

Climate change and future scenarios in the Arctic Region

**SUSTAINABLE HOUSING DESIGN
IN THE ARCTIC REGION**

**December 11-12, 2014
Venice International University
Isola di San Servolo, Venezia**

**Anna Devitofrancesco
Researcher, National Research Council of Italy (CNR)
*Construction Technologies Institute (ITC)***



01

01. SUSTAINABLE BUILDING IN ITALY THROUGH EUROPEAN DIRECTIVES

02. BUILDING SUSTAINABILITY ASSESSMENT

03. EUROPEAN INITIATIVE TOWARDS SUSTAINABILITY

04. COLLABORATION PROPOSALS ITALY-ARCTIC COUNTRIES

INTERNATIONAL OBJECTIVE OF CONSTRUCTION SECTOR:

LIMIT THE ENVIRONMENTAL IMPACT OF BUILDINGS

HOW?

- *Save resources*
- *Avoid pollution*
- *Reduce energy consumption and CO₂ emissions*
- *Minimize life cycle costs of construction*
- *Provide comfortable and healthy living space for users*

EUROPEAN DIRECTIVES

DIRECTIVE 2002/91/EU

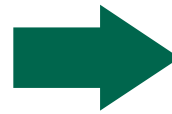
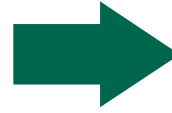
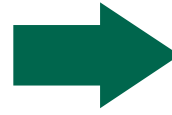
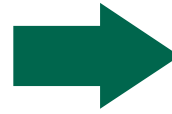
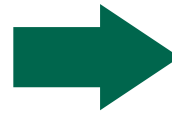
- Methodology of calculation of the integrated energy performance of buildings
- Setting of minimum requirements on the energy performance of buildings
- Energy certification of buildings
- Regular inspection of heating and of air-conditioning systems

DIRECITVE 2006/32/EU

- Energy Efficiency Action Plan to maximize efficient end use of energy:
- Provide necessary targets as well as mechanisms, incentives and institutional, financial and legal frameworks
 - Remove existing market barriers and imperfections

DIRECTIVE 2009/28/EU

Promotion of use of energy from renewable sources



ITALIAN IMPLEMENTATION

Dlgs192/2005, Dlgs 311/2006

Energy performance verification
Mandatory Thermal Transmittance limits
Mandatory Sun shade and Solar Thermal System

DPR50/2009

Confirmation of the minimum requirements of DLGS 192
Minimum cooling energy performance standard requirements

DM 26/06/2009

National Guidelines for Energy Certification

DLgs 155/2008

Volumetric increase is allowed for more insulated envelope and floor slabs
No DIA (mandatory documentation addressed to municipality for beginning design) if thermal solar and photovoltaic systems are used

DLgs 28/2011

New buildings have to supply part of the electric and thermal energy needs with renewable sources

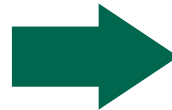
EUROPEAN DIRECTIVES

DIRECTIVE 2010/31/EU

- Improvement of energy performance considering:
 - external and internal climatic conditions
 - optimal cost levels

Objective: Nearly zero-energy buildings

- As of 2021 new buildings in the EU will have be NZEB
- As of 2019 all new public buildings
- Mandatory energy certification advertisements



ITALIAN IMPLEMENTATION

DL 63/2013 and Law 90/2013

- Evaluation of economical feasibility: Best cost-effectiveness
- Mandatory energy performance certificate
- NZEB: all new public buildings as of 2019 and as of 2021 all new buildings
- National programs for increasing the number of nearly zero-energy buildings by 31/12/2014

