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AIDA

AFFIRMATIVE INTEGRATED ENERGY DESIGN ACTION

Azione nZEB, per il piano d'azione per l'energia sostenibile verso edifici nZEB.

Jordi Cipriano,

19th September 2013

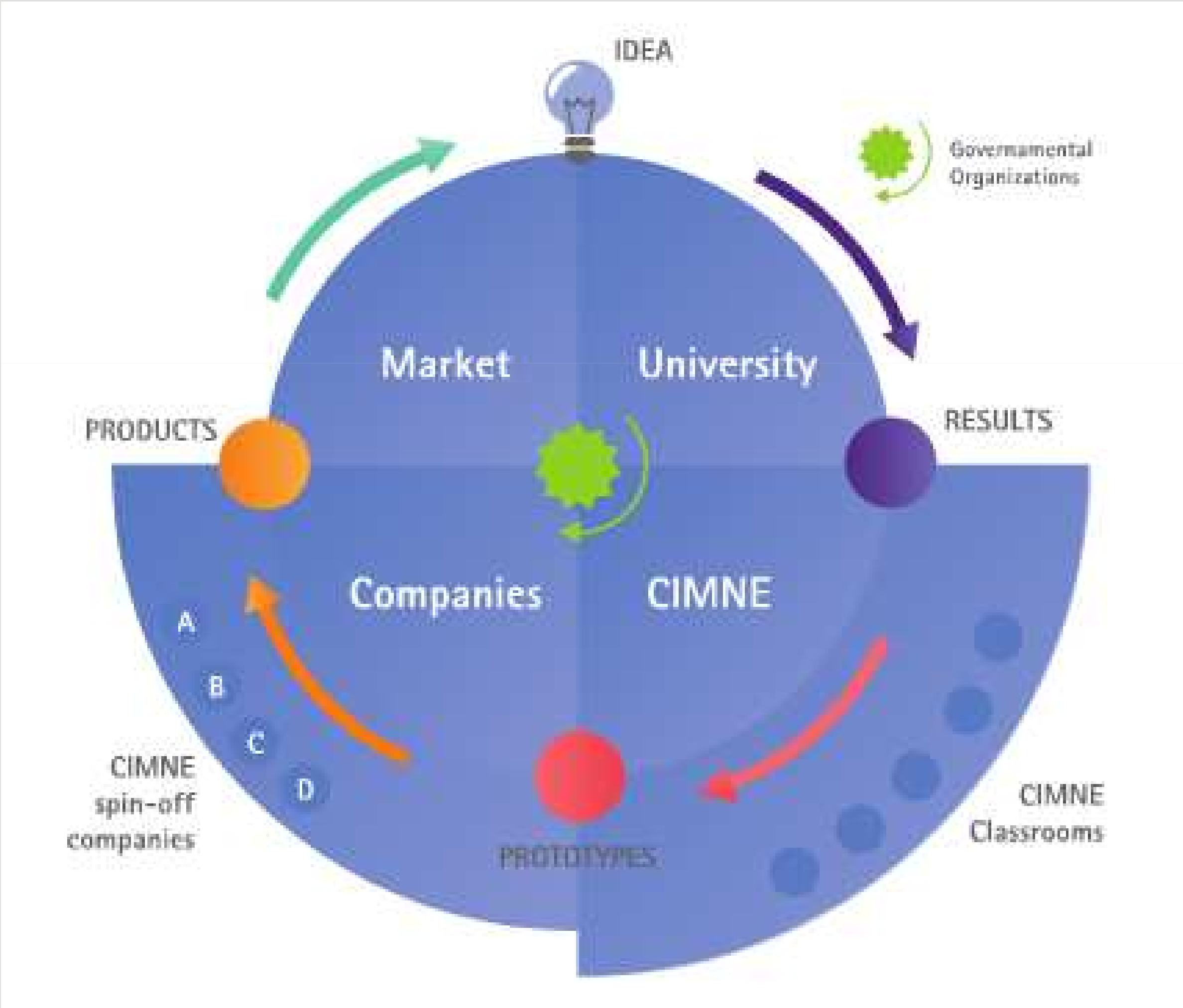
CIMNE

Co-funded by the Intelligent Energy Europe Programme of the European Union

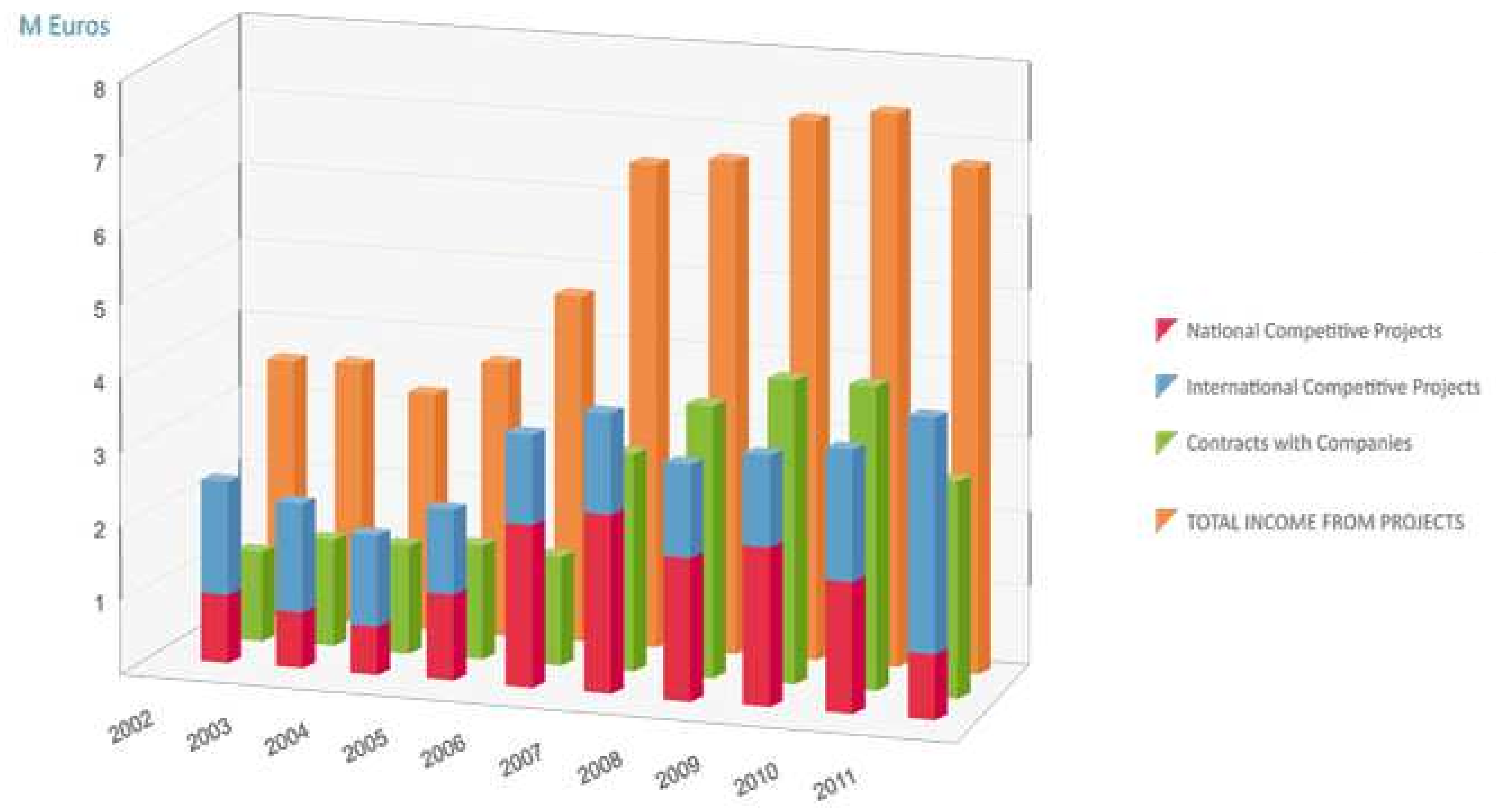
CIMNE

The **International Center for Numerical Methods in Engineering** is public research center with the mission of fostering the development, and application of numerical