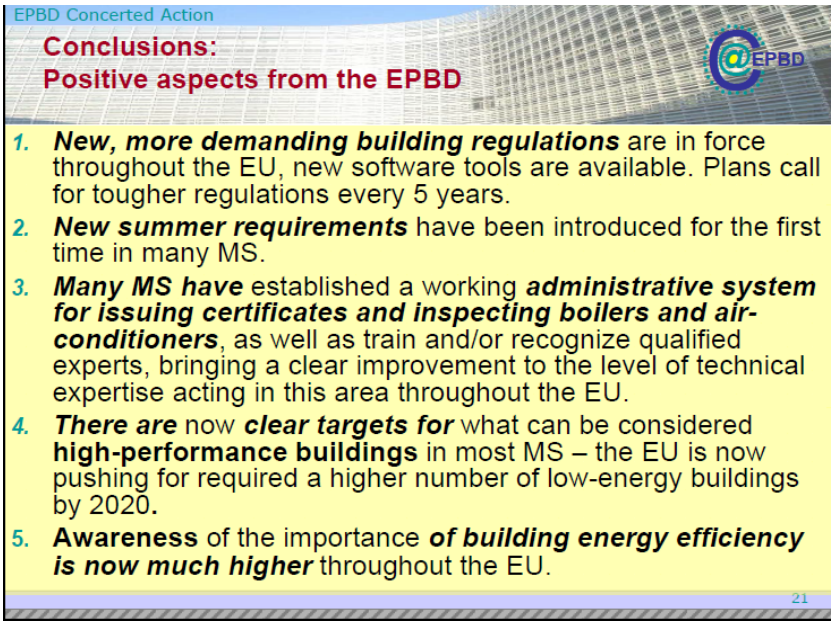
The results are tangible:



Further progress still needs to be made:

Concerted Action publishes an updated progress report every two years of the implementation of the directive in each member state. The latest report came out in 2011 with the 2010 update[47].

[47] access to the report :
http://jeancarassus.zumablog.com/images/2128_uploads/CA_Book_Implementing_the_EPBD_Featuring_Country_Reports_____.pdf

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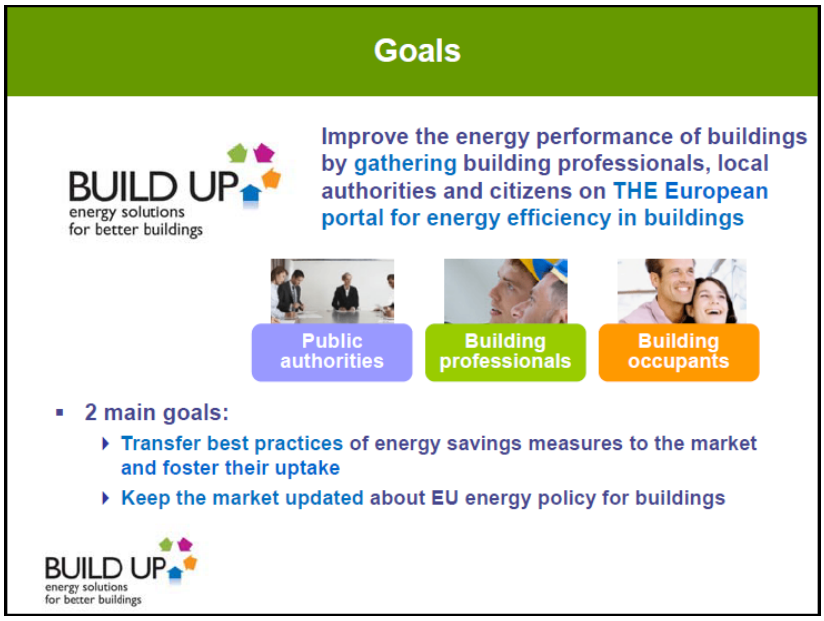
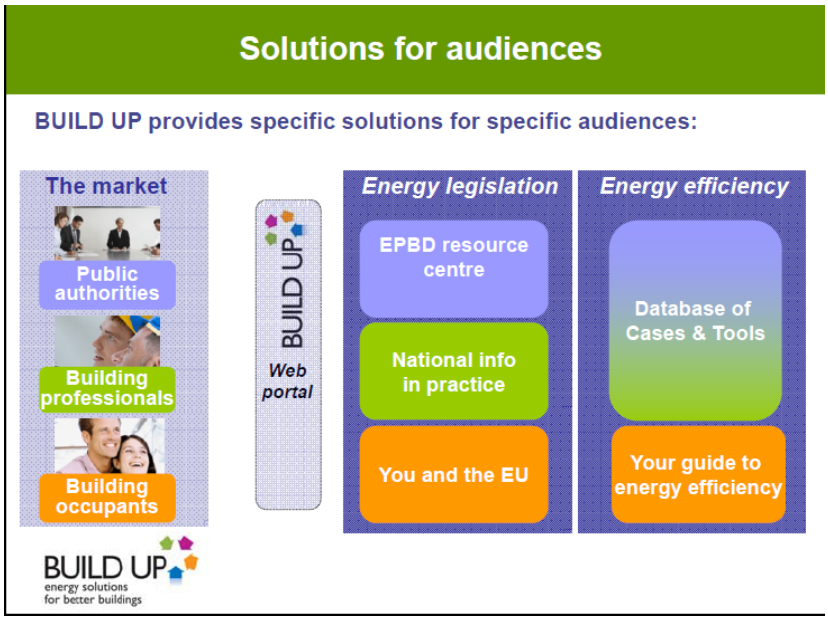
Peter Wouters[48] highlighted the goals and target audiences of the European Build Up portal:



Specific information is provided for each target audience:



[48] cf Appendix 1, access to the presentation :
http://www.cstc.be/homepage/download.cfm?dtype=services&doc=05_BUILDUP_Wouters_v03.pdf&lang=en

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A variety of tools are provided:

Three other European data bases are useful for our topic.

The Data hub for the energy performance of buildings was implemented by the Buildings Performance Institute Europe, a member of the Global Buildings Performance Network, funded by a North American foundation. It gathers information about 30 European countries[49].

The BigEE platform was created by research institutes and public agencies, coordinated by the Wuppertal Institute (Germany). It is dedicated to energy efficiency in buildings[50].

The MURE II Data is a data base on Energy efficiency policies and measures. It gives data on the impact of policies in the European Union members, Norway and Croatia[51].

[49] http://www.buildingsdata.eu/
[50] http://www.bigee.net/en/
[51] http://www.muredatabase.org/

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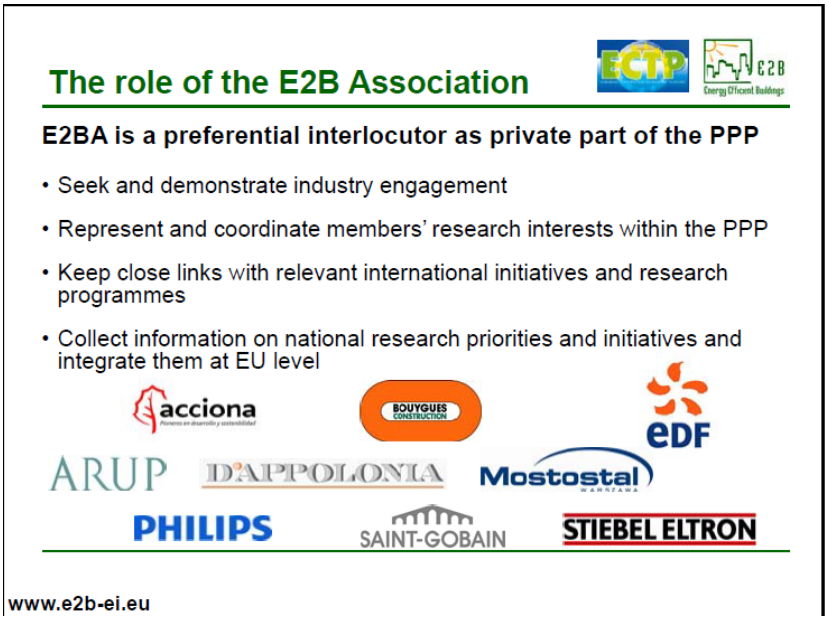
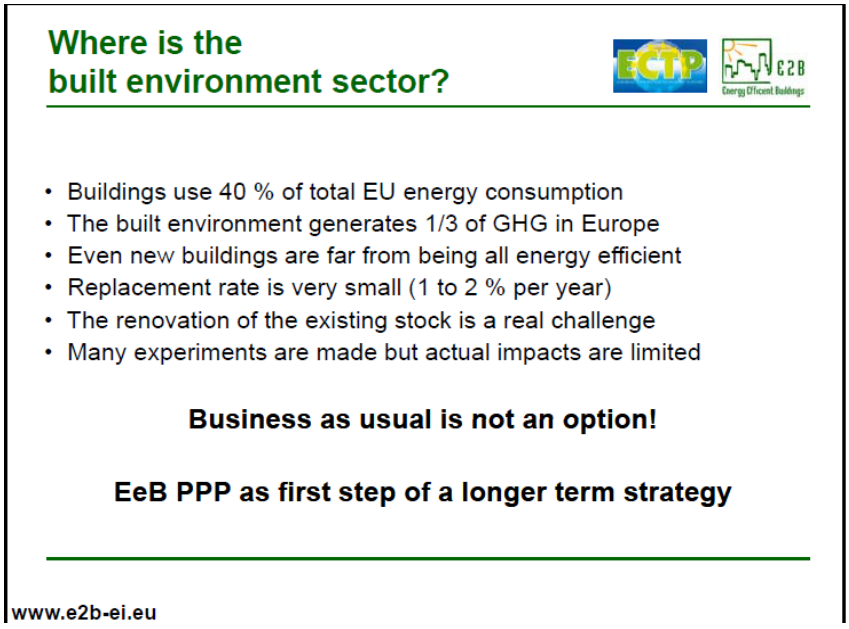
Luc Bourdeau[52], in partnership with Stefano Carosio, presented the industrial E2B Energy Efficient Buildings Association, founded by 9 large private companies in the framework of the European Construction Technology Platform (ECTP) :



The association, which comprised 160 members in March 2012, has a public private partnership with the European Commission to conduct an R&D programme in a promising but complex sector:



[52] cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=07_Bourdeau_E2BA_at_CIB_TG66.pdf&lang=en

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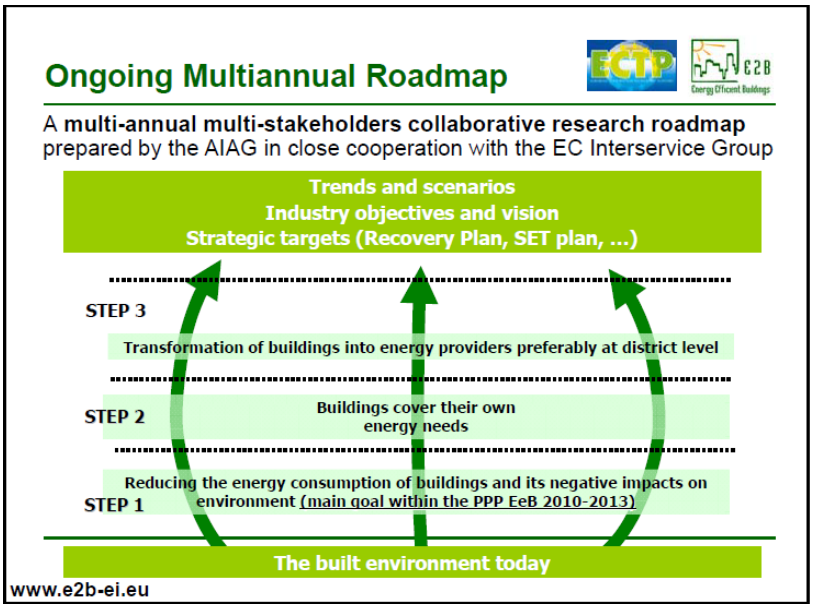
which translates into a collective research roadmap:



The « Energy Efficient Buildings Public-Private Partnership » R&D roadmap was published in 2010[53].

The 2012 Project Review described the 43 R&D projects financed in 2010 and 2011[54].

6.2 Five themes – five country approaches

As already indicated, the webinar on Europe did not report on progress country by country but six experts were requested to handle five horizontal themes.

Marleen Spielman (TNO, the Netherlands) dealt with the difficulty of comparing energy performance requirements across Europe, from the European ASIEPI project standpoint[55].

[53] Access to the roadmap:
http://www.ectp.org/cws/params/ectp/download_files/36D1191v1_EeB_Roadmap.pdf
[54] Access to Project Review 2012 : http://www.e2b-ei.eu/documents/36D2270v1_EeB_Project_Review_2.pdf
[55] Cf Appendix 2, access to the presentation :
http://jeancarassus.zumablog.com/images/2128_uploads/Spiekman_Koch_CIB_Task_group_.pdf

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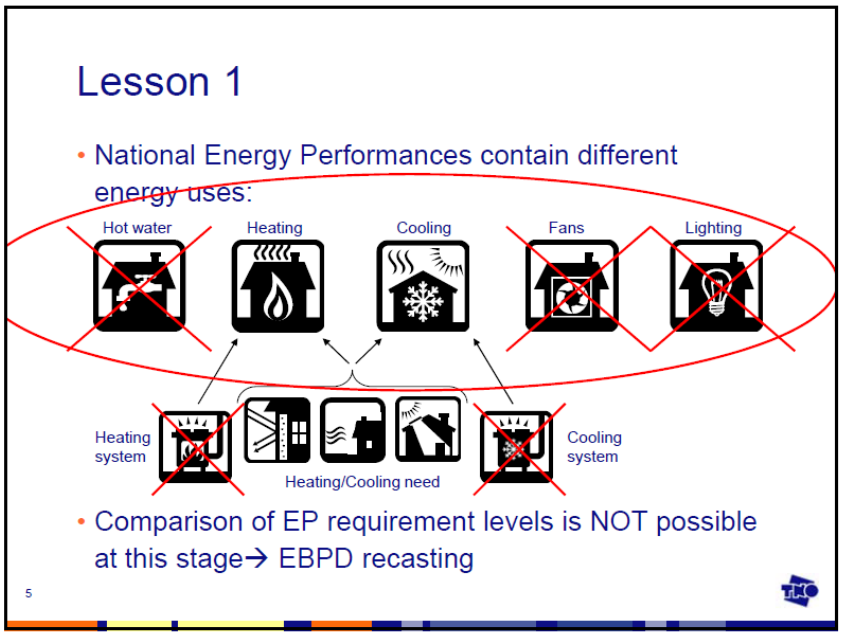
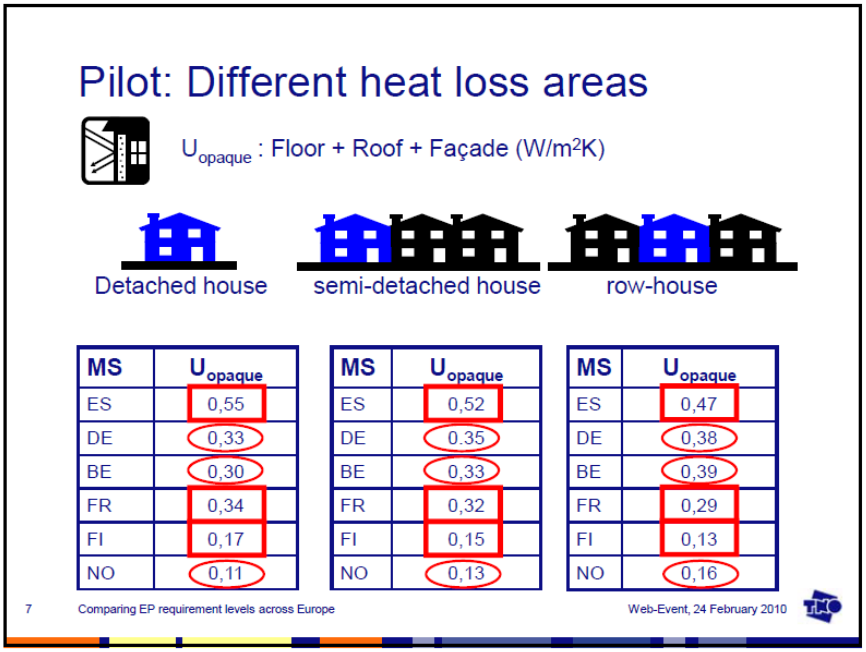
Energy use taken into account varies from country to country:



Envelope heat loss requirements can vary by a factor of five:



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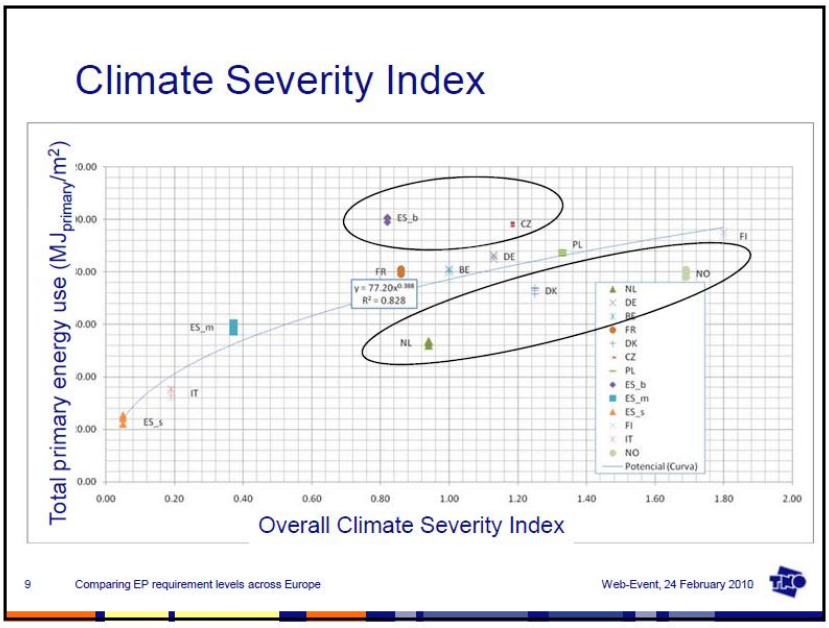
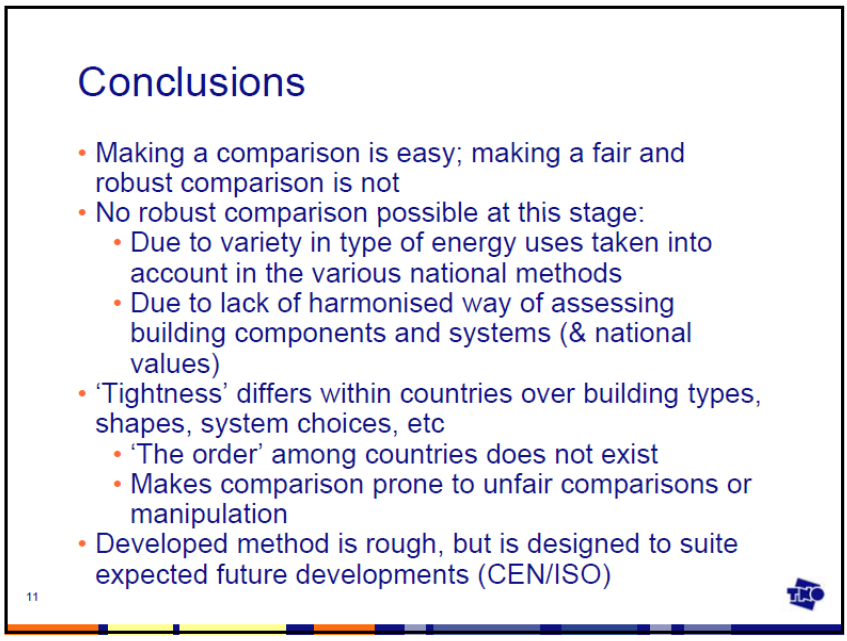
The climate severity index varies considerably from one country to another:



It is very difficult to make accurate and robust comparisons:



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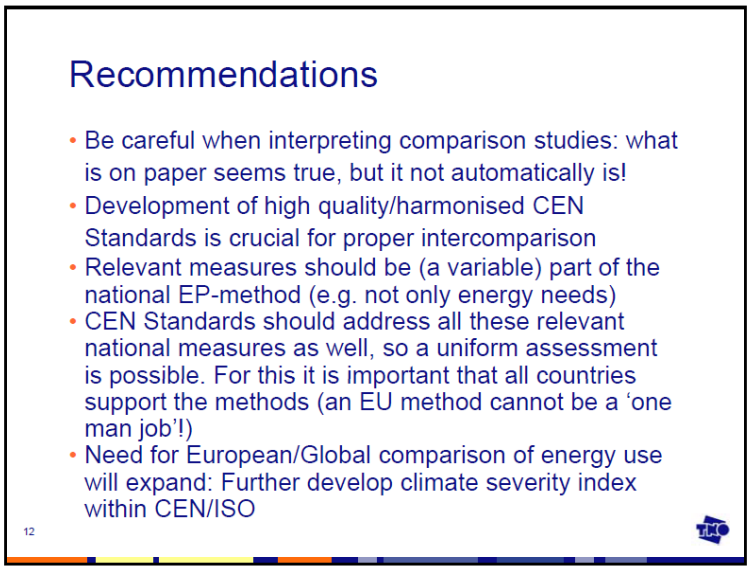
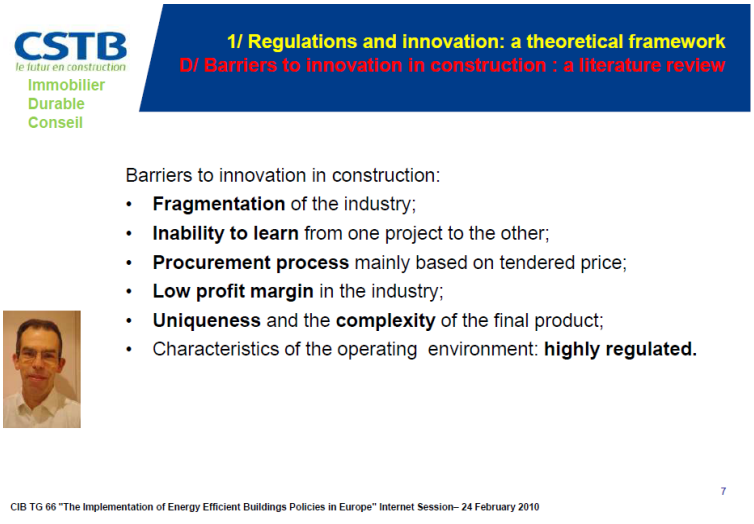
The harmonisation of standards at European (CEN) and international (ISO) levels is crucial:



One example of European comparison of energy performance requirements is the one for eleven countries from Central Europe dedicated to new buildings, made by German Institut Wohnen und Umwelt (IWU)[56].

Frédéric Bougrain (CSTB) and Jean Carassus (Ecole des Ponts ParisTech) (France) analysed the relationship between regulations and innovation based on the experience of France[57].

Barriers to innovation in the construction sector are already well documented

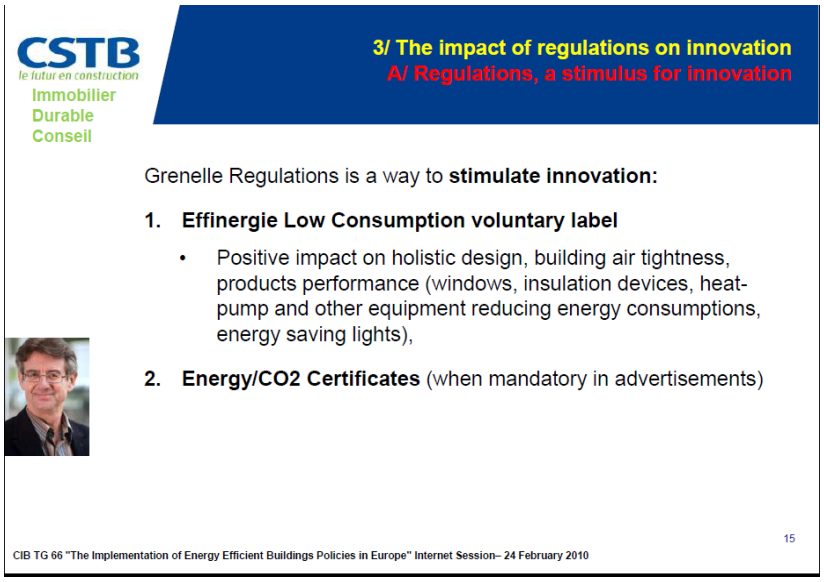


[56] http://www.iwu.de/fileadmin/user_upload/dateien/energie/werkzeuge/iwu_report_-_comp_req_new_buildings.pdf

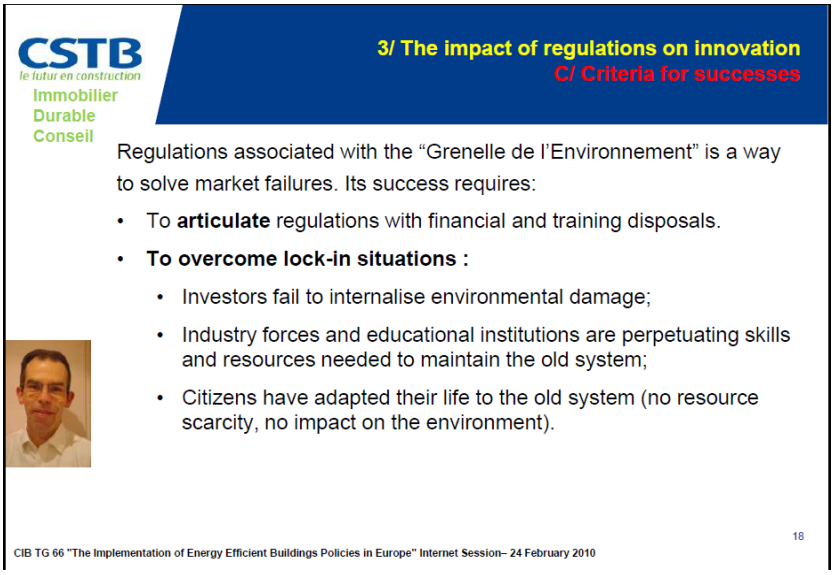
[57] Cf Appendix 2, access to the presentation : http://jeancarassus.zumablog.com/images/2128_uploads/Bougrain_Carassus_CIB_Task_group_____.pdf

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The level of requirements stipulated by the 2009 French Grenelle Environment law is a stimulus for innovation:



Although regulations may be a necessary condition of innovation, they do not alone suffice:



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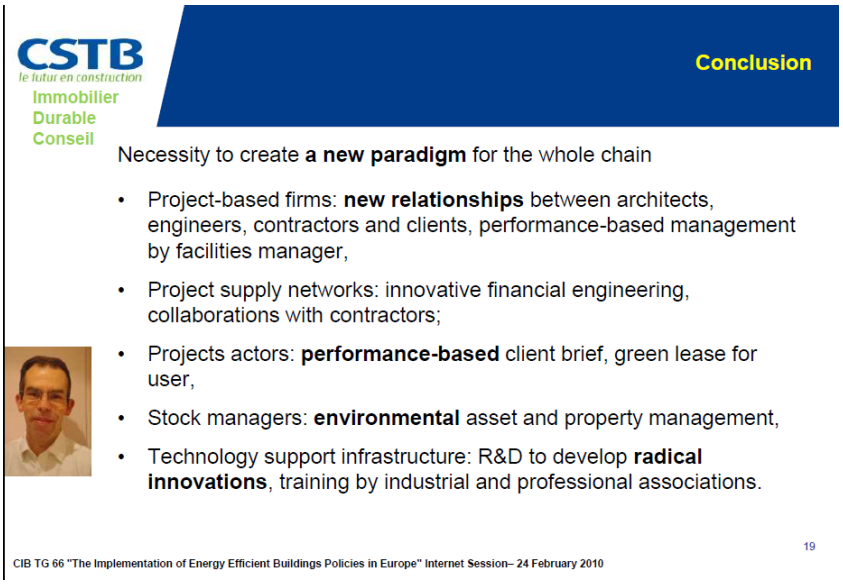
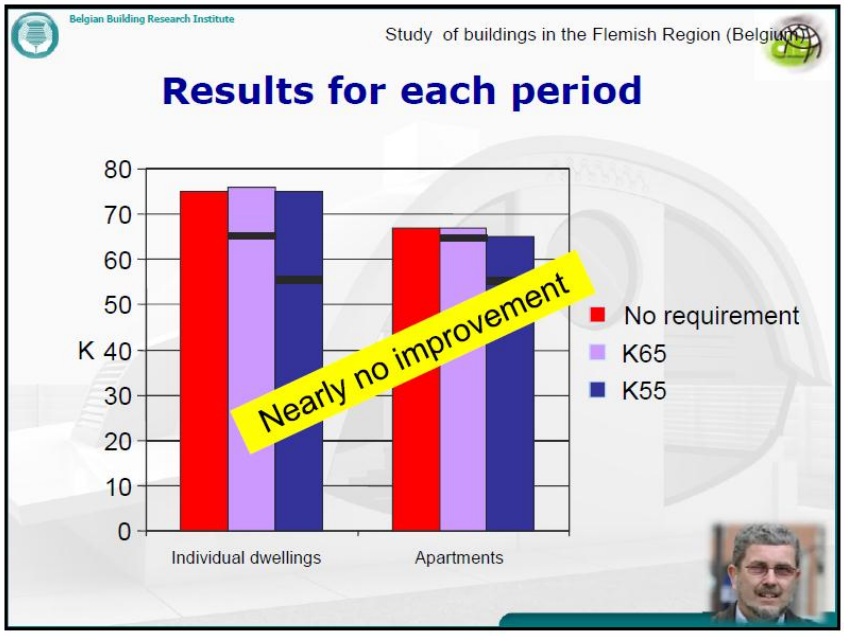
Multi-dimensional innovation gradually translates into a new paradigm for the whole construction chain:



Peter Wouters (BBRI, Belgium) tackled the crucial question of the control of regulations, based on the Belgian approach[58].

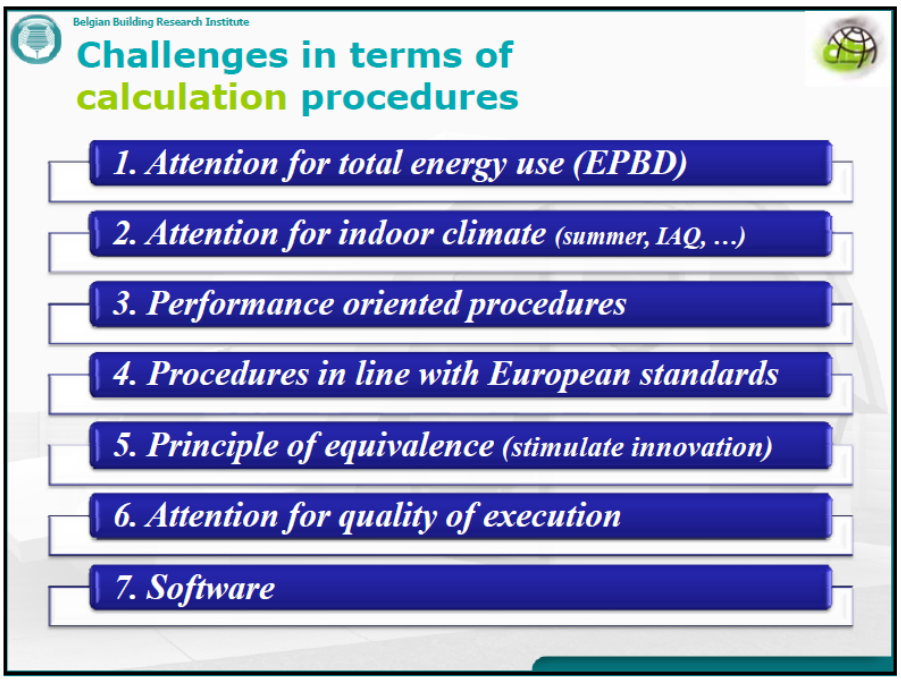
Indeed, in some cases, changing the regulations does not translate into actual improvements in the field:



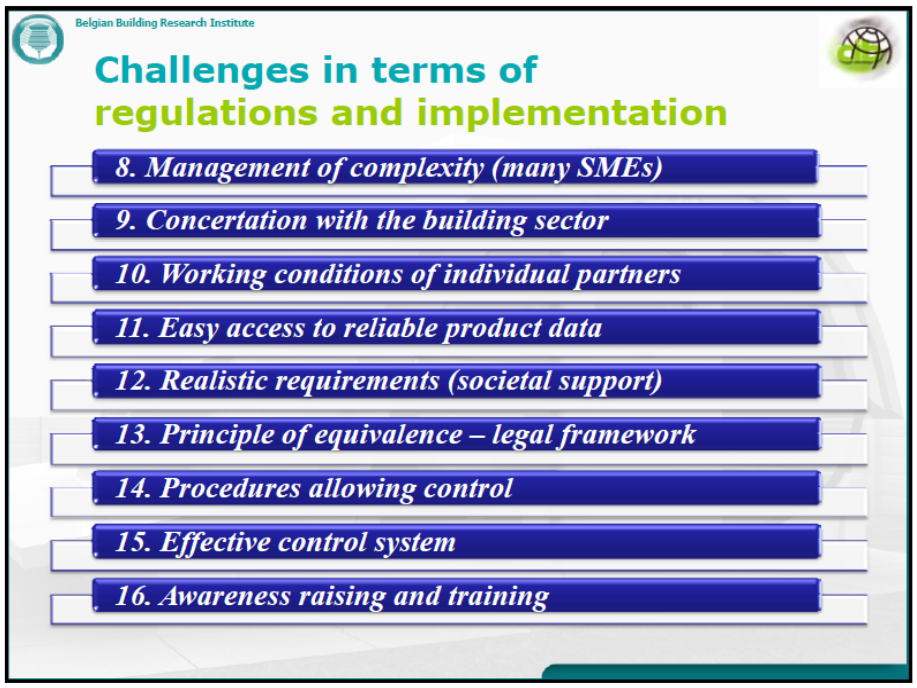
[58] Cf Appendix 2, access to the presentation :
http://jeancarassus.zumablog.com/imageks/2128_uploads/Wouters_CIB_Task_group_____.pdf

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Specific principles must be respected for the methods of calculation:

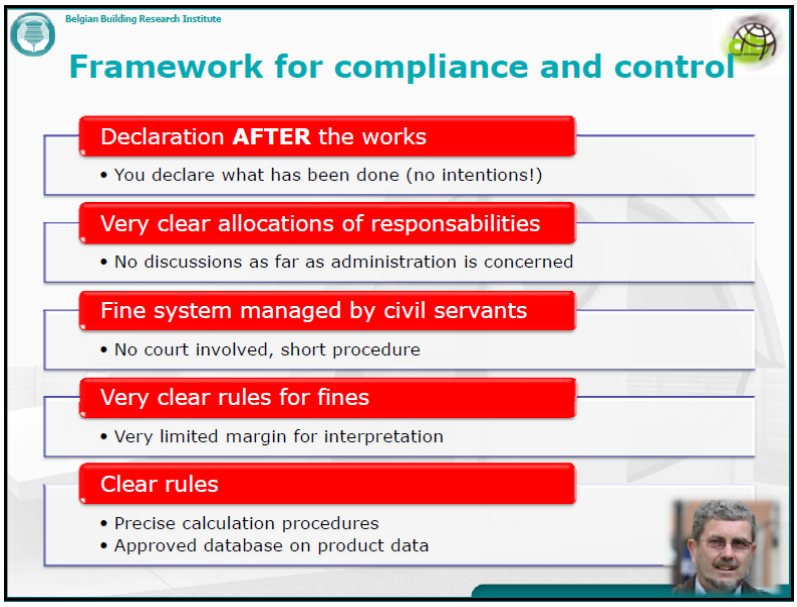


This is also true for the elaboration and implementation of regulations:



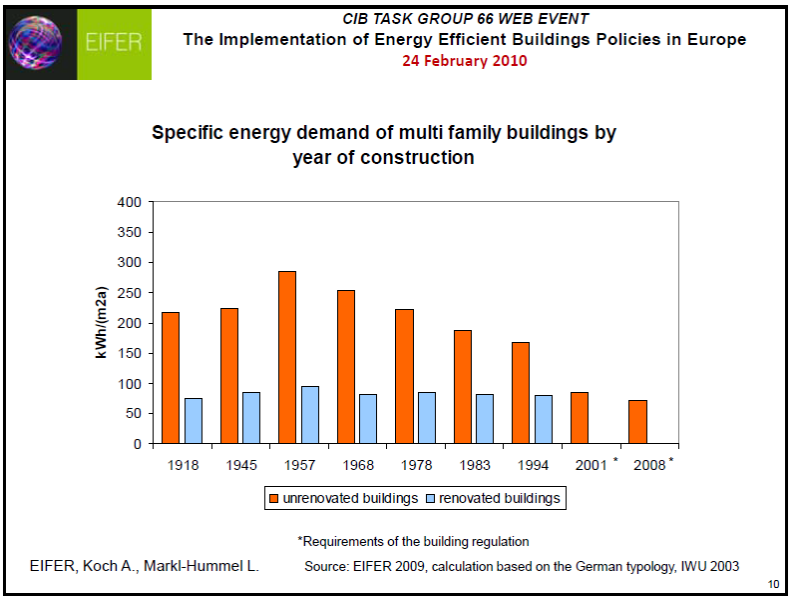
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Five rules were highlighted:



Andreas Koch and Lioba Markl-Hummel (Eifer, Germany) handled the crucial issue of regulations on existing stock, based on the German policy which is one of the most dynamic in Europe in this respect[59].