02

01. SUSTAINABLE BUILDING IN ITALY THROUGH EUROPEAN DIRECTIVES

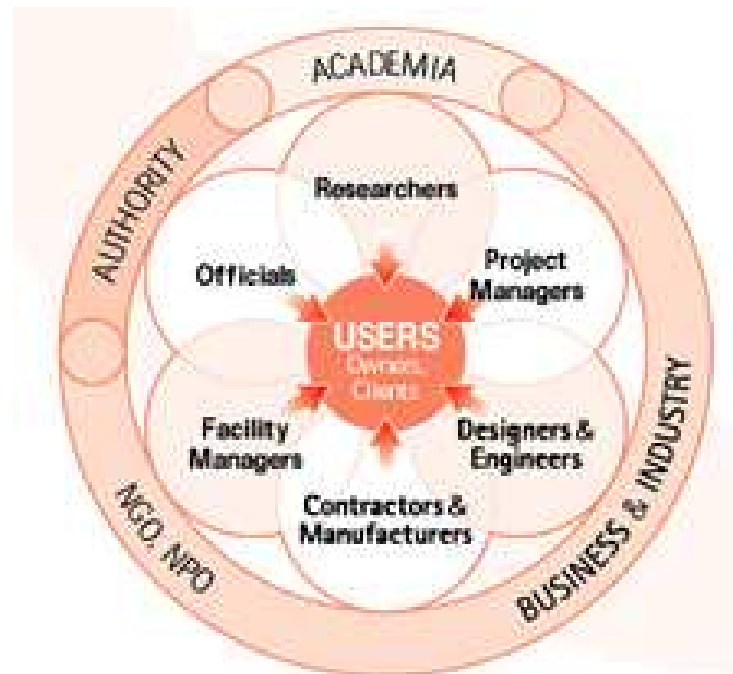
02. BUILDING SUSTAINABILITY ASSESSMENT

03. EUROPEAN INITIATIVE TOWARDS SUSTAINABILITY

04. COLLABORATION PROPOSALS ITALY-ARCTIC COUNTRIES

***WHAT IS REQUIRED TO FACILITATE MARKET MOVEMENT
TOWARDS A BETTER LEVEL OF SUSTAINABILITY AND NEARLY
ENERGY ZERO BUILDING?***

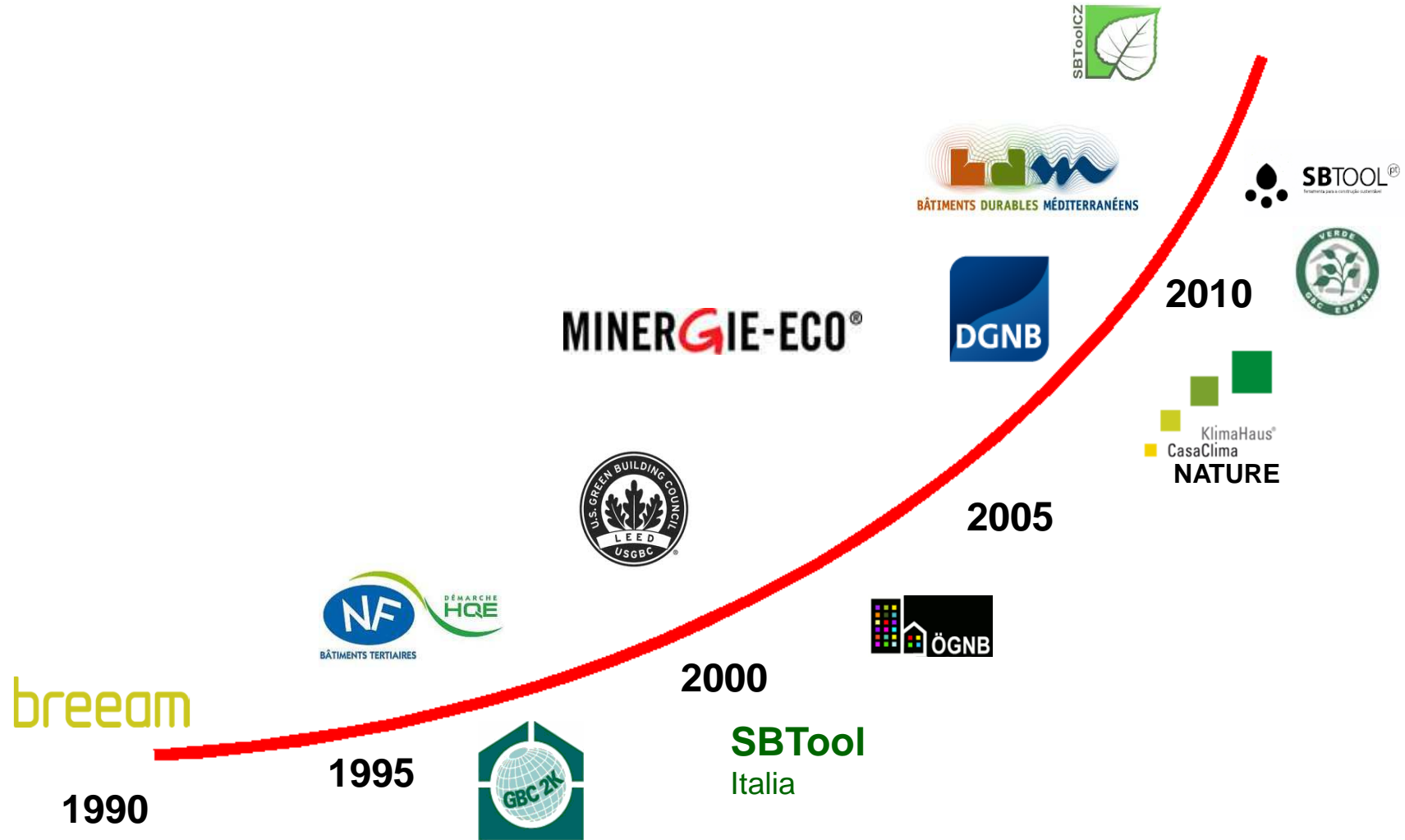
***Synergic actions and initiatives of all stakeholders of building
sector: experts, users, politician, big companies, house owner.***