and simulation methods for the solution of engineering problems in an international context.

CIMNE


IDEA
Governamental
Organizations
Market
University
PRODUCTS
RESULTS
Companies
CIMNE
A
B
C
D
CIMNE
spin-off
companies
PROTOTYPES
CIMNE
Classrooms

CIMNE: BIG NUMBERS



BEE Group - CIMNE

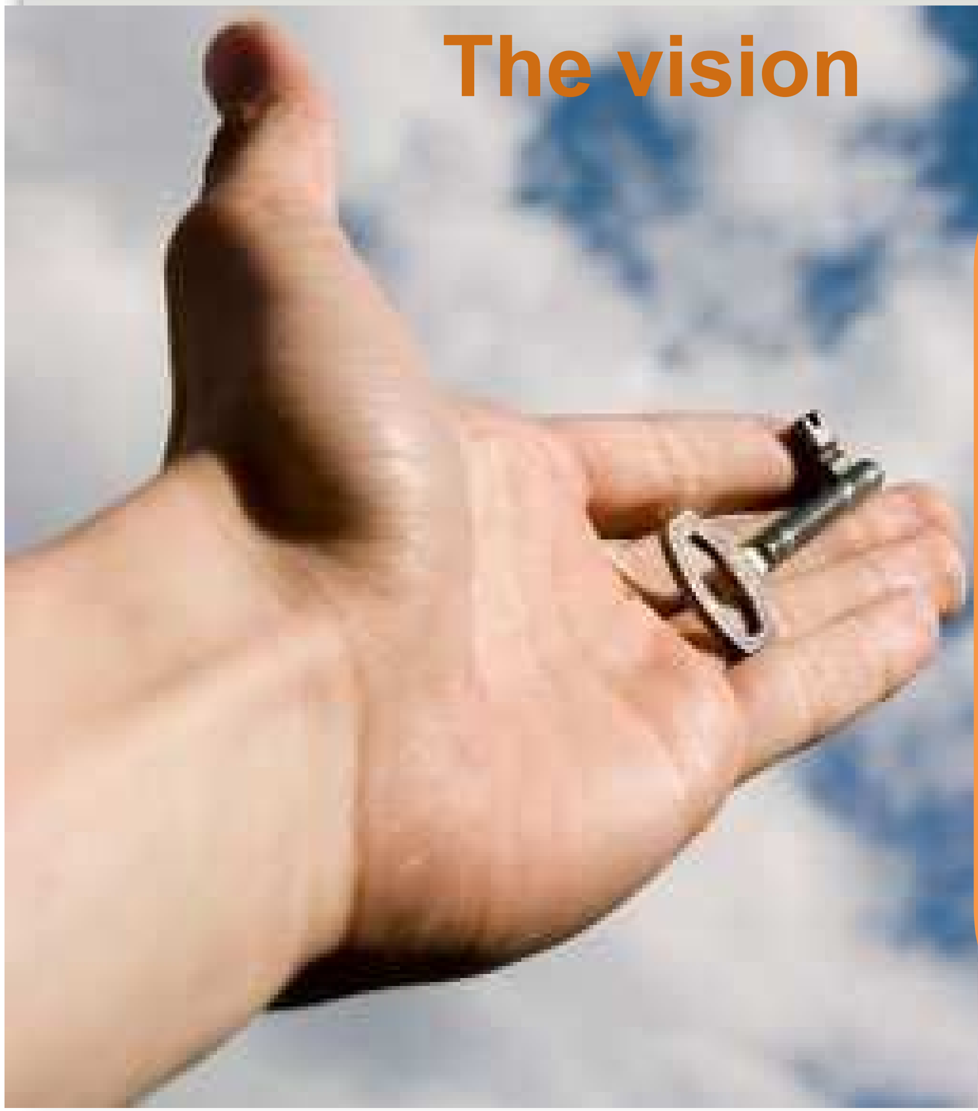
BEE Group

The **Building Energy and Environment Group (BEE)** is an autonomous research unit of CIMNE. It was founded in 2001. It has two main headquarters:

- **CIMNE-Terrassa:** It is placed at GAIA building of the UPC of Terrassa .

