FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

LNEG
Laboratório Nacional de Energia e Geologia, I. P.

Net Zero Energy Buildings, towards innovation and development solutions

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International Conference on:
Solar Energy and Architecture

FCT-UNL: 30.3. 2012

GOVERNO DE PORTUGAL | MINISTÉRIO DA ECONOMIA E DO EMPREGO

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

International Energy Agency
Energy Conservation in Buildings and Community Systems Programme

IEA SHC Task 40/ECBCS Annex 52

Towards Net Zero Energy Buildings

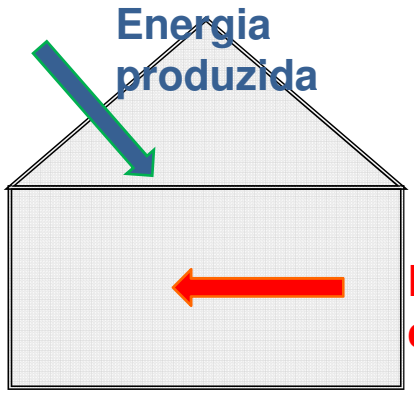
NZEB - definição

Energy Supply

- Electricity
  (PV, wind, geothermal)
- Thermal
  (Solar, Geothermal)

y Kwh

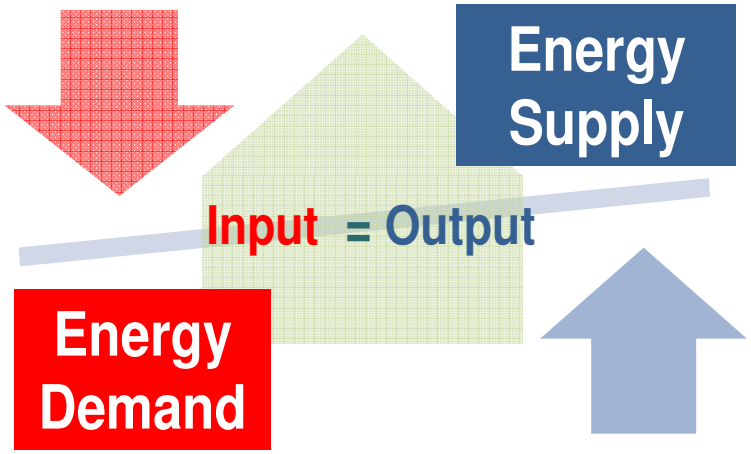
Necessidades = Produção



Energy Demand

- Heating
- Cooling
- Lighting
- Hot Water
- Appliances

x Kwh



Specific balance items

- Metric (Primary energy, carbon emission, cost)
- Balance boundary
- Balance items (heating, cooling, DHW)
- Balance period

Challenges

- Common Definition Framework
- Net ZEB Performance Indicators
- Building Code Relevance
- Architectural Integration
- Monitoring /Measured data

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RECAST EPBD

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 May 2010

on the energy performance of buildings

(recast)

Article 9

Nearly zero-energy buildings

1. Member States shall ensure that:

(a) by 31 December 2020, all new buildings are nearly zero- energy buildings; and

(b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings.

Member States shall draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of building.

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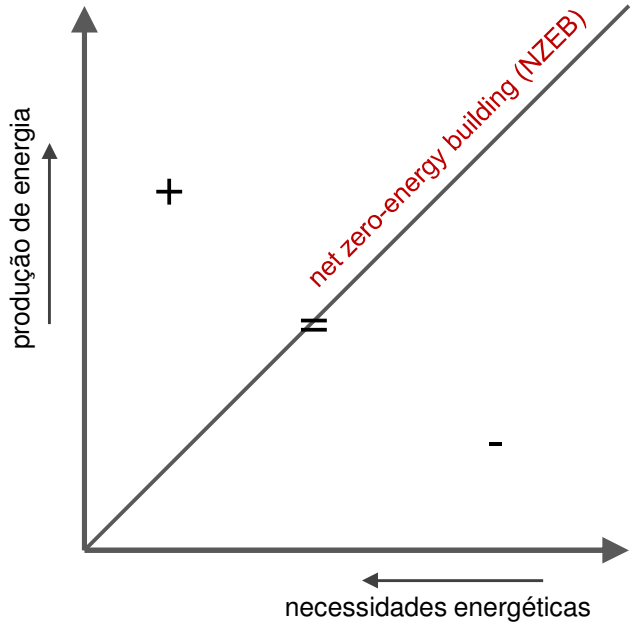
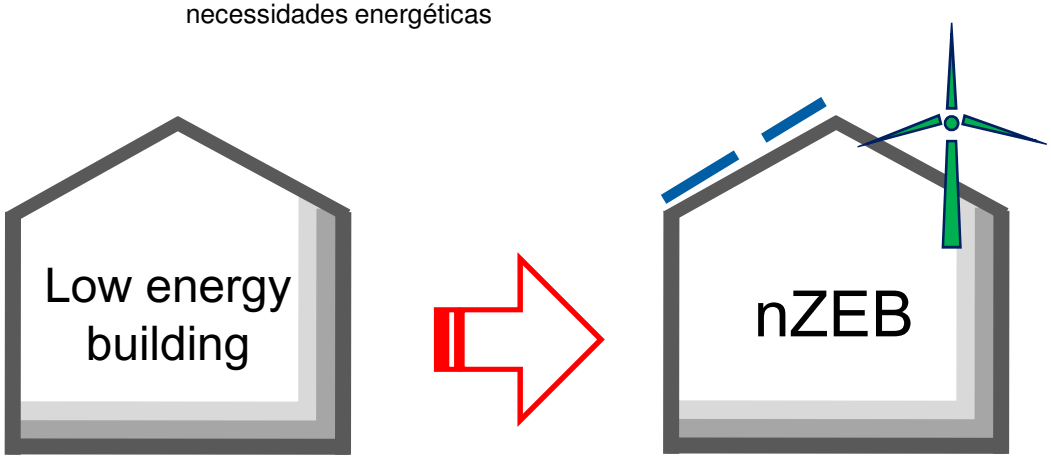
1. Definição



EPBD recast

Article 2
Definitions

'nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;



International Energy Policy

USA: “The building technologies program outlines the technology portofolio and activities that are necessary to **achieve our strategic goal of net zer-energy buildings** (NZEB) at low increment cost by 2025.”