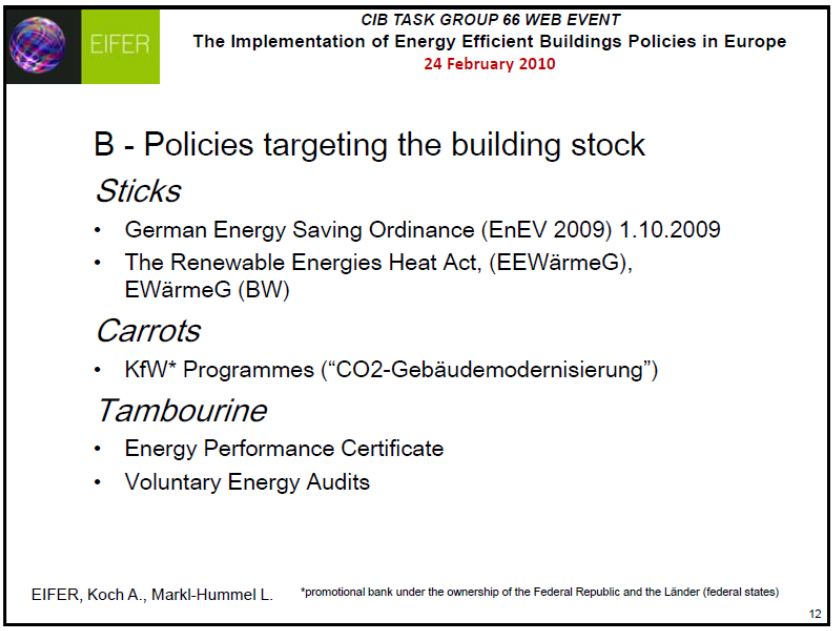
Renovation can in fact have a significant impact on the consumption of existing buildings:



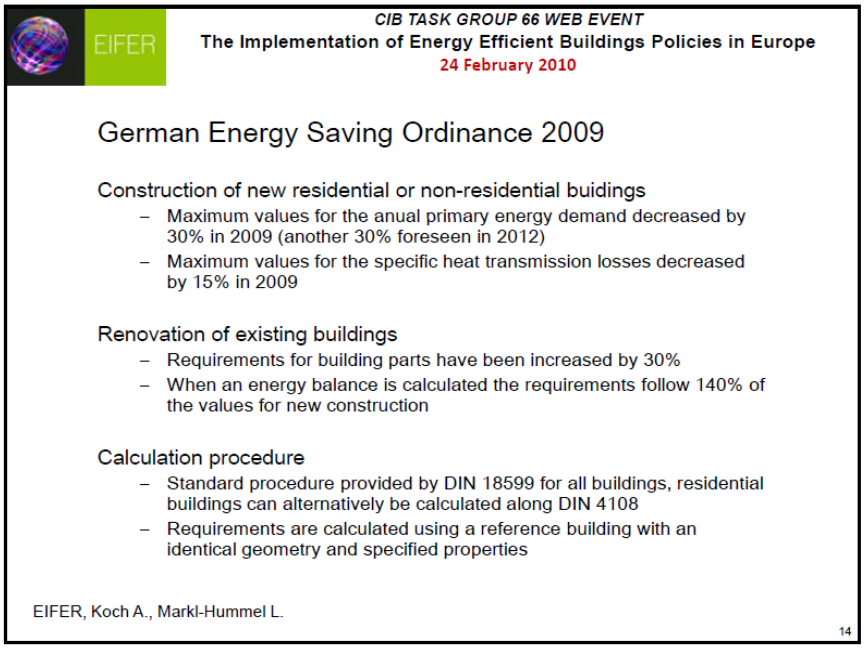
[59] Cf Appendix 2, access to the presentation :
http://jeancarassus.zumablog.com/images/2128_uploads/Koch_CIB_Task_group_____.pdf

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The building stock policy encompasses regulations, incentives and information:

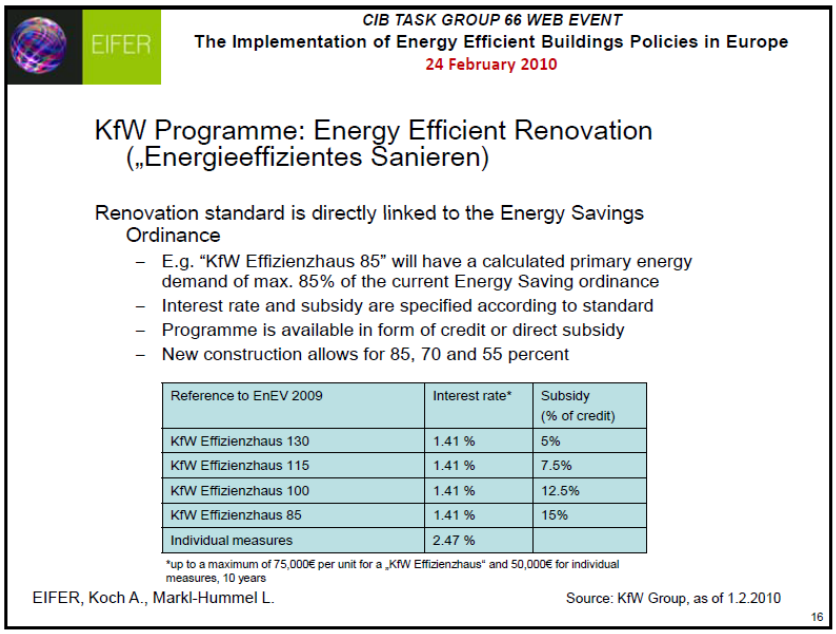


Regulations apply to both new and existing buildings:

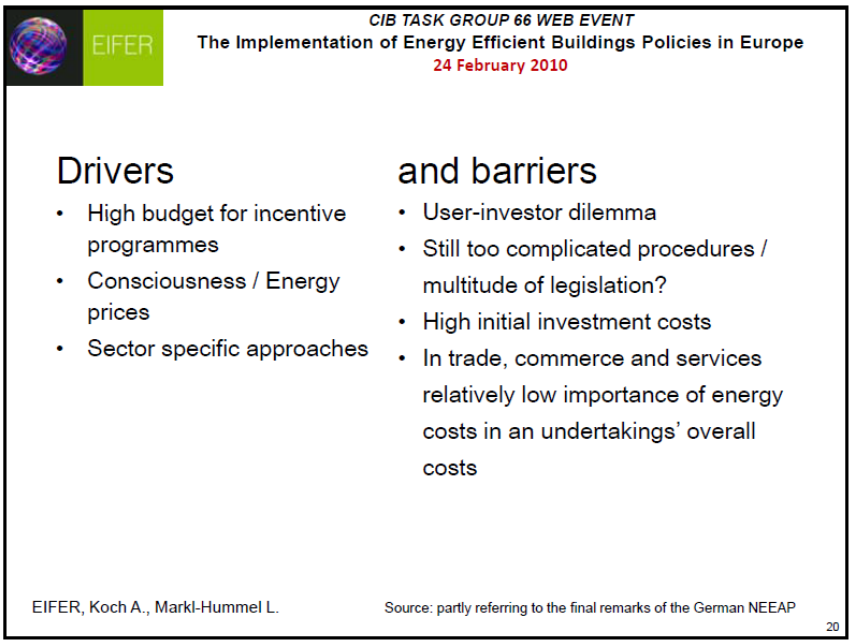


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The financial component, provided by the public KfW bank, is essential:



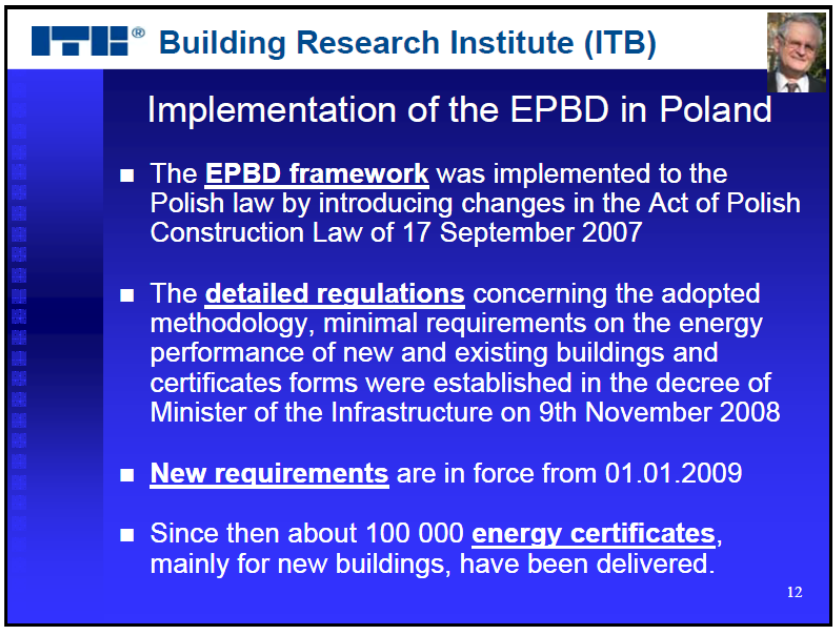
Public action must be assertive and act as a motor in the face of the many barriers:



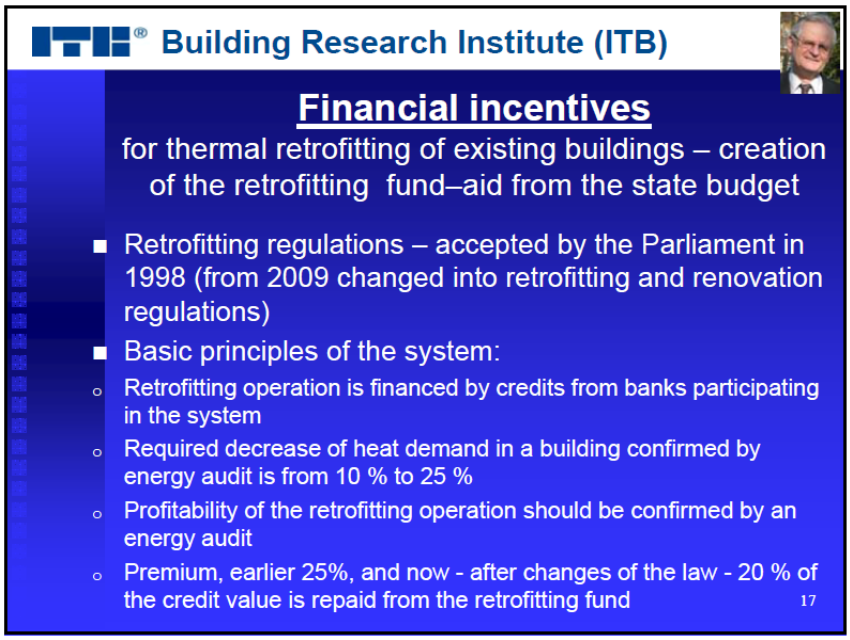
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Krzysztof Kasperkiewicz (ITB, Poland) presented the specificity of Eastern European countries through the case of his country[60].

After joining the European Union in 2004, Poland adopted the 2002 European energy performance of buildings directive in its legislation in 2007:



A financial incentive mechanism for retrofitting existing buildings was defined:



[60] Cf Appendix 2, access to the presentation : Krzysztof Kasperkiewicz text

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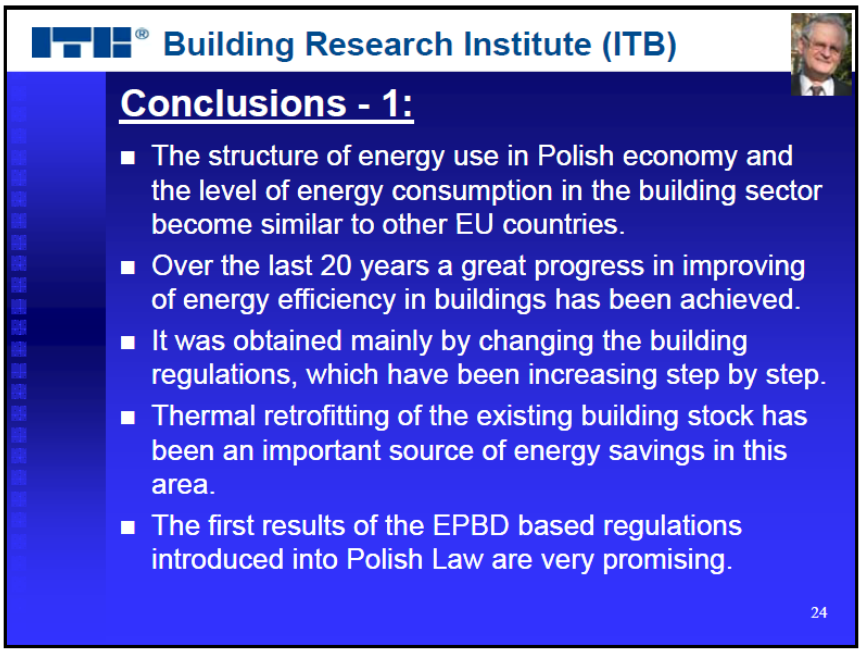
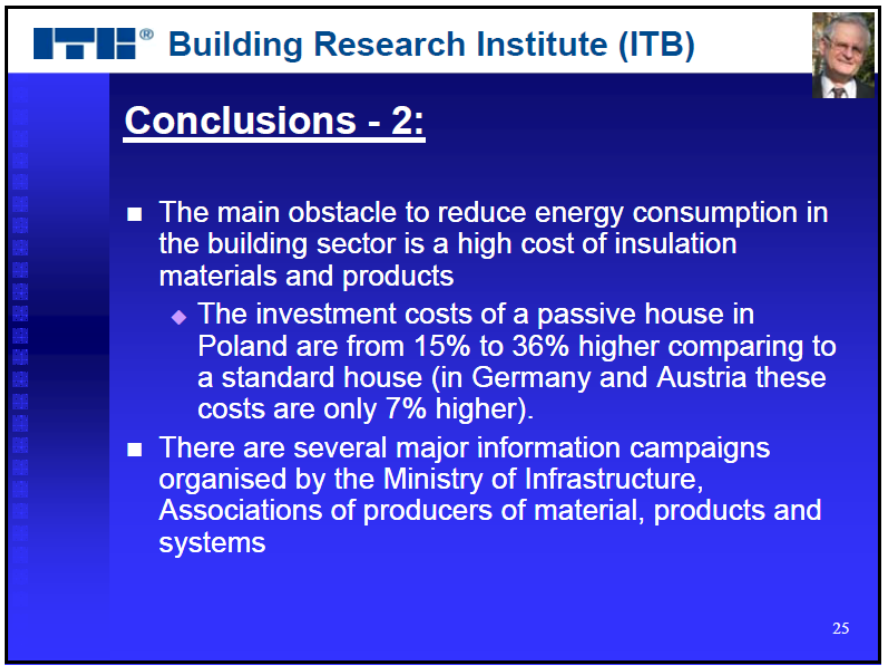
Poland is gradually beginning to catch up with the rest of the European Union:



The cost factor, particularly regarding materials, still has to be resolved:



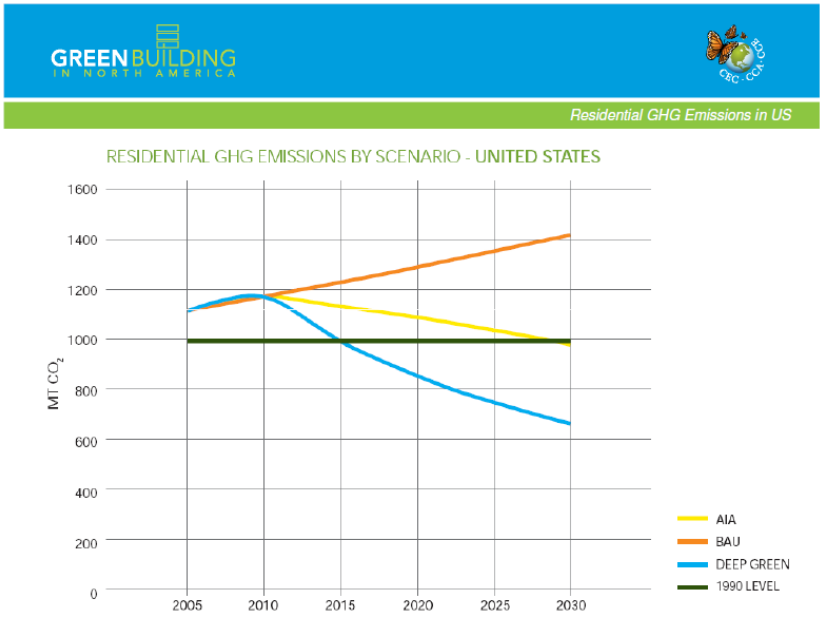
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

7. THE NORTH AMERICAN APPROACH

7.1 The continental analysis

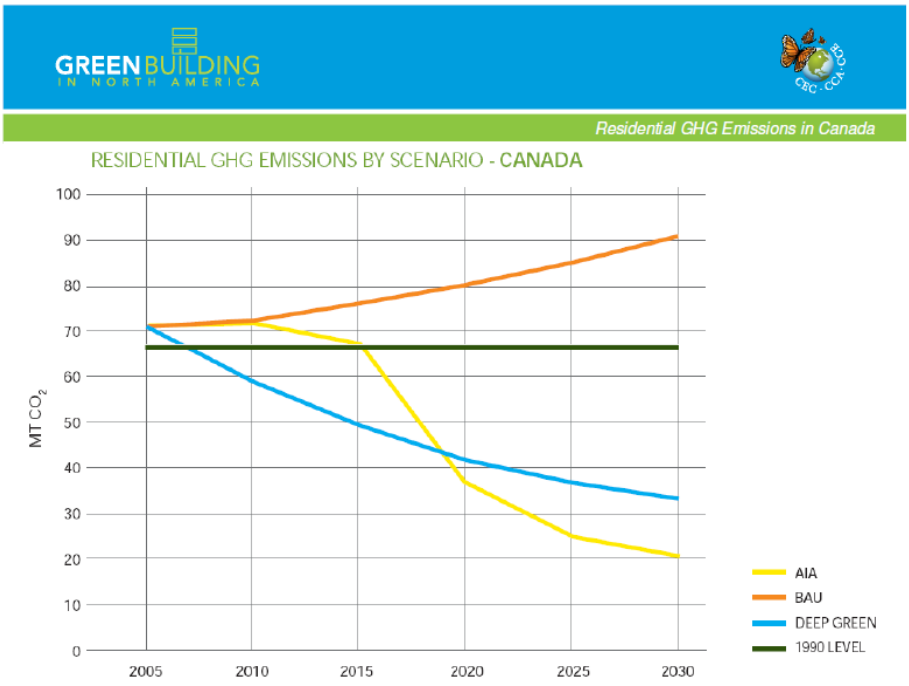
Jonathan Westeinde, Chair, Green Building Advisory Group, North American Commission for Environmental Cooperation[61] indicated that the environmental impact of buildings is higher in the United States and Canada than in Mexico:

In fact, the different scenarios for greenhouse gas emissions should translate into lower emissions for the United States and Canada:

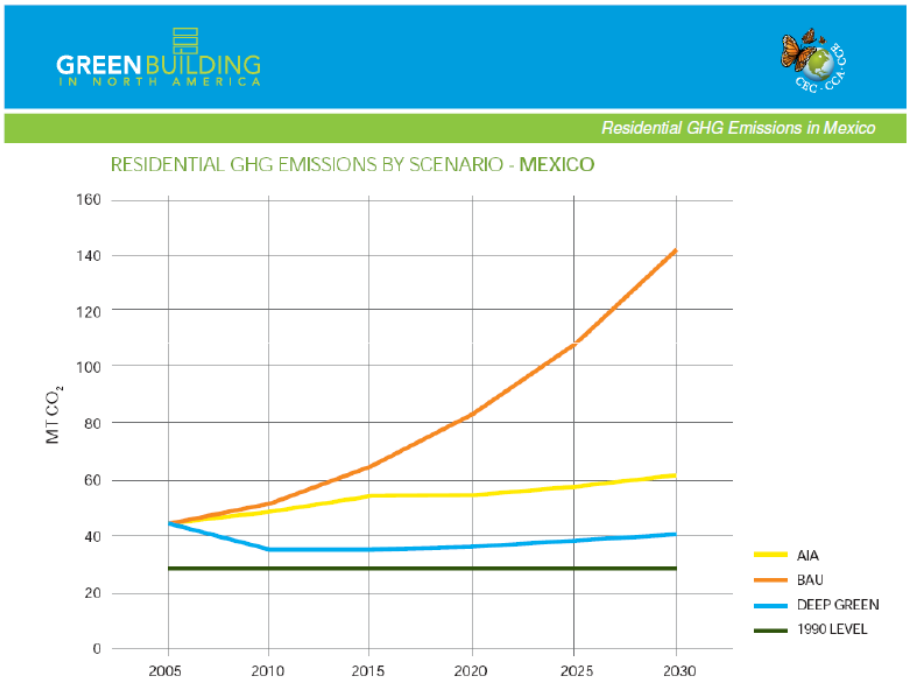


[61] Cf Appendix 3, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-north-america-webinar-20101012-1-jonathan-westeinde-6681151

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.



and somewhat higher emissions for Mexico:



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The North American Commission for Environmental Cooperation is in favour of a continental approach for the reduction of greenhouse gas emissions from buildings:

- Create national, multi-stakeholder task forces in each country, charged with achieving a vision for green building in North America;
- Support the creation of North American set of principles and tools;
- Set clear targets to achieve the most rapid possible adoption of green buildings in North America together with performance monitoring;
- Enhance ongoing or new support for green building including investment and valuation;
- Education;
- Increased R & D, use of labels and better disclosure of actual performance.

In reality, each country pursues its own policy.

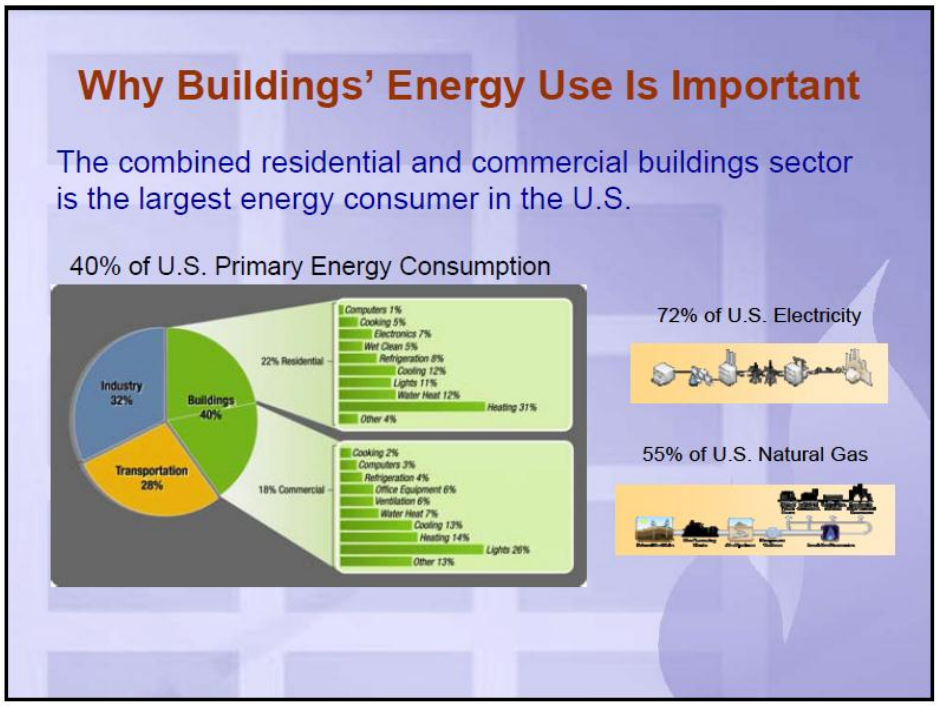
7.2 United States, Canada and Mexico: three different approaches

In his presentation at the introductory seminar in Brussels, Shyam Sunder of the National Institute of Standards and Technology (NIST, US Department of Commerce), went over the major lines of the United States federal energy policy[62] :

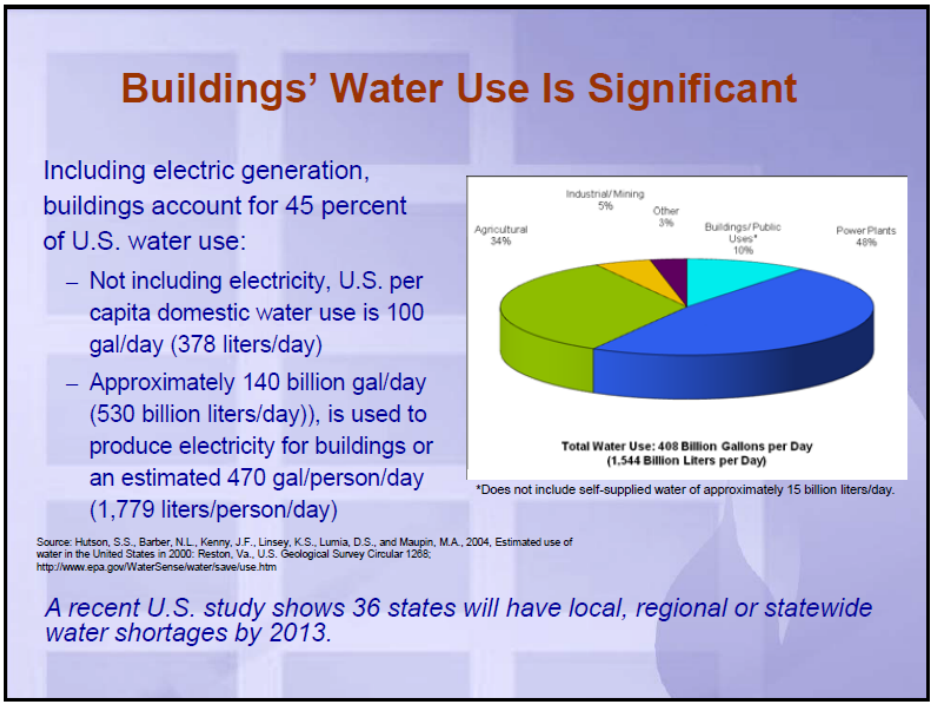
[62] Cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=12_Sunder_CIB_Brussells_101409.pdf&lang=en

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Buildings use more energy than transport and industry:



Buildings also account for a significant share of other uses, such as water:



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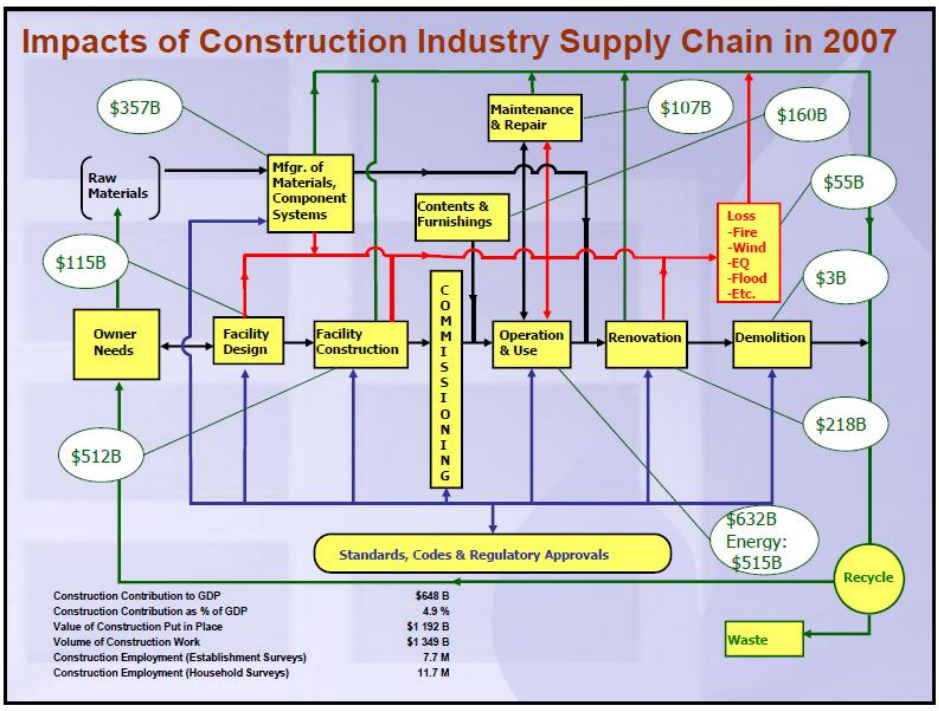
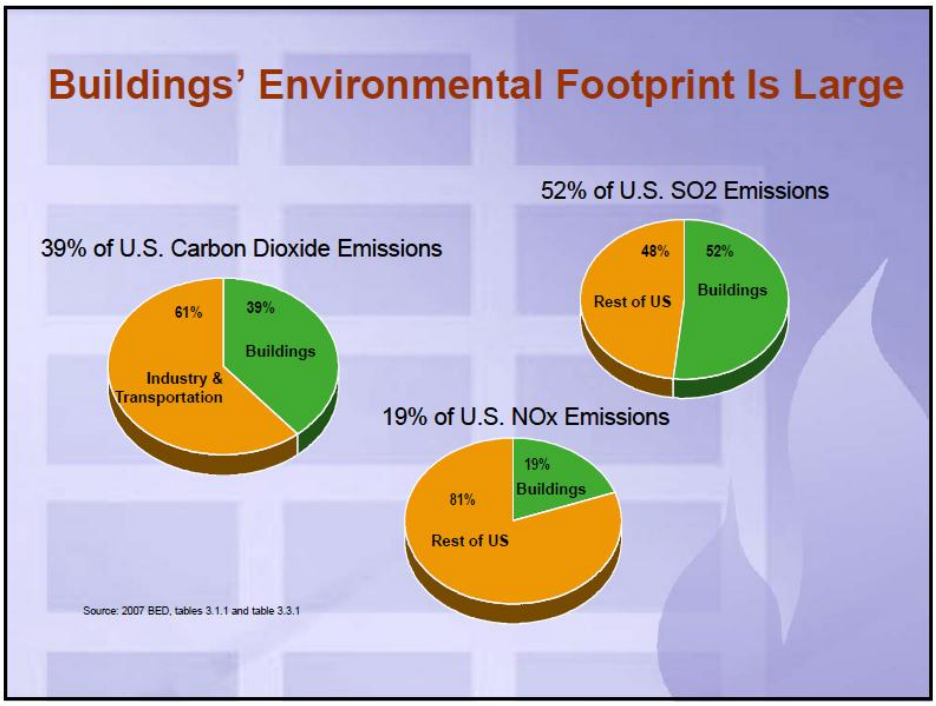
The extent of the economic weight of the construction and buildings chain …



….and the environmental impact of buildings…



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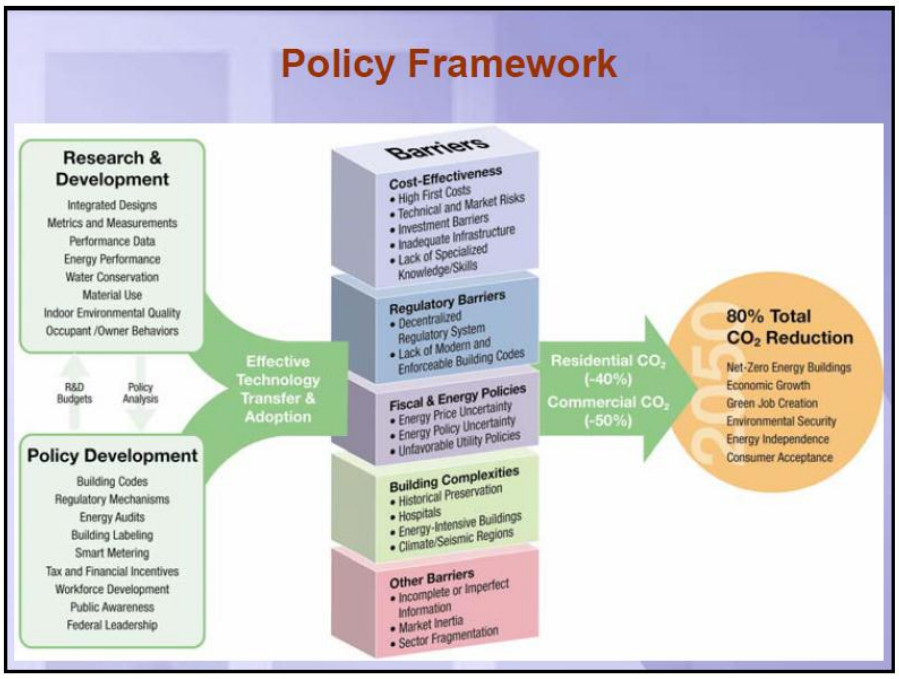
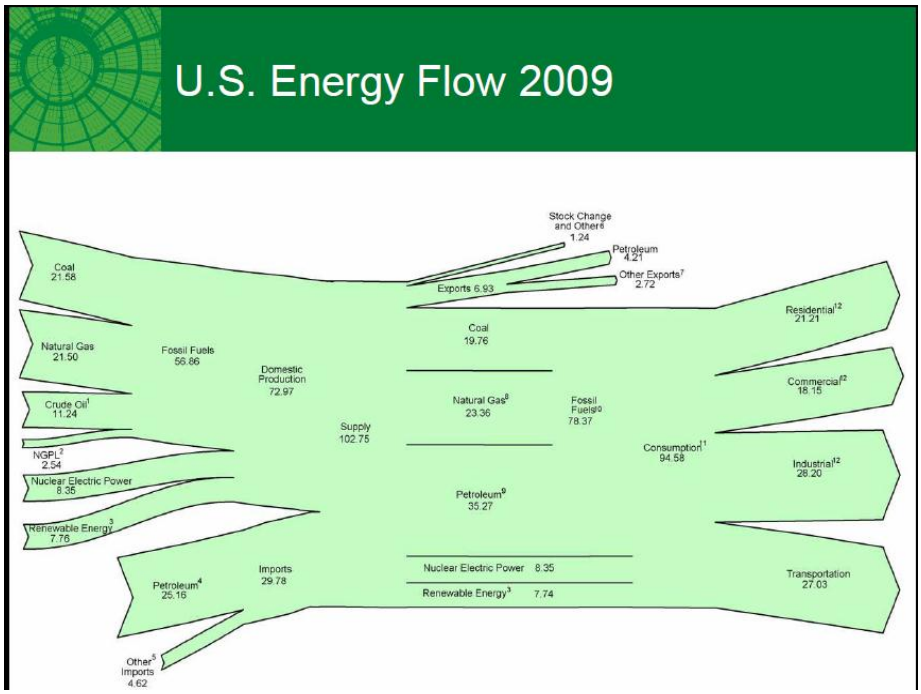
…call for an assertive policy in order to overcome the many barriers to a drastic reduction in CO2 emissions:



Darren B. Meyers, Technical Director, Energy Programs, International Code Council (ICC)[63] underlined the United States' high level of dependence on fossil energy:



[63] Cf Appendix 3, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-north-america-webinar-20101012-2-darren-b-meyers-6681153

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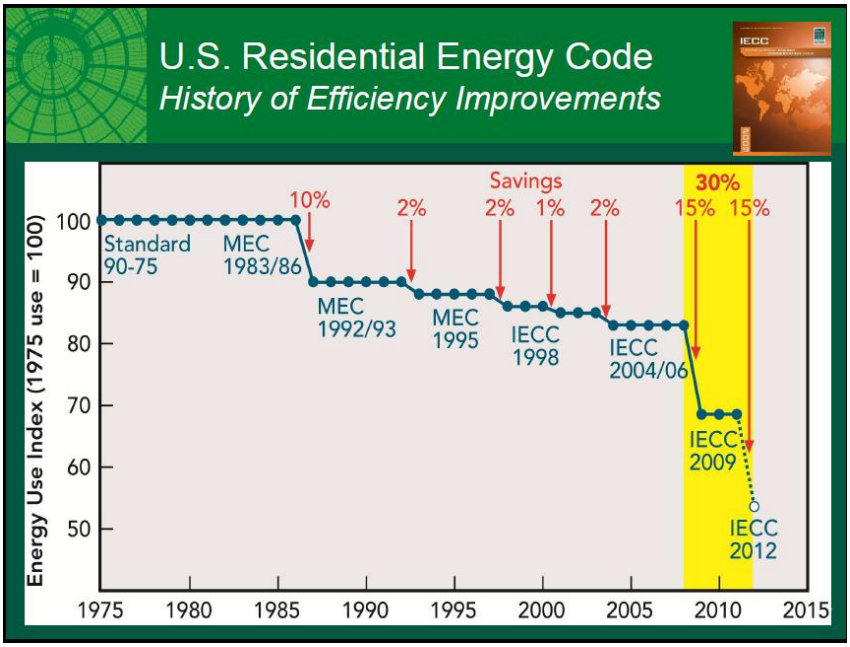
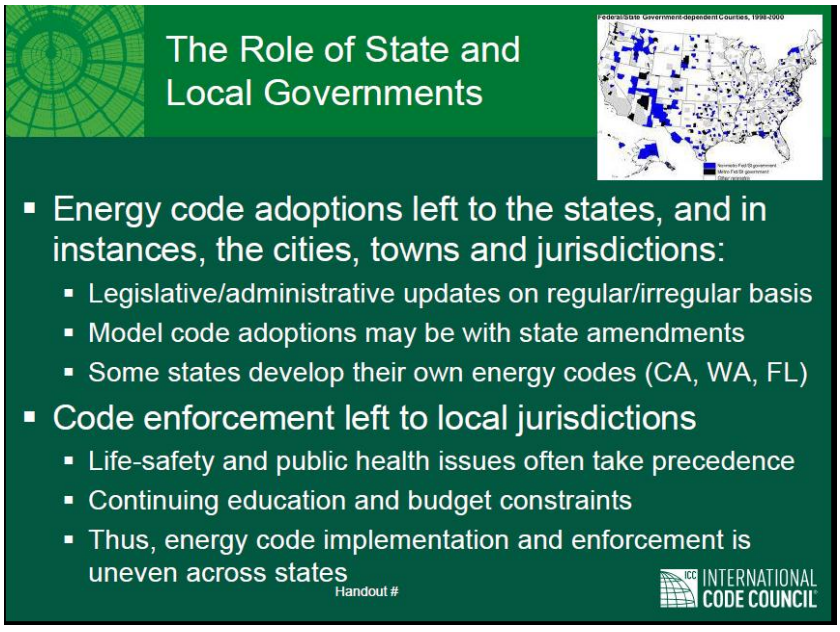
Thermal residential code requirements did not vary between 1975 and 1986. They then progressed slowly between 1986 and 2008, to accelerate in 2009 and 2012:



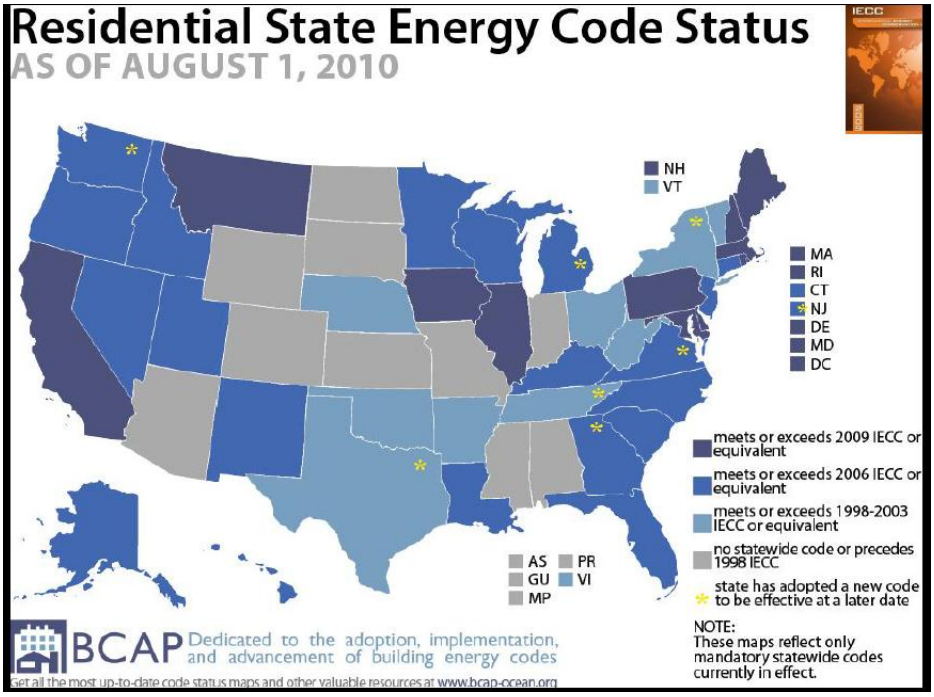
Two important legislative initiatives are the Energy Independence and Security Act of 2007 and the American Reinvestment and Recovery Act of 2009.