HOW?

Common language to evaluate both environmental and construction complexity

**BUILDING SUSTAINABILITY ASSESSMENT
IS A CRUCIAL TOOL TO FACE THIS COMPLEXITY**



SUSTAINABLE HOUSING DESIGN IN THE ARCTIC REGION
BUILDING SUSTAINABILITY ASSESSMENT
GREEN BUILDING CHALLENGE

02



R&D international process

- Started in 1996
- Included more than 25 countries
- Involved Italy and some Arctic countries



- ✓ *Common international methodological approach (SBMethod)*
- ✓ *Sustainability evaluation and certification tool, suitable for any local conditions (SBTool)*

SUSTAINABLE HOUSING DESIGN IN THE ARCTIC REGION
BUILDING SUSTAINABILITY ASSESSMENT
GREEN BUILDING CHALLENGE

France	CSTB	South Africa	CSIR
USA	Department of Energy	Australia	University of New South Wales
Canada	NRC	Austria	Ökologie Institut
Japan	Utsunomiya University	Finland	Motiva
Italy	ITC-CNR+iiSBE IT	Greece	University of Thessaloniki
South Korea	Ministry of Environment	China	University of Hong Kong
Taiwan	Cheng Kung University	Poland	University of Warsaw
Norway	Norwegian Building Research Institute	UK	BRE
Sweden	Royal Institute of Technology	Israel	iiSBE Israel
Germany	University of Karlsruhe	Mexico	GBC Mexico
Netherlands	Novem	Brasil	University of San Paolo
Argentina	University of Buenos Aires	Chile	Chilean Chamber of Construction

AIM

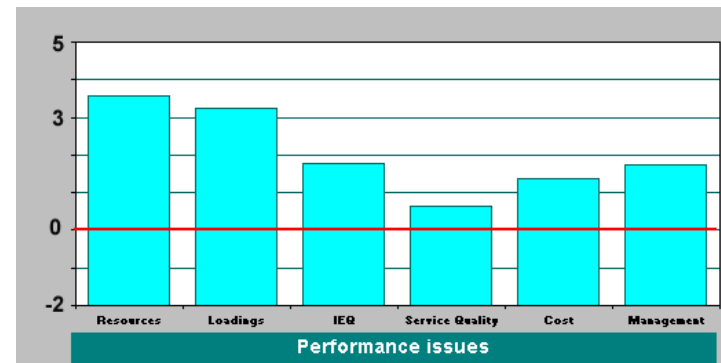
Evaluation of building sustainability level