[www1.eere.energy.gov/buildings/about/,01/2007]

UK: “The objective of the proposal is to set a timetable for movinf towards **zero carbon development** as a contribution to meeting the UK target to reduce carbon emission by 60% by 2050.”

[Department for Communities and Local Government, 13th of December 2006 press release]

Austria: “Vision 2050 on energy in buildings: The building stock of the year 2050 should be in total over the entire life cycle (involves the production and operation of the building**) free of any carbon emissions**.”

[www.e2050.at/pdf/energie_gebauede.pdf]

Netherlands: “In the Netherland, the government and the construction sector aim at achieving **energy neutral new construction in 2020**.”

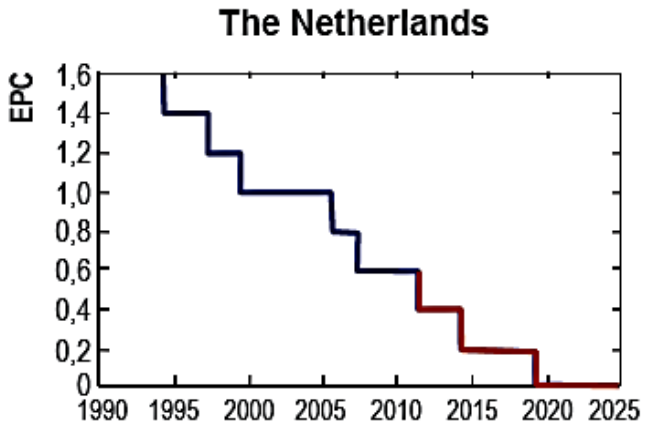
[Chiel Boomstra, Trecodome]

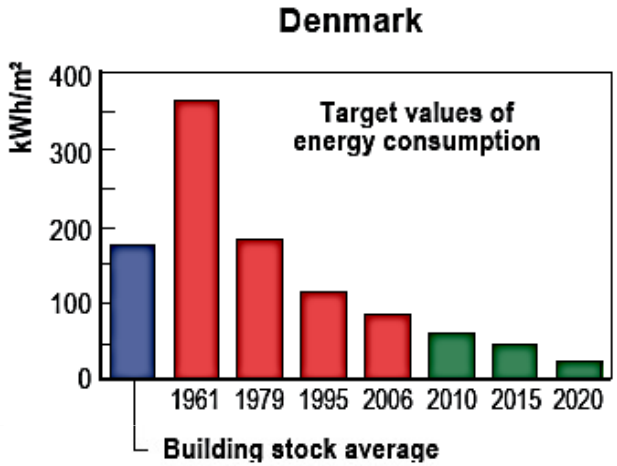
Germany: “ From current point of view future capable buildings are building architectural demanding with high user comfort, minimal energy demand, optimized technological equipment, meaningful integration into large energy supply systems as well as together economical energy demand cover. **Zero emission houses** are the long-term objective.”

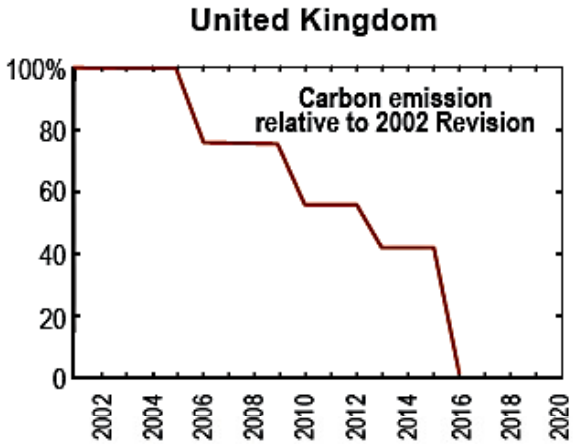
[“Das 5.Energgieforschungsprogramm der Bundesregierung”, BMWA, 07/2005

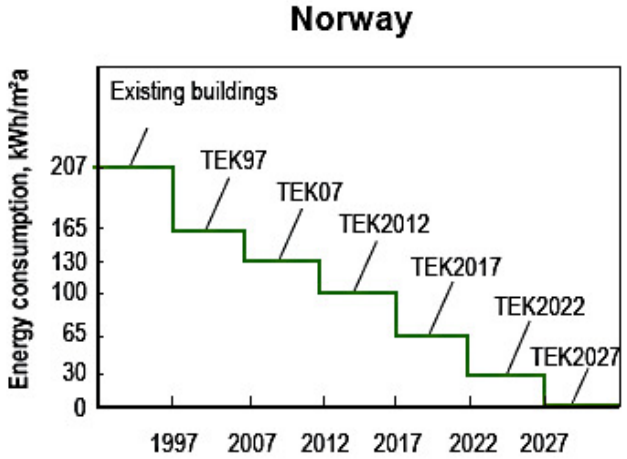
Towards NZEB – examples of national requirements and roadmaps