However, codes are defined by the states and local authorities:

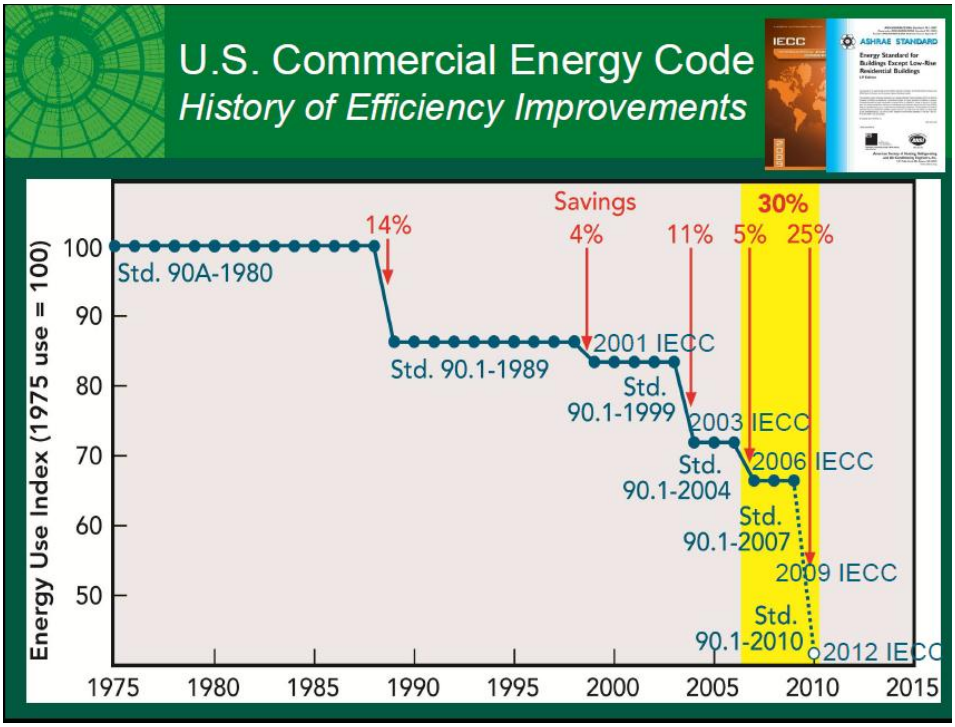


The States with the highest requirements are California and Montana in the west, Illinois and Iowa in the centre, and Pennsylvania, Maryland, Delaware, the District of Columbia, Massachusetts, Rhode Island, New Hampshire and Maine in

the east. On the other hand, ten central States, such as Colorado, Kansas and Missouri, have requirements which are under the 1998 IECC or have no codes in place at all:

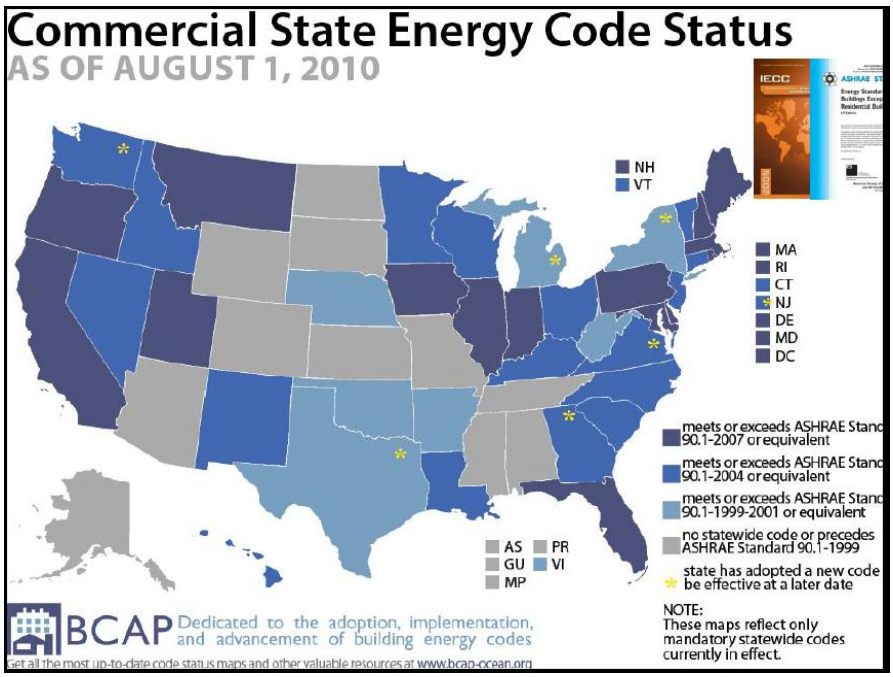


The situation is comparable for commercial buildings, with a more ambitious trend in terms of thermal regulations than for residential buildings …



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

…and considerable differences between states. For commercial buildings, Oregon, Utah, Indiana and Florida are to be added to the previous list of states with high requirements:

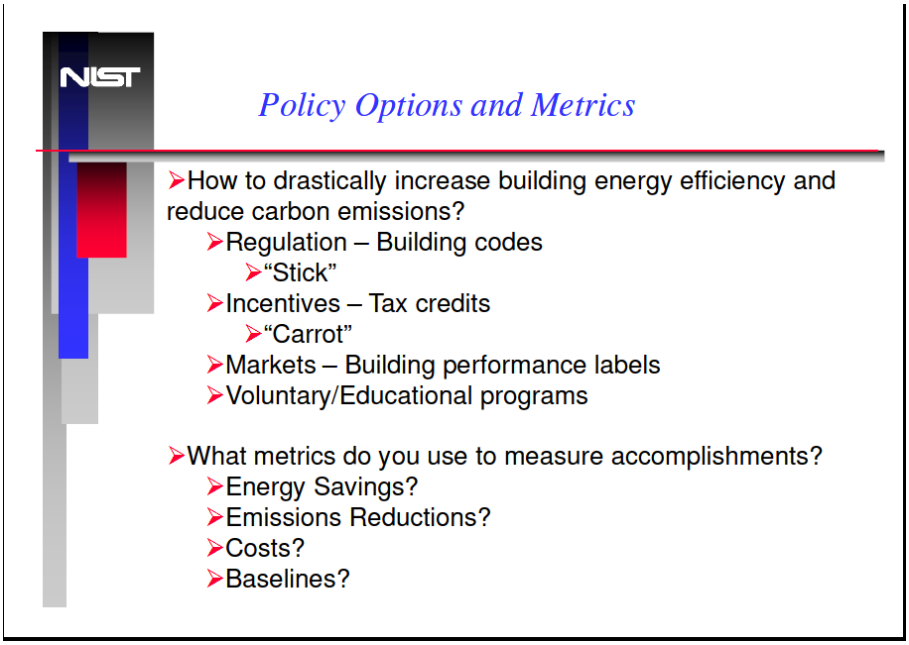


In April 2012, a methodology to compare cost-effectiveness of residential energy codes was published[64].

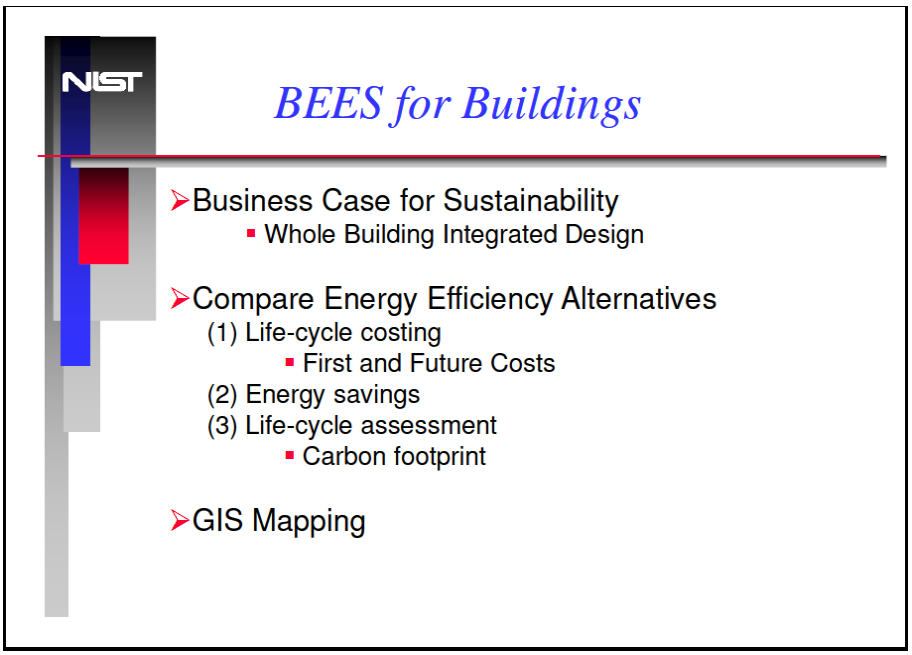
In April and June 2012, a comparison of the 2006, 2009 and 2012 editions of the International Energy Conservation Codes (IECC) was published at national level[65] and for a typical new residential dwelling unit[66].

[64] Access to the methodology:
http://jeancarassus.zumablog.com/images/2128_uploads/DOE_residential_methodology_April_____.pdf
[65] Access to the 2006, 2009 and 2012 national comparison report:
http://jeancarassus.zumablog.com/images/2128_uploads/DOE_NationalResidentialCostEffectiveness_April___.pdf
[66] Access to the 2006, 2009 and 2012 dwelling unit comparison letter report:
http://jeancarassus.zumablog.com/images/2128_uploads/DOE_IECC_Energy_Use_Letter_report_V____FINAL.pdf

Beyond the codes, Joshua Kneifel, Economist with the Engineering Laboratory of the NIST[67], raised the critical issue of the impact of building energy efficiency policies depending on how they are applied and measured:



Taking the example of a standard three-storey office block, Joshua Kneifel analysed energy efficiency according to three criteria:

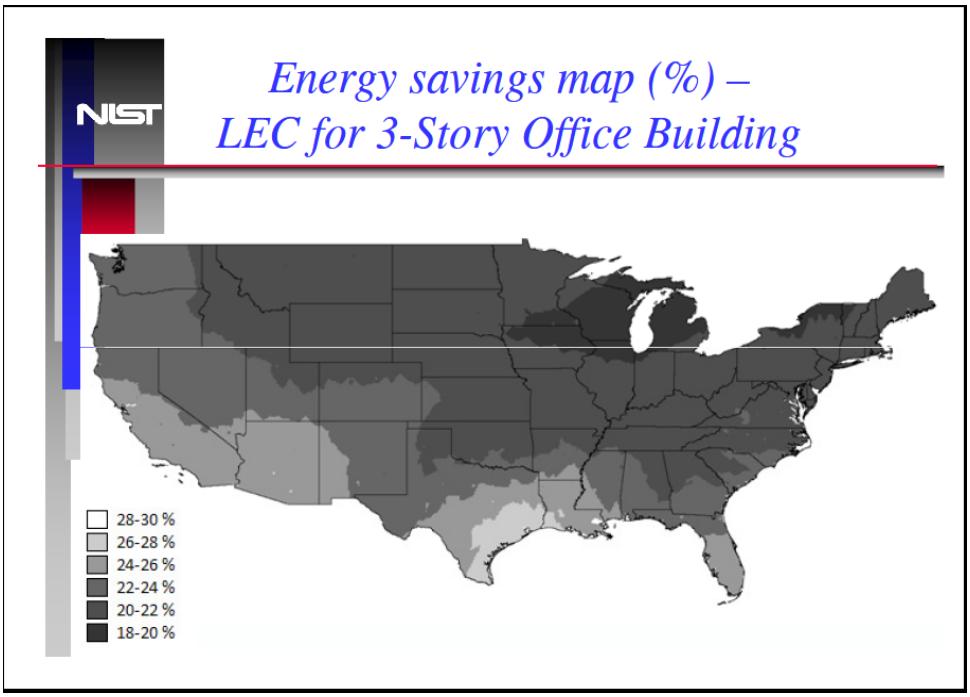


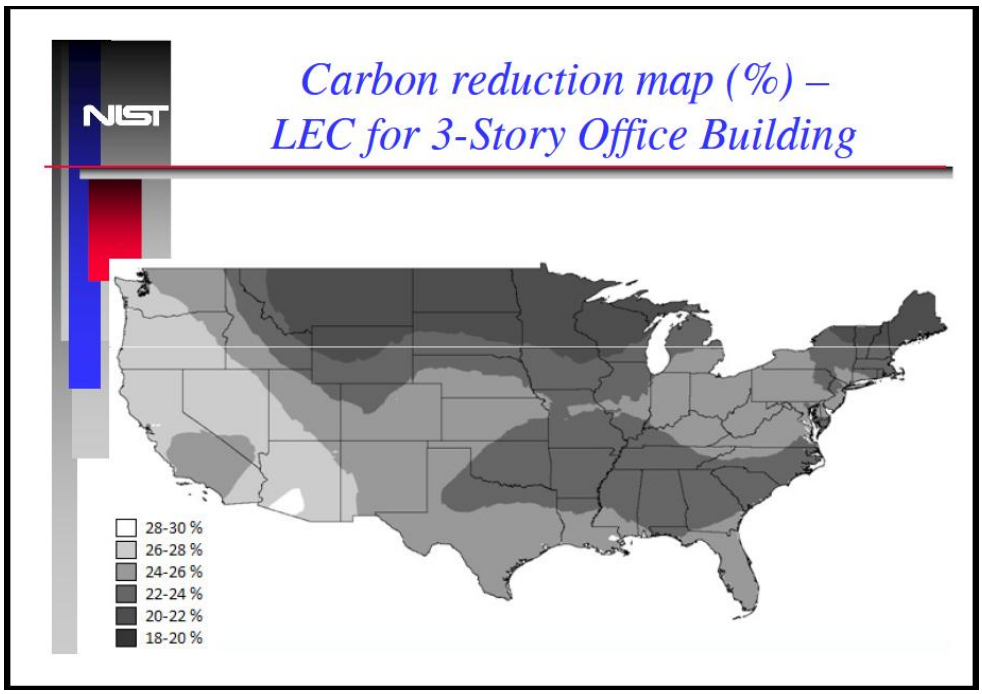
[67] Cf Appendix 3, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-north-america-webinar-20101012-5-joshua-kneifel-6681148

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

In all three cases, energy efficiency depends to a great extent on location due to differences in climate, code requirements, cost of energy, carbon content of electricity and construction costs, etc.

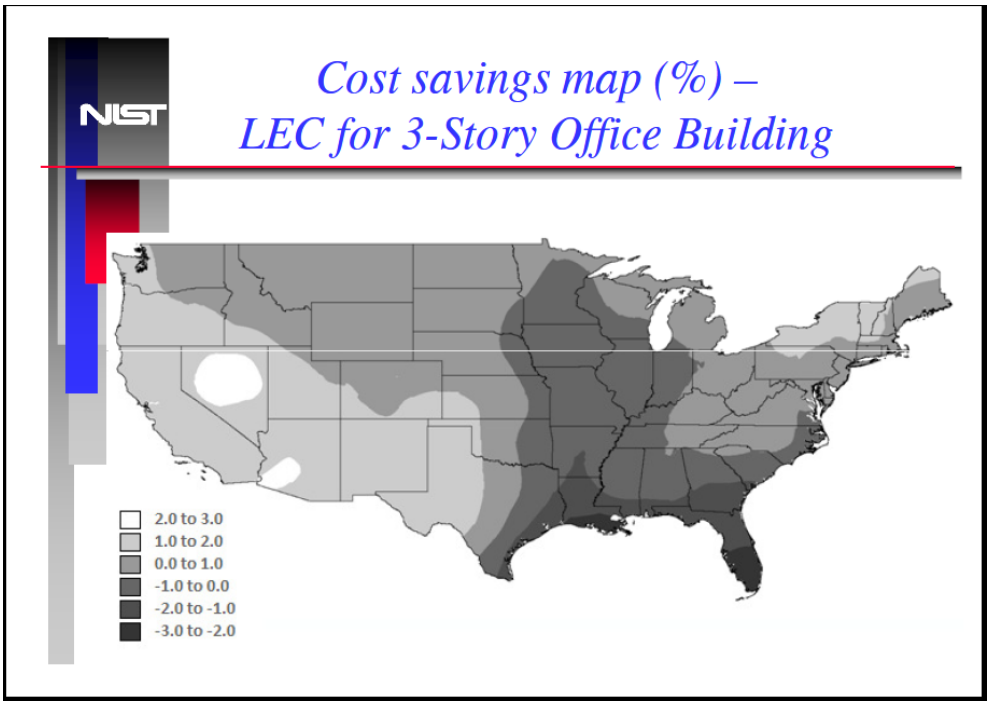
Although the energy savings map and the carbon reduction map show some similarities, they do however differ significantly:





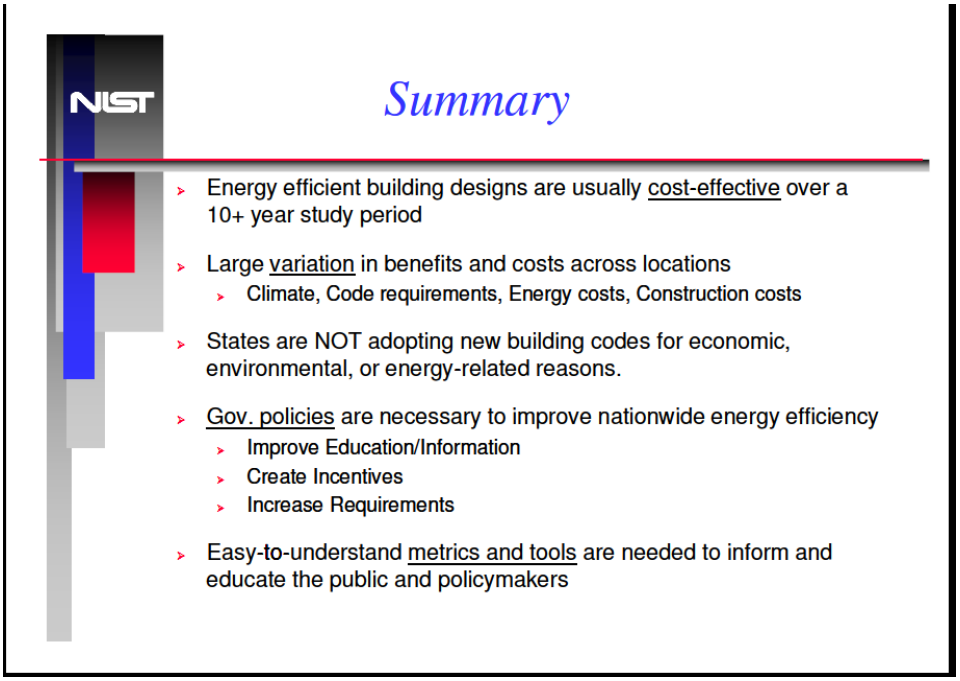
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

When analysed in terms of life cycle cost savings, the energy efficiency map is very different:



While building energy efficiency is mainly seen to be reasonably cost-efficient, the impact varies a lot according to location.

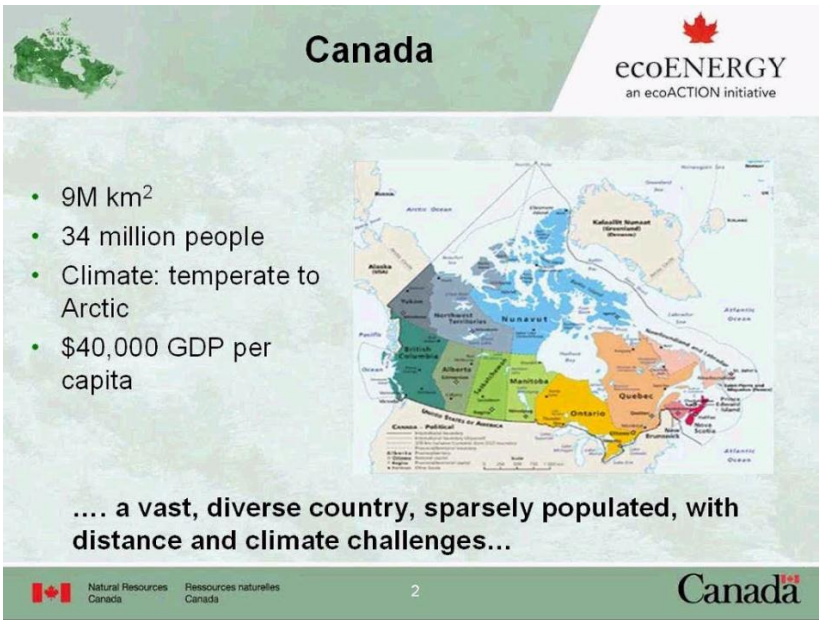
The issue of what tools and indicators are used is crucial in order to provide deciders and users with correct information:



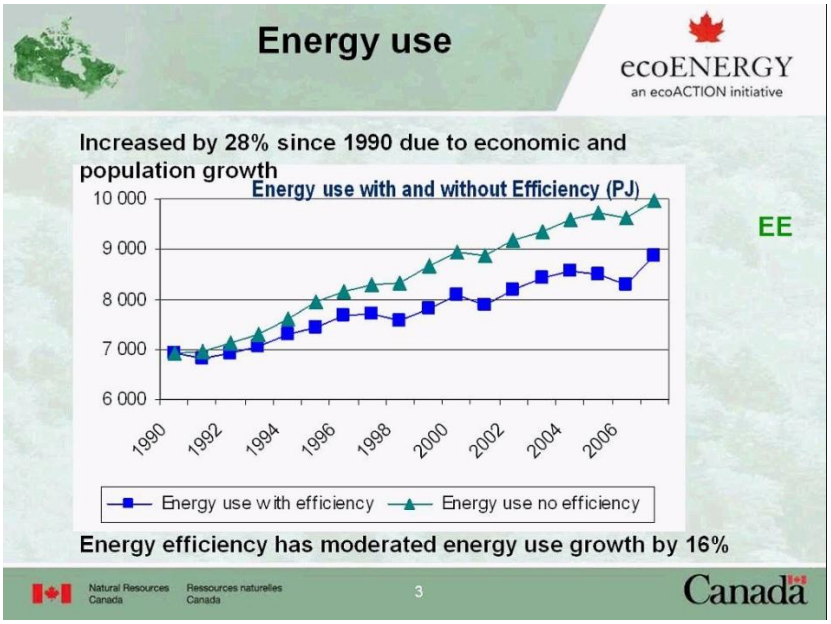
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

In February 2013, Joshua Kneifel published a report on Benefits and costs of energy standard adoption in new commercial buildings[68].

James Clark, from the Buildings Division of the Office of Energy Efficiency (Natural Resources, Canada)[69] pointed out the size and diversity of his country, where the climate ranges from temperate to arctic:



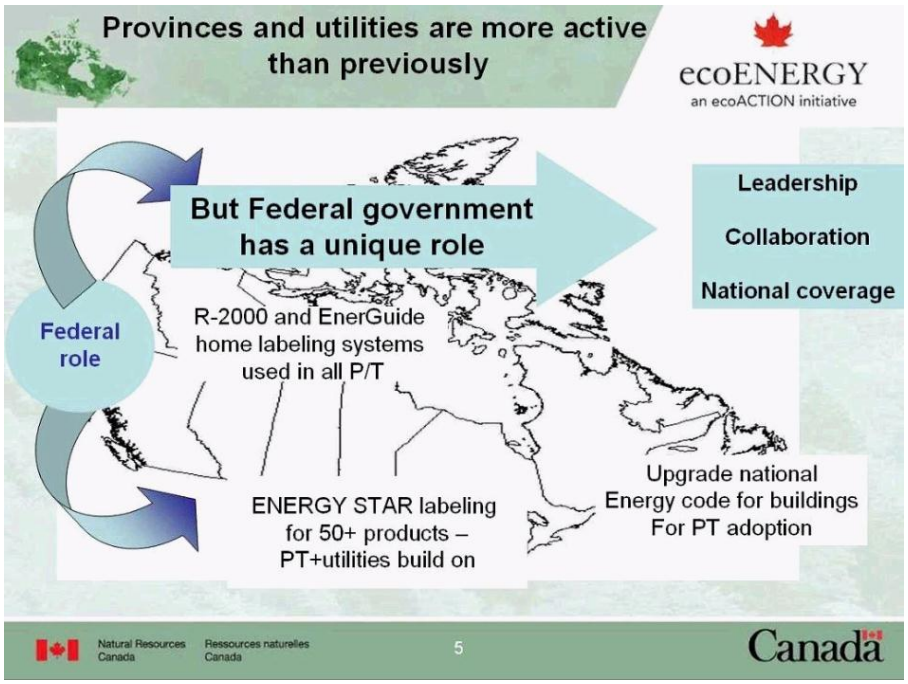
The energy efficiency policy has achieved significant results over the last 20 years:



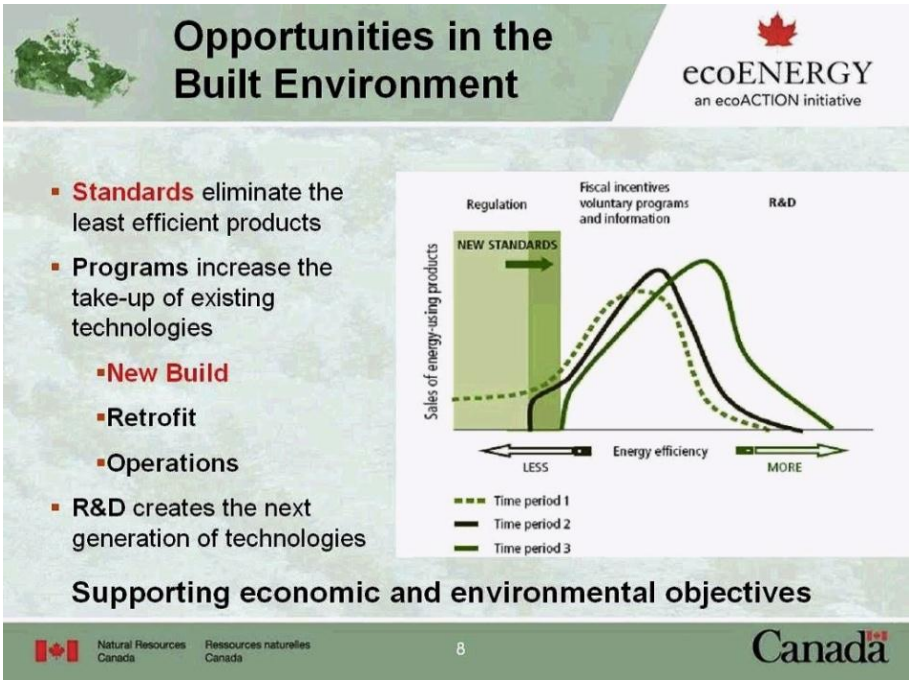
[68] Access to the report: http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1147.pdf

[69] Cf Appendix 3, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-north-america-webinar-20101012-3-james-clark

Provinces and utilities play an active role but federal government must also assume its responsibilities:

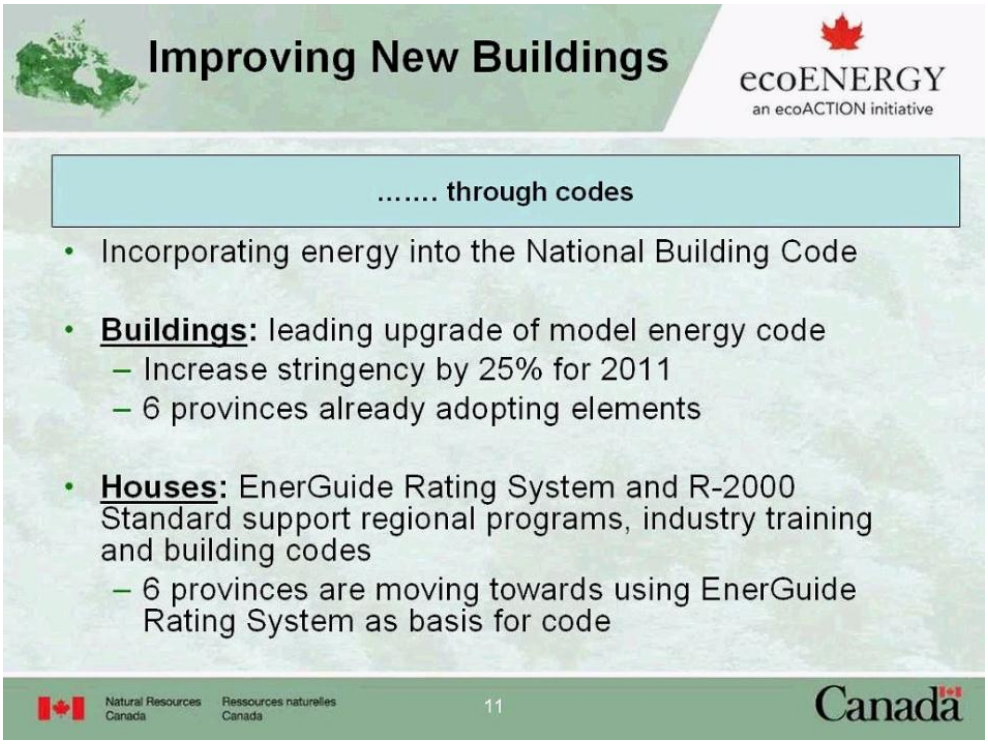


The energy efficiency policy encompasses research and development, incentives and regulation:

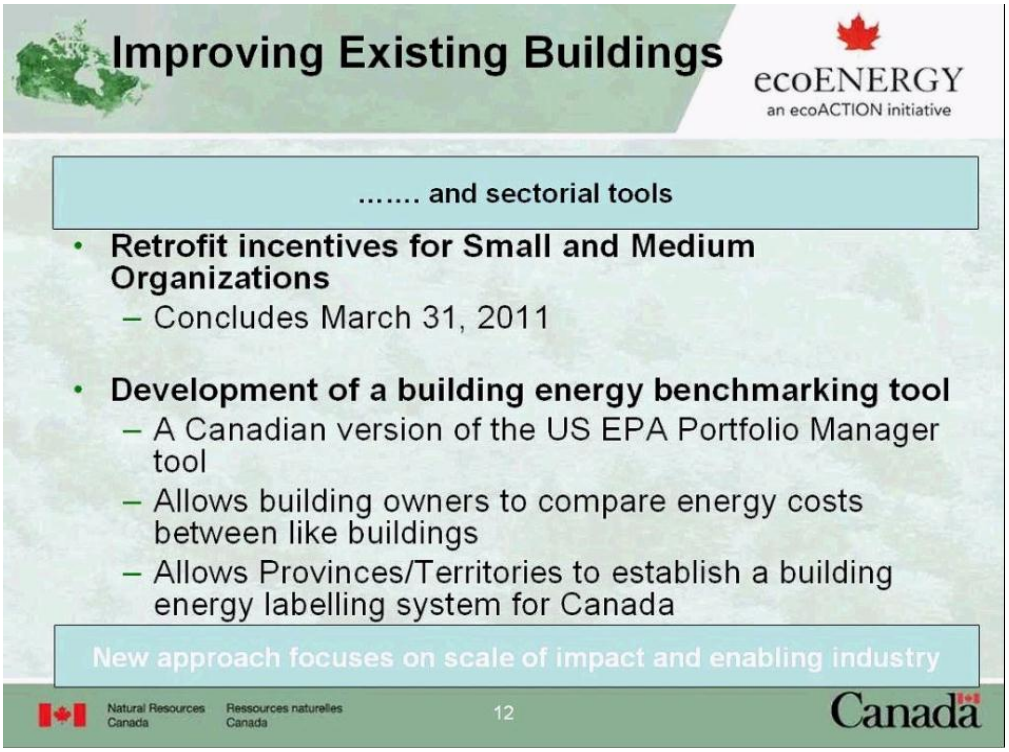


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Code requirements increased considerably in 2011:

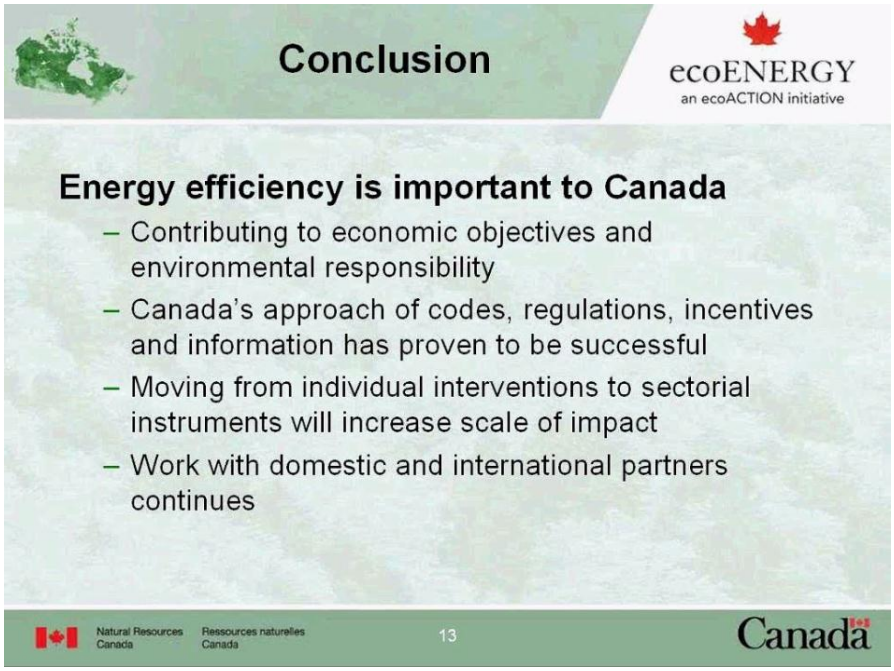


An observatory measures the actual energy use of existing building stock:

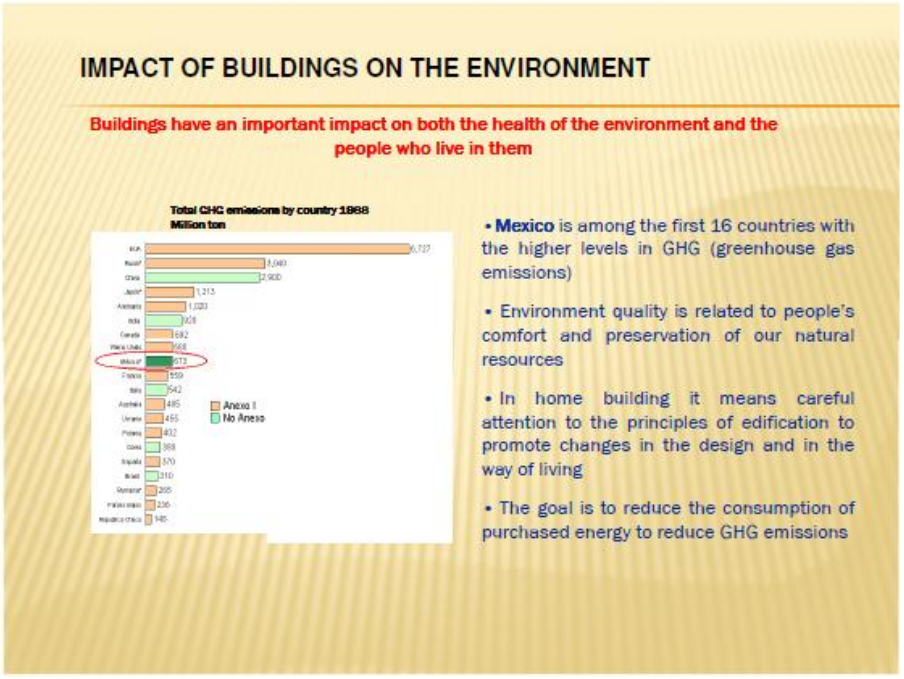


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The energy efficiency policy plays an important role:



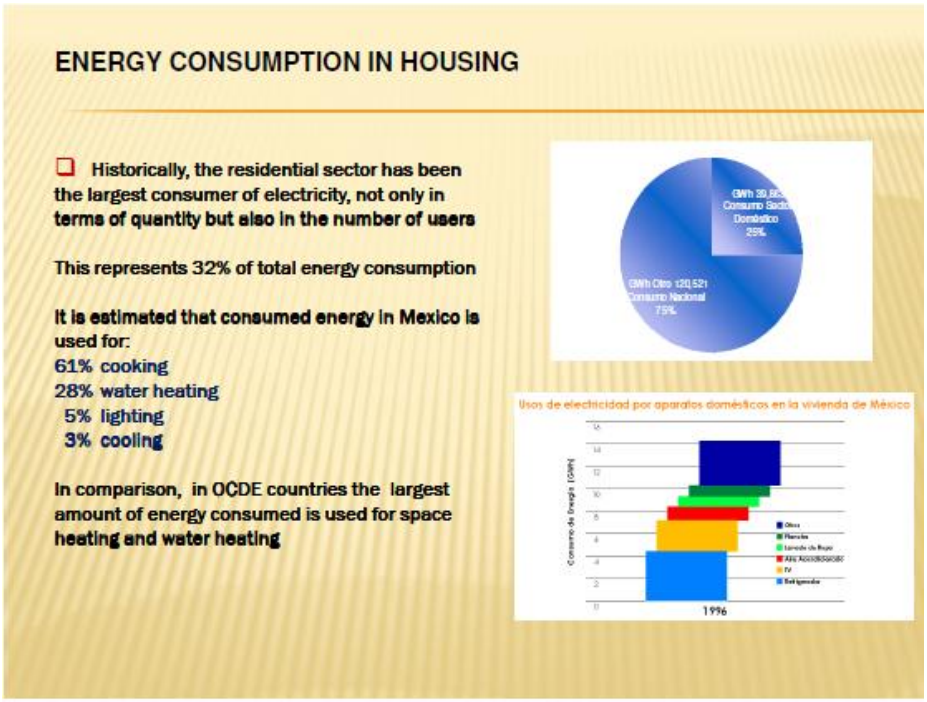
Evangelina Hirata, consultant on energy efficiency in the housing sector (Mexico)[70], highlighted the fact that energy efficiency affects both greenhouse gas emissions and people's quality of life:



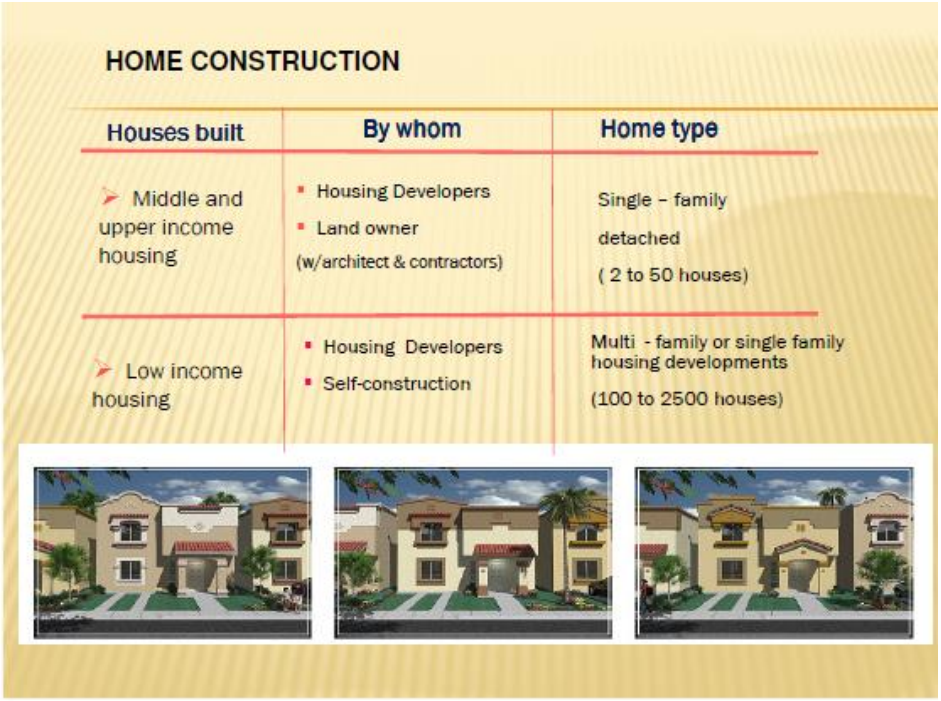
[70] Cf Appendix 3, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-north-america-webinar-20101012-4-evangelina-hirata-6681155

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

As opposed to developed countries, the greater part of energy used in the home is for cooking purposes:



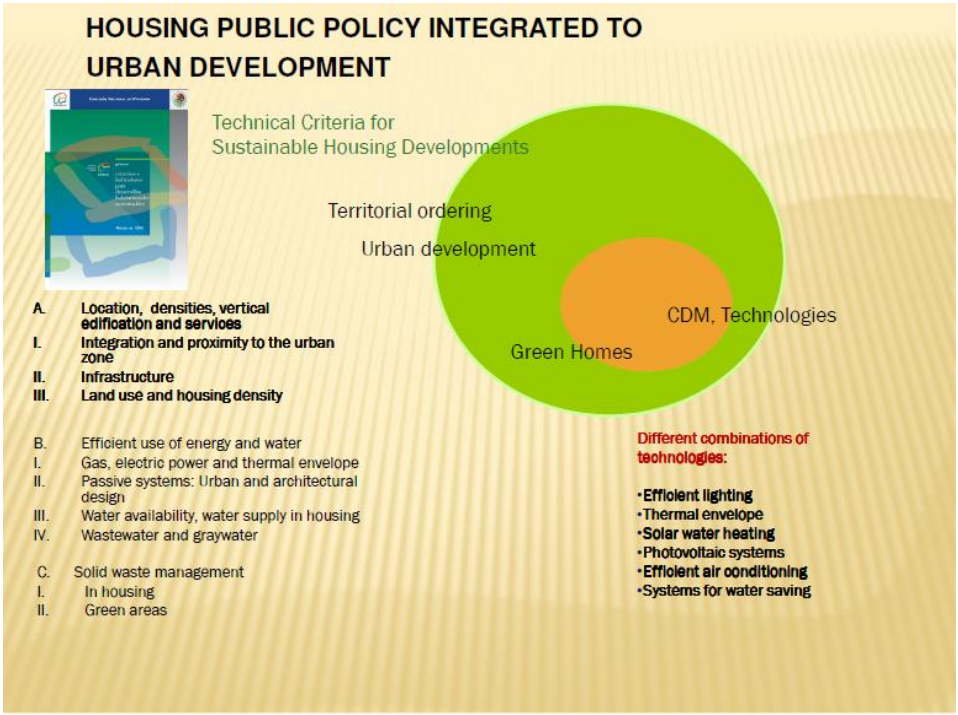
There are marked differences between the homes of middle- and high-income social groups, and those of low-income groups.



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

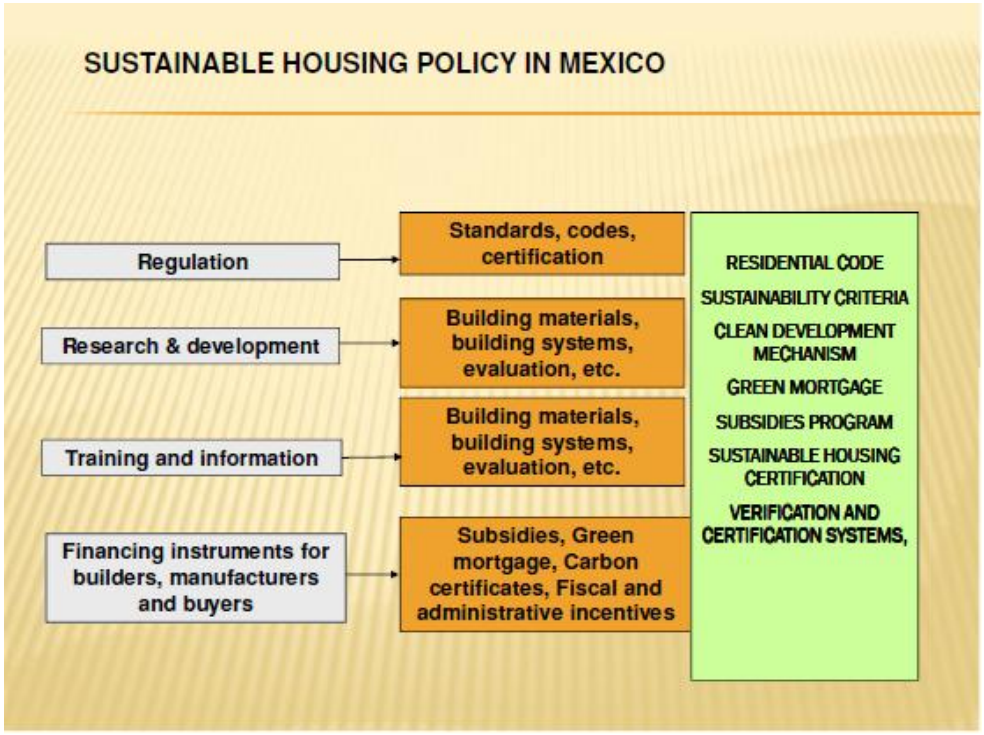
Housing developments for low-income populations can be sizeable, some offering up to 15 000 homes:

Thus, it is important to take into account the urban development aspect:

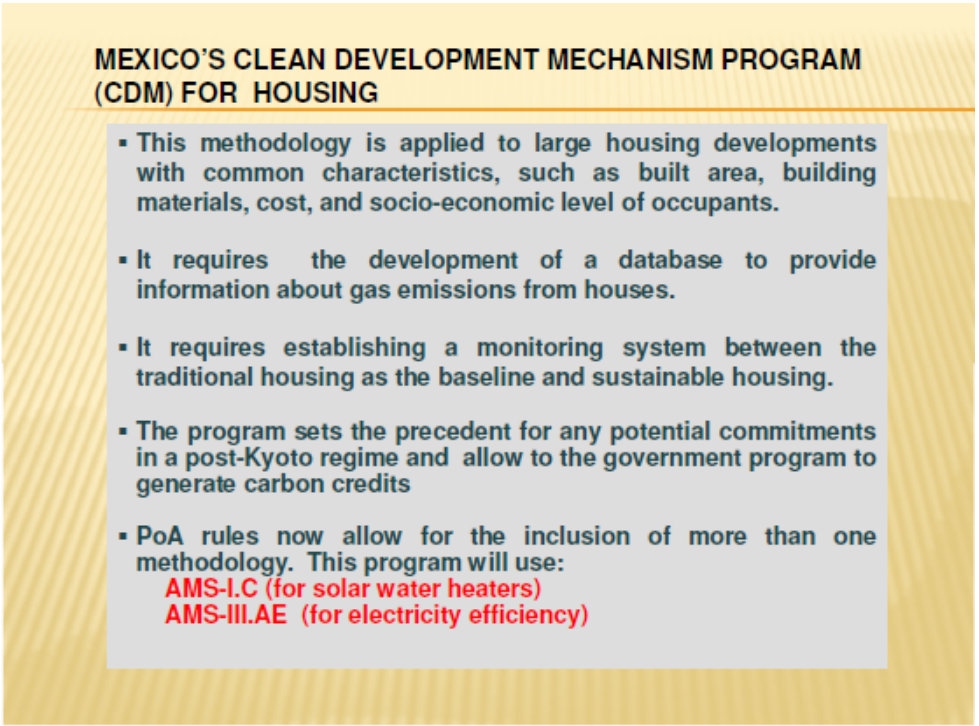


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The energy efficiency policy encompasses research and development, regulation, training, information and financial incentives.



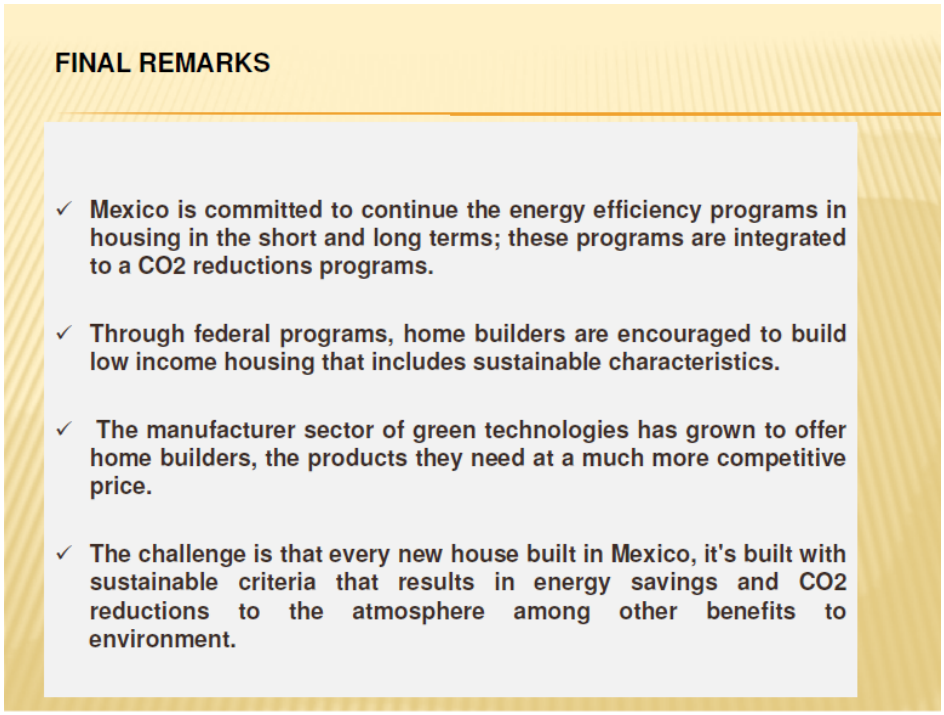
Financing can be provided by developed countries in the framework of the Clean Development Mechanism (CDM) defined in the Kyoto agreement …



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

… and by national support.

It is essential to integrate energy and environmental criteria into the construction of new large-scale housing developments:



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

It should be mentioned that the UNEP-SBCI published a discussion document in 2009 comprising an estimation of the situation and recommendations for an energy efficient buildings policy in Mexico[71].

[71] Access to the report: « Greenhouse Gas Emission Baselines and Reduction Potentials from Buildings in Mexico »: http://www.unep.org/sbci/pdfs/SBCI-Mexicoreport.pdf This report was sponsored by CSTB.

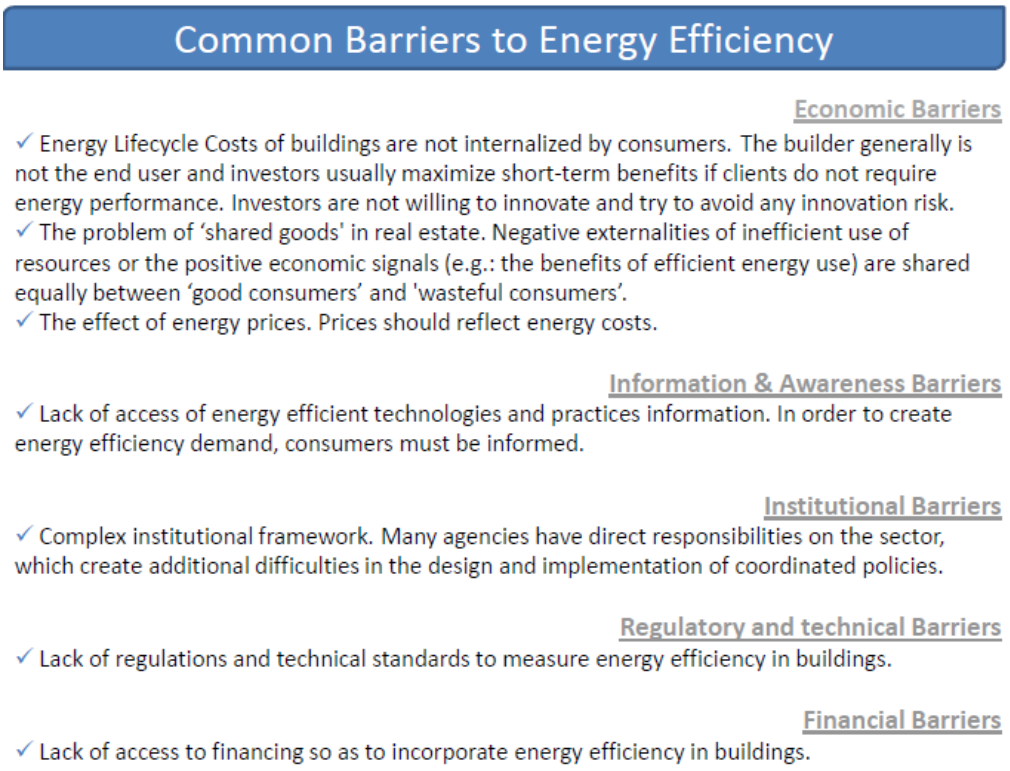
CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

8. THE SOUTH AMERICAN APPROACH

8.1 A very different approach compared to developed countries, based on the case of Uruguay

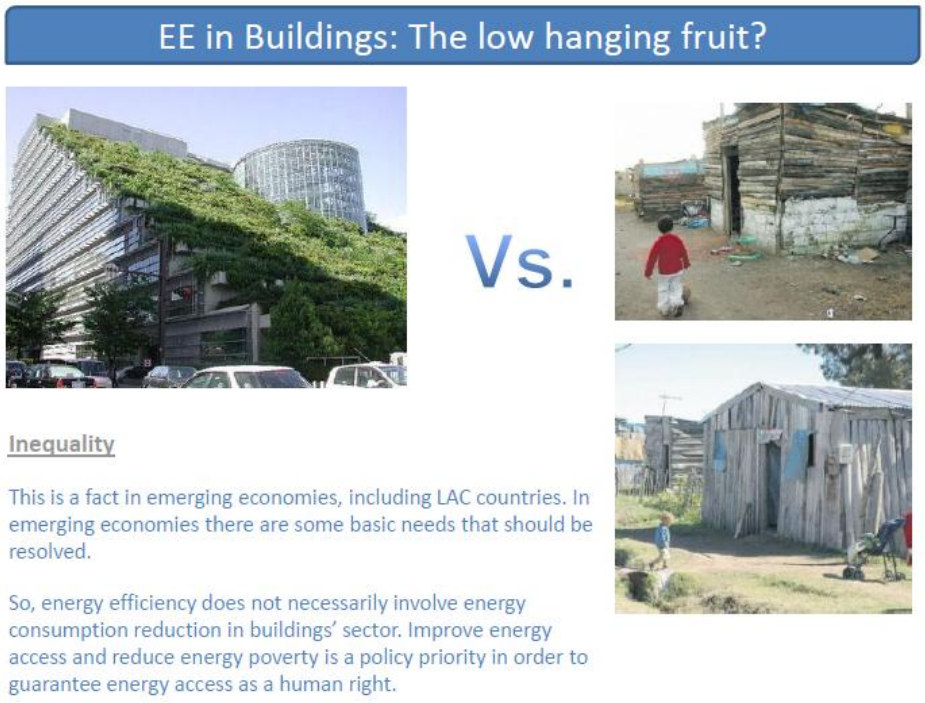
Alfonso Blanco, Director of Uruguay's Energy Efficiency Project[72], made a clear presentation of the very different issues of developing countries compared to developed countries.

The following are the usual barriers to energy efficiency:

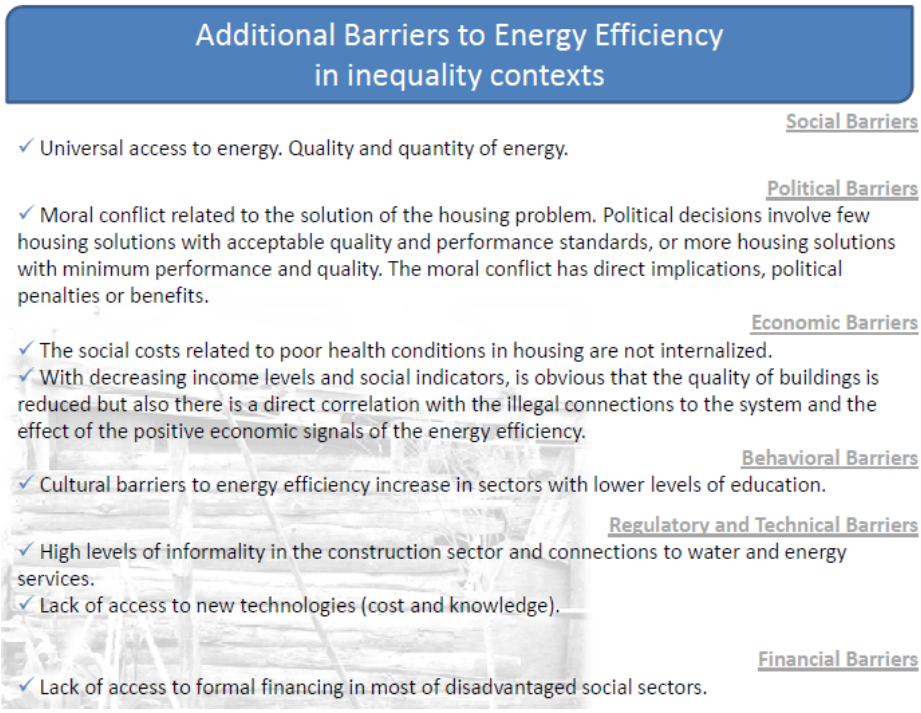


[72] Cf Appendix 4, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-south-america-webinar-20101104-3-alfonso-blanco

In developing countries where basic needs are not covered, access to energy and the reduction of energy poverty are priorities:



In fact, there are specific additional barriers in a context of poverty and pronounced inequalities:



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

Thus, the importance of a socioeconomic approach taking into account the issues of access to energy and social inclusion; energy efficiency should not be restricted to a technological and regulatory approach[73] :

The problem of the policy makers in emerging countries. How to 'catch' the 'fruit' with additional constraints?

In emerging countries energy efficiency in buildings acquires a different dimension than energy efficiency in developed countries. The environmental impact of energy consumption is not the driver of the energy efficiency in buildings.

The key issue for success in inequality contexts is to convert the energy efficiency in a 'bridge' correctly designed to incorporate the social inclusion, and improve energy access. A social and economical approach is necessary in order to resolve energy poverty and access.

Long term policies including housing, social and urbanization point of views in coordination with energy policies.

So, in Emerging Countries energy efficiency remains to be 'the low hanging fruit' in building sector, but long-term strategies and a multidimensional approach should be considered to successfully 'catch' the potential.

Not just technology or regulation

A holistic approach to energy efficiency is being implemented in Uruguay.

[73] In a different context, this socioeconomic approach can in fact also be applied to developed countries, where a technological and regulatory approach is generally too restrictive and where part of the population suffers from fuel poverty.

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

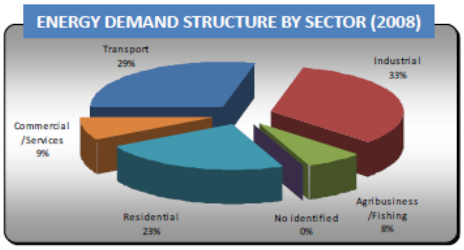
In Uruguay, buildings account for as much energy consumption as industry and more than the transport sector:

The Case of URUGUAY

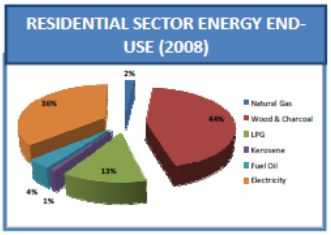
Uruguay is one of the countries of the region with better social indicators, but the previous barriers identified to energy efficiency are still present.

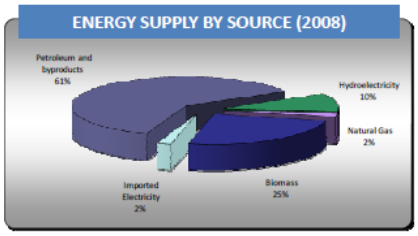
Promoting energy efficiency implies breaking down each of the identified barriers with a social, institutional, economic, technological, regulatory, political, access to information, cultural and behavioral change approach.

From 2005 using this framework Uruguay started energy efficiency policies in buildings.



Source: *Energy Balance 2008. DNETN – MIEM. Uruguay*





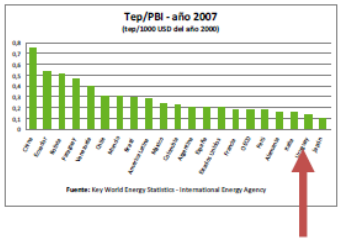
In the residential sector, hot water, lighting and refrigerators are the main items of energy consumption:

The Case of URUGUAY

The energy consumption in residential and commercial sectors show particular features:

- Low energy intensity.
- The electricity is the most important energy source in buildings.
- Biomass from renewable forest is used during winter season and traditional barbecues ('asado', wood stoves and fireplaces, CULTURAL)
- 34% of the electricity in residential sector is used in water heating, more than 90% of the residential sector use electric boilers for water heating.
- 17% of the electricity is used in refrigerators.
- 14% of the electricity consumption is due to lighting.
- Due to the country weather conditions (temperate) heating (winter) or air conditioning (summer) is needed in short periods of the year.
- Condensation and humidity represent a particular problem for buildings.

Energy efficiency policies should be focused on the energy consumption of buildings considering the characteristics of the energy demand of the country.



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Different approaches are needed for commercial users, middle and high-income households, and low-income households.

Economic Approach

Trade-offs between embodied energy and operating energy

The embodied energy in building materials needs to be considered along with operating energy in order to reduce total lifecycle energy use by buildings. For typical standards of building construction, the embodied energy is equivalent to only a few years of operating energy, although there are cases in which the embodied energy can be much higher. For traditional buildings in developing countries, the embodied energy can be large compared to the operating energy, as the latter is quite low.

• For residential consumers with medium and high incomes, domestic economic signals of energy prices are adequate, but there is no internalization of life cycle energy costs in real estate prices. Energy prices in URUGUAY in long term reflects energy generation costs.

• Smart Grids, starting with smart metering in industrial, commercial and residential buildings. At present around 25,000 residential consumers have smart metering and the goal of the utility company for 2011 is to reach up to 50,000. Users have a positive economic sign to modify their electricity tariff when the consumption is over 400 kWh/month.

Issues that need to be addressed:

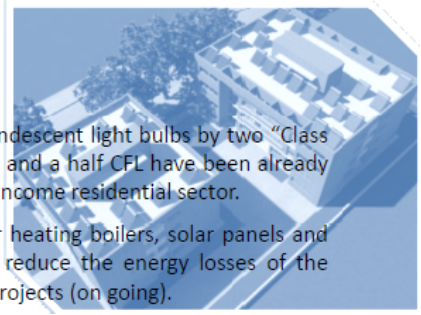
- Reduce upfront costs: grants, tax credits, subsidies
- More information to create consumers awareness.
- Access to finance to internalize energy costs in real estate prices.
- Taxes reduction to promote energy efficiency.

Social and Economic Approach for low income residential sector

Energy Access policies and energy poverty reduction

In URUGUAY electrification rate is higher than 98.5%.

For low income residential consumers, the strategy is to provide the proper economic signals for the regularization of energy services (including efficiency and safety conditions). A social assistance system including social security and health services is associated and conditioned to the regularization of energy utility services. The subsidies to energy for low income consumers are conditioned to a maximum energy consumption to assure energy efficiency, energy efficiency solutions and improvement of safety conditions is also provided. The program is included in a gradual social assistance policy designed for each particular group of slums. Demonstrative projects are under execution.



Residential Equipment Replacement Program

Residential electricity users were able to replace two incandescent light bulbs by two "Class A" Compact Fluorescent Lamps (CFL). More than a million and a half CFL have been already delivered, the main impact of this program was in the low income residential sector.

The next replacement programs will be focused on water heating boilers, solar panels and refrigerators. The replacement gives the opportunity to reduce the energy losses of the system. Incorporation of solar energy in national housing projects (on going).

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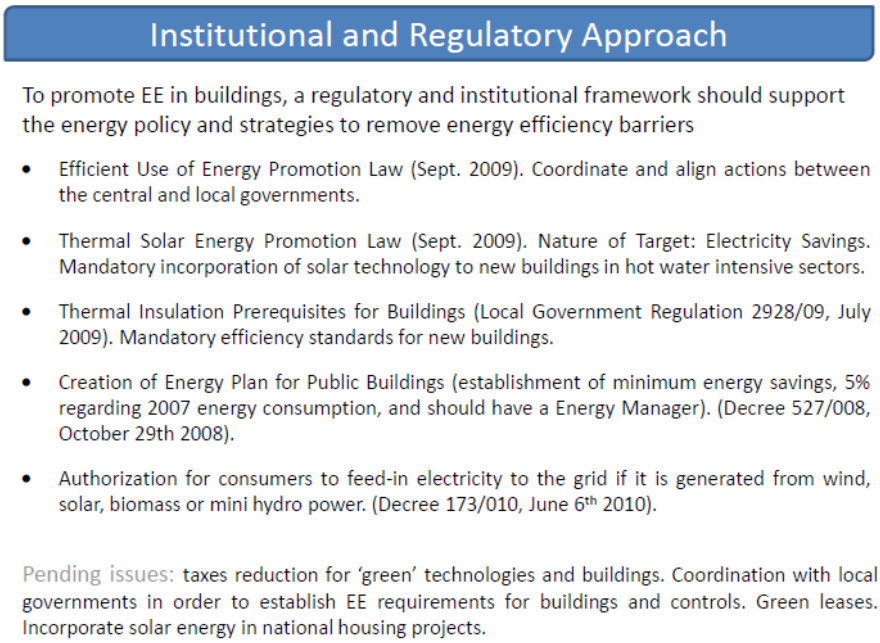
A regulatory device (including thermal insulation and solar energy for new buildings and an action plan for public buildings) is being implemented:



8.2 The examples of Brazil, Argentina, Chile and Venezuela

Vahan Agopyan, professor at the Polytechnic School of the University of Sao Paulo, and Roberto Lamberts, professor at the Federal University of Santa Catarina (Brazil)[74], presented the Brazilian experience.