- **CIMNE-UdL Classroom:** It is placed at CREA building of the University of Lleida.

The vision



to **make energy use in buildings** more sustainable by

making **better energy management**

more affordable, more effective, more attractive and therefore

more appealing.

BEE Group: Research lines

- **De-risking energy services:** *"overall vision of the real building energy performance, based on an understanding of the influence of building **pathologies and occupant behaviour**"*

- **Smart urban environments:** *"Working with local authorities aiming at integrating software tools and systems in **integral decision making platforms"***

- **Energy Positive living:** *"Working actively to raise the awareness in the trend towards an **energy balance where the building produces as much energy as it consumes"***

- **Customers empowerment:** *"Improving the quality of information provision to **empower citizens to participate more actively in their energy expenses** "*

BEE Group: European projects

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- **BECA** – Balanced European Conservation Approach – ICT services for resource saving in social housing (2011), http://www.beca-project.eu
- **SmartSpaces** - Saving Energy in Europe's Public Buildings Using ICT (2012), http://www.smartspaces.eu
- **EMPOWERING** (2013) – Intelligent Energy Europe
- **ENCERTICUS**- Energy Certification, Information and Communication Technologies for User Satisfaction.

- **SEMANCO** - Semantic Technologies For Carbon Reduction In Urban Planning, http://semanco-project.eu/index.htm
- **AIDA** - Affirmative Integrated Energy Design Action, http://www.aidaproject.eu/

- **Build up 2** - the European web portal for energy efficiency in buildings, http://www.buildup.eu/

BEE Group: INERGY

Start up company with RSM GASSÓ.

Since 2006, CIMNE and Gassó RSM created a start-up company called INERGY. www.inergybcn.com, specialized in energy efficiency consultancy and monitoring software development.

RSM Gassó Cimne Energy, SL

Two main software tools are being commercialized and are now used by

250 municipalities, 10 private companies, and 2 public housing companies, in more than 5,000 office buildings , 3,000 electric lighting systems and 300 dwellings.

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The AIDA project

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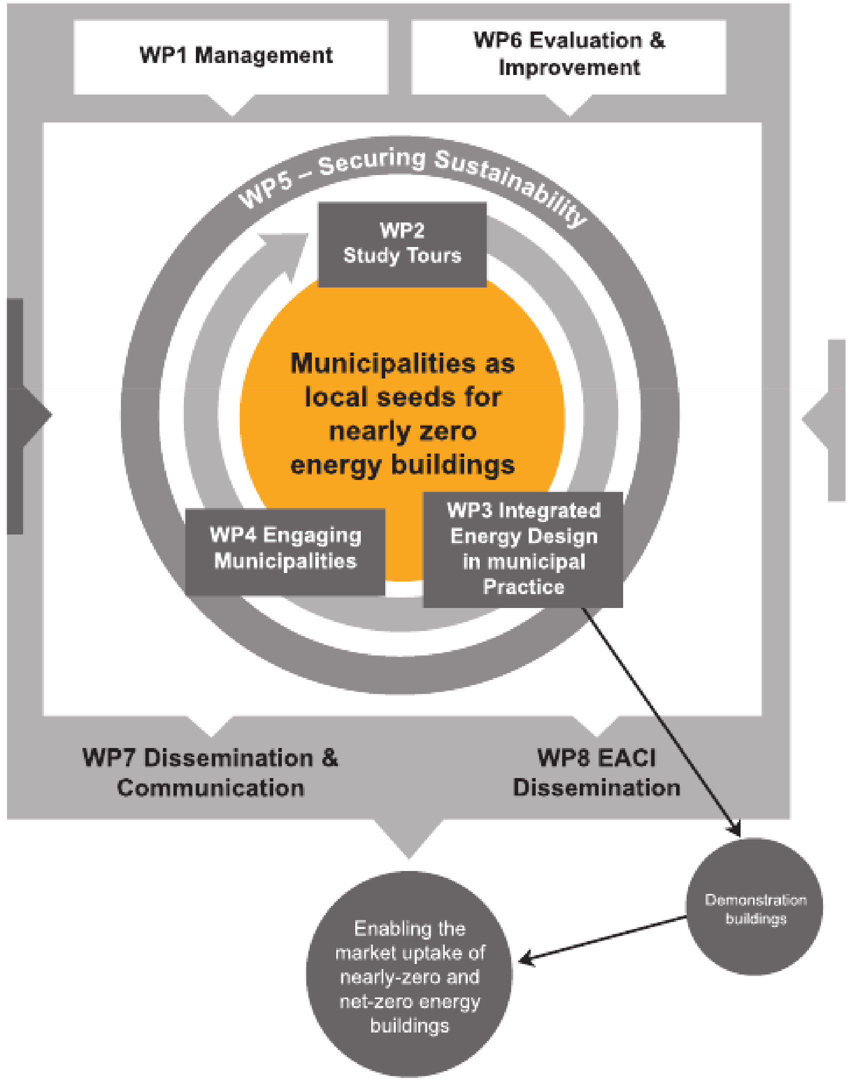
The AIDA project aims to accelerate the market entry of NZEB.

Target groups

- Municipal representatives
- Architects
- Master-builders.