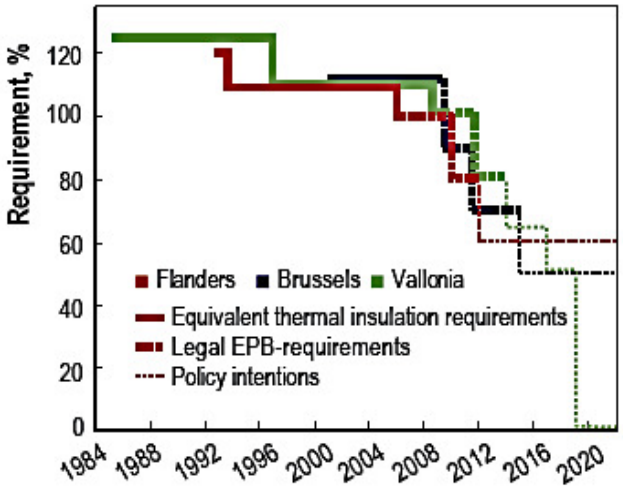
Ref: REHVA 03/2011

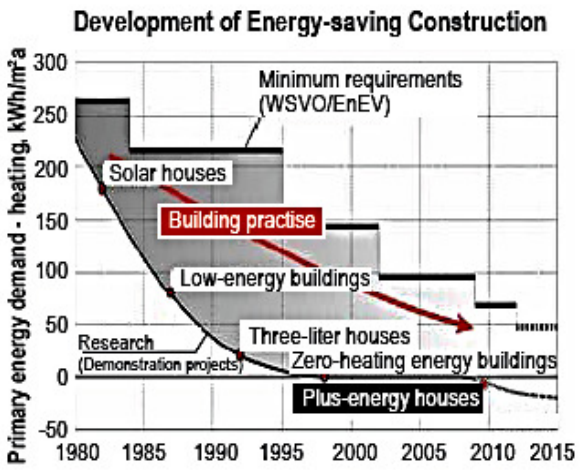








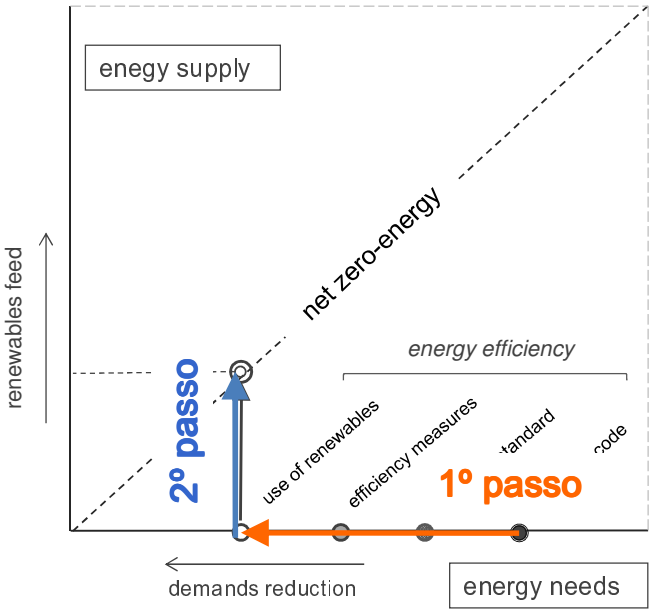




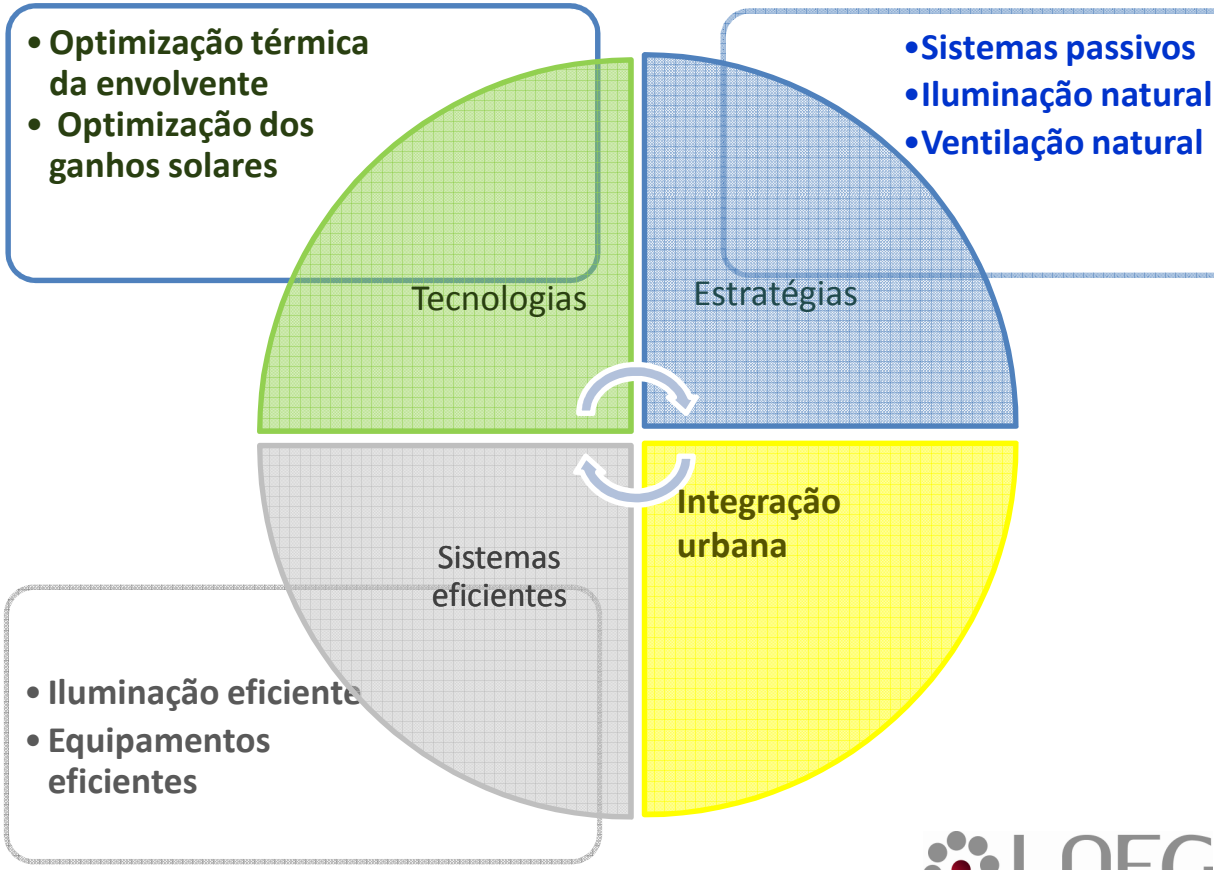
Definições/Metodologias/Desafios

Corollary of First nZEB Principle: **Threshold on energy demand**	Corollary of Second nZEB Principle: **Threshold on renewable energy share**	Corollary of Third nZEB Principle: **Threshold on CO_2 emissions in primary energy**
A threshold for the maximum allowable energy need should be defined.	A threshold for the minimum share of renewable energy demand should be defined.	A threshold for the overarching primary energy demand and CO_2 emissions should be defined.
Implementation approach: For the definition of such a threshold, it could be recommended to give the Member States the freedom to move in a certain corridor, which could be defined in the following way: • The upper limit (least ambitious, maximum allowed energy demand) can be defined by the energy demand that develops for different building types from applying the principle of cost optimality according to Article 5 of the EPBD recast. • The lower limit (most ambitious) of the corridor is set by the best available technology that is freely available and well introduced on the market. Member States might determine their individual position within that corridor based on specific relevant national conditions.	