[74] Cf Appendix 1 access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=13_Agopyan_Brazilian_presentation_final.pdf&lang=en
and Appendix 4 access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-la-2010-1104-6-roberto-lamberts

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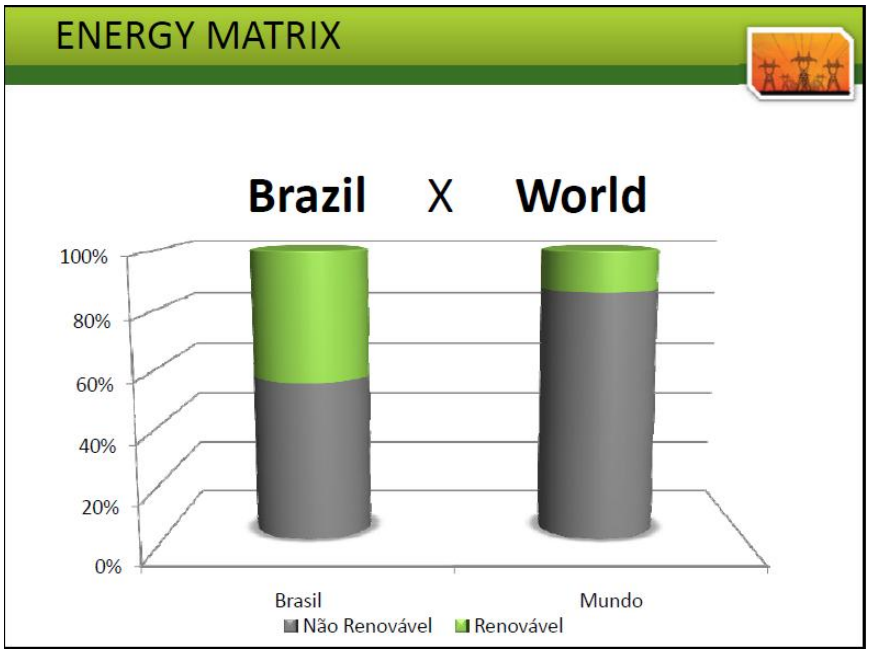
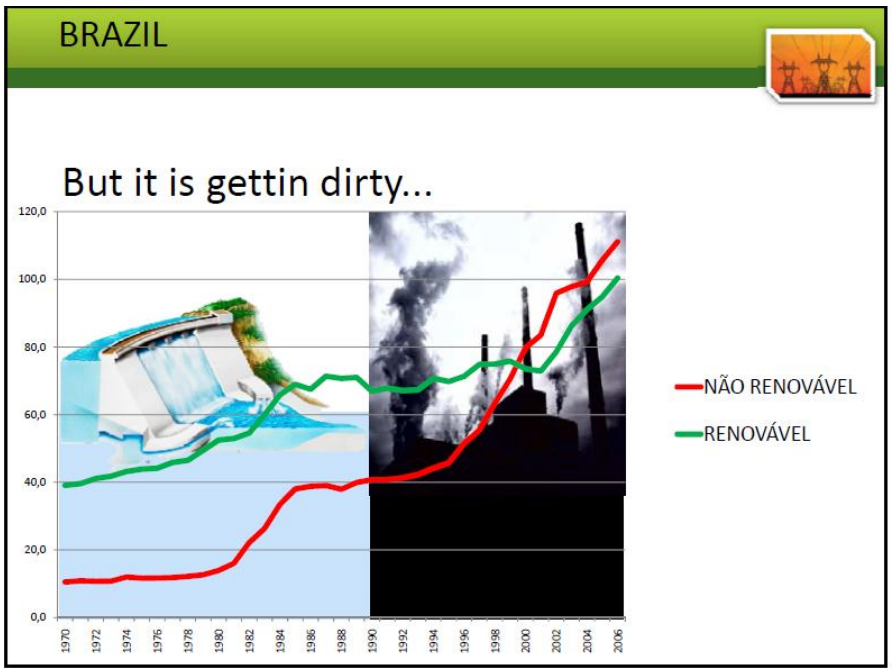
They stressed the fact that, compared to developed countries, renewable energy represents a very large share of overall energy in Brazil:



However, this share has been falling sharply since the country began its rapid development in the mid 90's:



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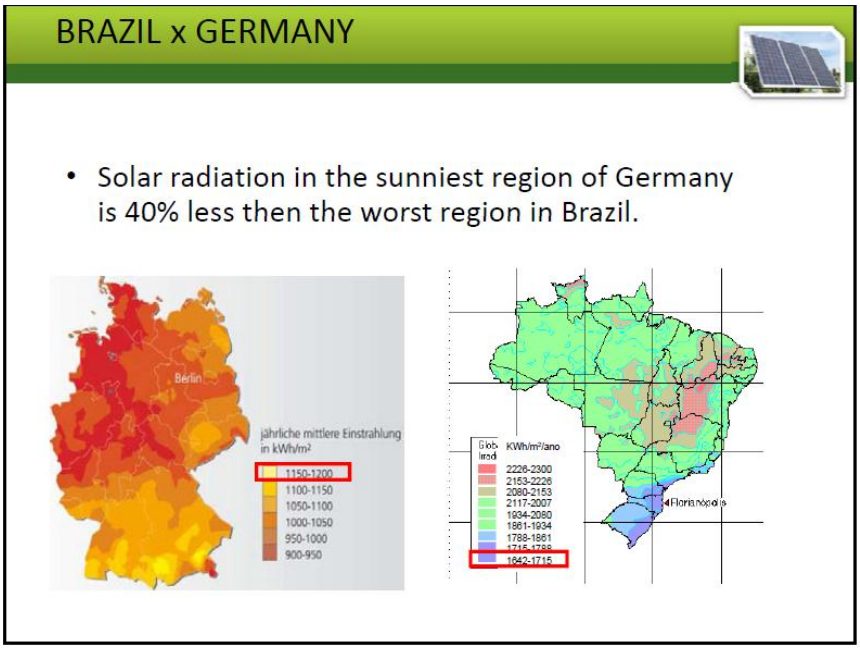
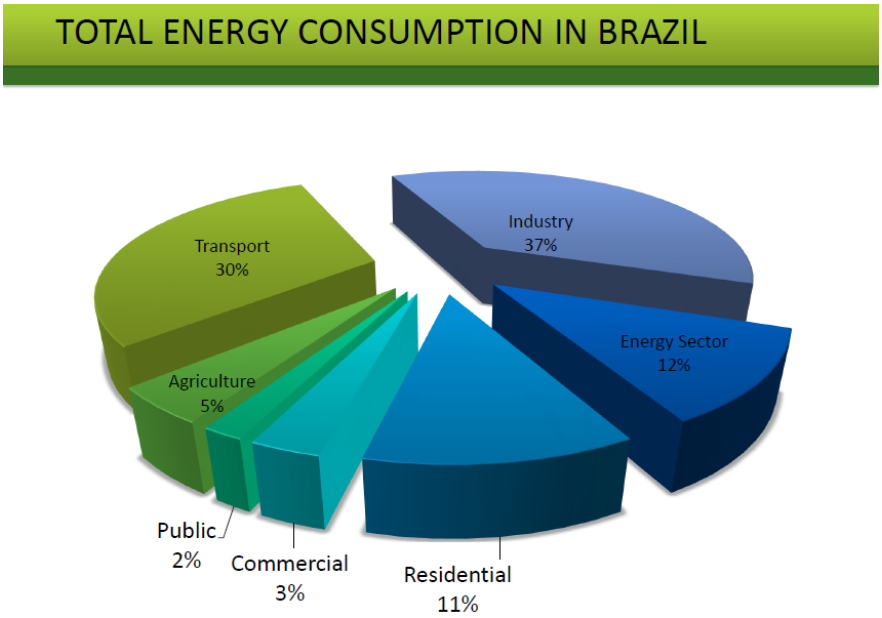
Moreover, it is paradoxal that a number of developed countries, where the possibilities are limited compared to Brazil, are actively promoting solar energy:

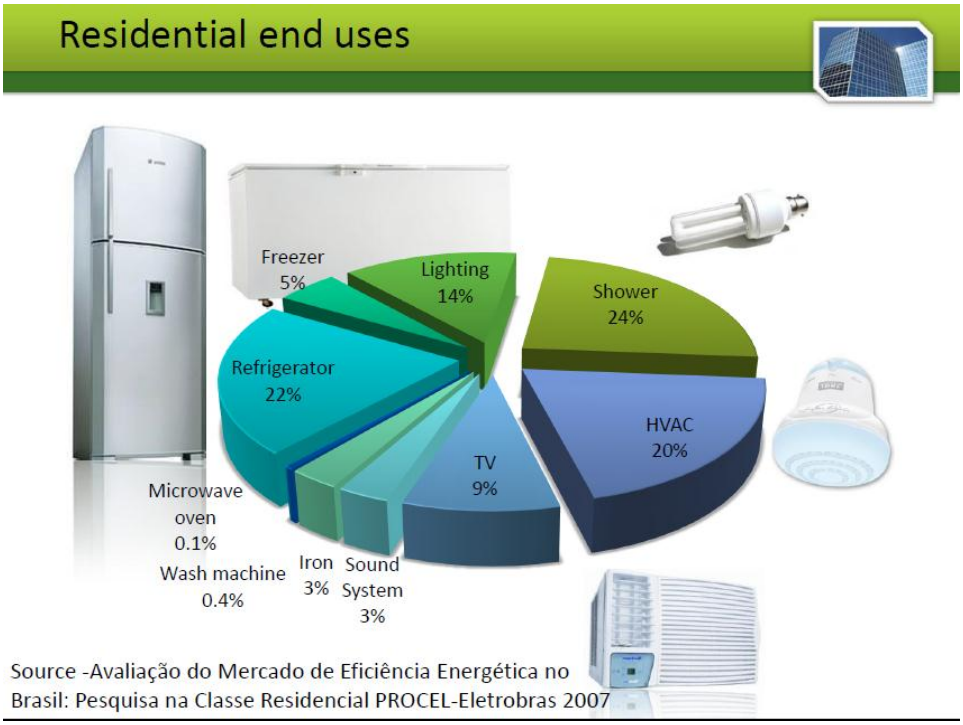


In contrast with many developed countries, buildings account for less energy consumption than transport and industry in Brazil:

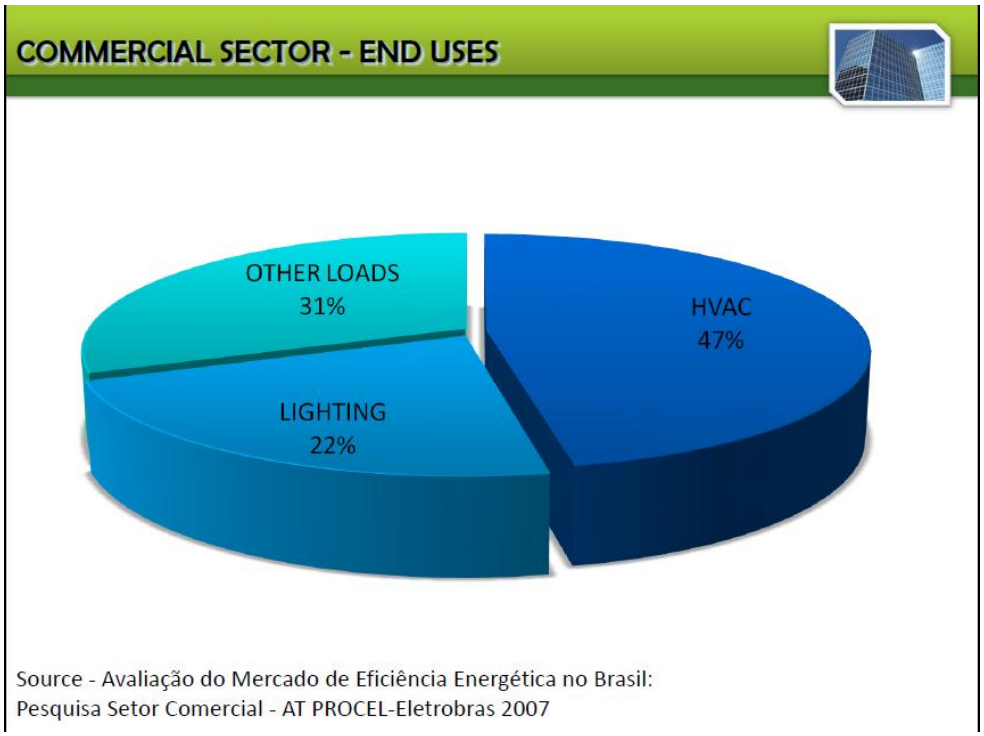


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

In the residential sector, hot water, lighting and domestic appliances use the most energy, with heating accounting for only a small share, unlike the developed countries in the north:



In the commercial sector, air conditioning and lighting are major items:



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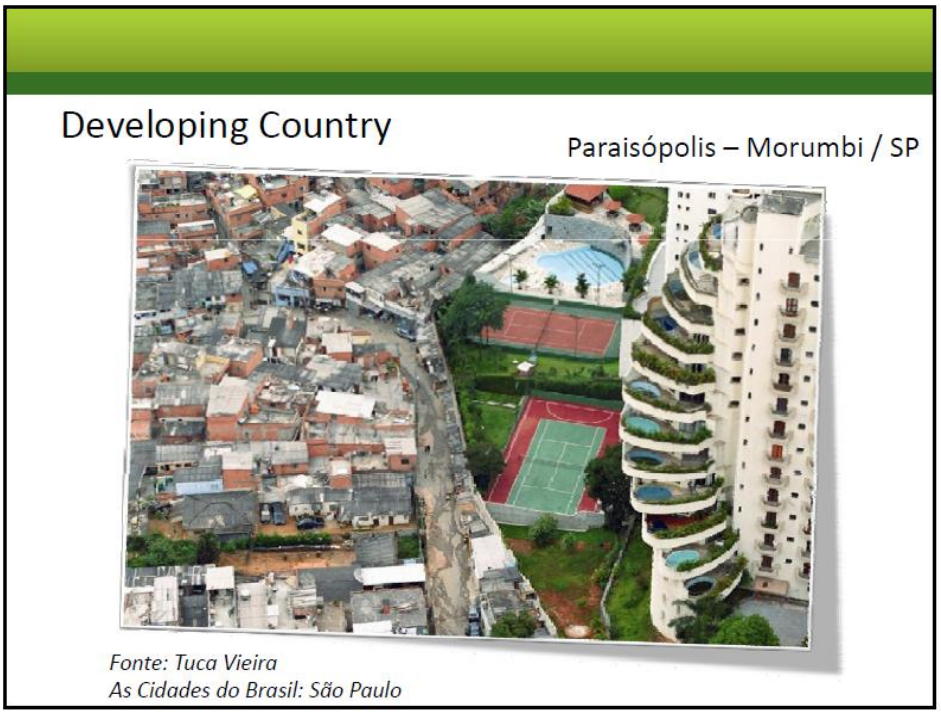
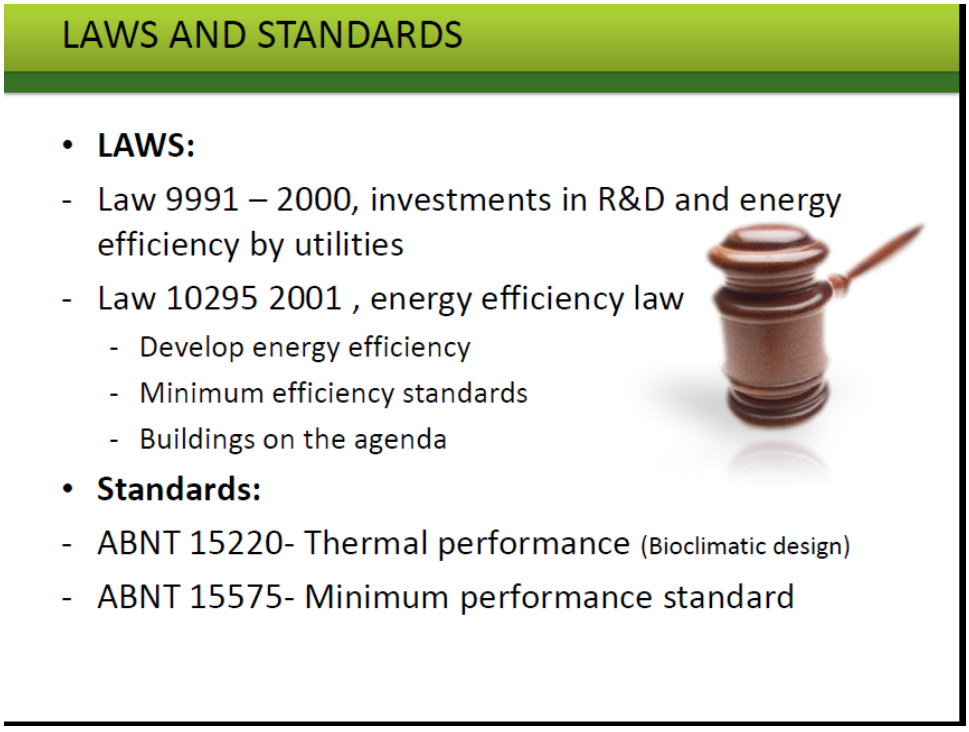
The residential sector is undergoing large-scale development. This sector is highly contrasted, with luxury housing on the one hand and informal substandard housing on the other:

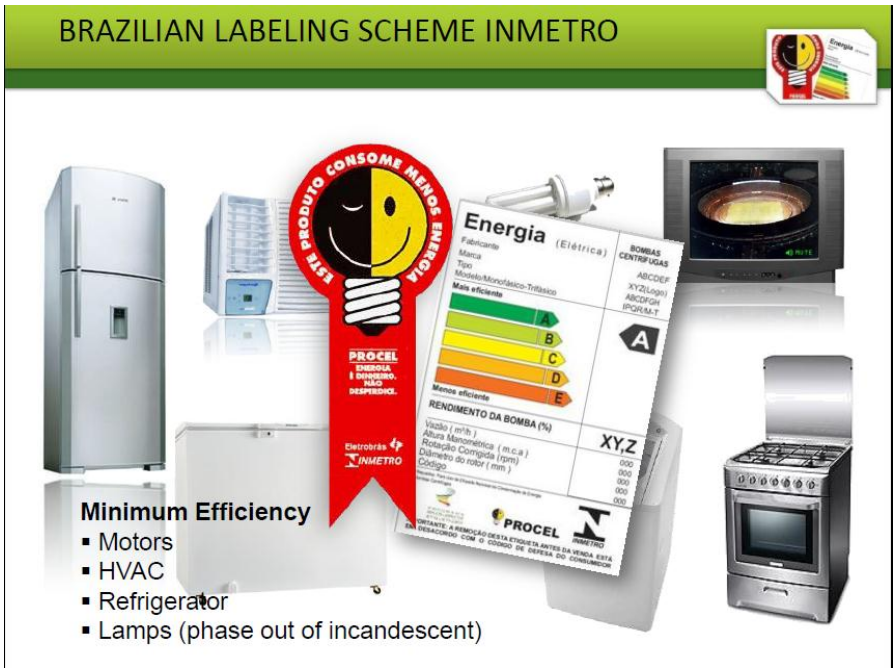


In the early 2000s, two laws set a general legislative energy efficiency framework and two standards were defined, including one for thermal performance through bioclimatic design:



CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

An energy performance labelling scheme has been designed for domestic appliances:



The country is gradually defining its energy efficiency plan. Environmental certification is being developed in the commercial sector and initiated in the residential sector.

The extent of informal construction makes it difficult to effectively implement the energy efficiency policy:

Conclusions

- Law 10295 2001 , gives the country a good framework for implementing energy efficiency
- There are standards but the enforcement is very difficult- Informal market
- Energy efficiency is part of the national energy planning now
- The national energy efficiency plan is being finalised
- Labels for commercial building are being used (voluntary) but we still have a long way to make them compulsory
- Labels for residential buildings are being implemented this year (voluntary)

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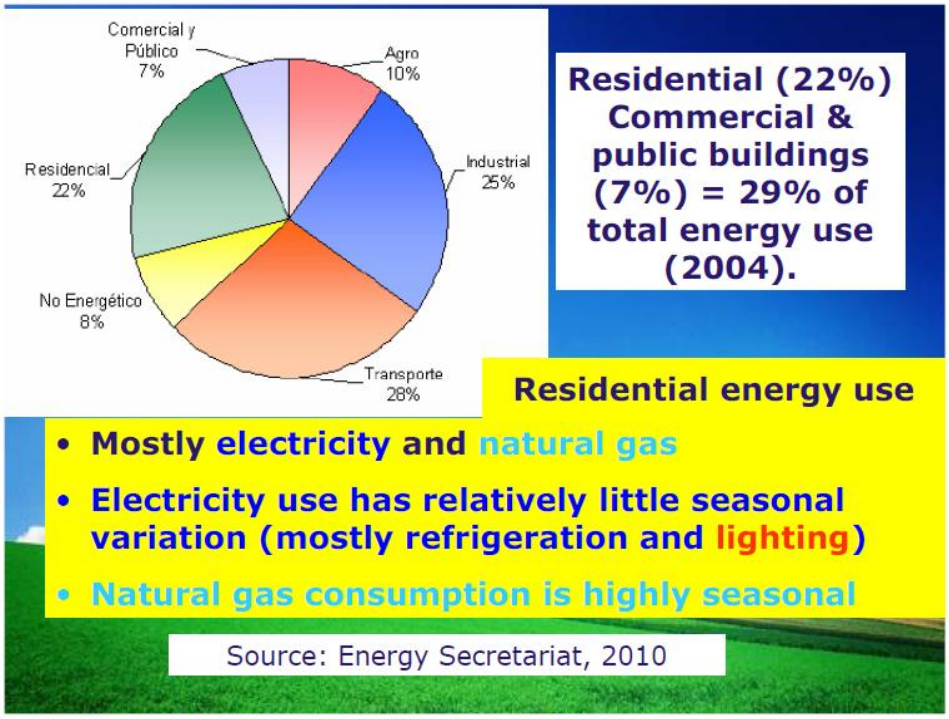
In Argentina, Gautam Dutt, an expert with MGM Innova[75], pointed out that buildings use as much energy as transport and more than industry:

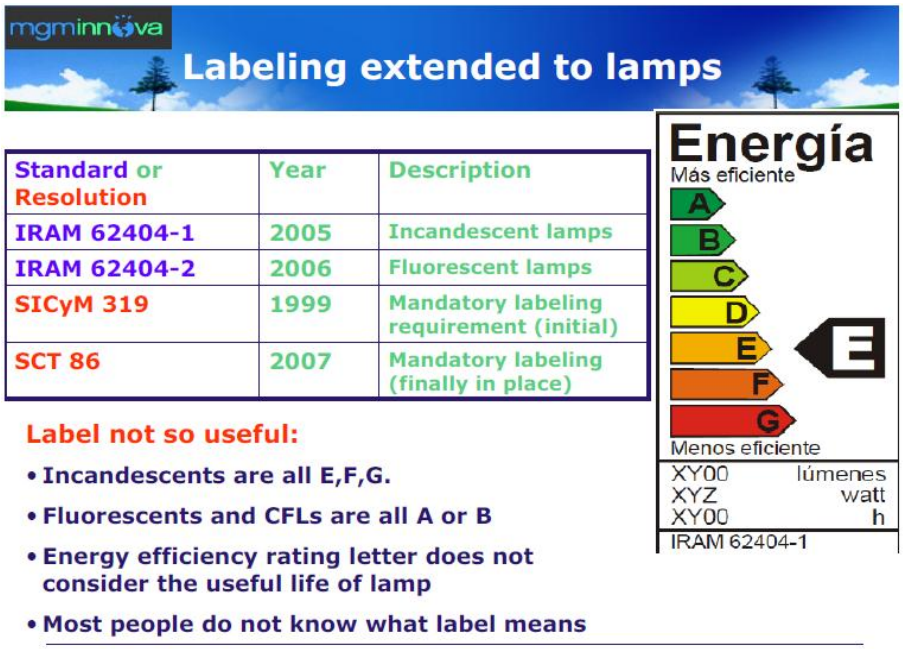


Domestic appliances, such as refrigerators, are gradually being equipped with energy performance labels:

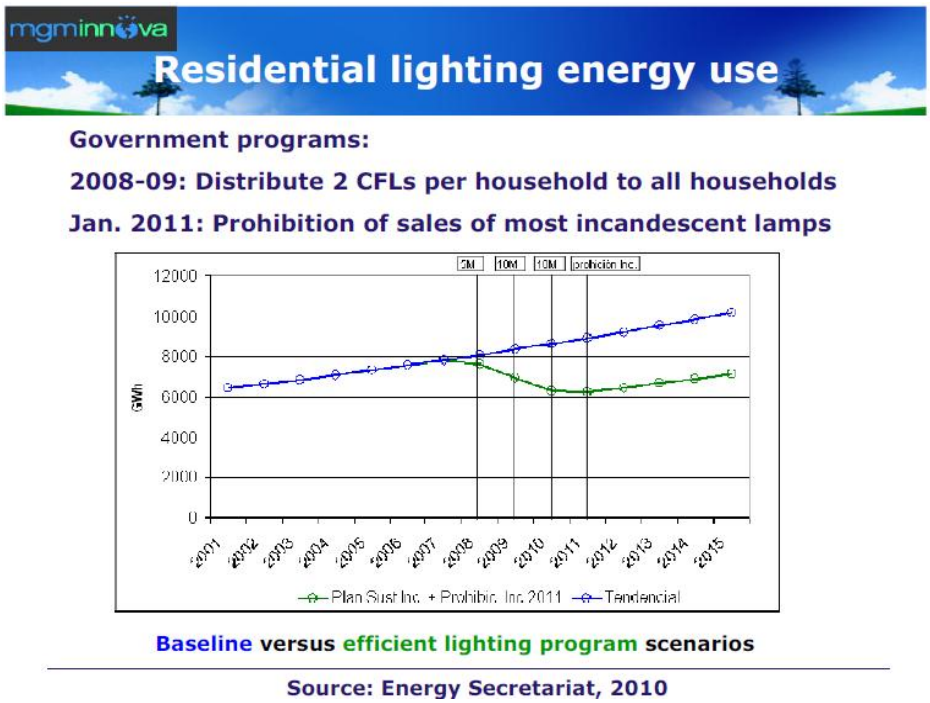
Standard or Resolution	Year	Description
IRAM 2404-1	1997	Measurement of energy consumption
IRAM 2404-2	2000	Measurement of noise
IRAM 2404-3	1998	Label design
SICyM 319	1999	Mandatory labeling requirement (initial)
SCT 35	2005	Mandatory labeling (finally in place)

[75] cf Appendix 4, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-south-america-webinar-2010-11-04-2-gautam-dutt-temporary-file

…and light bulbs:



Incandescent lamps are prohibited and compact fluorescent lamps distributed to the general population:



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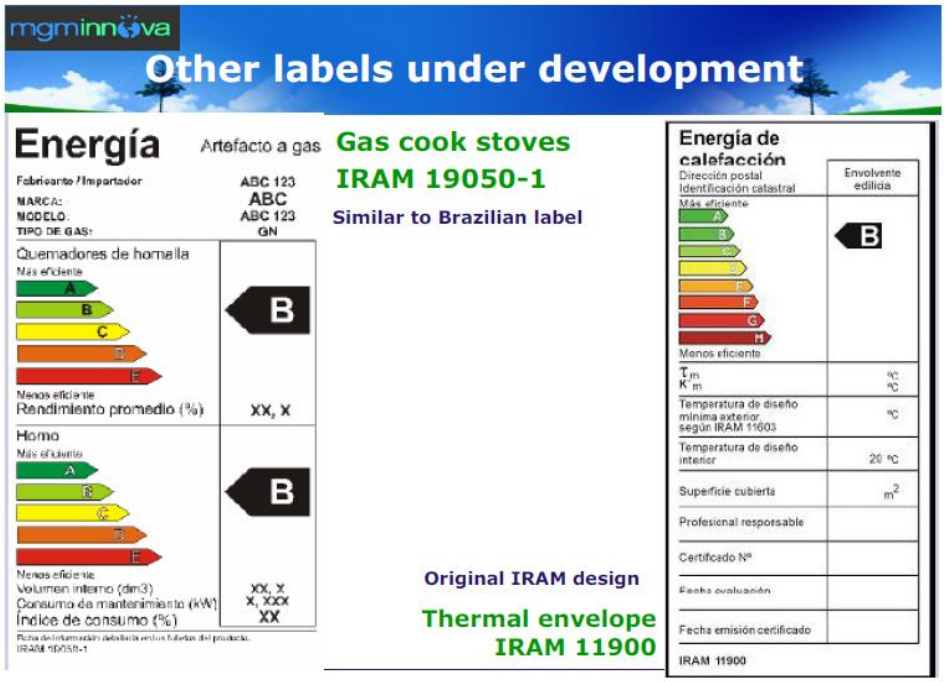
An energy performance label is being developed for the thermal envelope of buildings:



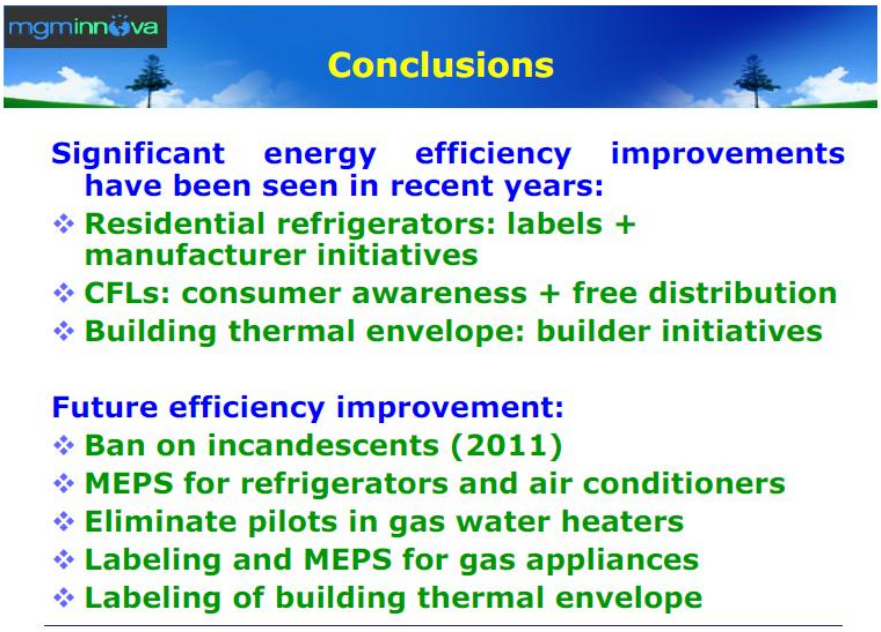
The on-going action plan has been defined:

National Program for the Rational and Efficient Use of Energy

Key elements (for building energy efficiency)

- **Replace incandescent lamps by CFLs**
- **Develop Minimum Efficiency Performance Standards (MEPS) for major end uses**
- **Education**
- **Energy efficiency in public buildings**

The action plan concerns primarily energy use in buildings:

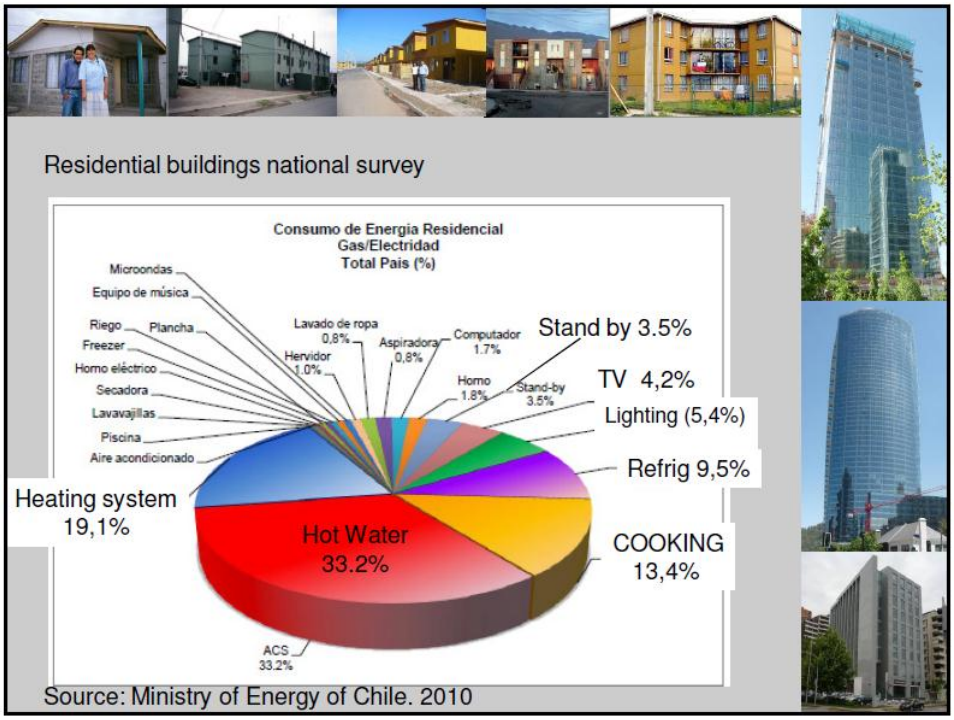


In Chile, Waldo Bustamante, professor at the School of Architecture of the Catholic University of Chile[76], indicated that buildings account for less energy consumption than transport or industry:

[76] cf Appendix 4, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-la-2010-1104-5-waldo-bustamante

CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

In the residential sector, hot water and cooking account for almost half of energy consumption, heating for under 20%, and domestic appliances and lighting for a little over one third:



The first thermal regulation was introduced in 2000. It concerned only loft insulation. The 2007 regulation concerns the walls, floors and windows, with the country divided up into 7 thermal areas:

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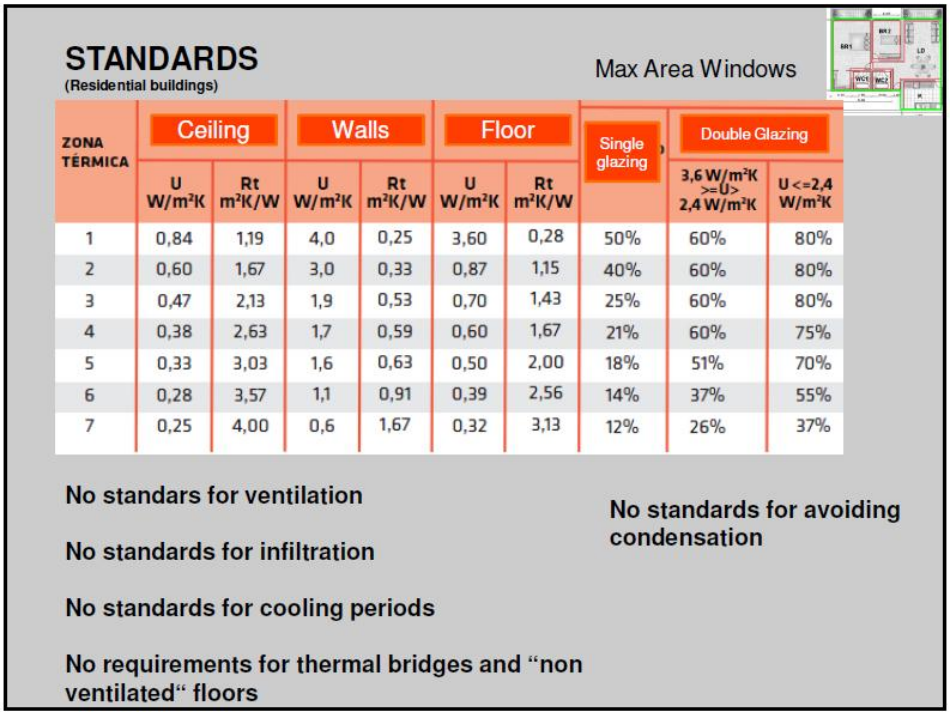

STANDARDS
(Residential buildings)

Max Area Windows

ZONA TÉRMICA	Ceiling		Walls		Floor		Single glazing	Double Glazing	
	U W/m²K	Rt m²K/W	U W/m²K	Rt m²K/W	U W/m²K	Rt m²K/W		3,6 W/m²K >=U> 2,4 W/m²K	U <=2,4 W/m²K
1	0,84	1,19	4,0	0,25	3,60	0,28	50%	60%	80%
2	0,60	1,67	3,0	0,33	0,87	1,15	40%	60%	80%
3	0,47	2,13	1,9	0,53	0,70	1,43	25%	60%	80%
4	0,38	2,63	1,7	0,59	0,60	1,67	21%	60%	75%
5	0,33	3,03	1,6	0,63	0,50	2,00	18%	51%	70%
6	0,28	3,57	1,1	0,91	0,39	2,56	14%	37%	55%
7	0,25	4,00	0,6	1,67	0,32	3,13	12%	26%	37%

No standars for ventilation

No standards for infiltration

No standards for cooling periods

No requirements for thermal bridges and "non ventilated" floors

No standards for avoiding condensation

The heating demand defined by the regulation ranges from 21 to 185 KWh/m²/year depending on the geographical area:

City	Thermal Zone	Máx U Wall W/m2 K	Máx U Ceiling W/m2 K	Minimum Heating Demand kWh/m2 year
Iquique	1	4,0	0,84	21
Calama	2	3,0	0,60	123
Copiapó	2	3,0	0,60	59
Valparaíso	2	3,0	0,60	80
Santiago	3	1,9	0,47	100
Concepción	4	1,7	0,38	115
Temuco	5	1,6	0,33	131
P. Arenas	7	0,6	0,25	185