Actions

- Study tours
- Success stories
- Active support for municipalities
- Close cooperation with key actors



The AIDA consortium

Vienna University of Technology - Energy Economics Group	
AEE - Institute for Sustainable Technologies	
CIMNE BEEGROUP, - Building Energy and Environment	
Centre for Renewable Energy Sources and Saving - Energy Policy Analysis Department	
EURAC research - Institute for Renewable Energy	
Geonardo Environmental Technologies Ltd.	
HESPUL - énergies renouvelables & efficacité énergétique	
IREC - Catalonia Institute for Energy Research	
Greenspace Live Ltd.	
Energy Cities (sub-contractor)	

AIDA: Study tours

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Blood and Tissue Bank of Catalunya
Barcelona (ES)

Kehrerhof Siebeneich
Bolzano (IT)

Naturaliabau
Merano (IT)

RCTECH's HQ
Athens (GR)

Retrofitted multi-family house
Kapfenberg (AT)

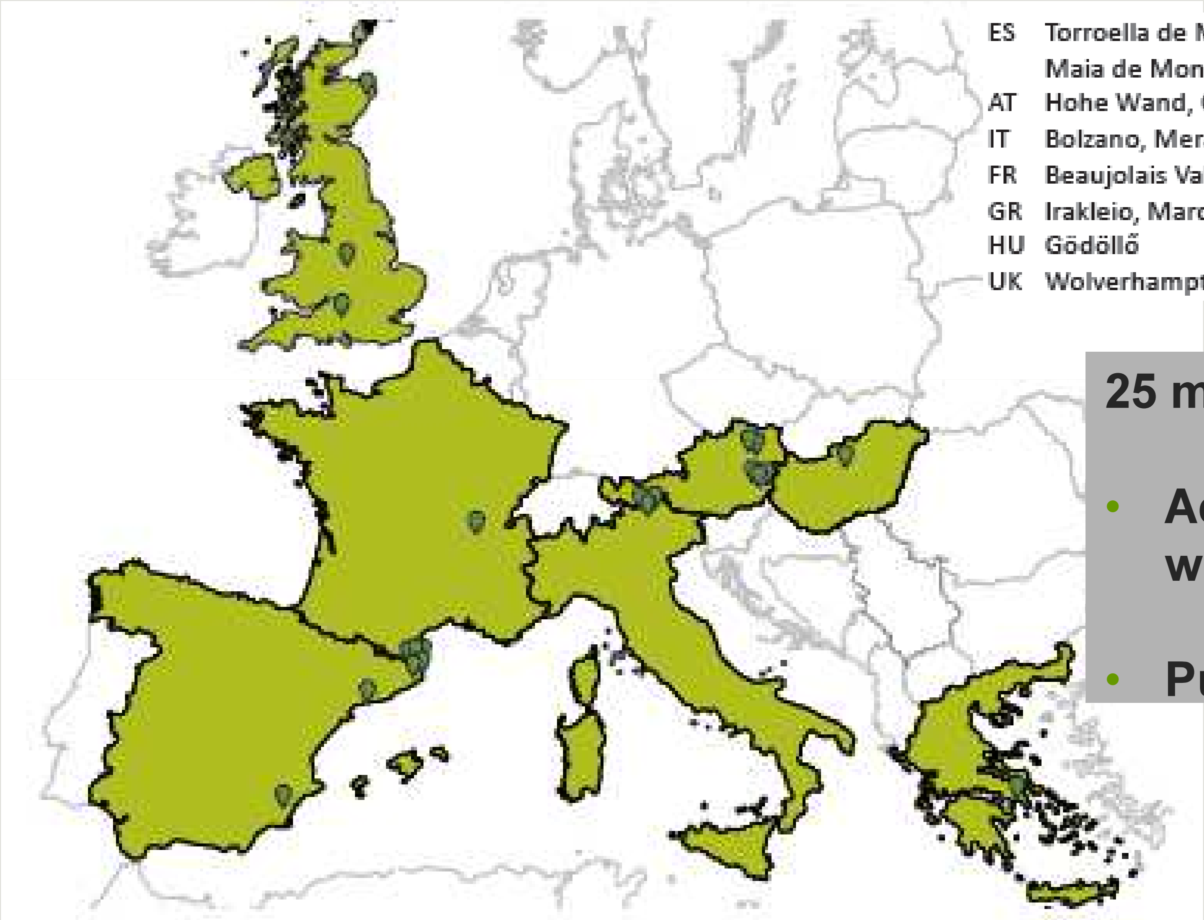
Salewa Spa HQ
Bolzano (IT)

Student Dormitories "Aliki Perroti" at the American Farm School
Thessaloniki (GR)

HLFS Forstwirtschaft
Bruck an der Mur (AT)

Regional Environmental Center HQ
Szentendre (HU)

AIDA: Municipalities



ES Torroella de Montgri, Gualta, Ordis, Girona, Tarragona, Figueres, Maia de Montcal, Murcia
AT Hohe Wand, Gutenstein, Hartberg, Gleisdorf, Weiz
IT Bolzano, Merano, Brixen
FR Beaujolais Val de Saone
GR Irakleio, Maroussi
HU Gödöllő
UK Wolverhampton, Hampshire Council, Grampian Regional Council

25 municipalities engaged in:

- **Actions to promote NZEB within SEAP**
- **Public tenders of NZEB**

Background: SEAP

A **SEAP** is the key document in which the Covenant signatory outlines how it intends to reach its CO_2 reduction target by 2020.

It defines the activities and measures set up to achieve the targets, together with time frames and assigned responsibilities.

Template: (http://www.eumayors.eu/support/library_en.html)

Two sections:

1. Baseline Emission Inventory and local baseline.
2. Sustainable Action Plan

Background: SEAP

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NZEB WITHIN SEAP'S

In this project **the promotion of nZEBs** is limited to **public buildings**.

They can be **new or existing buildings** with a retrofitting plan.