**Implementation approach:** The share of energy from renewable sources which is considered to be "very significant" should be increased step-by-step between 2021 and 2050. The starting point should be determined based on best practice, nearly Zero-Energy Buildings serving as a benchmark as to what can be achieved at reasonable life-cycle cost. A reasonable corridor seems to be between 50% and 90% (or 100%).	**Implementation approach:** For meeting the EU long term climate targets, the buildings CO_2 emissions related to the energy demand is recommended to be below 3 kg $CO_2/(m^2\,yr)$. The EPBD clearly promotes primary energy as indicator for the energy performance of buildings. However, the buildings should follow also the EU's long-term goals by 2050 and definitively the CO_2 reduction is in close relation to the reduction of energy consumption and energy decarbonisation. Consequently, introducing an indicator on the CO_2 emissions of buildings (linked to the primary energy indicator for the energy demand) is the single way to ensure coherence and consistence between the long-term energy and environmental goals of the EU.

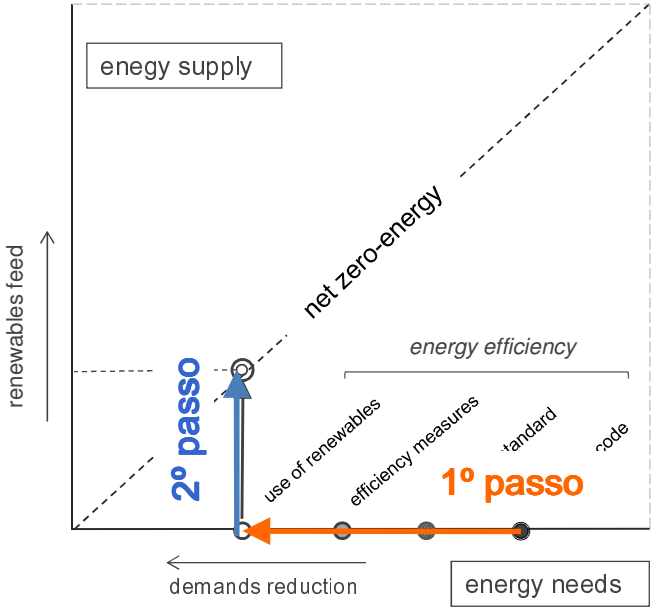
Como alcançar NZEB



1º passo: reduzir as necessidades energéticas do edifício



2º passo: produção de energia



NET ZEB
TASK 40 /ANNEX 52

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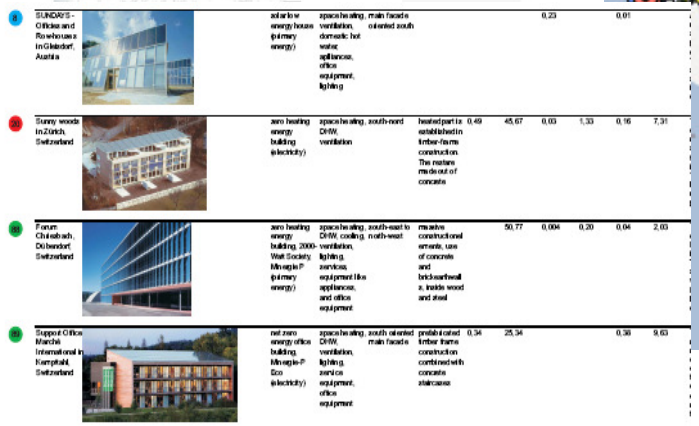
International Energy Agency
Energy Conservation in Buildings and Community Systems Programme

SHC TASK 40 - ECBCS ANNEX 52

Towards Net Zero Energy solar Buildings

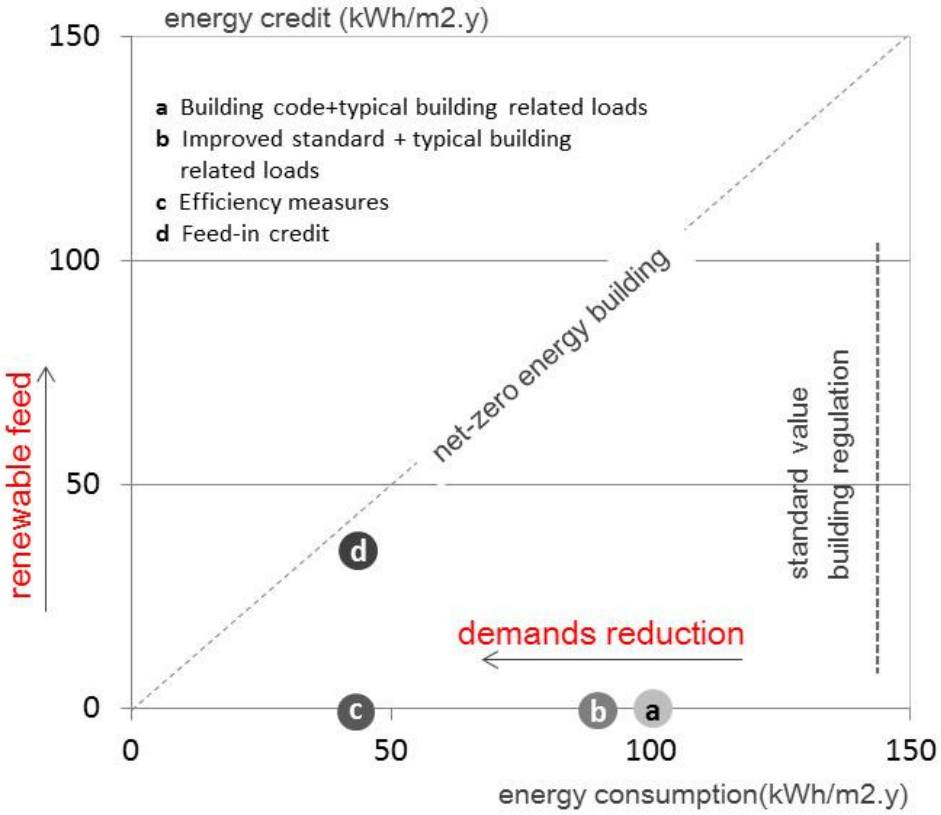
(October 2008 – September 2013)