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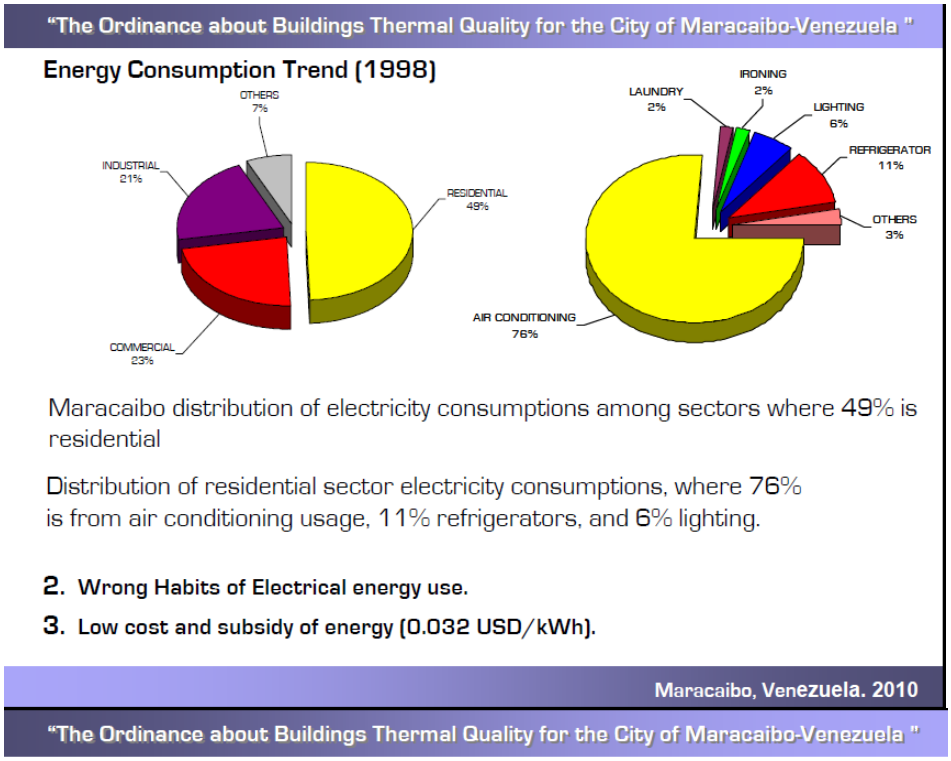
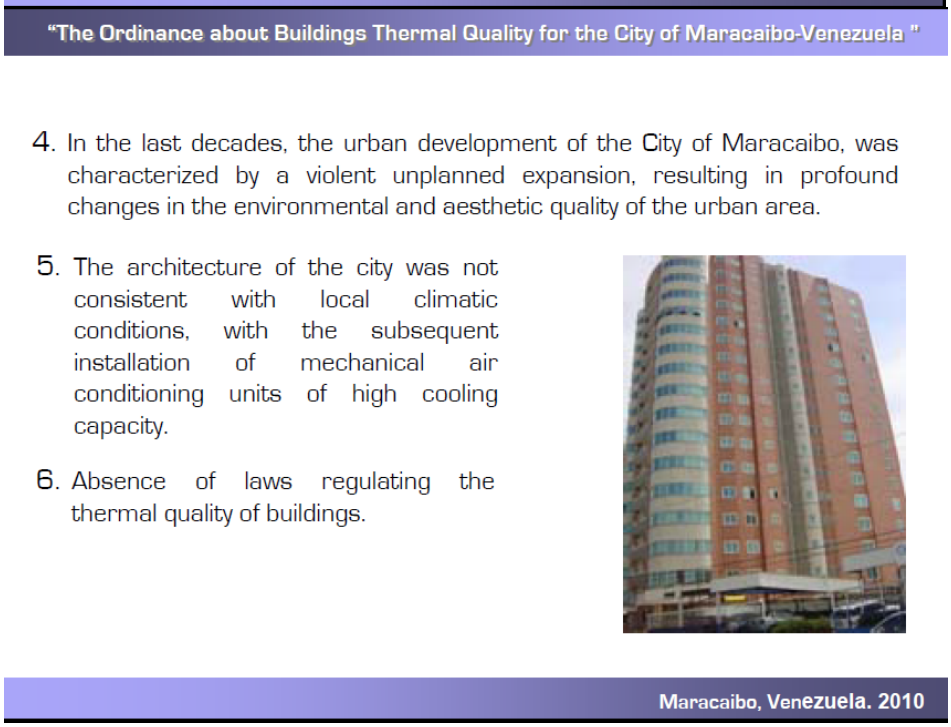
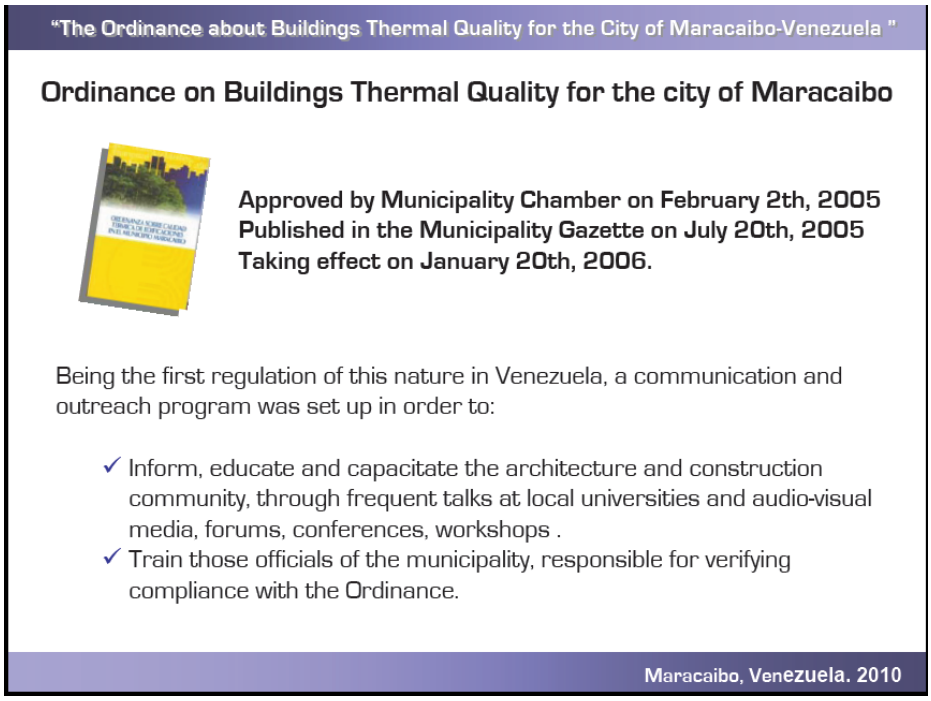
Nastia Almao, emeritus professor at the University of Zulia (Venezuela), gave a presentation on the ordinance related to the thermal quality of buildings for the city of Maracaibo[77]. Urban development has gone ahead uncontrolled in this city and accounts for three quarters of total energy consumption, with a large share used for air conditioning in the residential sector :



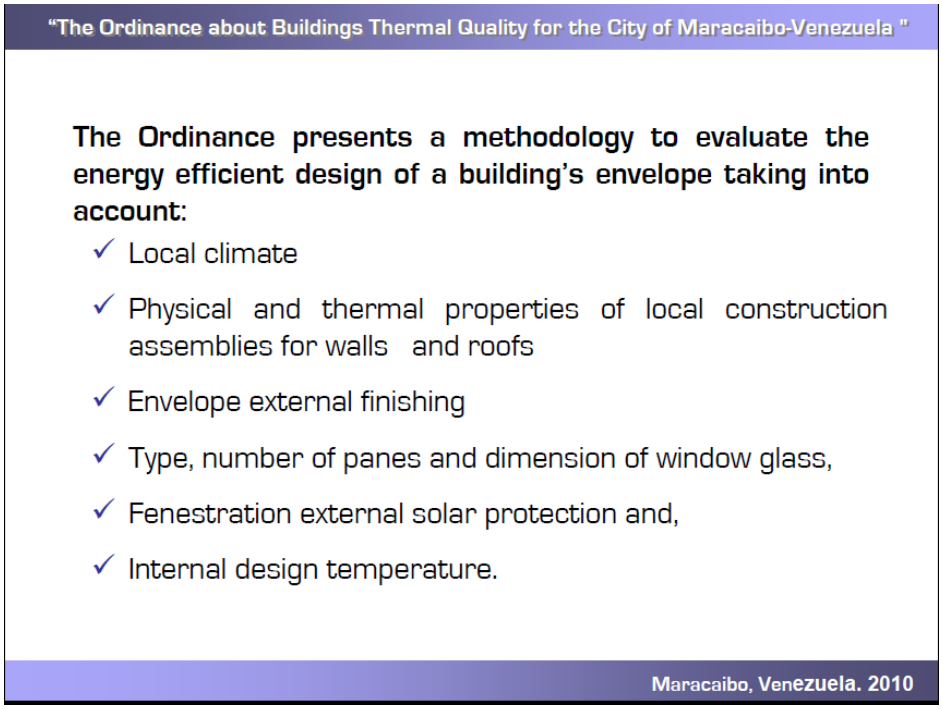


[77] Cf Appendix 4, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-la-2010-1104-1-nastia-almao

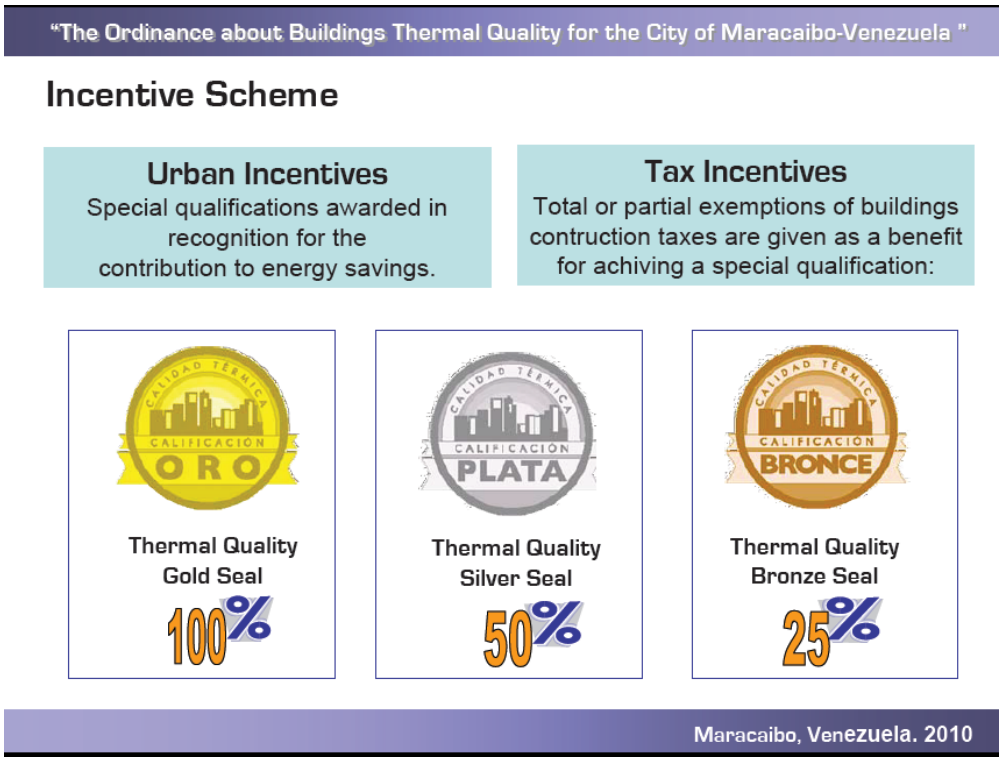
The Maracaibo ordinance is the first regulation of its kind in the country:

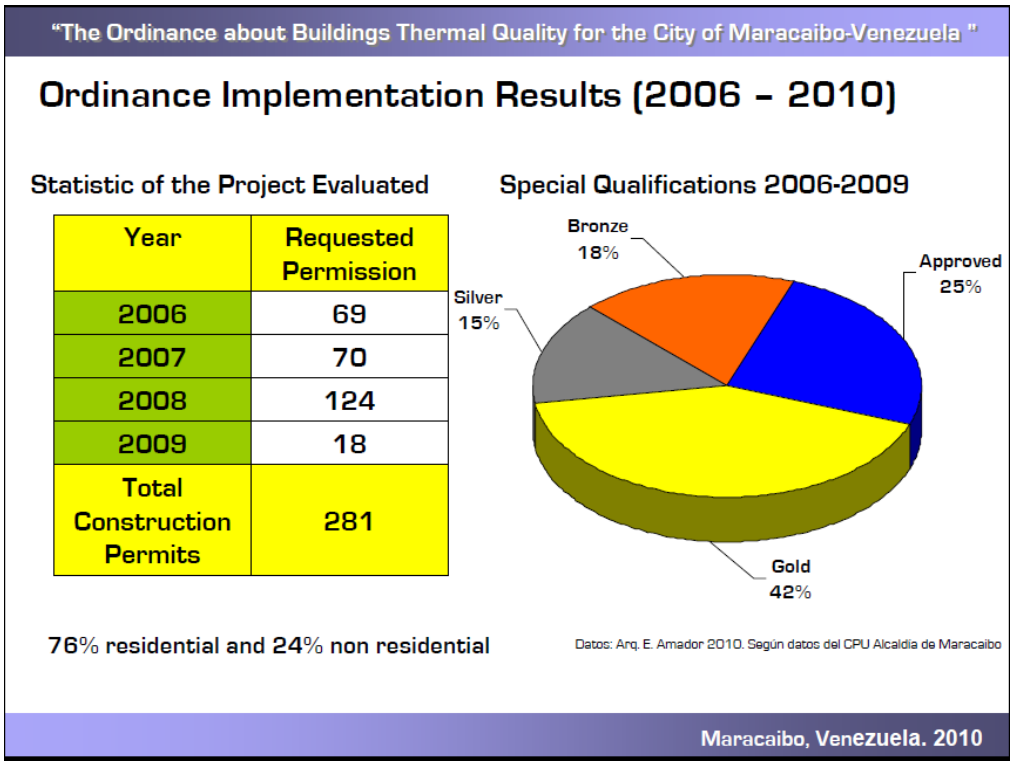


The ordinance defines a method of evaluation of the energy efficiency of building envelopes:



It sets out an incentive system for different levels of thermal quality:





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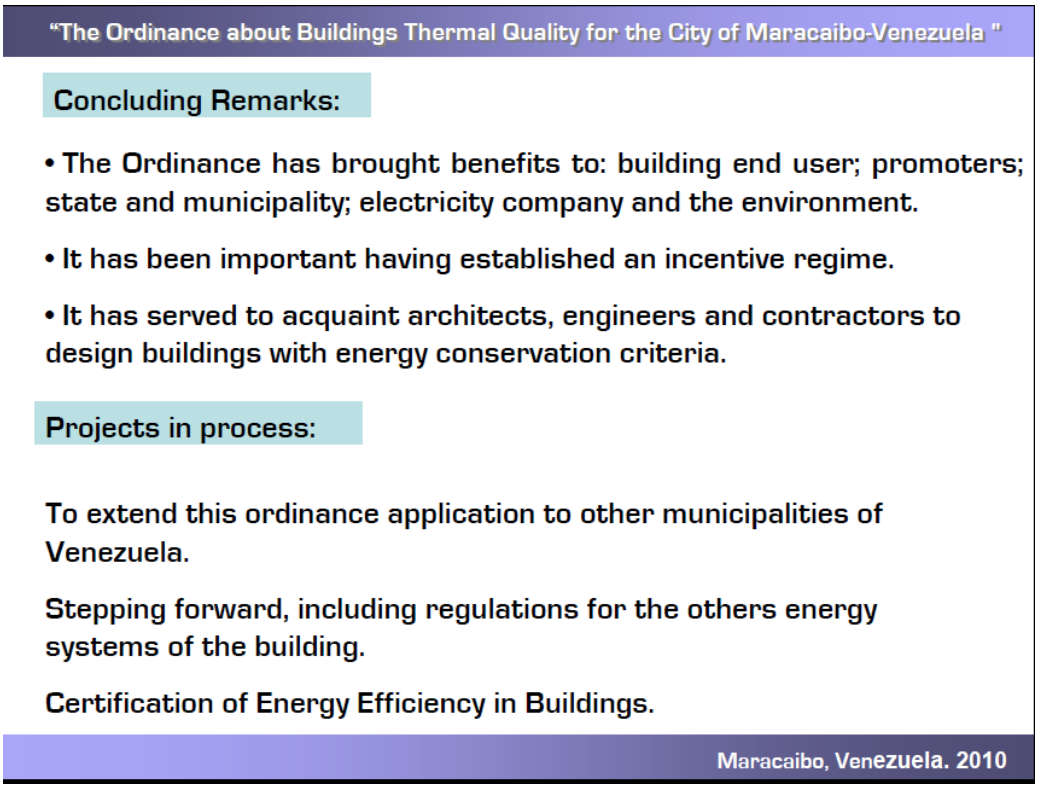
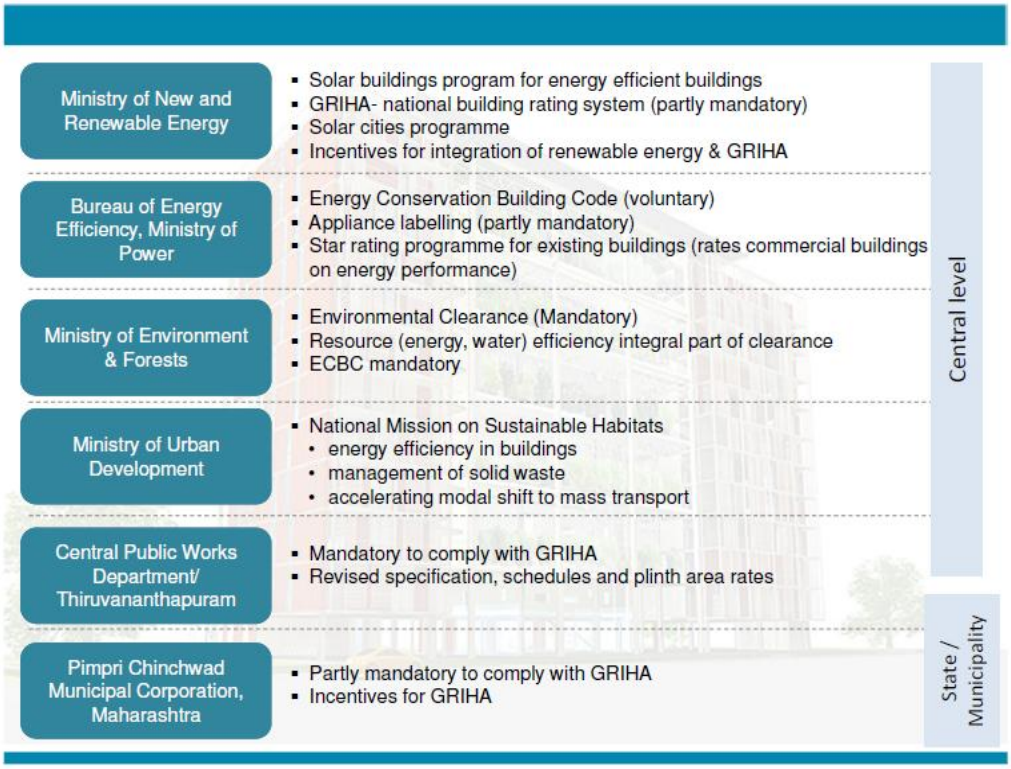
The ordinance and its implementation pave the way for the development of energy efficient buildings in the country:



9. ELEMENTS ON INDIA, CHINA AND SOUTH AFRICA

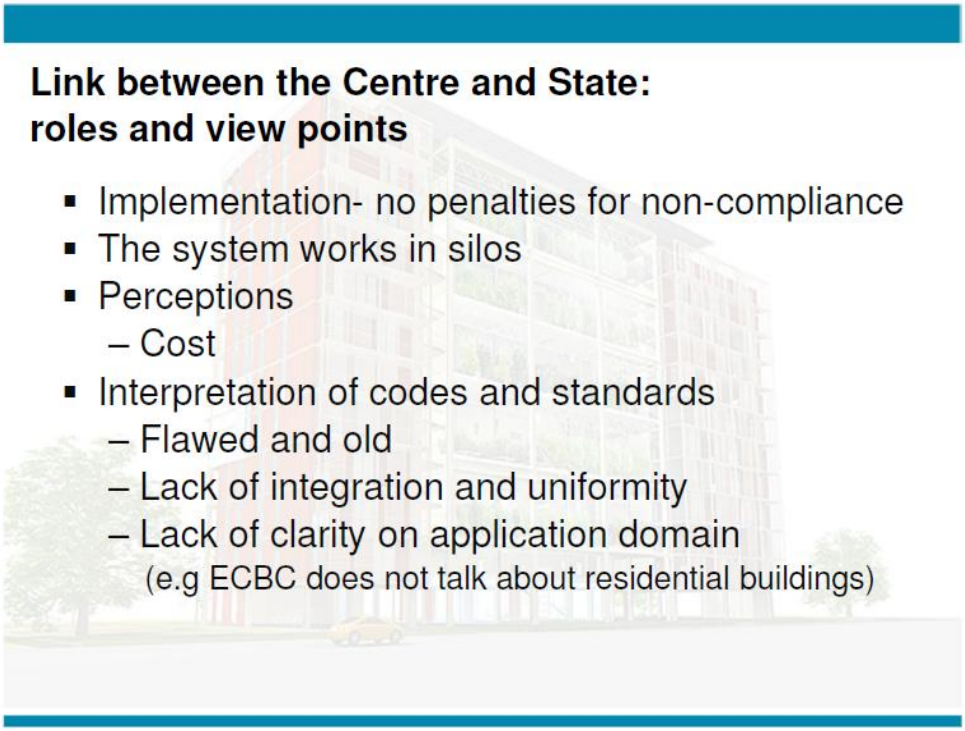
9.1 India

Priyanka Kochhar, Sustainable Habitats Division, The Energy and Resources Institute, New Delhi[78] presented the experience of India.
No less than five ministries are involved in the energy efficient buildings policy and, in addition, policies are also defined by the different states and municipalities:

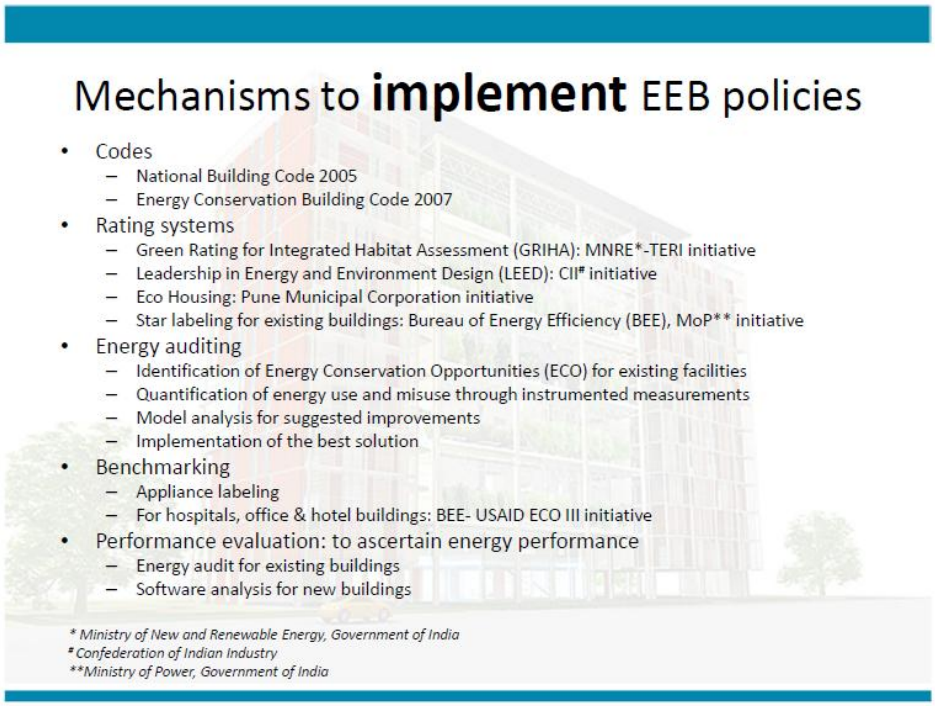


[78] Cf Appendix 5, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-india-webinar-20120628-priyanka-kochhar-energy-efficiency-in-buildings
Priyanka Kochbar is the author of a report on sustainable buildings in India, published in 2010 under the auspices of the UNEP-SBCI: « The State of Play in Sustainable Buildings in India ». Access to the report : http://www.unep.org/sbci/pdfs/State_of_play_India.pdf

There is a strong need for convergence, particularly between central administration and the states:



The mechanisms for the implementation of energy efficient buildings policies concern five aspects:



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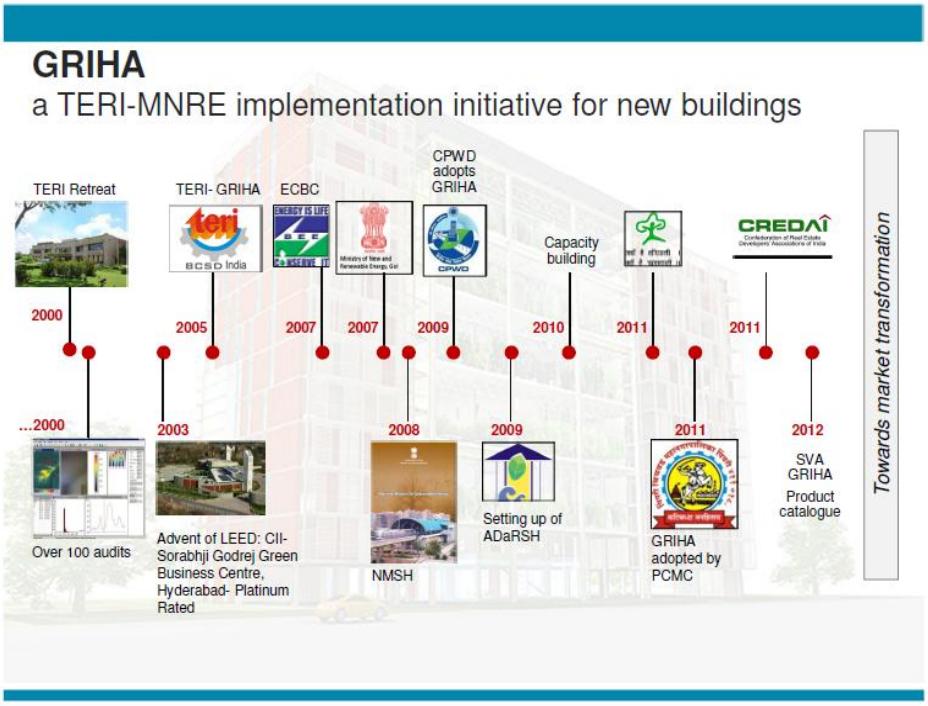
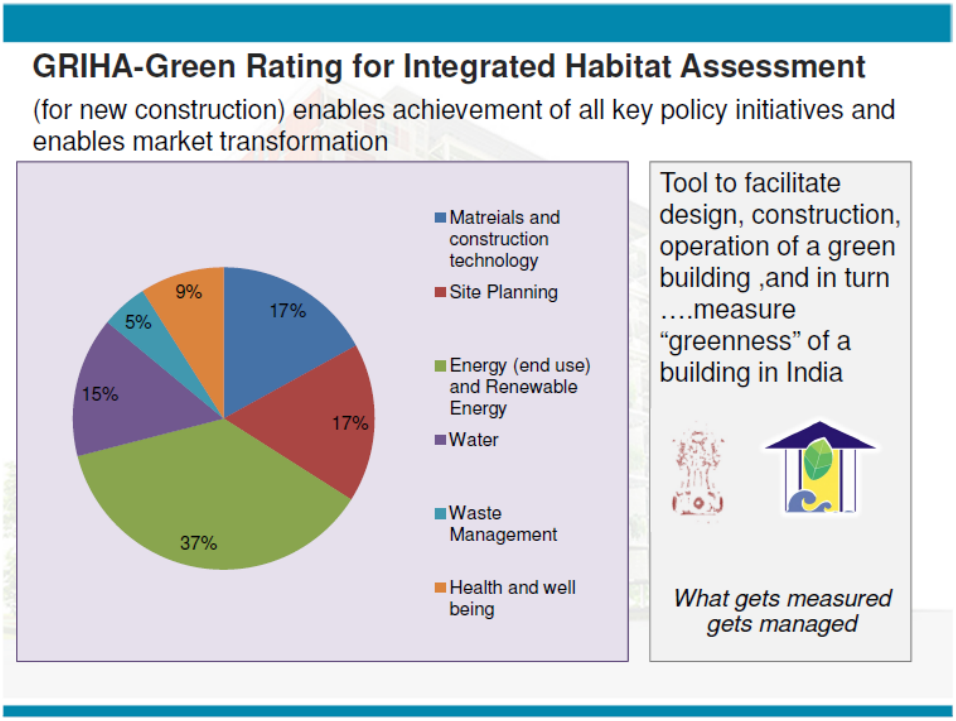
The Green Rating for Integrated Habitat Assessment (GRIHA) is the result of a process initiated in the year 2000:

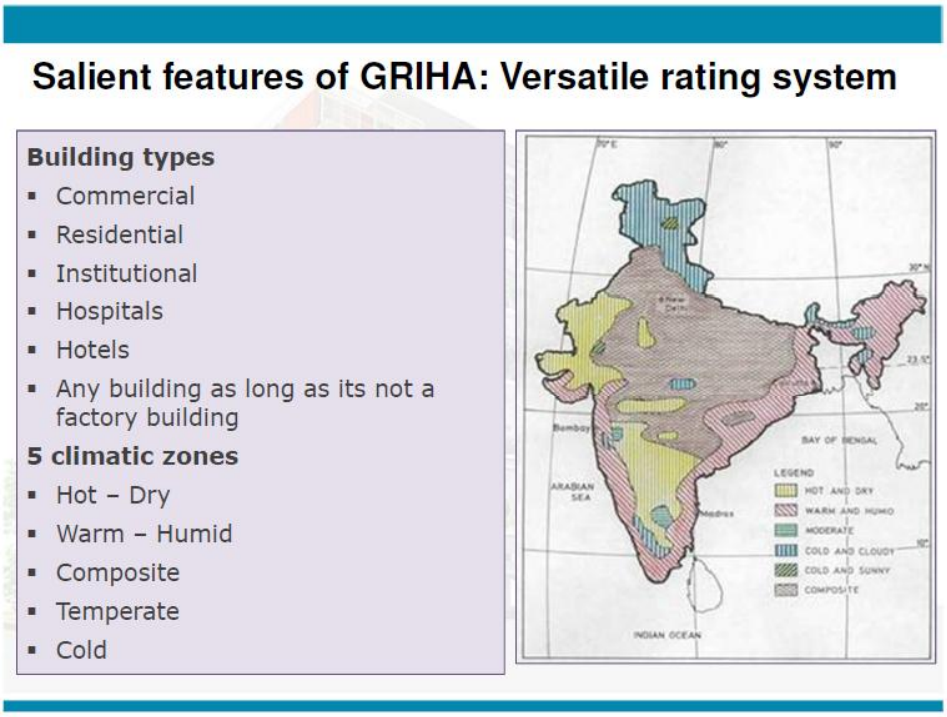


GRIHA, the use of which can be compulsory, enables the assessment of the environmental quality of buildings in six areas:

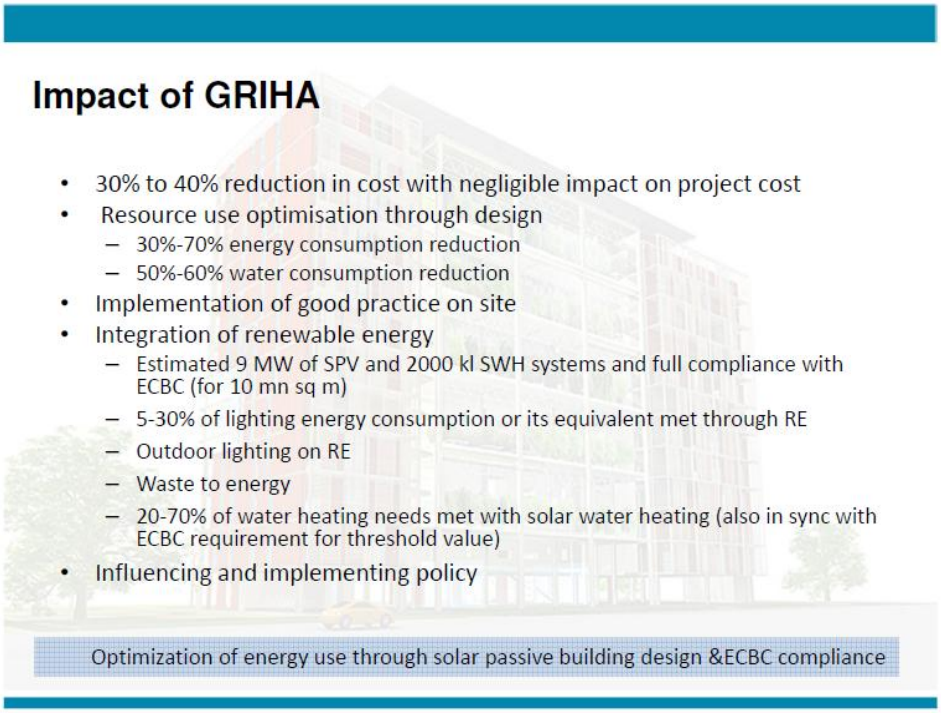


CIB – CSTB Carnot Institute. *The implementation of energy efficient buildings policies: an international comparison. CIB Task Group 66 « Energy and the Built Environment » - Review of activities 2009-2012.* Final report. English version. Jean Carassus. August 2013.

The device is adapted to the different building types and to the country's five, predominantly warm, climate zones:



GRIHA has a wide-ranging impact:



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…with what can be a negligible incremental cost:

At the same time, the Indian Green Building Council (IGBC) has developed variants of the American LEED® certification, on a voluntary basis, with significant results:

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Mahua Mukherjee, Assistant Professor, Department of Architecture & Planning, Indian Institute of Technology, Roorkee, pointed out the strong pressure from growth in India[79].

INDIA: Growth Pressure

- Economy growing at ~8 % pa
- Population of 1.22 billion+
- Urban Housing deficit of 23 million
- 40 million rural Housing units deficit
- Increased migration to urban areas
- Climate refugees - Climate change induced post disaster reconstruction

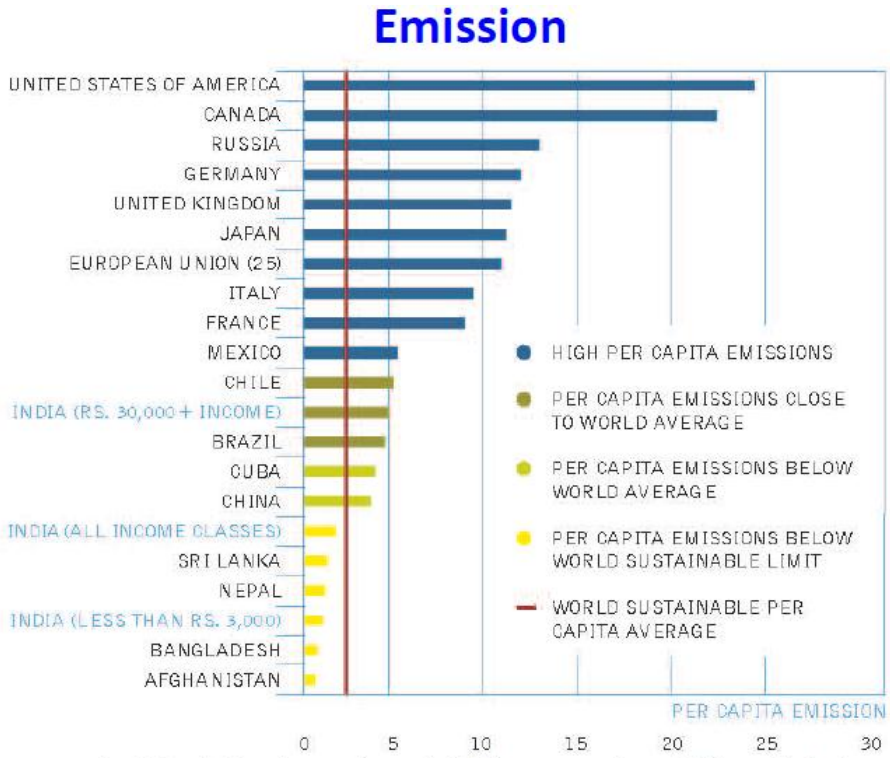
3. Census Data of India, 2011; Government of India

INDIA: Growth Drivers

- Fast urbanization
- Increased migration
- Younger population
- Population growth
- Increased aspirations

[79] Cf Appendix 5, access to the presentation : http://fr.slideshare.net/INIVE/cib-tg66-india-webinar-20120628-mahua-mukherjee-beyond-the-building

Greenhouse gas emissions per capita are much lower than in developed countries but they vary tremendously within India depending on the income bracket. While emissions are similar to those of Sri Lanka on average, the emissions of high-income households are similar to those of Chile and those of the poorest households to the emissions of Bangladesh:



Average per capita CO2 emissions (tonnes/annum) of different countries and different Indian income classes;
Source: [2] Hiding behind the poor - A report by Greenpeace on Climate injustice, 2007

There are marked contrasts:

India's Emission Pattern

The urban top 10% accounts for emissions of 3416 kg of CO_2 per year

The rural bottom 10% class accounts for only 141 kg of CO_2 per year.