The action to promote nZEB must be included in the second section of the SEAP

Following **indicators** must be obtained:

- Estimated **costs** per measure
- **Energy savings** at primary energy level
- **Renewable energy** production
- Reduction of **CO_2 emissions**
- **Payback period**
- **Abatement cost** (€/Kg $CO_{2\ saved}$)

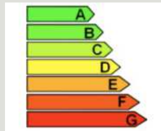
NZEB DEFINITION

nZEB acceptance criteria	Calculation method
Criterion 1: Building energy classification of **Class A (at primary energy level)** Energy loads: Space heating and cooling Domestic hot water Ventilation Auxiliaries Built-in-lighting	To determine the total energy demand of the building, the final energy consumption, the primary energy consumption and, finally, to evaluate the primary energy of CO_2 emissions
Criterion 2: Remaining primary energy must be covered by a **Renewable contribution of 50-70%**	To calculate and define both the power and the energy production of the renewable energy supplier system.
Criterion 3: Overall primary energy consumption of **50-60 kWh/m^2·year or maximum CO_2 emission of 3 Kg CO_2/m^2·year**	To calculate the total balance of primary energy

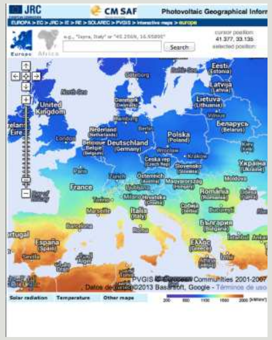
SOFTWARE TOOLS

Criterion 1: Energy Label A ⟹ **Official simplified tool for Energy certification**

CE3



Generation EU project:
(http://www.environmentcentre.com/rte.asp?id=31)
(http://www.provincia.modena.it/page.asp?IDCategoria=7&IDSezione=3640&ID=79458).



Criterion 2: RES production ⟹ **PV systems: PV GIS**
(http://re.jrc.ec.europa.eu/pvgis/)

Solar Thermal systems:
CHEQ4 (Spain) (http://www.idae.es)

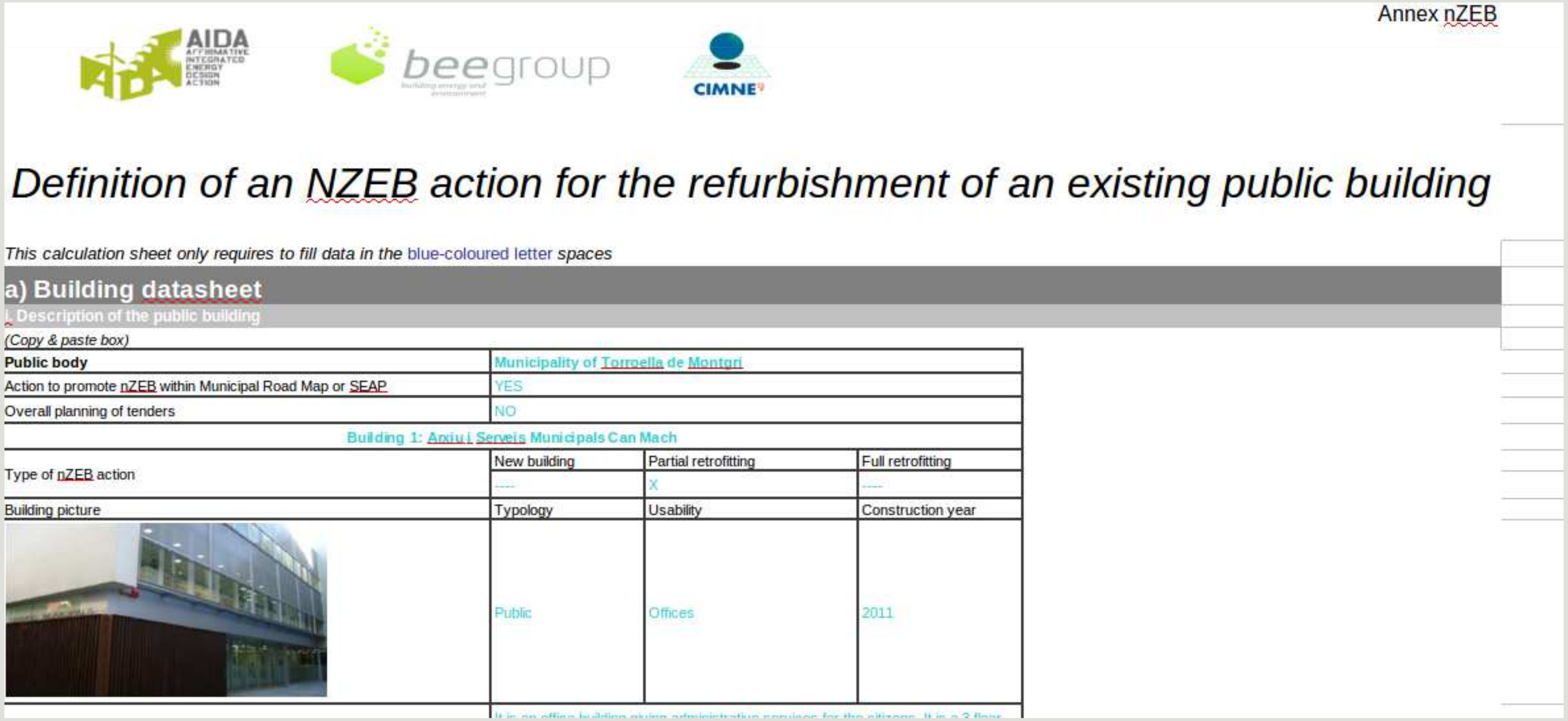
Biomass boilers: BIOHOUSING project
(http://www.biohousing.eu.com/heatingtool/).

SOFTWARE TOOLS

Criterion 3: CO_2 emissions saved ⟹ Excel file of AIDA project:

http://www.aidaproject.eu/library/wp4/annex_nzeb_paes_set_cat.xls

Economical calculations: ⟹ Excel file of AIDA project:



Annex nZEB

AIDA AFFIRMATIVE INTEGRATED ENERGY DESIGN ACTION · beegroup · CIMNE

Definition of an NZEB action for the refurbishment of an existing public building

This calculation sheet only requires to fill data in the blue-coloured letter *spaces*

a) Building datasheet

i. Description of the public building

(Copy & paste box)

Public body	Municipality of Torroella de Montgri		
Action to promote nZEB within Municipal Road Map or SEAP	YES		
Overall planning of tenders	NO		
Building 1: Arxiu i Serveis Municipals Can Mach			
Type of nZEB action	New building	Partial retrofitting	Full retrofitting
	----	X	----
Building picture	Typology	Usability	Construction year
	Public	Offices	2011

Step 1: Selection of buildings

The **energy consultancy companies** involved in the SEAP **should participate** in the selection.