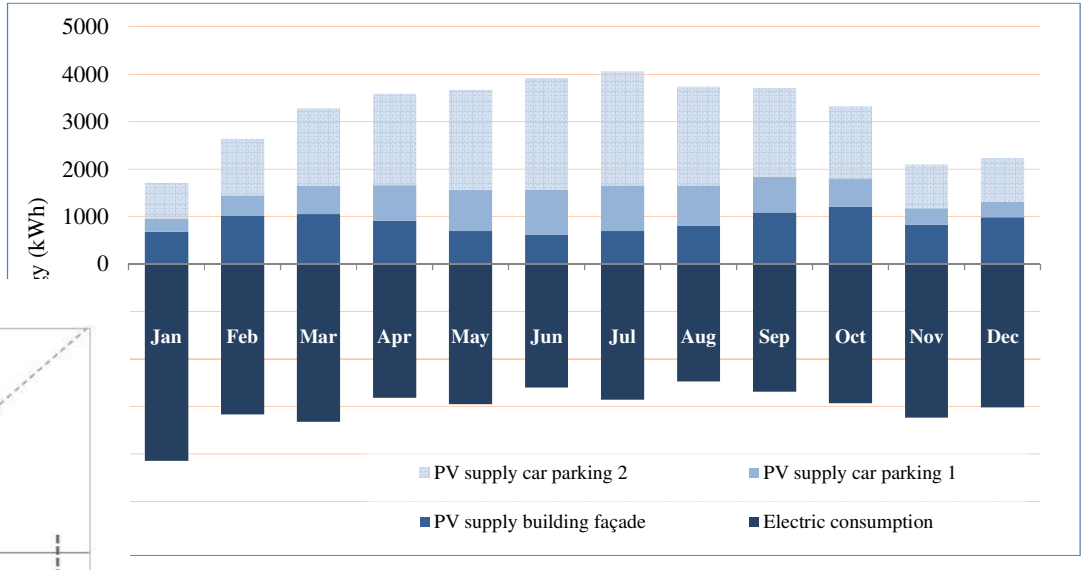
BERGISCHE UNIVERSITÄT WUPPERTAL
UNIVERSITÉ DE LA RÉUNION
EURAC research
Natural Resources Canada
Ressources naturelles Canada
ENEA
NREL
National Renewable Energy Laboratory
Concordia University
VICTORIA UNIVERSITY OF WELLINGTON
AEE INTEC
SAPIENZA Università di Roma
SINTEF
NTNU Norwegian University of Science and Technology
SINTLIEVENHOGESCHOOL
AALBORG UNIVERSITY DENMARK
n|w Fachhochschule Nordwestschweiz
SAMSUNG C&T
LNEG
PORTUGAL
NUSSMÜLLER ARCHITEKTEN
VTT
De reflex voor Energiebewust Bouwen
Passiefhuis - Platform vzw