10. CO2 emissions structure of Indian economy, Parikh J et al., Energy (2009), doi:10.1016/j.energy.2009.02.014

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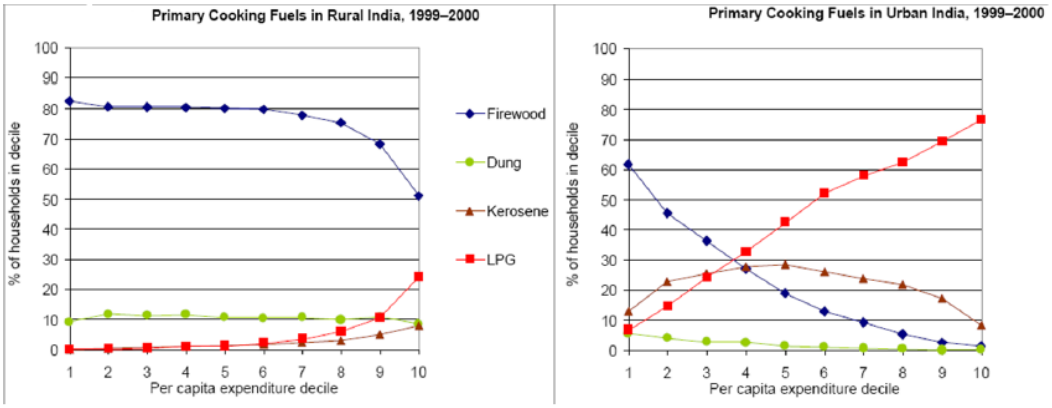
…which are evident when comparing cooking habits in urban and rural areas:

India's Energy Consumption Pattern



9. Access of the Poor to Clean Household Fuels in India: Household Energy Use Patterns; Joint United Nations Development Programme (UNDP)/ World Bank Energy Sector Management Assistance Programme (ESMAP)

India combines climate change adaptation and mitigation policies:

3. Adaptation or Mitigation for India

India would preferably opt for a mix of two strategies which the **local economy and people can sustainably afford**.

Integrated policies like **Coastal Zonal Management** and mangrove forest regeneration, **sustainable livelihoods** through revival of marine ecosystems , construction of dykes and dams, solid waste and water resource management, **disaster mitigation and management planning and implementation** etc. are well-established **mitigation strategies**.

Urban planning for changed scenario, green technology, **sustainable brackets**, renewable solar energy generation to satisfy increasing demand, etc. are few potential **adaptation strategies**.

8. Adaptive Planning approach for the Caribbean Islands' Habitat; *M. Mukherjee*, International Conference on Responding to Climate Change in the Caribbean , London University, 2011

Mahua Mukherjee stressed the importance and advantages of sustainable development at district-level, over and above the necessary action on buildings themselves:

Surrounding Open Area

Beyond the buildings' envelopes in urban area

can positively contributes to:

- physical and psychological health
- social cohesion
- climate change mitigation
- pollution abatement
- biodiversity conservation
- provisioning of the ecosystem goods and service to urban inhabitants

Government organisations are implementing sustainable urban planning initiatives:

Initiatives in India

Government Organisations:

- **Building byelaws with development controls over open spaces**
- **Investing in experimental studies to mitigate Urban Heat Island Effects & other environmental impact**
- **Developing knowledge-base on appropriate construction Materials**

as are local governments:

Initiatives in India

Local Governments:

- **In Indore,** an initiative to **reuse natural channels for drainage** not only brought changes in water logging scenario, also improved vulnerable slum dwellers' condition.
- **In Kolkata, East Kolkata waste land is an exemplary conservation attempt for natural sewage treatment**
- Cities like **Delhi, Pune, Hyderabad, Bangalore** are implementing **Rainwater harvesting system** with increasing awareness about **permeability issue/ surface transformation**

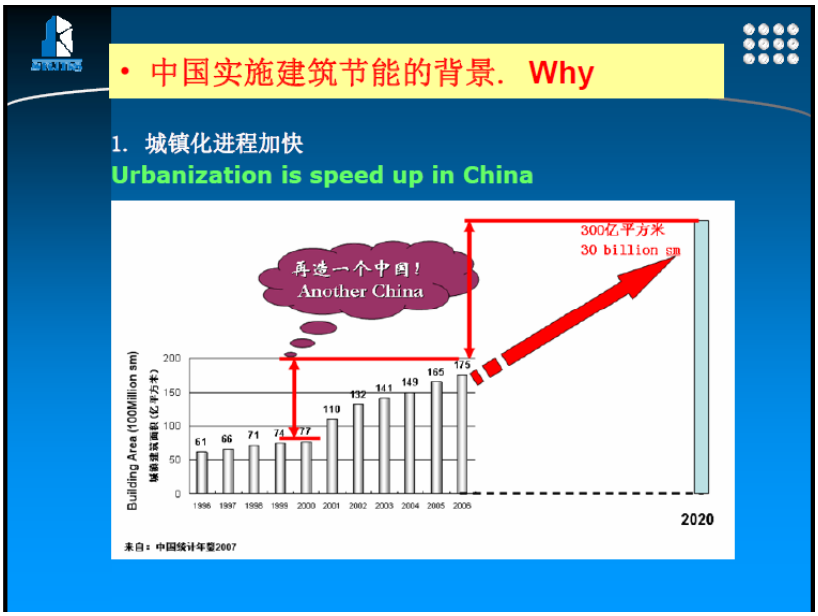
… and the private sector:

Initiatives in India

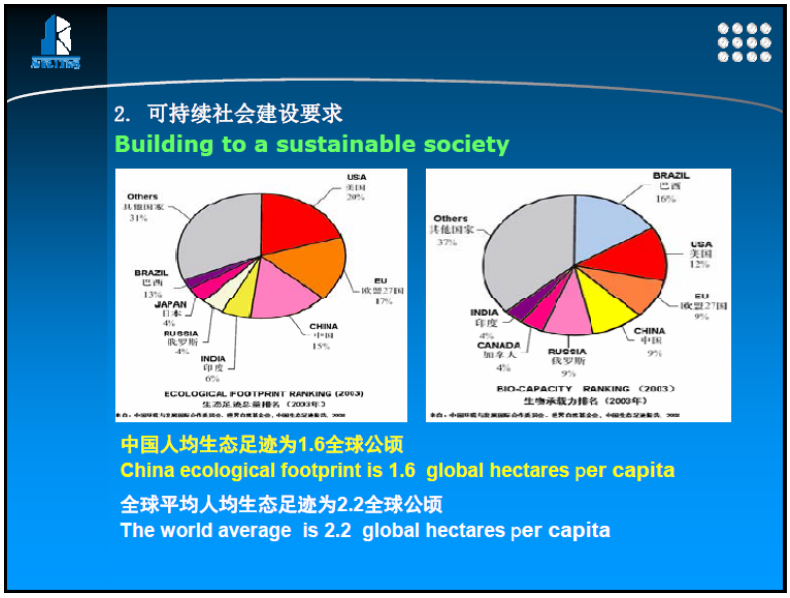
- Corporate Houses:
  - **SAP Labs-** Bangalore, while renovating, **commissioned Ornithologists** instead of **Landscape Architects** to get back the birds within the campuses
  - **TCS Bangalore promoted 'Urban Forestry' among common citizens in June 2011**
  - **Retrofitting** offices in **Mumbai & Delhi** with prior importance to **surroundings**

9.2 China

Professor Wang Wei, Shanghai Research Institute of Building Sciences (SRIBS) and Professor Fang Dongping, Tsinghua University, Beijing[80], indicated that building stock in China will rise from 20 billion m2 today to 30 billion m2 by 2020[81] :



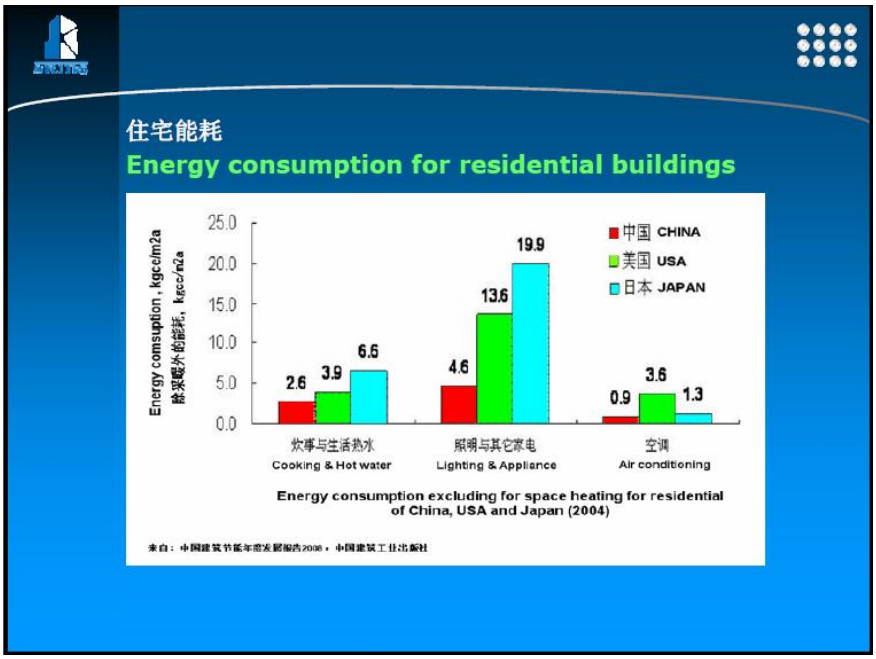
For the time being, the ecological footprint per capita in China is considerably lower than the global average:



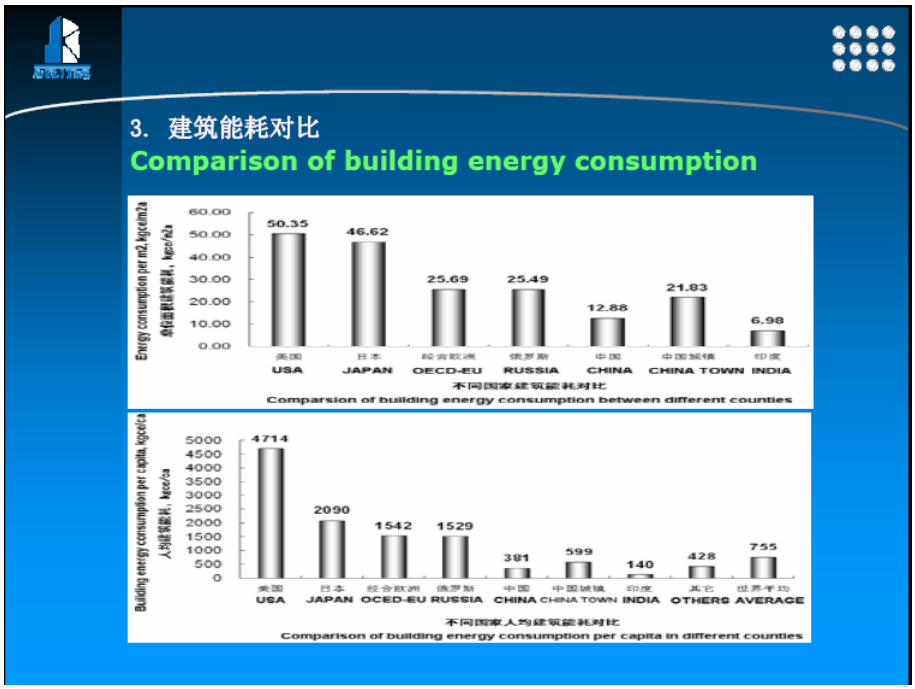
[80] Cf Appendix 1, access to the presentation :
http://www.cstc.be/homepage/download.cfm?dtype=services&doc=11_Fang_CIB.pdf&lang=en

[81] In good years, China builds the equivalent of half the French building stock in one year (representing approximately 3.5 billion m²).

The standard of comfort is significantly lower than in developed countries:



However, energy consumption per m² in urban China is close to the European Union average:



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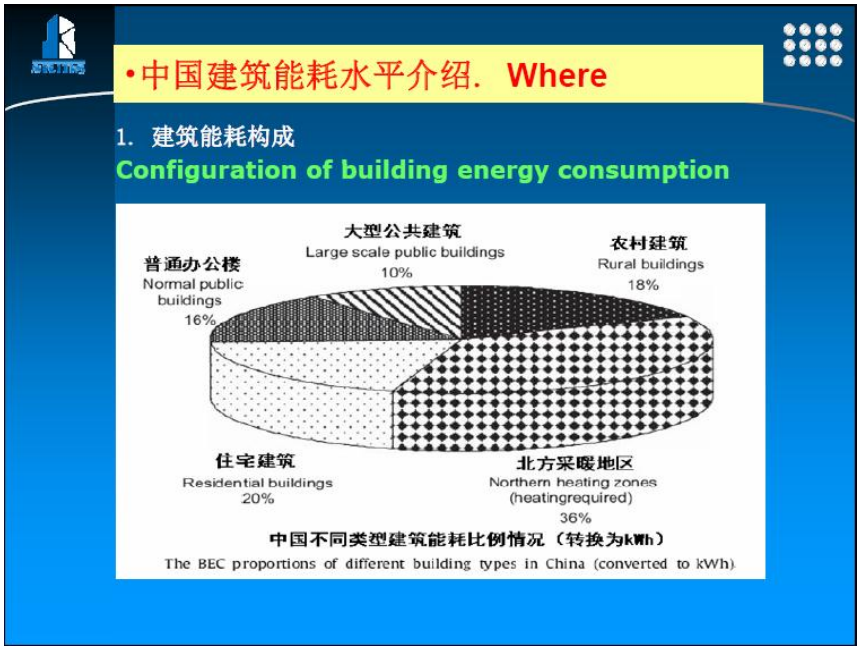
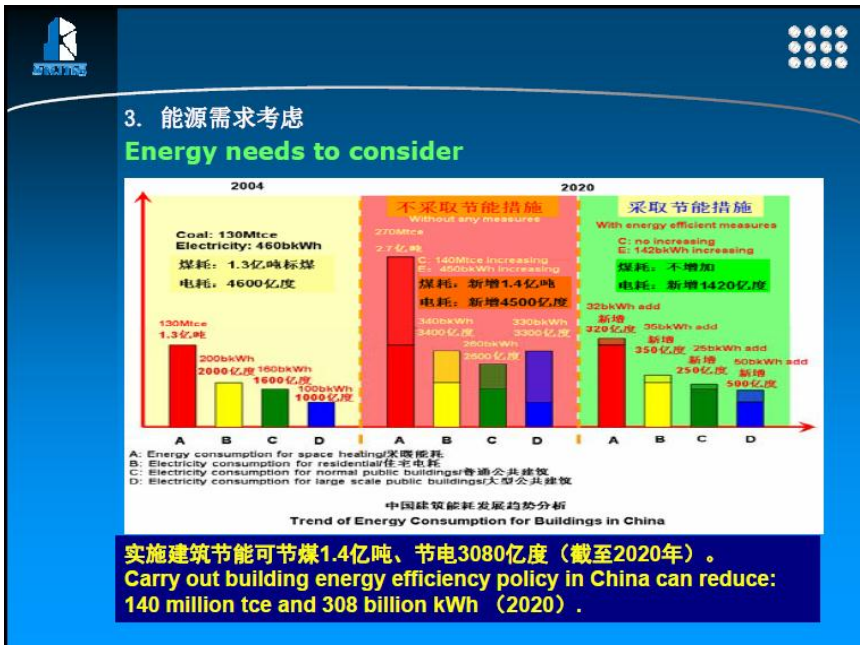
Buildings in the cold northern climate account for a large share of energy consumption:



In the absence of an energy efficiency policy, energy consumption in buildings would explode:



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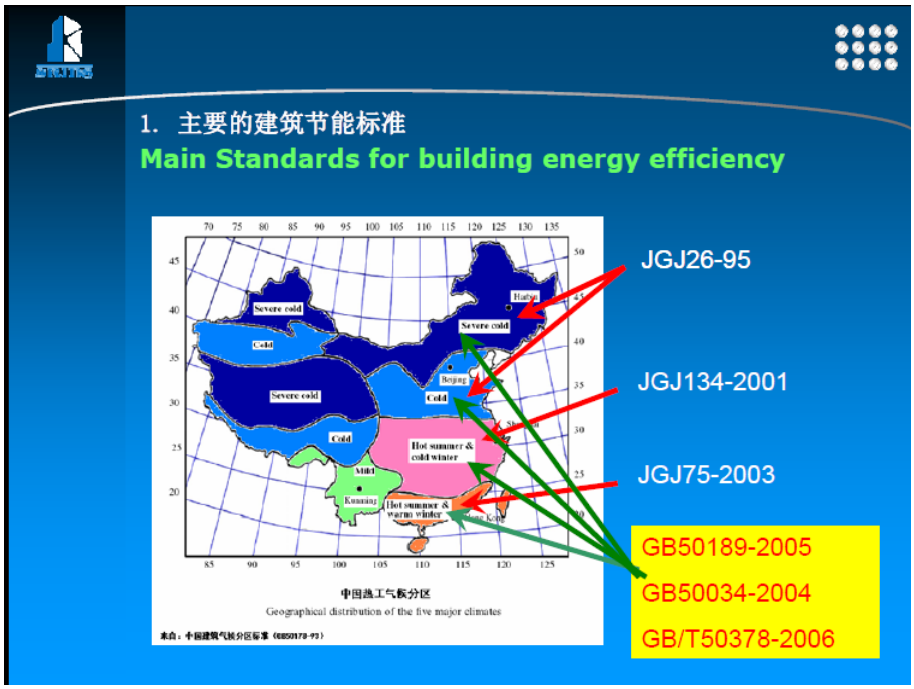
This energy efficient buildings policy is five-fold:

with different thermal standards for the five climate zones:



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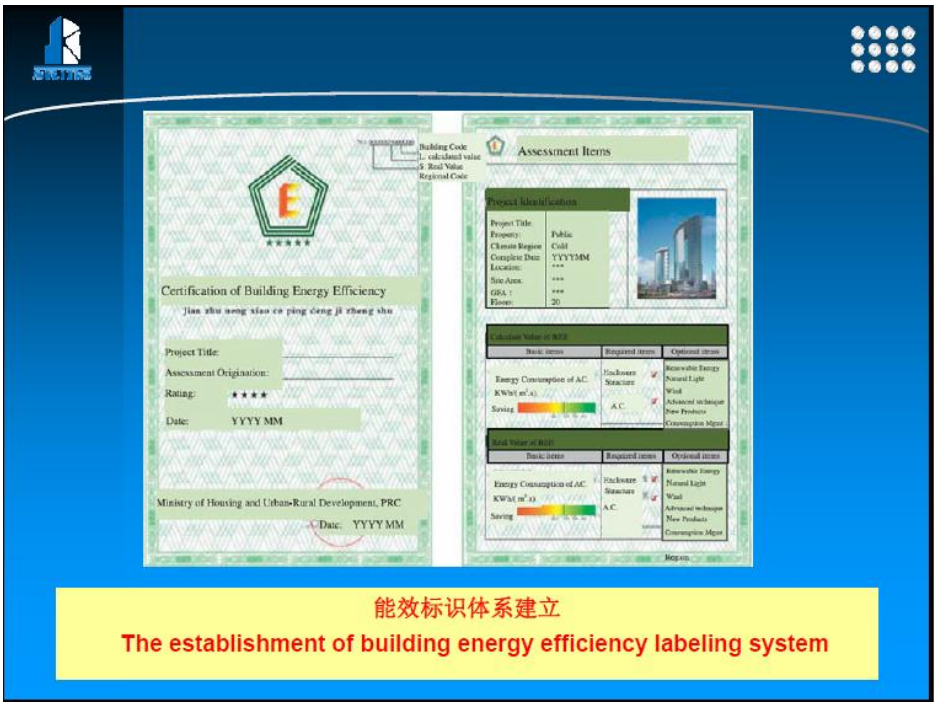
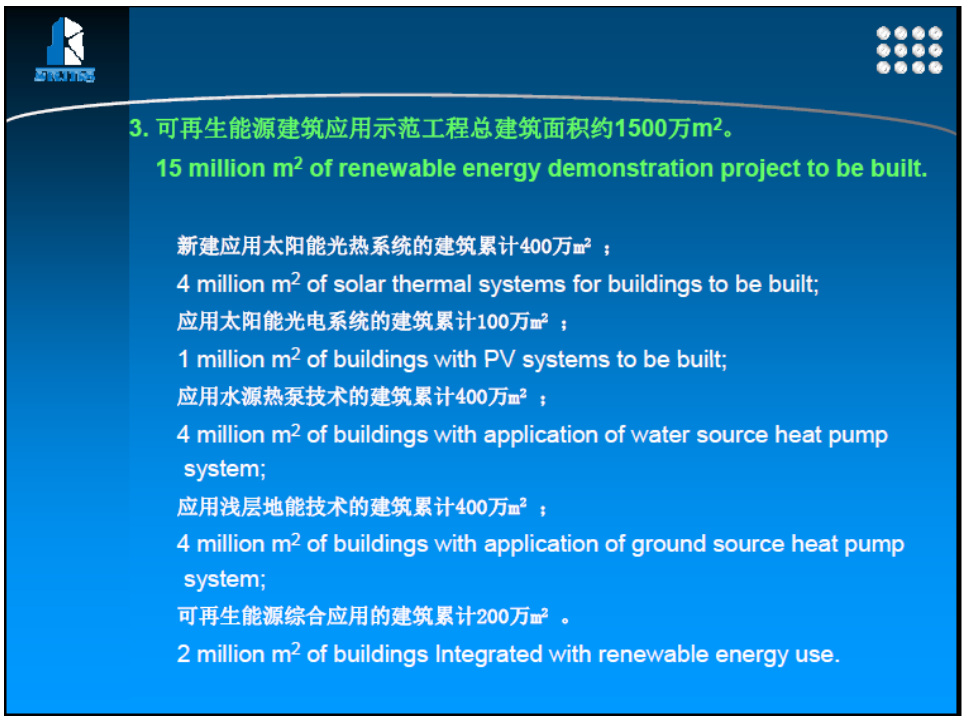
This policy encompasses energy performance labelling:



…and the massive development of renewable energy:



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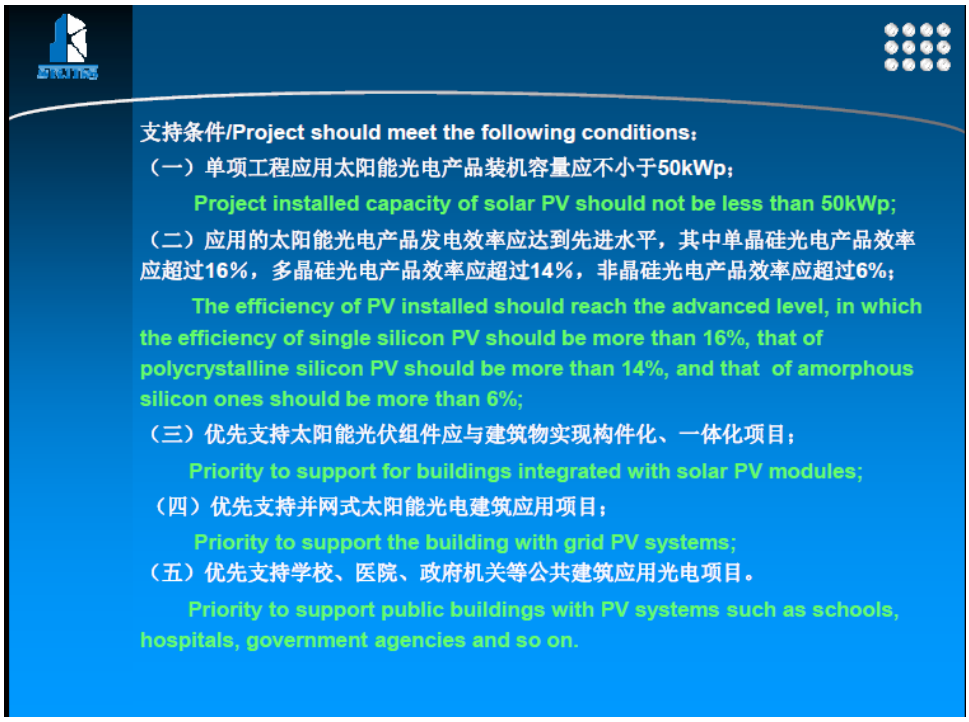
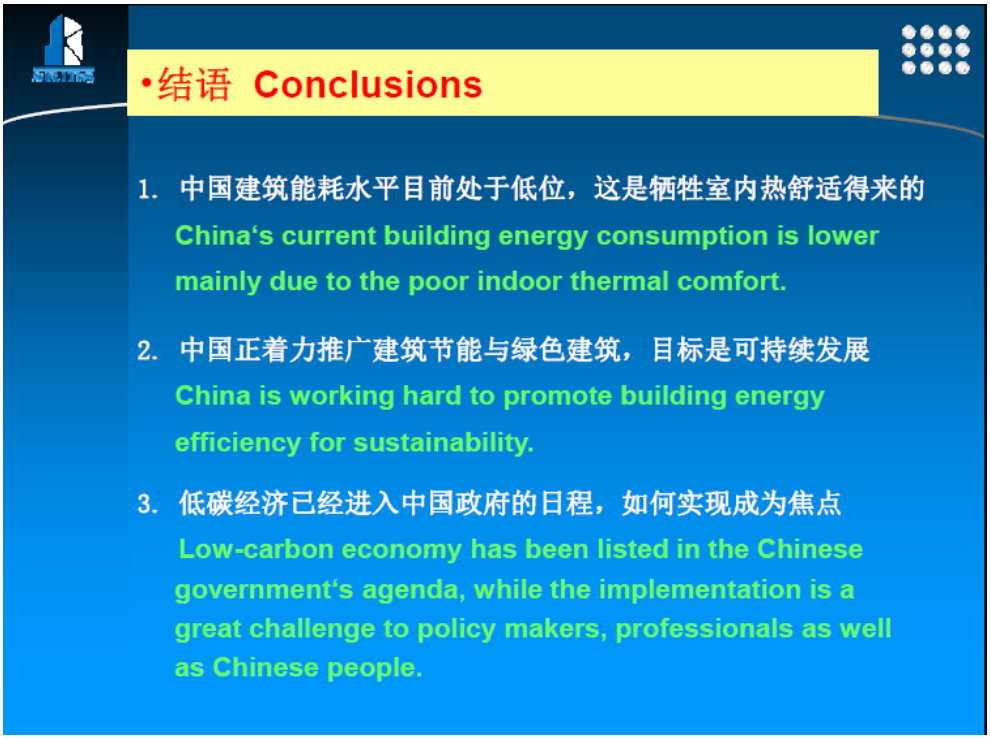
…more especially solar photovoltaic energy:



The urban explosion and the rising demands for comfort require the implementation of an assertive energy efficient buildings policy. This is a true challenge for Chinese society, its national and local leaders, construction professionals and population alike:



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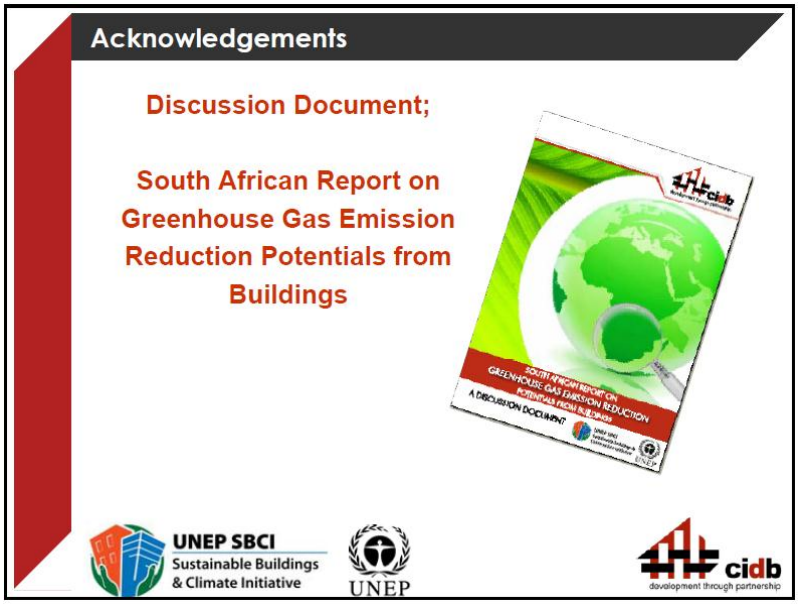
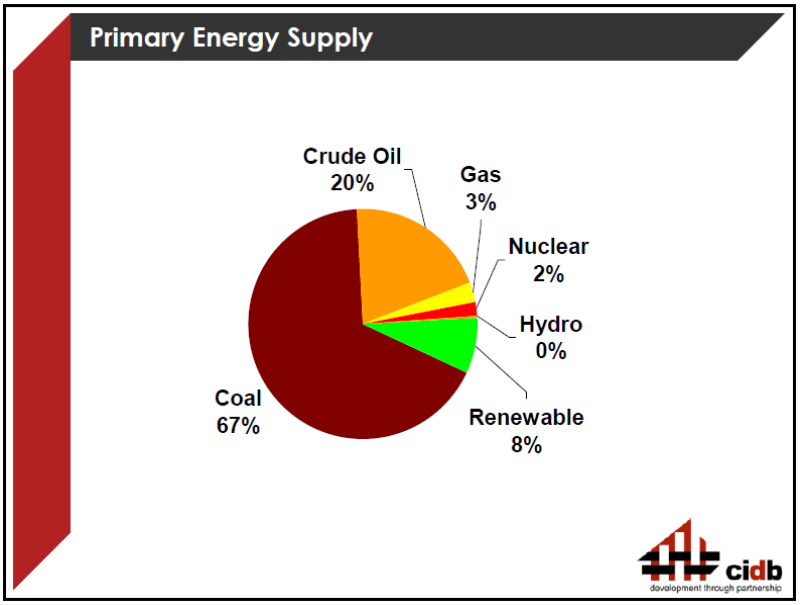
9.3 South Africa

Rodney Milford, of the Construction Industry Development Board (CIDB), South Africa[82], pointed out that a discussion document had reported on the situation of energy efficient buildings policies in his country in 2009[83] :



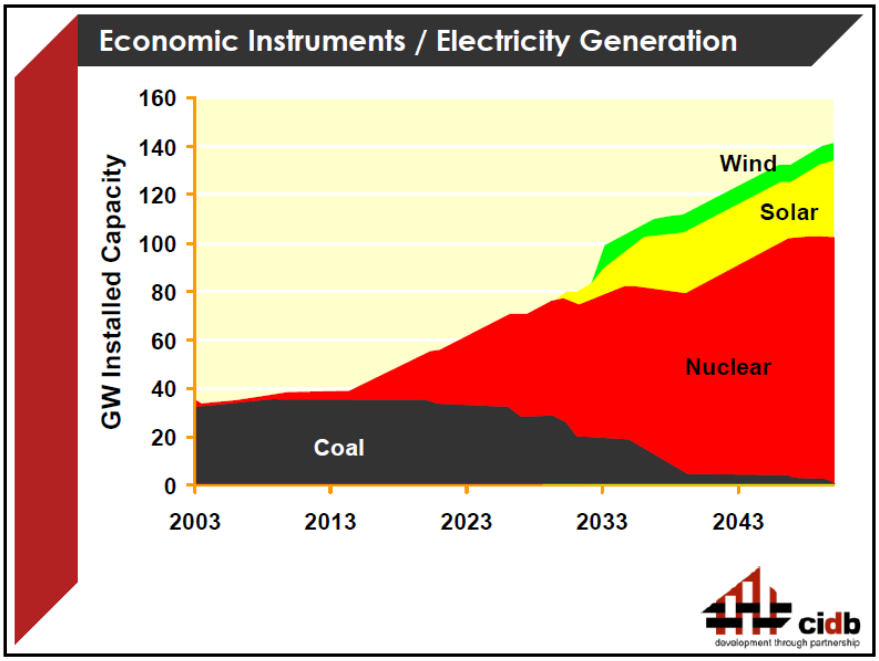
He stressed the heavy dependence of South Africa on fossil fuels and more especially on coal:



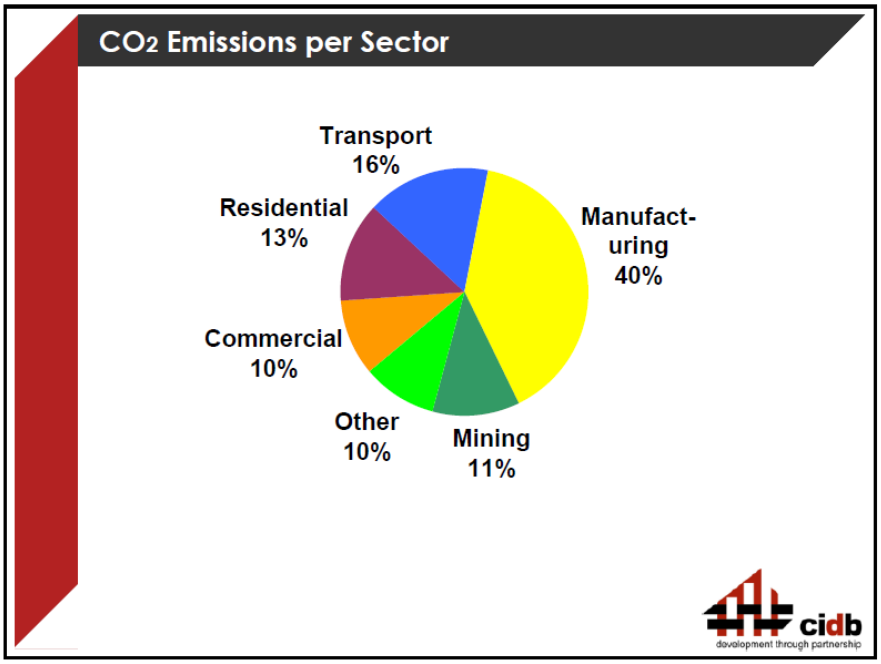
[82] Cf Appendix 1, access to the presentation : http://www.cstc.be/homepage/download.cfm?dtype=services&doc=14_Milford_SB_SA_Energy_Effecient_Building_Policy_2009_10_16.pdf&lang=en

[83] Rodney Milford is the author of the report published under the auspices of the UNEP-SBCI and sponsored by the CIDB and the CSTB, access to the report : http://www.unep.org/sbci/pdfs/SBCI-SAreport.pdf

The country has projected the growth of renewable energy, but also the massive development of nuclear energy to replace coal:



Energy efficiency must take into account buildings, since they are currently in second position for carbon emissions, with industry in first place and transport in third:



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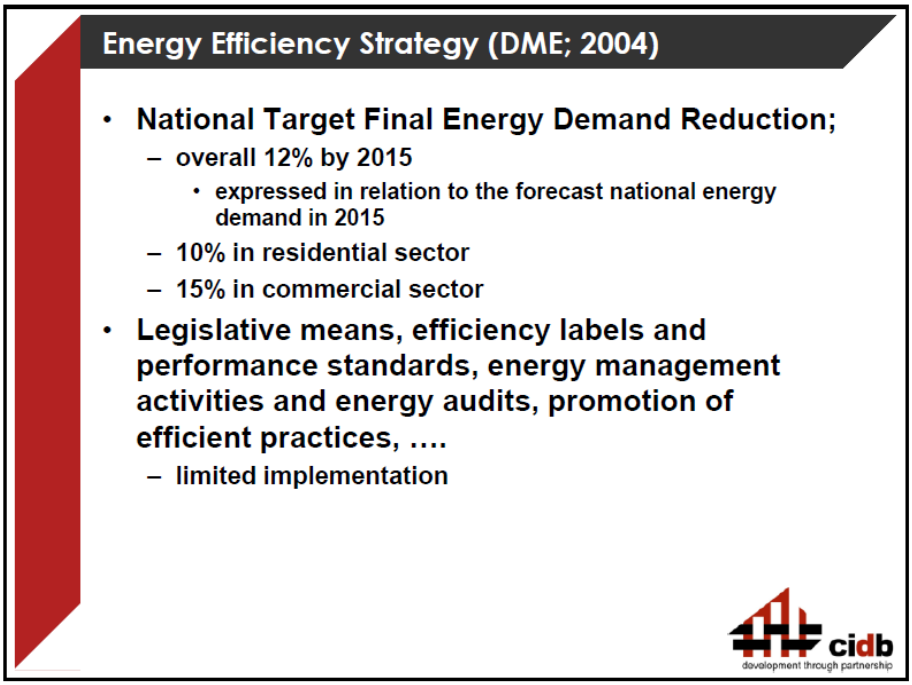
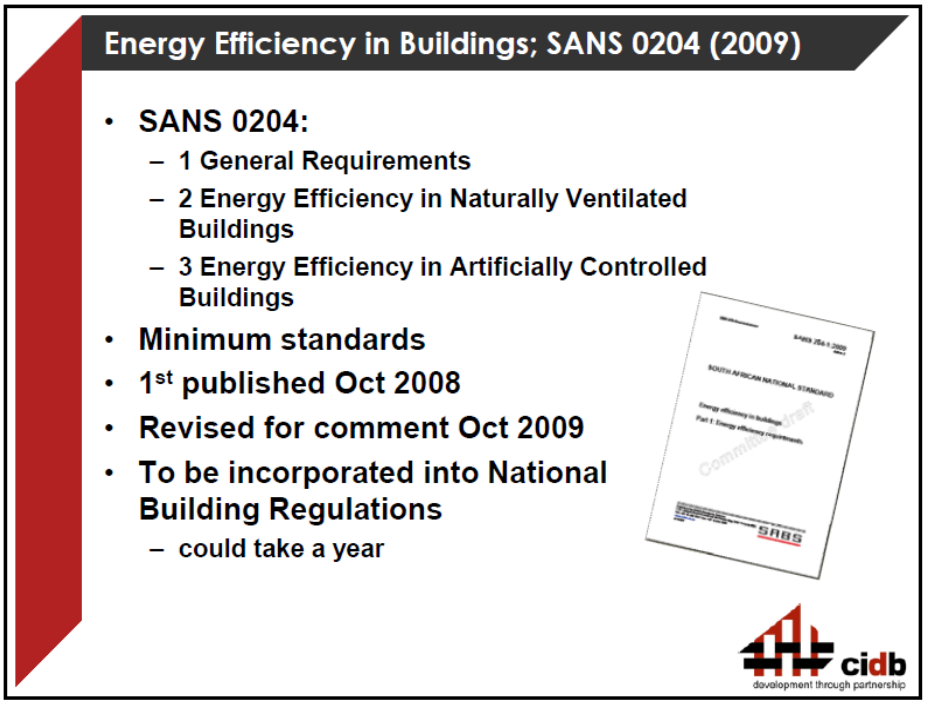
An energy efficiency strategy was defined in 2004:



and a specific section for buildings in 2009



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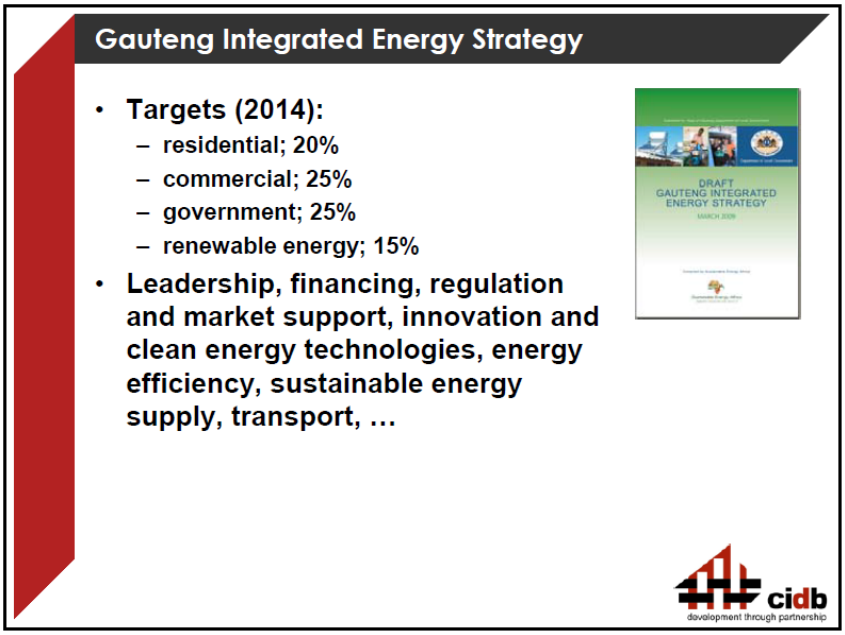
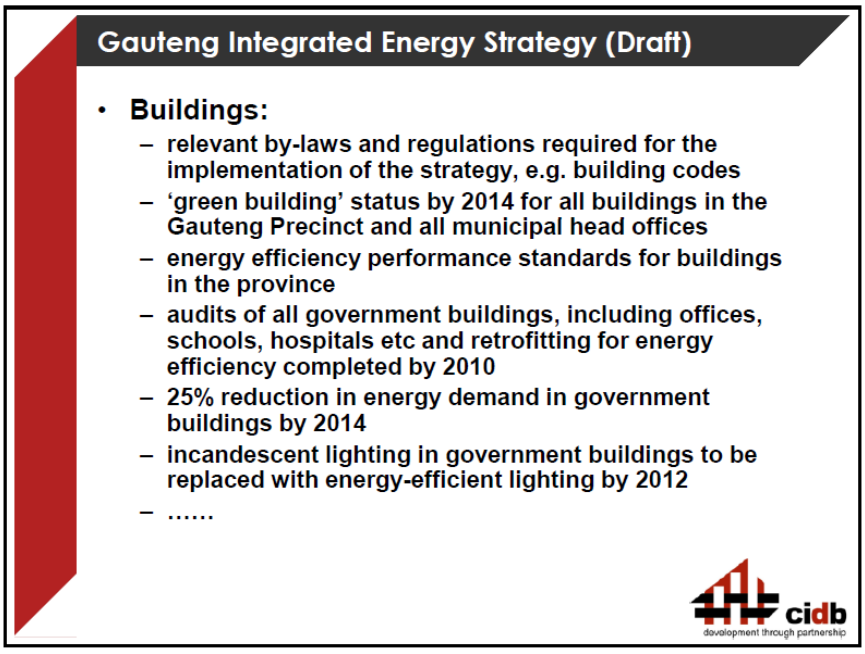
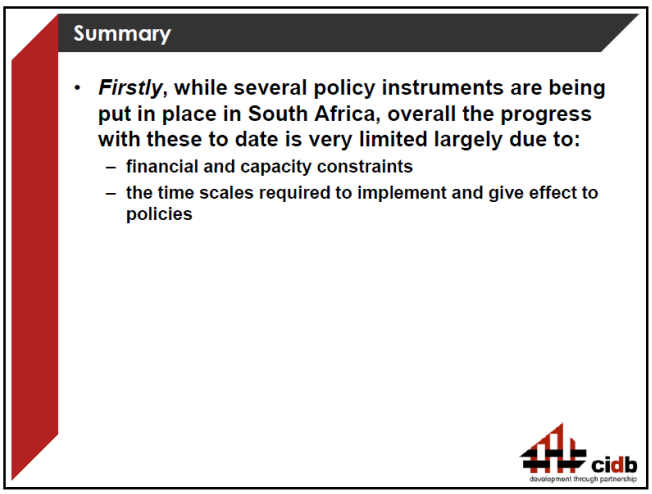
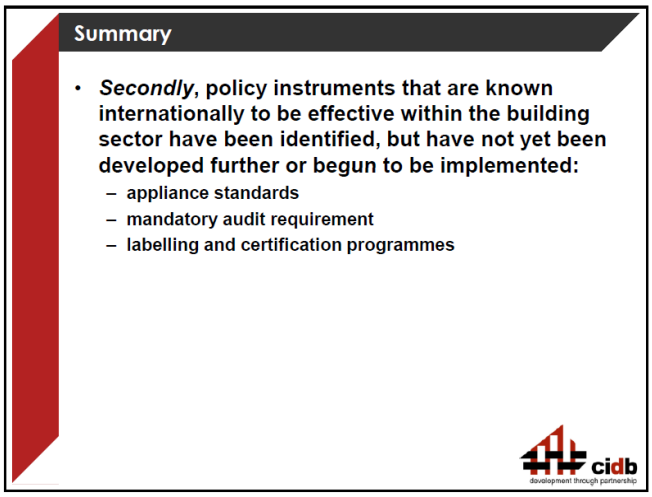
Policies have been defined at province level, such as Gauteng, the country's economic hub, and its two main towns: Pretoria, the political capital, and Johannesburg, the economic capital:

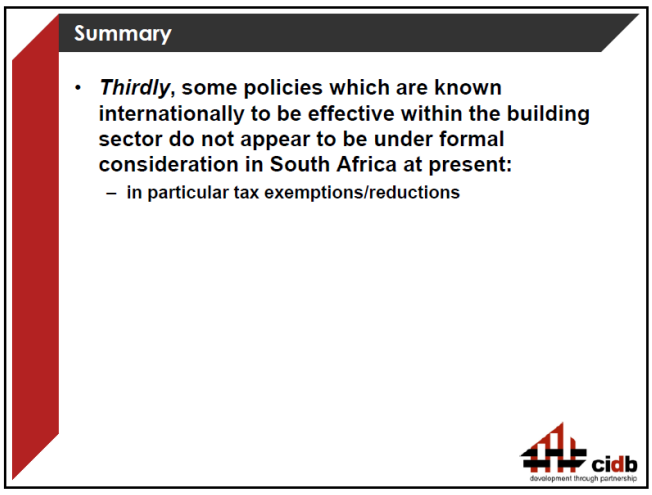




However, the implementation of an ambitious energy efficiency buildings policy is coming up against a number of difficulties:







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10. A SYNTHETIC OVERVIEW

10.1 The input of three international organisations

The three international organisations in question have much to contribute on the subject of the implementation of energy efficient buildings policies[84].

The International Energy Agency's online Sustainable Buildings Centre[85] is certainly a great asset.

More particularly, this centre has created an *international data base on energy efficient buildings policies* (Buildings Energy Efficiency Policies - BEEP Data Base[86] -).

Policy content is registered in three areas:

- Regulations (Building Codes)
- Energy performance and environmental labels (Labelling Schemes)
- Incentives (Incentive Schemes): loans, grants, taxes, tax reductions and energy economy certificates, etc.

In January 2013, data had been collected for 34 countries, including 6 emerging countries: China, India, Turkey, Brazil, South Africa and Tunisia.

Aside from the importance of its lobbying activity in negotiations on climate change in particular, the United Nations Environment Program – Sustainable Buildings and Climate Initiative (UNEP-SBCI) focuses on developing countries with the SPoD project (Sustainable Building Policies in Developing Countries)[87].

In addition to country studies (India, Mexico and South Africa, etc.), the UNEP-SBCI makes an interesting contribution in terms of *methodology for designing energy efficient buildings policies*[88] and *cost effectiveness of on-going policies*[89].

[84] Other international organisations can also play a useful role in this respect, such as the World Green Building Council (http://www.worldgbc.org), which focuses on environmental certification and has a considerable network per country. In France, France GBC : http://www.francegbc.fr/

[85] http://www.sustainablebuildingscentre.org/pages/home

[86] http://www.sustainablebuildingscentre.org/pages/beep

[87] http://www.unep.org/sbci/pdfs/SPoD_2pager_english_220812.pdf

[88] See the « Policy Quick Scan Tool » : http://www.unep.org/SBCI/QuickScanTool/index.html

[89] « Assessment of policy instruments for reducing greenhouse gas emissions from buildings » Central European University, 2007. http://www.unep.org/sbci/pdfs/SBCI_CEU_Policy_Tool_Report.pdf

The World Business Council for Sustainable Development is a good example of *private multinational lobbying* for high energy performance in buildings. Its « Energy Efficiency in Buildings »[90] project has produced a clear analysis and mobilised a hundred or so large international companies around the energy efficiency of their buildings.

10.2 Four criteria for country differentiation

In order to provide a tentative synthesis of an international benchmark on energy efficient buildings policies, it was decided to differentiate the countries referred to in the Task Group 66 seminars according to the following four criteria:

- Wealth, measured as GDP per capita (in purchasing power parity), together with an indication of CO2 equivalent emissions per capita, as well as the country's population,

- Differentiation of the population's needs within the countries, taking into account emerging countries where a large fraction of the population suffer from energy poverty and should thus have priority for access to energy rather than energy savings,

- Existence, or not, of an « informal » construction sector, substandard and without building permits,

- Predominant energy uses, taking into account the need for heating in the north and the absence of same in the south, and energy used for cooking, hot water and air conditioning.

From the 16 countries referred to in the Task Group 66 seminars:

- 7 are developed countries,
    - 2 in North America : United States and Canada,
    - 5 in the European Union : Germany, Belgium, France, the Netherlands and Poland,
- 9 are emerging countries,

[90] http://www.wbcsd.org/buildings.aspx

- 6 in Latin America : Argentina, Brazil, Chile, Mexico, Uruguay, Venezuela,
- 2 in Asia : China, India,
- 1 in Africa: South Africa.

None of these nations are part of the Least Developed Countries (LDC).

One of the initial criteria of differentiation is the wealth indicator of GDP per capita (in purchasing power parity), together with an indication of CO2 equivalent emissions per capita and population.

Table 5. *Developed countries: GDP per capita, CO2 emissions per capita, population*

Country	GDP per capita US $ (purchasing power parity) in 2010	CO2 equivalent emissions per annum in tons per capita in 2007	Population in 2011 (in thousands)
United States	47 199 $	18.9 t	315 674
Netherlands	42 955 $	10.5 t	12 042*
Canada	38 989 $	16.9 t	34 244
Belgium	37 600 $	9.8 t	11 000
Germany	37 260 $	9.6 t	81 800*
France	33 820 $	6 t	66 517*
Poland	19 985 $	8.3 t	38 511

*2012, Source: World Bank, International Energy Agency, National institutes

The GDP per capita in the United States is significantly higher than the European Union average (31 384 $ in 2009)[91].

CO2 emissions per capita are also very much higher in the United States, and also in Canada. France stands out from the average indicated for the other European countries listed, due to its carbon-free nuclear electricity.

[91] Where there are marked differences: the GDP per capita in Bulgaria and Romania is lower than in Chile or Mexico.

Table 6. *Emerging countries: GDP per capita, CO2 emissions per capita, population*

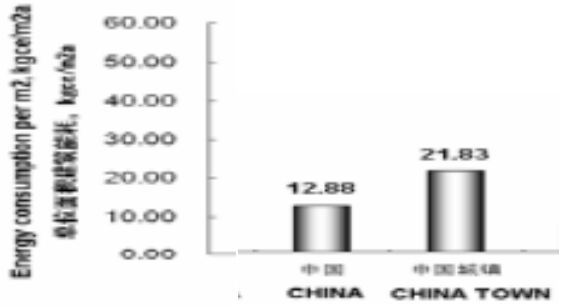
Country	GDP per capita US $ (purchasing power parity) in 2010	CO2 equivalent emissions per annum in tons per capita in 2007	Population in 2011 (in thousands)
Argentina	16 012 $	4.7 t	40 117**
Chile	15 779 $	4.3 t	16 572*
Mexico	14 564 $	4.4 t	112 336**
Uruguay	14 108 $	1.9 t	3 477*
Venezuela	12 233 $	6 t	28 946*
Brazil	11 210 $	1.9 t	192 376
South Africa	10 565 $	8.8 t	51 770
China	7 599 $	4.9 t	1 355 045*
India	3 425 $	1.4 t	1 210 193

*2012 **2010, Source: World Bank, International Energy Agency, National institutes

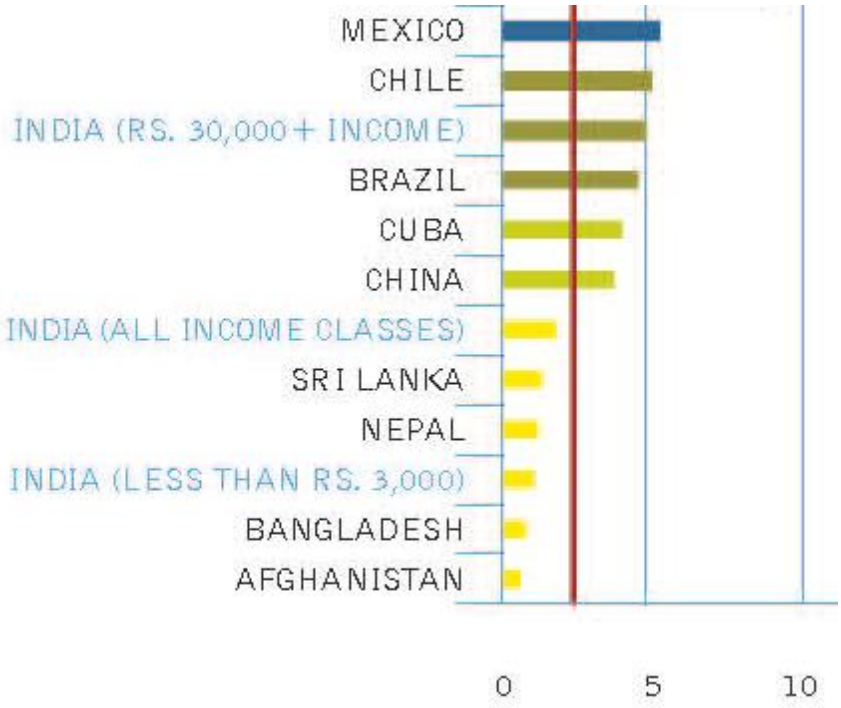
The greater part of the Latin American countries listed have a relatively high GDP per capita. Countries producing fossil fuels (South Africa and Venezuela) have relatively high C02 emissions per capita.

The low average wealth per capita indicated for China and India actually conceals stark contrasts within each country.

Urban China uses 70% more energy per m² in buildings than rural China[92] :



Annual CO2 emissions vary from 1 to 5 tons per capita in India[93] depending upon income[94] :



A second criterion of differentiation, connected to the first, is the greater heterogeneity in the energy needs of populations in emerging countries.

[92] Presentation by Prof. Wei and Prof. Fang Dongping, op cit.
[93] Presentation by Mahua Mukherjee op cit.
[94] The link between purchasing power and CO_2 emissions is of course not exclusive to emerging countries. In France, emissions per capita represent 8.1 t in an executive family compared to 5 t in a working class family. cf Fabrice Lenglart, Christophe Lesieur, Jean-Louis Pasquier. *Les émissions de CO2 du circuit économique en France*. INSEE 2010, access to the report (in French): http://jeancarassus.zumablog.com/images/2128_uploads/Insee__missions_CO__par_m_nage.pdf

It is true that a minor yet significant percentage of the population in developed countries suffers from fuel poverty. This population has access to energy but devotes an overly large portion of its income to energy payments. Energy efficient buildings policies must incorporate a section providing specifically for this population[95].

In many emerging countries, an often very large fraction of the population has no access to energy. As so well displayed by Alfonso Blanco from the example of Uruguay, an energy efficient buildings policy must have two very different targets: the middle and high-income population and the low-income population.

A third criterion of differentiation, connected to the second one, is the existence, or not, of an imposing « informal » construction sector, unregulated and without building permits.

The 7 developed countries do not encounter this phenomenon. It is however very common in the 9 emerging countries, especially in three of them (India, Brazil and Mexico).

The fourth criterion of differentiation is the item that predominates in energy consumption in buildings.

In the northern countries, heating is the main energy requirement. In France, in spite of the Mediterranean climate in the south, heating represented 63% of energy consumption in existing homes in 2010[96].

In Mexico, cooking and hot water are the main items. There are some regions in countries such as China and Chile where heating requirements are high. In spite of that, in Chile for example, hot water and cooking represent 47% of domestic energy consumption, compared to under 20% for heating.

10.3 Outline for a classification of energy efficient buildings policies

Although the different elements collected during the TG 66 seminars do not enable an in-depth analysis of a classification of on-going energy efficient buildings policies and their implementation, they do allow a preliminary analysis.

Basically, four main types of energy efficient buildings policies seem to emerge.

[95] See, for example, the « Vivre mieux » programme in France for the renovation of 300 000 energy-intensive low-income homes, strongly supported by the public authorities.
[96] ADEME. Chiffres clés bâtiment 2011. 2012. Page 41.

The first two concern developed countries and the two others, emerging countries.

The first type is *a well-structured energy efficient buildings policy pursued by several developed countries.*

This policy is in line with quantified and measured goals for greenhouse gas emissions, energy savings and the development of renewable energies.

It uses five policy instruments: regulations on standards, informative regulations, economic and market-based instruments, fiscal instruments and incentives, and information, education and voluntary actions.

The Northern and Western Europe countries can be ranked in this category. The European Union operates with directives, one of which is specific to the energy performance of buildings. But implementation clearly varies from one country to another. Western and Northern European countries are in advance in comparison to Southern and Eastern Europe countries.

In spite of somewhat patchy information, in the United States, the policies of some Western states, such as California, and some North Eastern states can be also ranked in this category. Concerns for cost-effective investments are more pronounced than in Europe.

One of the important criteria for the effectiveness of this type of policy is its impact on energy efficiency in existing buildings.

The second type of policy is *a less ambitious energy efficient buildings policy and considered to be of lower priority by the authorities in a number of developed countries. Quantified and measured goals are not highlighted. Not all the policy instruments mentioned above are used.*

Several Southern and Eastern Europe countries and several American states, especially in the centre of the United States, seem to fall into this category. In Southern and Eastern Europe, the European Union directives are progressively harmonizing the energy efficient buildings policies in the same way as in the USA, where federal actions and the dissemination of certifications such as Energy Star® and LEED® can counteract the less ambitious policies of several American states.

The third type of policy is *the beginning of a structured energy efficient buildings policy in emerging countries applied both to buildings and energy use in buildings.*

This policy tends to differentiate:

- *middle and high-income housing and the commercial sector, using some of the five political instruments applied in developed countries, more particularly regulations on standards, informative regulations, incentives and information,*

- *low-income housing where specific action plans are required for the « informal » substandard construction sector, with a focus on use and the dissemination of energy-efficient domestic appliances.*

In spite of patchy information, China, India, Brazil, Chile and Uruguay seem to be moving in this direction.

The fourth type of policy seems to be *the start of an energy efficient buildings policy in emerging countries, principally focusing on energy use, with few or no regulations on buildings themselves.*

The emphasis is on energy use, and especially on certain appliances, such as light bulbs, refrigerators and cooking apparatus, etc., with little or no regulations on building envelopes.

South Africa, Argentina, Mexico and Venezuela seem to fall into this category.

It is worth noting that a number of emerging countries have stressed the importance of the socioeconomic aspect of the policies. In fact, it is also essential to take this dimension into account in developed countries, where a focus on only thermal regulations and technological progress could lead to disappointing results in actual energy consumption, especially in existing buildings.

Such analysis and classification may only be temporary. A more comprehensive analysis would be necessary to go further. It could be the topic of a new CIB Commission dedicated to Energy and the Built Environment, continuing the work initiated by the Task Group 66.

PROPOSALS

The Task Group's mandate ended in December 2012. It is of course suggested that the CIB continue handling the theme of energy in buildings. Five proposals are made in this respect:

1/ *The theme of energy in buildings should be the subject of a permanent Commission* and not of a fixed-term Task Group. The name « Energy and the Built Environment » can be maintained.

Energy is a key factor in the present global context of an ecological and energy transition from a world dominated by fossil fuels toward a world where renewable energies will, eventually, be in the majority.

The work of the Commission should be in line *with the perspective of the on-going third industrial revolution and which, according to the assumptions of the American economist Jeremy Rifkin, is based on five pillars:* the development of renewable energies, the production of energy by buildings, energy storage in buildings and throughout the infrastructure, the internet-energy interface for

running decentralised local networks and the development of electric plug-in means of transport[97].

The term « Built Environment » has the advantage of not limiting the approach to buildings *stricto sensu* but of widening it to the housing block and the urban district.

Focusing on energy and greenhouse gas emissions is not in contradiction with addressing environment (water and waste) and health issues, in a sustainable building perspective.

2/ *The « Energy and the Built Environment » Commission could deal with the implementation, monitoring and evaluation of energy efficient buildings policies.*

A feasibility study could define the Commission's field of action, highlighting the specificity of CIB in comparison to IEA and UNEP-SBCI.

The topic could deal with the implementation, monitoring and evaluation of energy efficient buildings policies, bearing in mind that the issues of « how to proceed » and « how cost-effective » are essential today.

In terms of sphere of operations, it is suggested that the « Energy and the Built Environment » Commission *give priority to the dialogue between developed countries and emerging countries, the accent to be placed on the latter since developed countries already have organisations that are active in this field.*

Lessons learnt from emerging countries could be of use to the least advanced countries, which could also be handled by the Commission.

The approach should be a socioeconomic-technical one. The reason is that a purely technical analysis is too restrictive and a socioeconomic approach which overlooks the technical aspect is ineffective.

3/ The Commission should be steered by *a coordinator and a project team*.

The project team could be made up of researchers and people from the university world on the one hand and private and public sector representatives on the other.

There would be a representative from the following entities and countries in the project team: United States, European Union, China, India, Japan, South Africa, Latin America and the Middle East.

4/ The Commission would have *two target audiences* with a method adapted to each one:

- *University and researcher target* : seminars on a relatively wide subject (with a minimum framework), in a physical location, with presentations of

[97] *The third industrial revolution.* Jeremy Rifkin. Published by Palgrave Macmillan. 2011.

papers, adequate time set aside for debate and the proceedings rapidly made freely available on line, or alternatively internet seminars (webinars),

- *Representatives of the private and public (ministries, local authorities, and public companies) sectors and international organisations:* exclusively webinars on a specific topic, lasting two hours, with Powerpoint type presentations, time set aside for debate, and the presentations made freely available on line[98].

TG 66 has opened up promising perspectives for the CIB with the introduction of webinars[99], and inspired several CIB Commissions and Task Groups to use the same format[100].

5/ The Commission would operate in an *active partnership* framework with:

- The UNEP-SBCI (Sustainable Buildings and Climate Initiative),
- The International Energy Agency,
- The European Union,
- The World Business Council for Sustainable Development.

[98] The detailed information on hand from the analysis of the Europe and North America webinars clearly indicates that being able to attend the conference in one's office, for a duration of two hours at the most, makes the CIB events accessible to new private and public audiences.

[99] Recognised in 2010 by the CIB Programme Committee :
http://heyblom.websites.xs4all.nl/website/newsletter/1101/commendation_2010.pdf

[100] See http://www.cibworld.nl/site/recordings-van-de-webinars.html

APPENDICES

APPENDIX 1: LIST OF PRESENTATIONS MADE AT THE KICK-OFF SEMINAR IN BRUSSELS & INTERNET LINKS

- European Commission: What's Europe doing regarding energy efficiency in buildings – M. Holl, EC DG TREN VIDEO PDF
- BUILD UP: The European Information Platform for energy efficiency in buildings – P. Wouters, BBRI VIDEO PDF
- EPBD Concerted Action: 29 European countries collaborate on energy efficiency policies – E. Maldonado, coordinator EPBD Concerted Action II VIDEO PDF
- European Construction Technical Platform and Energy Efficient Buildings (E2B) Joint Initiative – L. Bourdeau, ECTP VIDEO PDF
- What is the International Energy Agency doing regarding energy efficiency policies in buildings? – J. Laustsen, IEA VIDEO PDF
- The Sustainable Buildings and Construction Initiative of the United Nations Environment Programme – R. Milford, CIDB VIDEO PDF
- Business oriented project: the Energy Efficiency in Buildings project of the World Business Council for Sustainable Development – D. van der Weele, Philips Lighting VIDEO PDF
- Implementation of energy efficient building policy in China – Wang Wei, SRIBS & D. Fang, Tsinghua University VIDEO PDF
- Implementation of energy efficient building policy in the USA S. Sunder, NIST VIDEO PDF
- Implementation of energy efficient building policy in Brazil – V. Agopyan, USP VIDEO PDF
- Implementation of energy efficient building policy in South Africa – R. Milford, CIDB VIDEO PDF

APPENDIX 2: LIST OF THE EUROPE WEBINAR PRESENTATIONS & INTERNET LINKS

- Benchmarking of national energy performance requirements – methodologies and results by Marleen Spiekman, TNO VIDEO PDF
- Regulations as tool for innovation: the French "Grenelle de l'Environnement" case by Frédéric Bougrain, CSTB and Jean Carassus, TG 66 Coordinator VIDEO PDF
- Compliance and control of policies: the Belgian approach by Peter Wouters, BBRI VIDEO PDF
- Renovating the building stock in Germany by Andreas Koch and Lioba Markl-Hummel, EIFER VIDEO PDF
- The specificity of Eastern Europe: the Polish example by Krzysztof Kasperkiewicz, ITB VIDEO PDF

APPENDIX 3: LIST OF THE NORTH AMERICA WEBINAR PRESENTATIONS & INTERNET LINKS

- North America: Public and Private Measures for Fostering the Adaptation of Green Building Practices, Jonathan Westeinde, Chair, Green Building Advisory Group, North American Commission for Environmental Cooperation VIDEO PDF
- United States: Country Report on Building Energy Codes & Standards Regulation in the United States, Darren B. Meyers, Technical Director, Energy Programs, International Code Council VIDEO PDF
- Canada: Canadian Energy Efficient Building Policies, James Clark, Buildings Division, Office of Energy Efficiency, Natural Resources Canada VIDEO
- Mexico: Toward Energy Efficiency in Housing in Mexico, Evangelina Hirata, Consultant on Energy Efficiency in Housing VIDEO PDF
- United States: Beyond the Code — Energy, Carbon, and Cost Savings using Conventional Building Technologies, Joshua Kneifel, Economist, National Institute of Standards and Technology VIDEO PDF

APPENDIX 4: LIST OF THE SOUTH AMERICA WEBINAR PRESENTATIONS & INTERNET LINKS

- The Ordinance on Buildings Thermal Quality for the City of Maracaibo-Venezuela – Nastia Almao, Emeritus Professor, University of Zulia VIDEO PDF
- Energy efficiency in buildings in Argentina – Gautam Dutt VIDEO
- Barriers to Energy Efficiency in Buildings in Emerging Economies. Strategies to start actions: The case of Uruguay. – Alfonso Blanco, Mechanical and Industrial Engineer of UdelaR University VIDEO
- Chilean Building Thermal Performance regulations: what we´ve done and what we haven´t. – Waldo Bustamante, Professor at the School of Architecture. P. Catholic University of Chile (PUC) VIDEO PDF
- The Brazilian Energy Efficiency Label for Buildings" – Roberto Lamberts, UFSC, Professor, Federal University of Santa Catarina, South Brazil VIDEO PDF

APPENDIX 5: LIST OF THE INDIA WEBINAR PRESENTATIONS & INTERNET LINKS

- The Implementation of Energy Efficient Buildings' Policy in India - Priyanka Kochar, Programme Manager, Sustainable Habitats Division, The Energy and Resources Institute, New Delhi. VIDEO PDF
- Beyond the Building: Energy Efficient Surrounding is Future of India, Dr Mahua Mukherjee, Assistant Professor, Department of Architecture & Planning, Indian Institute of Technology, Roorkee. VIDEO PDF

APPENDIX 6: LIST OF THE SALFORD RESEARCH SEMINAR COMMUNICATIONS & INTERNET LINKS

- Technically oriented communications:
  - Building envelope:
    - Effects of tall office building envelope technologies and design strategies on comfort and energy consumption in hot, arid climate Sameh Monna
  - Phase change materials:
    - Experimental and numerical investigation of thermal energy storage in natural stone treated with PCMs Dimitrios Katsourinis
    - Phase Change Materials (PCM) Treated natural stone for thermal energy storage in buildings: influence of PCM melting temperature Maria Dolores Romero Sanchez
  - Photovoltaic and solar energy:
    - Performance assessment of PV/T air collector by using CFD Zhangyuan Wang
    - Photovoltaic Integrated Sloped Timber Roof System Alternatives in Turkey A Mutlu, A Nil Turkeri
    - Monitoring useful Solar Fraction in Retrofitted Social Housing Andrew Waggott
  - Embodied energy and life cycle:
    - Protocol for Embodied Energy Measurement Parameters Manish Kumar Dixit
    - Considering the Risk Factors of Reliability, Maintainability and product Life Cycle in a Zero Carbon Commercial Building. Alexander John Mitchell

- Internet and socioeconomic-biased communications:
  - Internet:
    - The Implementation of Condition Monitoring Techniques for the Automated Generation of Display Energy Certificates Mohammed Hoque
    - DOCETpro: Energy Certification and Diagnosis software on web platform Lorenzo Belussi
  - Urban rehabilitation and renovation of buildings:

- Urban Rehabilitation of the Coimbra Baixinha Historical Centre - Portugal Isabel Torres
- The necessity of the modernization of modern buildings Tamas Horvath
- Challenges and opportunities of the passive house concept for retrofit Mlecnik Erwin

– Commercial buildings:
- Cost-effectiveness of Energy Efficiency Measures Exceeding Current Standards in New Commercial Buildings Joshua Kneifel
- The Building Energy End-use Study (BEES): Study design and early findings Michael Camilleri

– Energy efficiency and user behaviour:
- The effect of mandatory insulation on household energy consumption Michael Camilleri
- Space Heating in New Zealand Houses Michael Camilleri
- An attitudinal and behavioural study of Scottish pupils in regards to energy consumption in schools Jonny Dobson

– Innovation systems:
- Up scaling energy related innovations Mieke Oostra

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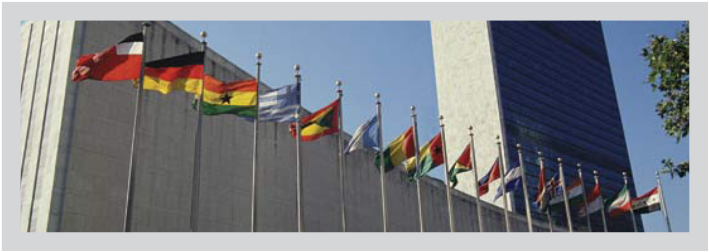
we provide:
access to experts and information worldwide



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W086 Building Pathology
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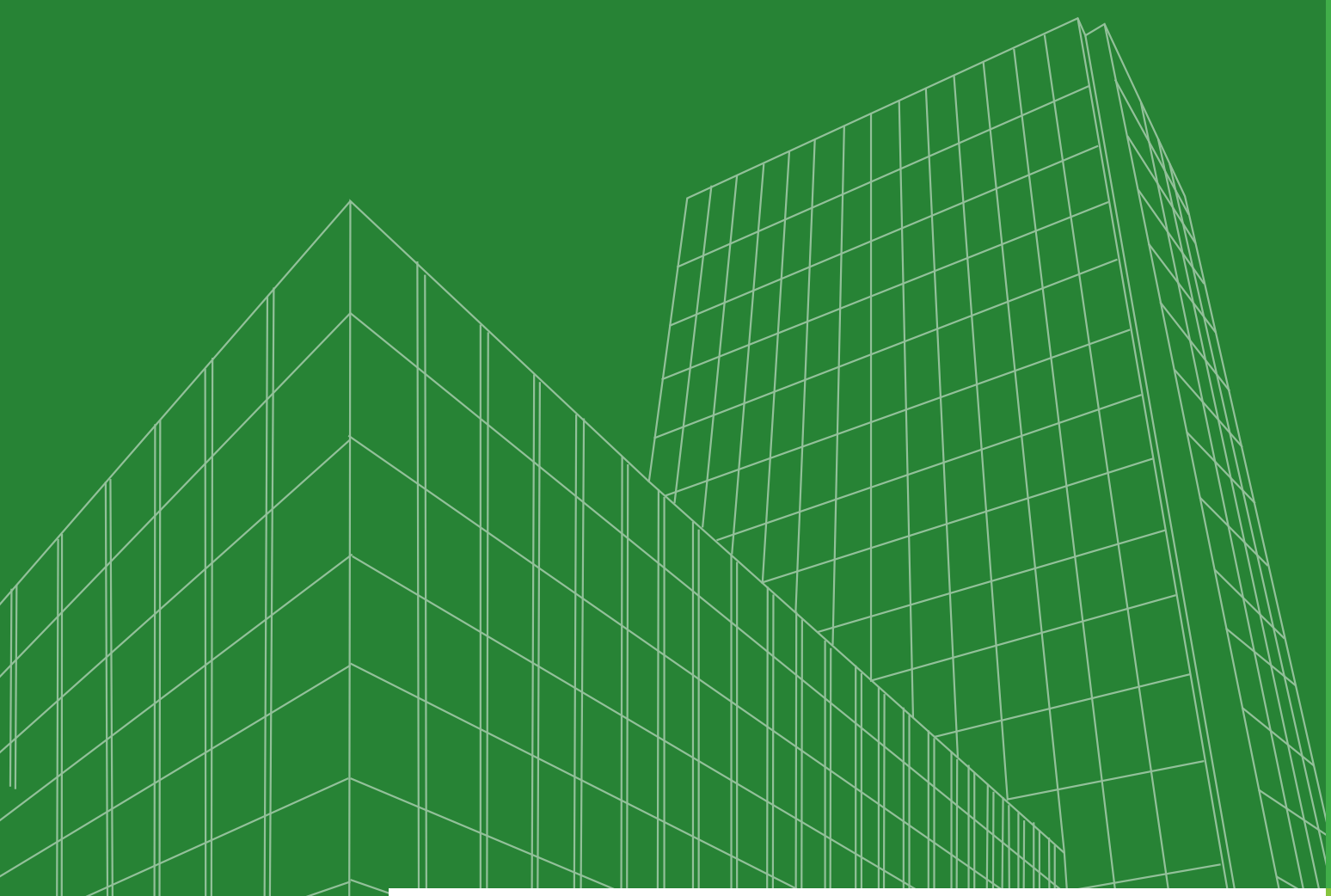

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