If a **new building** is selected, then the **NZEB action affects the Public Tender.**

In case of **buildings to be retrofitted** a filtering of existing energy consumption and economical viability should be carried out.

Only buildings with **high energy savings potential** should be selected

Step 1: NZEB in new buildings

The 3 criterion should be included **within the Public tender definition**

In the SEAP an economic quantification of the overcost of NZEB and expected CO2 emissions savings should be estimated

Example: Municipality of Murcia (Spain)

Descripción del Plan de Acción de Energía Sostenible de Murcia

Murcia | ALEM

MEDIDAS DEL PLAN DE ACCIÓN DE ENERGÍA SOSTENIBLE DE MURCIA

SECTORES & *campos de actuación*	Acciones/ medidas clave por campo de actuación	Institución-Empresa Respon-sable	Periodo temporal de implementación de la actuación [fecha de inicio y fin]	Coste estimado (€) por acción /medida	Ahorro energético o esperado por medida [MWh/ acción al año]	Producción de energía renovable esperada por medida [MWh/ acción al año]	Reducción de CO2 esperada por medida [tCO2/ año]	Objetivo de ahorro energético por sector [MWh] en 2020	Objetivo de producción local de energía renovable por sector [MWh] en 2020	Objetivo de reducción CO2 por sector [tCO2] en 2020	Reducción de CO2 acumulada hasta 2020 [tCO2/ acción]	Ahorro energético acumulado hasta 2020 [MWh/ acción]	Ahorro económico acumulado hasta 2020 [€/ acción]
	Acción 8: Utilización de iluminación de alta eficiencia y bajo consumo en los nuevos edificios municipales o los rehabilitados	Ayuntamiento de Murcia	2010-2020	0	1.450	0	682				6.380	14.500	2.030.000
	Acción 9: Construcción de un edificio municipal de consumo casi nulo.	Ayuntamiento de Murcia	2020	360.000	331	100	190				948	1.655	231.700

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Step 1: NZEB in retroffiting

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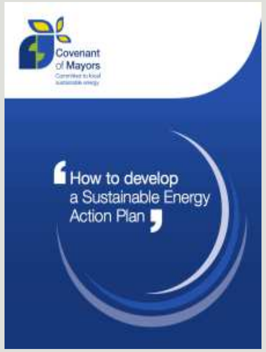
Example: Girona Province: 3 public buildings

Torroella de Montgrí

Ordis

Gualta

Diputació de Girona
221 municipis



Generic guide to incorporate NZEB actions in 180 municipalities

Step 2: Criterion 1

Base case scenario: Energy labeling before retrofitting

Current Situation	Heating	Cooling	DHW	Lighting	Total	Energy Class
Building energy demand (kWh/m²y)	43,46	13,32				Heating: D Cooling: E
Final energy consumption (Kwh/m²y)	8,69	2,66		149,15	160,51	D
Primary energy (kWh/m²y)	27,94	9,93	_	189,53	227,40	D
CO2 emission (kgCO_2/m²y)	6,95	2,47	_	47,13	56,55	D

Retrofitting measures to achieve A label:

Detected deficiencies	Improvement measures to carry out
Summer heat gains within the South façade.	Measure 1: Installation of shading protection devices in the ground floor above the South façade (in front of entry courtyard) .
High electric energy consumption of the building due to the lighting system.	Measure 2: Replacement of the existing lighting devices by LEDs.
Lack of renewable energy production.	Measure 3: Solar Energy PV facility for self-supply

Step 2: Criterion 1

Achievement of Criterion 1:

Case N	Improvement measures	Primary Energy savings (kWh/m2y)					Energy Class
		Heating	Cooling	DHW	Lighting	Total	
1	None	0	0	0	0	0	D
2	1	11,39	-1,29	0	0	10,10	D
3	2	17,13	-4,26	0	150,32	163,19	A
4	1+2	11,39	-1,29	0	150,32	160,42	A

Step 3: Criterion 2

RES production: PV systems in the rooftop

Performance of Grid-connected PV

PVGIS estimates of solar electricity generation

Location: 42°2'31" North, 3°7'12" East, Elevation: 10 m a.s.l.,
Solar radiation database used: PVGIS-CMSAF

Nominal power of the PV system: 10.0 kW (crystalline silicon)
Estimated losses due to temperature and low irradiance: 15.0% (using local ambient temperature)
Estimated loss due to angular reflectance effects: 2.6%
Other losses (cables, inverter etc.): 14.0%
Combined PV system losses: 28.7%

	Fixed system: inclination=38 deg., orientation=0 deg. (optimum)			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	28.90	895	3.81	118
Feb	36.30	1020	4.87	136
Mar	40.80	1260	5.64	175
Apr	42.30	1270	5.93	178
May	43.60	1350	6.23	193
Jun	44.80	1340	6.54	196
Jul	44.80	1390	6.66	206
Aug	43.50	1350	6.44	200
Sep	41.70	1250	6.01	180
Oct	35.20	1090	4.94	153
Nov	29.40	881	3.95	118
Dec	27.90	863	3.67	114
Year	38.20	1160	5.39	164
Total for year		14000		1970

Ed: Average daily electricity production from the given system (kWh)
Em: Average monthly electricity production from the given system (kWh)
Hd: Average daily sum of global irradiation per square meter received by the modules of the given system (kWh/m2)
Hm: Average sum of global irradiation per square meter received by the modules of the given system (kWh/m2)

Step 4: Criterion 3

nZEB criteria	Software tool	Baseline scenario	Result	Improvement measures
1	CE3	Class D	Class A	Class A retrofitting measures
2	PVGIS	0% RES	PV production: 14.000 KWh/y 50% RES	RES system measures
3	Excel of Annex nZEB	227,40 kWh/m²·year 56,55 Kg CO_2/m²·year	66,98 kWh/m²·y 7,07Kg CO_2/m²·y	All