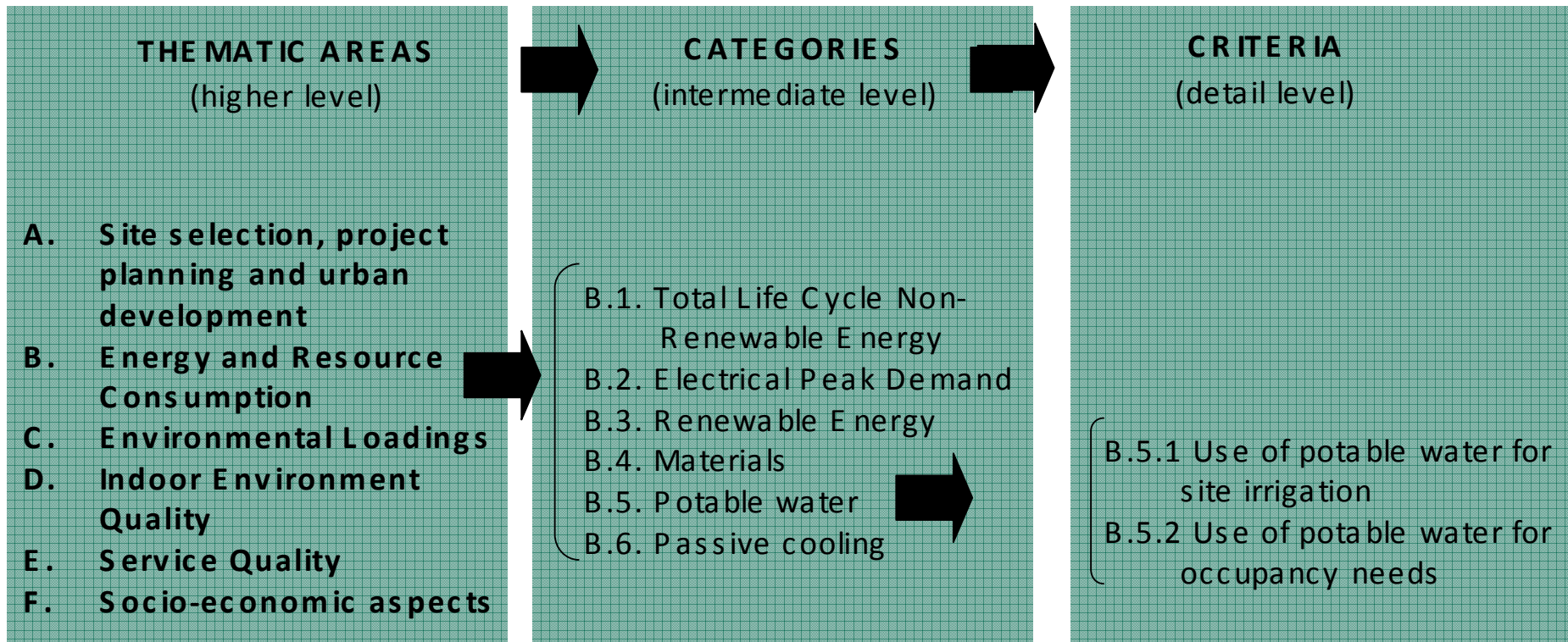
HOW

Analysis of performance using criteria based on objective indicators. Their values are calculated or measured with specific instruments

RESULT

Assessment and rating





ACTIVITIES FOR DEVELOPING ASSESSMENT TOOLS

● **ASSESSMENT CHECK-LIST**

- ✓ *Select of criteria from a general masterlist*

● **BENCHMARKING**

- ✓ *Establish reference performance with which to compare those of building*

● **WEIGHTING**

- ✓ *Assigne percent weights to all levels of evaluation (thematic areas, categories and criteria)*

Each activity includes a contextualization process concernig:

- *Use destination of building (housing, commercial, industrial buildings, offices, schools...)*
- *Possibility to provide objective evaluation of criteria*
- *Climatic, social and economic context*
- *Technical and political choices*