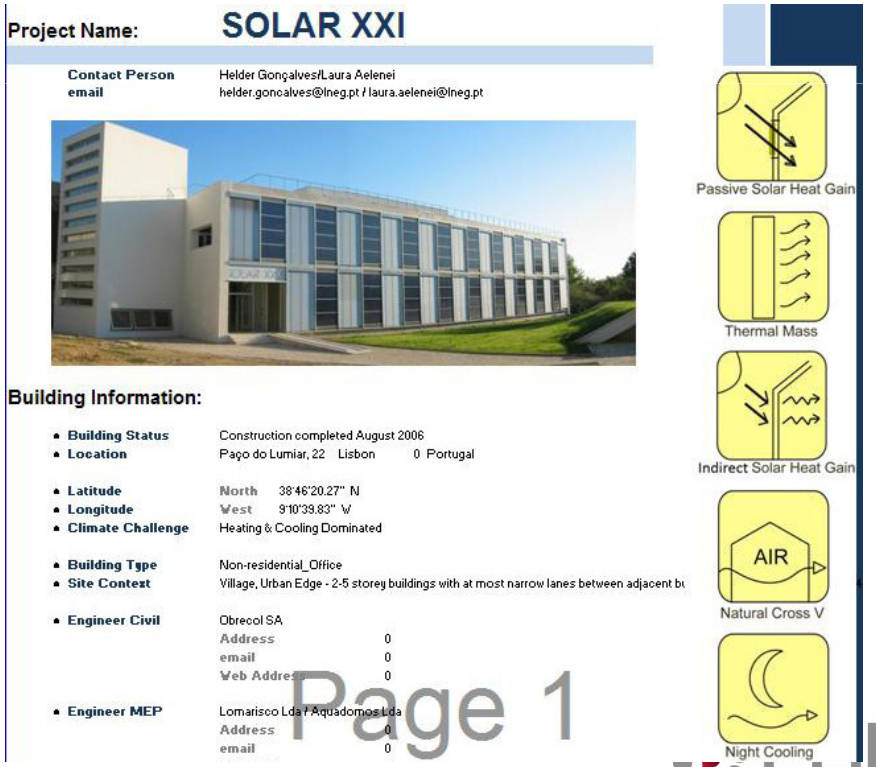
Net Zero Energy Buildings - worldwide

SOLAR XXI
NZEB Performance



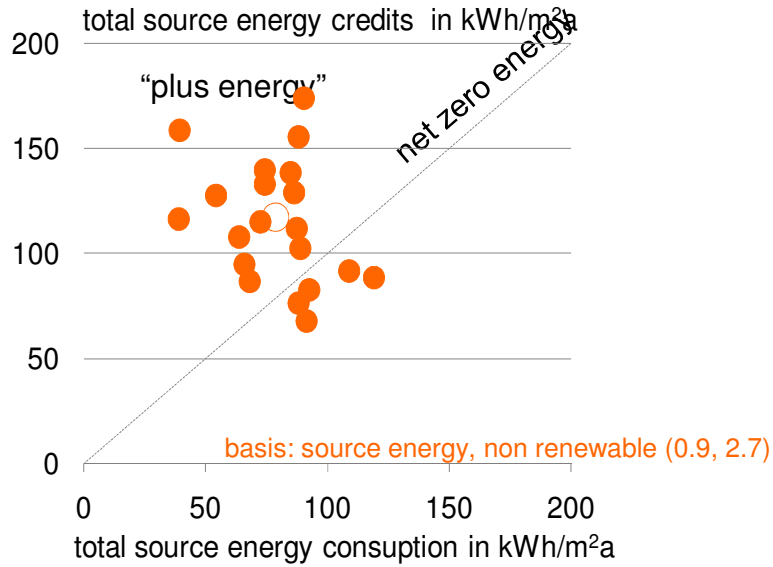


Solar XXI - monthly electric energy consumption/PV energy supply



Residential buildings

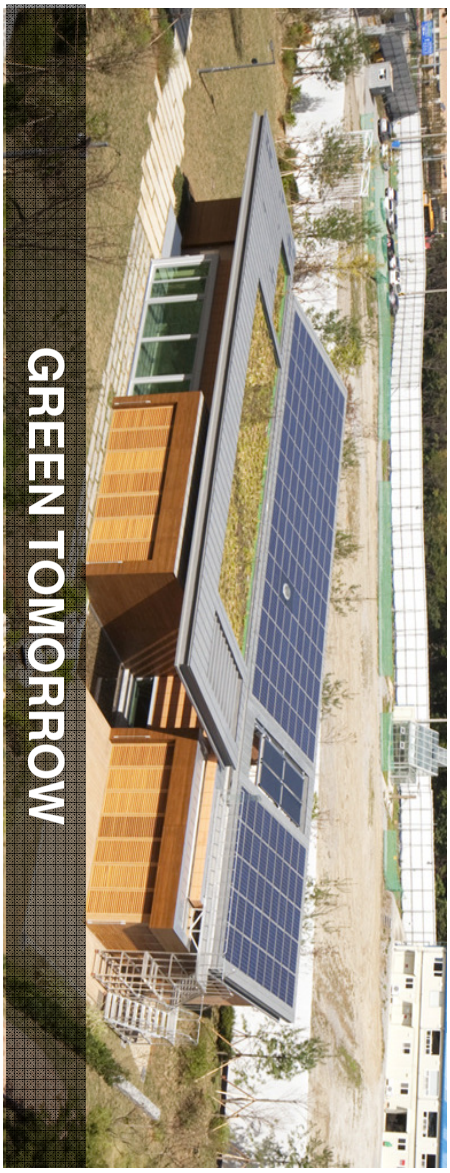
Solar Settlement, Freiburg
Architecture and concept: Rolf Disch

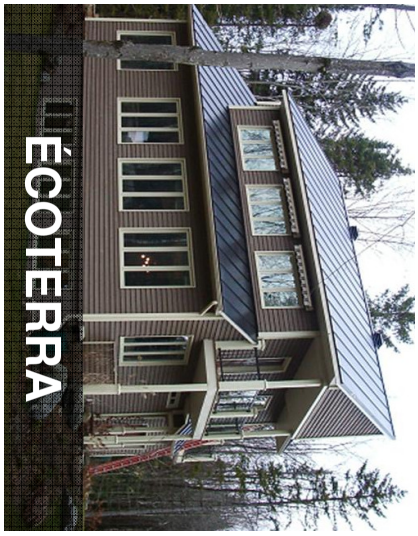


note: 100 kWh/m²y = 32 kBTU/ft" y

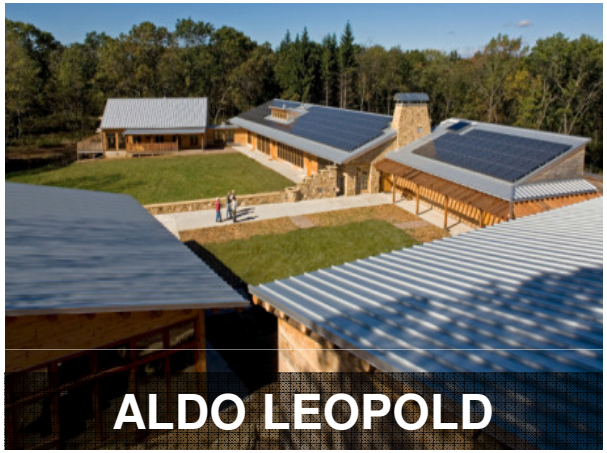
University of Wuppertal - Department of Architecture
Environmental building design / Bauphysik und Technische Gebäudeausrüstung, btga
Prof. Dr.-Ing. Karsten Voss
Eike Musall, M.Sc.arch.
www.btga.uni-wuppertal.de
Pauluskirchstr. 7, 42285 Wuppertal