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Step 5: Economical evaluation

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nZEB action summary	Main original SEAP fields				Added fields by the AIDA project	
SEAP measures	Estimated costs per action/measure (€)	Expected energy saving per measure (MWh/y)	Expected renewable energy production per measure (MWh/y)	Expected CO2 reduction per measure (Tn CO2/y)	Payback period (y)	Abatement cost (€/kg CO2 saved)
Class A retrofitting measures	43.548,14	48,61	0,00	17,46	3,24	0,77
RES system measures	23.900,00	0,00	14,00	3,78	7,15	0,88
Overall nZEB action	67.448,14	48,61	14,00	21,24	4,67	0,68

Introduction in SEAP template

SECTORS *& fields of action*	KEY actions/measures per field of action	d
BUILDINGS, EQUIPMENT / FACILITIES & INDUSTRIES:		
Municipal buildings, equipment/facilities	Action 1.1.1: Reduced heating needs in municipal facilities Action 1.1.2: Replacing inefficient computers in municipal facilities Action 1.1.3: Rehabilitation of school with zero emissions standard Action 1.1.4: Improved weather system in municipal buildings ~~Action 1.1.5: Optimisation of municipal pumping system~~ Action 1.1.6: Rehabilitation of public building 'Local Social Ajuntament d'Ordis' as 'Net Zero Energy Building' or NZEB Action *: Installing solar energy systems to provide hot water in the nursery according to the Technical Building CodeAction Action *: Solar panels in the locker room (is hot water)	Acti Acti Acti Acti Acti Acti Acti Acti
Tertiary (non municipal) buildings, equipment/facilities	Action 1.2.1: Performing audits in the tertiary sector	Acti

What ?

SEMANCO is a three year research project co-funded by the FP7 "ICT systems for Energy Efficiency" programme of the European Union. It began in September 2011.

The research is developing IT tools and methods to help planers and developers to reduce CO2 emissions in our neighbourhoods, cities and regions.

SEVENTH FRAMEWORK PROGRAMME

Related experiences: MARIE

MARIE

MEDITERRANEAN BUILDING RETHINKING FOR ENERGY EFFICIENCY IMPROVEMENT

L'Europe en Méditerranée
Europe in the Mediterranean

Projet cofinancé par le Fonds Européen de Développement Régional

Project cofinanced by the European Regional Development Fund

http://www.marie-medstrategic.eu/

-To develop and adopt new requirements and tools to achieve EPBD goals.
-To Find financial mechanisms to stimulate thermal retroffitting of buildings.
-Energy renovation support to local medium and small businesses.

Mediterranean regions: 9 countries and 23 partners

The MARIE project

OUR WORK:
"Consultant for development of Design and Implementation of Urban Plans for Energy Efficiency Improvement in existing buildings"

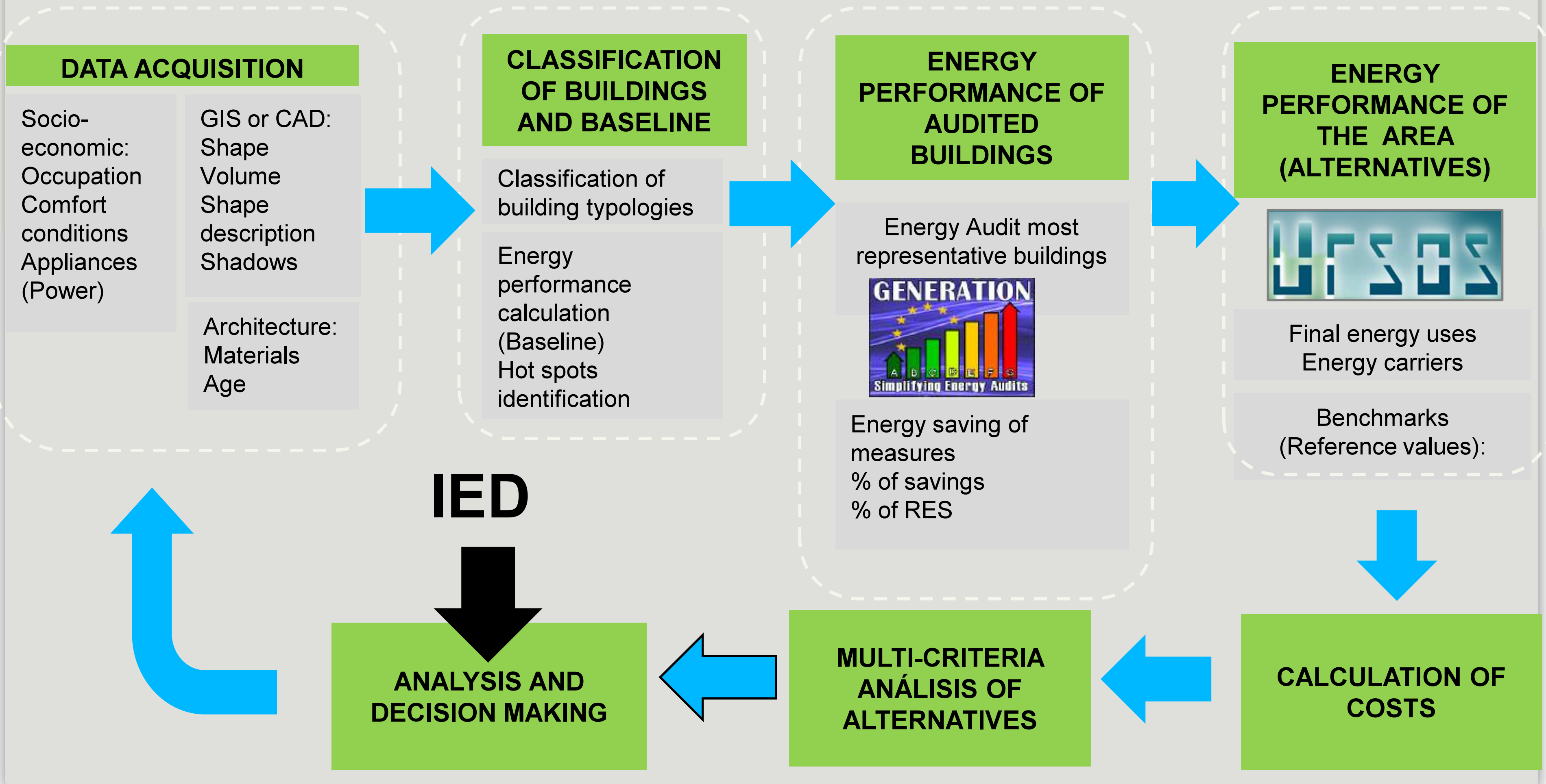
1- Define a METHODOLOGY and TOOLS for calculating energy efficient urban plans