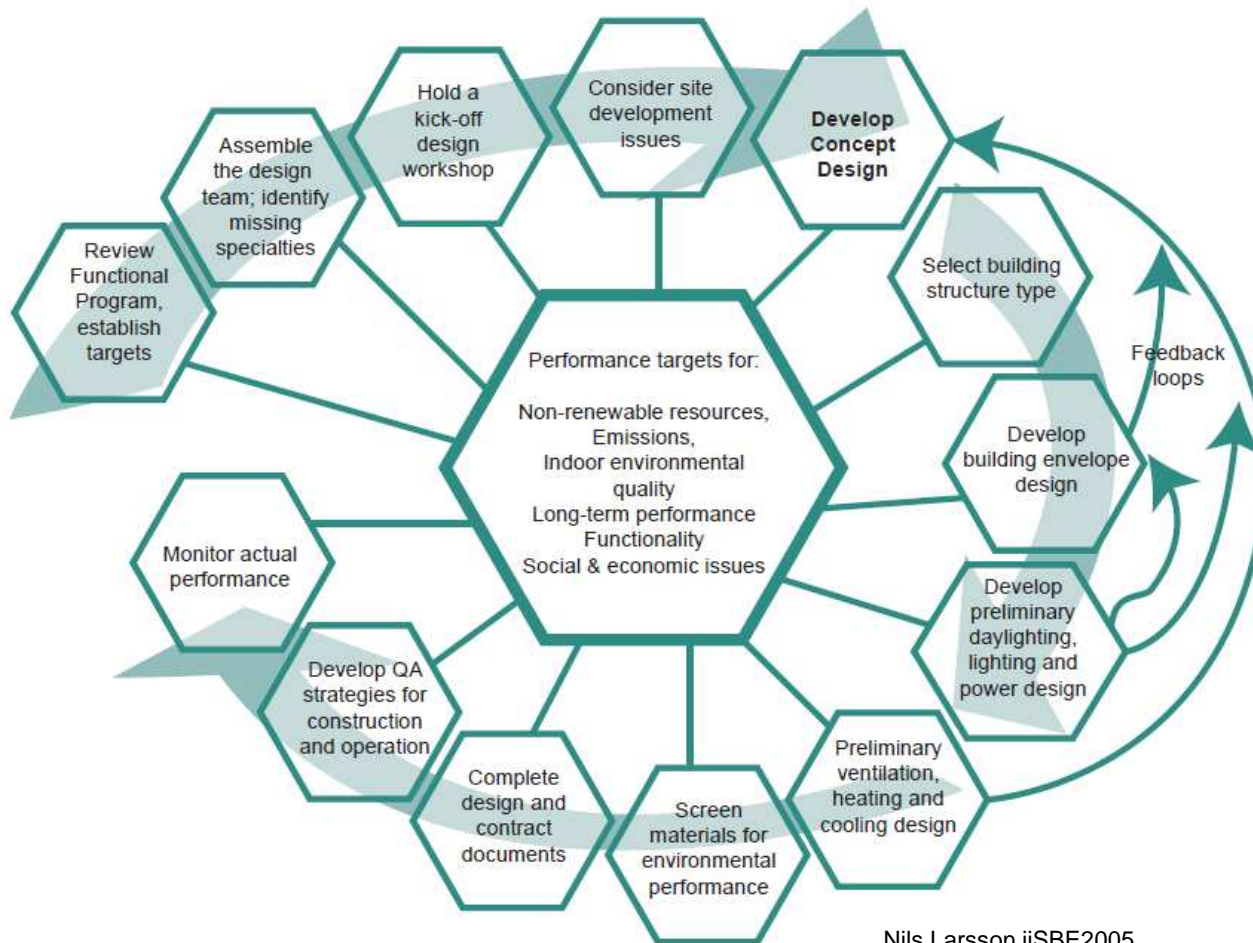
Performance	Score
Performance below of standard practice	-1
standard practice	0
Moderate improvement of standard practice	1
Significant improvement of standard practice	2
best practice	3
Moderate improvement of best practice	4
excellence	5

- 1 Evaluate sustainability level in relation to local context**
- 2 Analyze quality in terms of performance**
- 3 Consider the whole life cycle**
- 4 Support integrated design process**