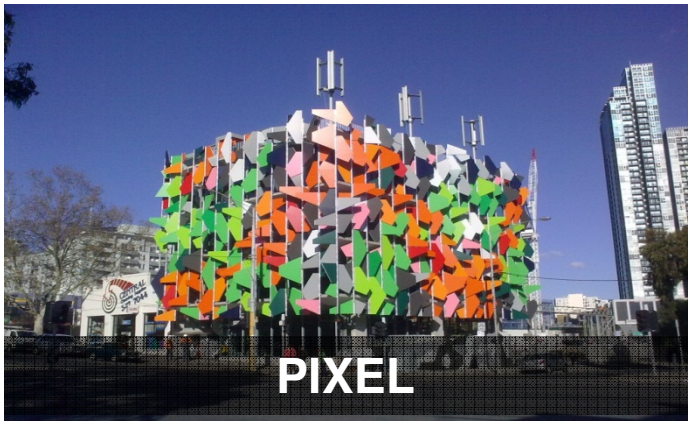
Residential buildings





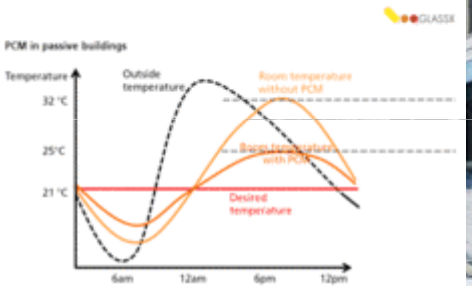
Non-residential buildings





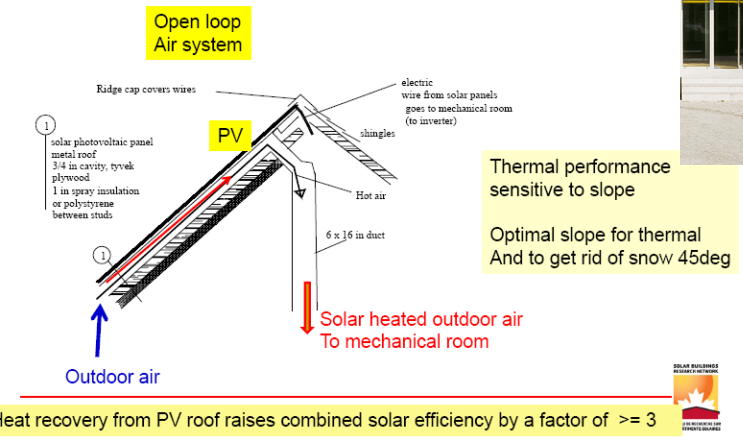
Towards Innovation - Towards NZEB

PCM



www.glassx.ch

Building-integrated photovoltaic/thermal system principle and design (Theme 1 of SBRN)

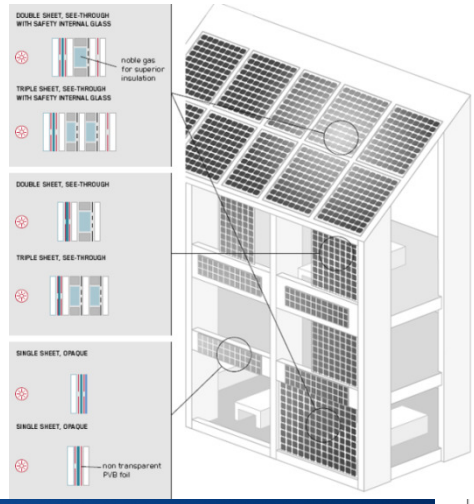


Thermal performance sensitive to slope

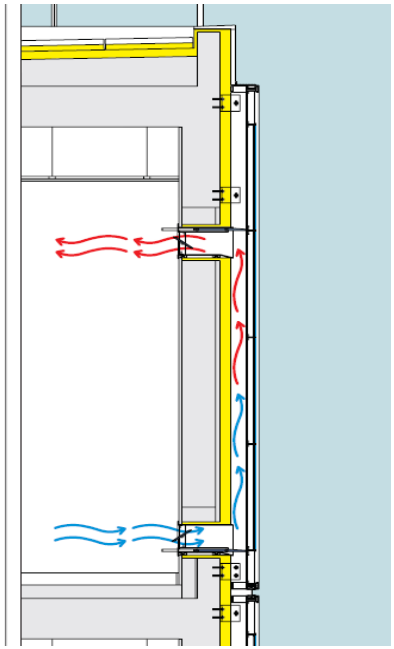
Optimal slope for thermal
And to get rid of snow 45deg