2- Implementation of the methodology in the Pilot Activity of Bar (Montenegro)

3- Analysis of the impact and conclusions of comparison between the other different Pilot Acitivies.

OPŠTINA BAR

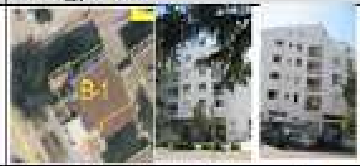
Methodology for an energy efficient urban planning



Pilot Activity:

Municipality of Bar (Montenegro)

BASELINE

Building Reference	Building pictures	Typology	Construction period	Last year of retrofitting	Type of
B-1		T1	60s		Mixed1
B-2		T1	60s		Mixed1
B-10		T1	70s	1980	Mixed1
B-11		T1	70s	1980	Mixed2
G-1B		T1	60s		Mixed1
G-14		T1	60s	1980	Mixed1
E-5		T1	80s		Mixed2
E-6		T1	80s		Mixed2

MARIE
MEDITERRANEAN BUILDING RETHINKING FOR ENERGY EFFICIENCY IMPROVEMENT

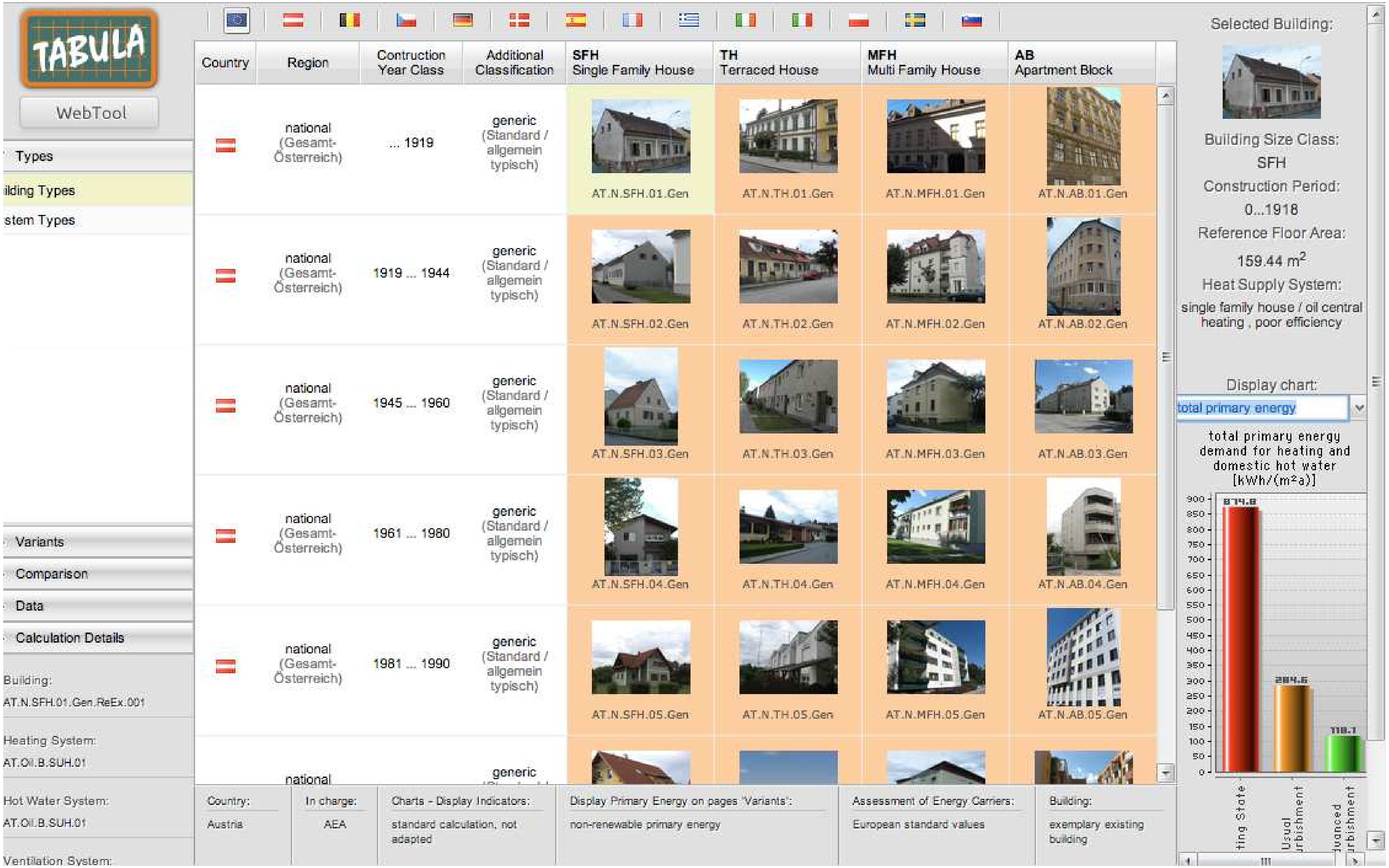
OPŠTINA BAR

Pilot Activity: Municipality of Bar (Montenegro)

MARIE
MEDITERRANEAN BUILDING RETHINKING FOR ENERGY EFFICIENCY IMPROVEMENT

OPŠTINA BAR

IMPROVEMENT MEASURES



Simulation of alternatives for the Best future scenario