DESIGN APPROACH TOWARDS BUILDING WITH HIGH PERFORMANCE LEVEL OF SUSTAINABILITY REDUCING COSTS

IDP KEY-WORDS

- ***Inter-disciplinary work between occupants, architects, engineers, costing specialists and other relevant actors***
- ***Process started from the beginning of the design process to the operational stage building***
- ***Design objectives shared by all key-actors***
- ***Contextualization***
- ***Budget restrictions applied at whole-building level***
- ***Need of a specialist in the field of energy and sustainability***



Nils Larsson iISBE2005

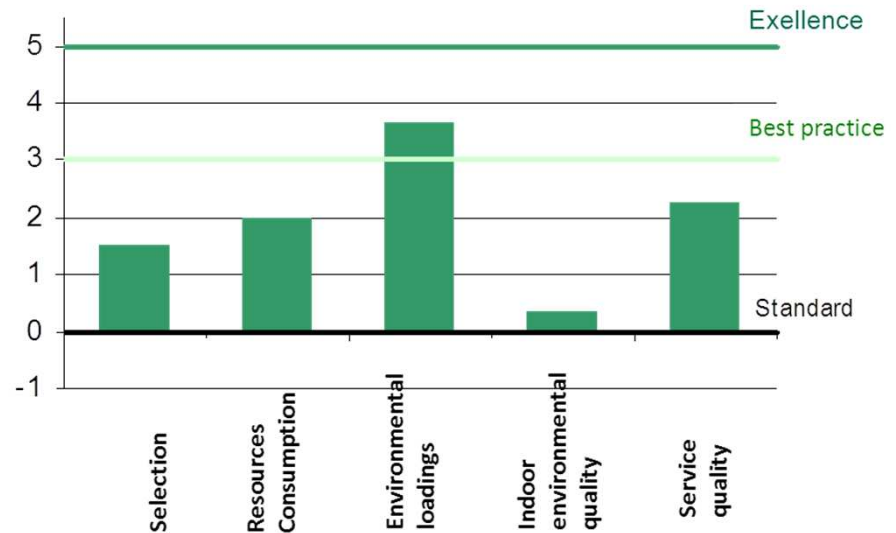
1. *Listen occupants needs*
2. *Define performance targets and develop preliminary strategies*
3. *Reduce heating loads and optimize daylighting, handling architectural and building variables*
4. *Use of renewable technologies and efficient HVAC systems, while optimizing IEQ performances*
5. *Produce at least two concepts design solutions iterating the process to enhance building configuration and then select the most promising*

BUILDING SUSTAINABILITY ASSESSMENT TOOLS SUPPORT IDP

- *Definition of performance targets*
- *Selection of optimal energy and environmental design strategies*
- *Monitoring of behaviour of operational stage of building to guarantee sustainability level reached at design stage*



Performance	Score
Performance below of standard practice	-1
standard practice	0
Moderate improvement of standard practice	1
Significant improvement of standard practice	2
best practice	3
Moderate improvement of best practice	4
excellence	5