Heat recovery from PV roof raises combined solar efficiency by a factor of >= 3

BIPV



sapa-solar

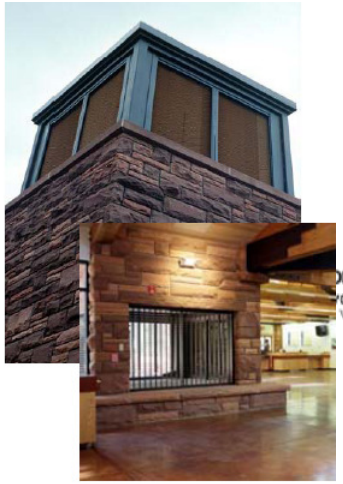


BIPV-T

LNEG

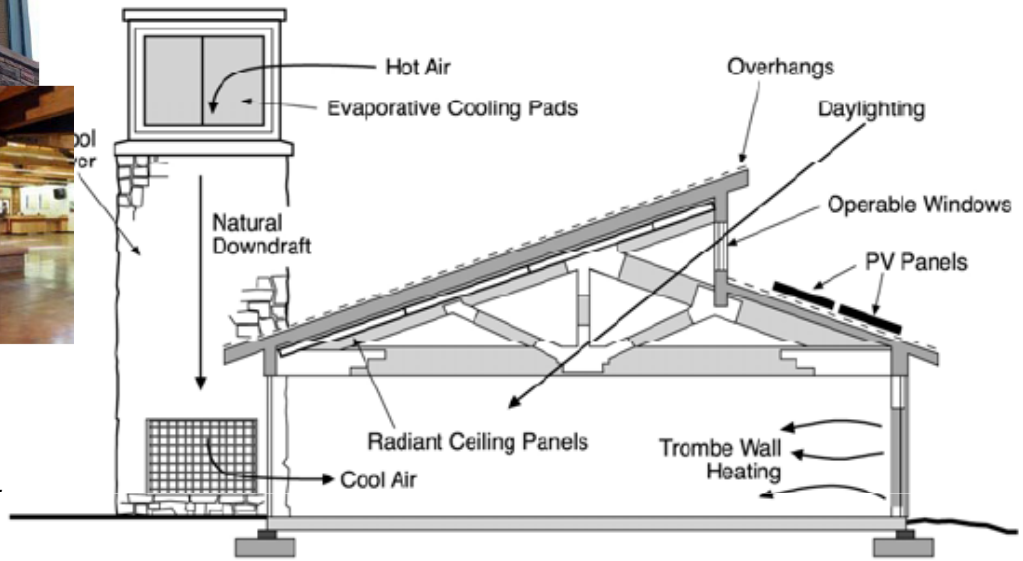
ex. Canada

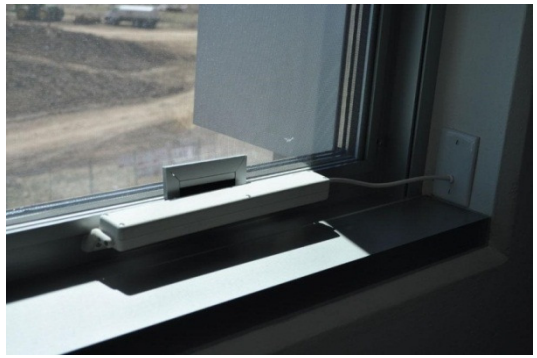
Towards Innovation - Towards NZEB



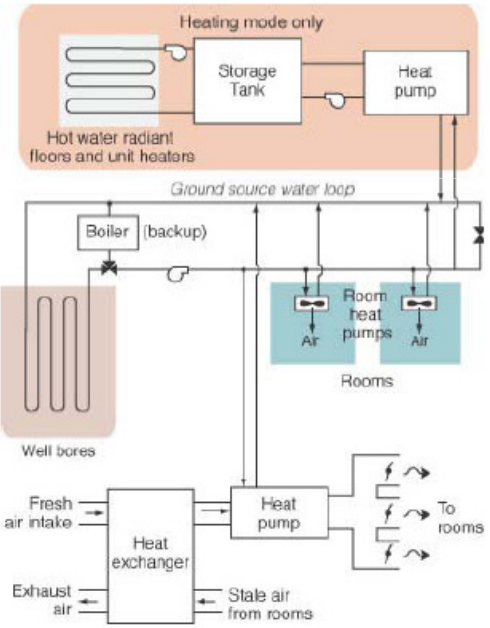
cooltower

P. Torcellini NREL





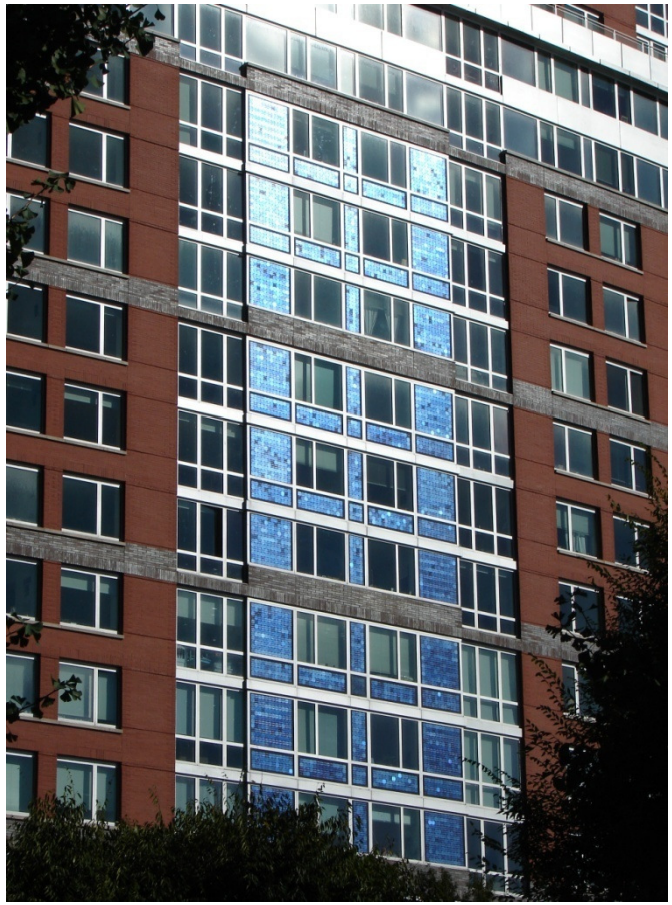
Ground source heat pump
Heat recovery ventilators
Radiant slab

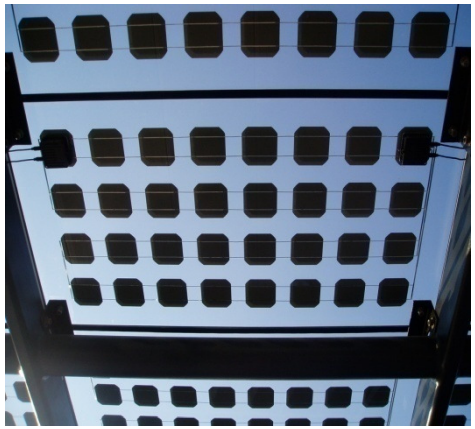


ARCHITECTURAL INTEGRATION CHALLENGE

Solaire – Battery Park City, NY: 33 kWp USGBC LEED – Gold

Architect: Cesar Pelli





Cortesy

altPOWER®

RELAB

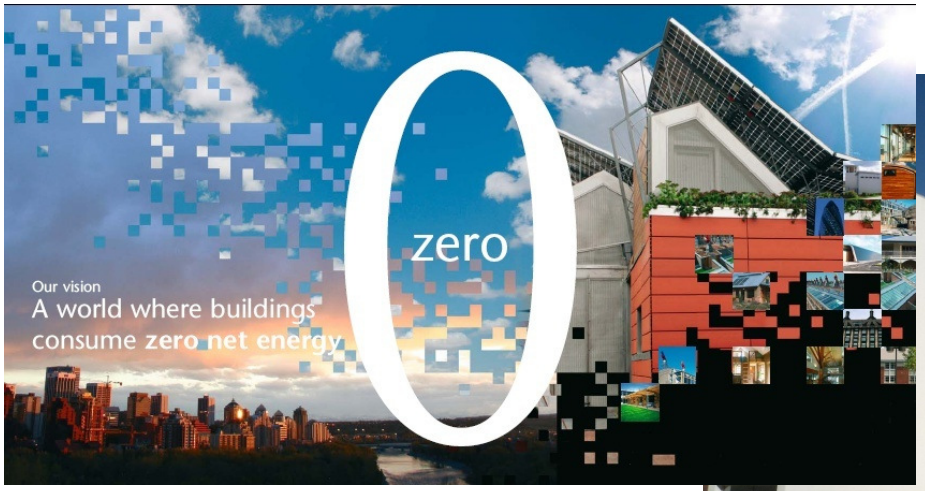
RENEWABLE ENERGY LABORATORY

ARCHITECTURAL INTEGRATION CHALLENGE

Bahrain World Trade Center

Sigma House
BRE Innovation Park

Innovation_Park/InnovParkBrochure2012.pdf



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