03

01. SUSTAINABLE BUILDING IN ITALY THROUGH EUROPEAN DIRECTIVES

02. BUILDING SUSTAINABILITY ASSESSMENT

03. EUROPEAN INITIATIVE TOWARDS SUSTAINABILITY

04. COLLABORATION PROPOSALS ITALY-ARCTIC COUNTRIES

CESBA INITIATIVE



Common European Sustainable Building Assessment

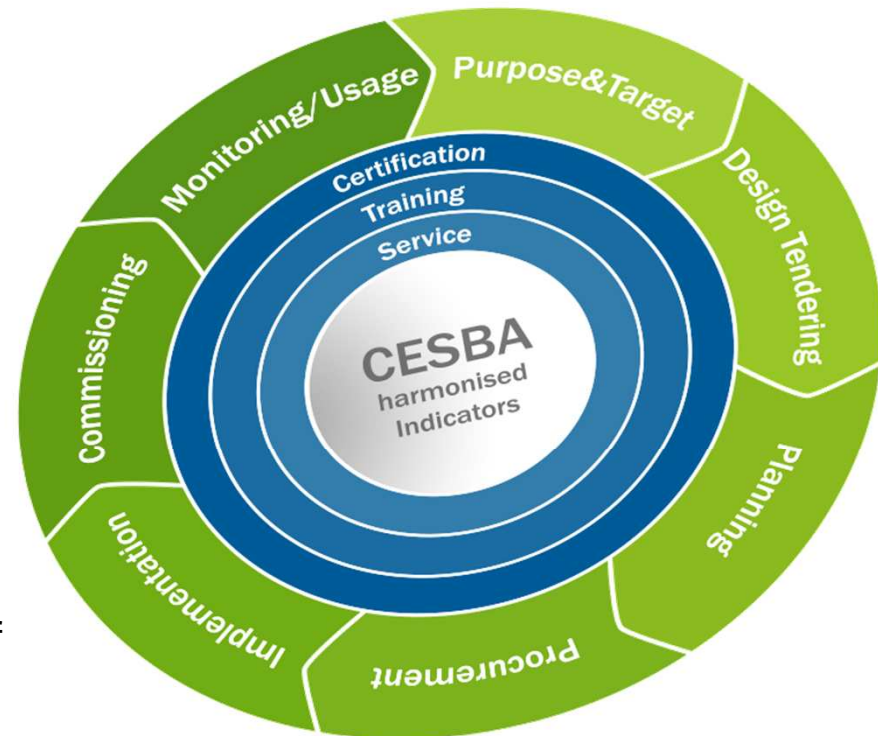
14 European Countries, included ITALY
(recent endorsement of CNR)

Vision:

“A Europe where high quality living in a sustainable built environment is common standard practice”.

Mission:

- Facilitate the diffusion and adoption of sustainable built environment principles
- Involve all stakeholders of building sector in using **harmonized assessment systems**



On the 1st of July 2014 the European Commission published the COM(2014) 445

calling for the establishment of a common flexible framework of core indicators for the evaluation of sustainability that consider the whole building life cycle.

Need for action coincides with the CESBA goals and philosophy.

CESBA NEW PROJECT IDEA FOR FUTURE INTERREG PROGRAMS

- **Common Sustainable Building Assessment in Alpine Regions**
Development of a set of harmonized regional assessment tools to be validated in public initiatives
- **Planning Sustainable Neighborhoods**
Development, integration and test of assessment tools at urban scale in urban planning processes
- **Funding programs:**
✓ Interreg Europe 2014-2020

04

01. SUSTAINABLE BUILDING IN ITALY THROUGH EUROPEAN DIRECTIVES

02. BUILDING SUSTAINABILITY ASSESSMENT

03. EUROPEAN INITIATIVE TOWARDS SUSTAINABILITY

04. COLLABORATION PROPOSALS ITALY-ARCTIC COUNTRIES

PROBLEMS AND OBJECTIVES IN THE ARCTIC REGION

● **PROBLEMS**

- ✓ *Overcrowding (negative consequences to health and well-living)*
- ✓ *Degradation of housing (extra cost for repairs and upgrades)*
- ✓ *High cost of living and public services*
- ✓ *High cost of energy/fuel*

● **OBJECTIVES**

- ✓ *Development of sustainable design solutions*
- ✓ *Contextualization in relation to northern climate*
- ✓ *Best cost-effectiveness*
- ✓ *Sustainability in the area of social housing*
- ✓ *IDP improving engagement of housing occupants*
- ✓ *Use of building sustainability assessment tools*

- 1** Common Sustainable Building Assessment: R&D process to develop common core indicators for the evaluation of sustainability level in Arctic climate (environmental, economic and social sustainability).
- 2** Pilot building design and construction, energy and environmental efficient, durable cold climate solutions, adapted to new climatic and environmental realities. Best practices case studies both in each Arctic country and in Italy with particular attention to social housing.
- 3** Develop tools associated with environmental rating, heat loss and degradation, housing public policies and better communications to end users including Northerns and indigenous people.
- 4** Develop methods and work on integrated design process to improve occupants awareness and engagement.



THANK YOU!

anna.devitofrancesco@itc.cnr.it



Construction Technologies Institute of National Research Council of Italy