“Experiences of integrated design and nZEB from the European project AIDA”

WP3
Integrated Energy Design in municipal Practice

Gothenburg 23/05/2013
Giulia Paoletti, project manager of WP3
European Academy of Bozen / Italy.
AIDA project objective

The AIDA project aims at stimulating and accelerating the market entry of nearly zero-energy buildings (nZEB), which means to increase the energy efficiency and the use of renewable energy source.

The objective of WP3 ‘Integrated Energy Design in municipal Practice’ is to provide a methodological approach based on integrated energy design process, for public authorities, to introduce energy requirements into public design tenders.
The final objective of WP3 is the development of guidelines on **how to require the nZEB energy target into public design tenders**.

The guidelines will include:

- tender requirements development through an integrated approach
- technical, legislative, financial etc. barriers overcoming
- case studies and lessons learned
Design tender layout + NZEB or nZEB concept

Analysis of public tenders typologies and tenders structures:
• Tender parts required by law
• Architectural rules (design, function)
• National/local laws and standard accomplishment
• ...

• nZEB definition
• Energy balance calculation method
• Tools
• Building system boundary
• RES
• Weighting system

Integrated Energy Design (IED)

To understand when and how to support Municipalities in nZEB design tender development
### Analysis of Italian public tenders typologies

- **Public tenders for ideas or design competition**
  - to elect the best design project

- **Public tenders for a specific service**
  - to elect the most economically advantageous offer or a ‘service’
    (Negotiated tender)

<table>
<thead>
<tr>
<th>Typology of Italian public tender</th>
<th>1st phase: Preliminary design</th>
<th>2nd phase: Definitive design</th>
<th>3rd phase: Executive design</th>
<th>4th phase: Building construction</th>
</tr>
</thead>
</table>
| **1. Public tender for competition of ideas or design** | Concept design tender  
- first idea  
- building concept  
- scale of building plans: 1:200 | Definitive design tender | Executive design tender | Public tender to choose the enterprises for the building  
(the most economically advantageous offer) |
| **2. Public tenders for a specific service** | Negotiated tender  
Public tender to choose the designer team  
(by evaluation of:  
- the design teams experience (CV)  
- the most economically advantageous offer) | DESIGN OF THE BUILDING |

**TIME LINE**
Action time means the AIDA partners effort to support municipalities in:

- writing the public design tender (energy performance requirements part)
- implementing the IDP
- Developing simplified tools for energy demand and generation from RES estimation
- supporting the Jury in projects evaluation

<table>
<thead>
<tr>
<th>Typology of Italian public tender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>1st phase: Preliminary design</td>
</tr>
<tr>
<td>Action Time</td>
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<tr>
<td></td>
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<tr>
<td>Definitive design tender</td>
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<td></td>
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<tr>
<td>Definitive design tender</td>
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<tr>
<td>2nd phase: Definitive design</td>
</tr>
<tr>
<td>Tendering of the building</td>
</tr>
<tr>
<td>construction/services</td>
</tr>
<tr>
<td>Action Time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Action Time</td>
</tr>
</tbody>
</table>
### Structure of the public design tender

#### Structure of standard tenders

**Objective of the project**
- description of the state of the art (urban issues, connected to the transport network, etc.).
- theme of the project
- description of the aims of the project

**Guidelines for the design project**
- urban laws
- legislative rules (acoustic, static, ...)
- other laws specific for the use of the building (school, office, residence legislative rules ...)

**Technical requirements**
- construction requirements
- plant requirements
- energy requirements

**Functional and architectonical concept**
- description of the functions
- functional diagram of summary

**Design team**
- architects
- engineers (mechanic, electric, structural ...)
- builder

**General requirements**
- costs for the building construction
- operating costs

**Award scoring criteria**
System of comparing different aspect of the design proposals. The ranking list usually is based on the main specific variants, such as aesthetic value, functional aspect, costs of the building and assigns different weight to each aspect. The result with the highest number is the winner.

**Jury composition**
The commission is usually set up by figures with different specialization (architects, engineers, Municipality representatives, owners, tenants ...)

### Energy requirements section

- **Target nZEB target**
- **National/regional energy laws about nZEB rules**
- **Describe the methodology for the energy balance calculation**
- **Describe the energy strategy**:
  - passive and active solutions
  - orientation, form, SV...
  - day lighting
  - integration of the energy production systems
  - heating plans
  - ... etc.
- **Figure specialized in energy efficiency of the building and RES**.
- **National/regional energy laws**
- **Add into the ranking list a point about energy balance. Higher score will be assigned to design building which energy balance is close to zero (NZEB)**.
- **Figure specialized in**:
  - energy efficiency of the building
  - RES
NZEB or nZEB concept

- NZEB definition
- Energy efficiency requirements
- Energy balance calculation method
- Building system boundary
- Balance metric (primary energy, emission..)
- Energy generation system from RES
- Weighting system

International project
IEA SHC Task 40/ECBCS Annex 52

National-local energy laws
Exploiting the existing energy performance evaluation tools
International project
IEA SHC Task 40/ECBCS Annex 52

Net ZEB Evaluation Tool
Developed within the IEA "SHC Task 40/ECBCS Annex 52: Towards Net Zero Energy Buildings" Created by Euro Research within B7A

Building Project - static Net ZEB evaluation
- Net ZEB limited
- Net ZEB primary
- Net ZEB strategic
- Net ZEB carbon

Click here to compare definitions

Show/Hide GENERATION/LOAD BALANCE

<table>
<thead>
<tr>
<th>GENERATION/LOAD BALANCE</th>
<th>Net ZEB limited</th>
<th>Net ZEB primary</th>
<th>Net ZEB strategic</th>
<th>Net ZEB carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>38.9 kWh/m²y</td>
<td>-6.1 kWh/m²y</td>
<td>34.9 __/m²y</td>
<td>-0.8 kgCO₂eq/m²y</td>
</tr>
<tr>
<td>Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Generation/Load balance**

**Electricity Load Match** 57.5%

**Thermal Load Match** 51.1%

A Net Zero Energy Building is the "building system" delimited by set physical boundaries, connected to any energy infrastructure, which balance between its weighted energy loads and supplies is zero.

**Building system boundary**

<table>
<thead>
<tr>
<th>Nearly Net ZEB</th>
<th>Net ZEB primary</th>
<th>Net ZEB strategic</th>
<th>Net ZEB emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEATING</td>
<td>HEATING</td>
<td>HEATING</td>
<td>HEATING</td>
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<tr>
<td>COOLING</td>
<td>COOLING</td>
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<td>VENTILATION</td>
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<td>AUXILIARIES</td>
<td>AUXILIARIES</td>
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<tr>
<td>BUILT-IN LIGHTING</td>
<td>BUILT-IN LIGHTING</td>
<td>BUILT-IN LIGHTING</td>
<td>BUILT-IN LIGHTING</td>
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<tr>
<td>PLUG LOADS</td>
<td>PLUG LOADS</td>
<td>PLUG LOADS</td>
<td>PLUG LOADS</td>
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<tr>
<td>EMBODIED ENERGY</td>
<td>EMBODIED ENERGY</td>
<td>EMBODIED ENERGY</td>
<td>EMBODIED ENERGY</td>
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</table>

**Weighting system**

<table>
<thead>
<tr>
<th>Nearly Net ZEB</th>
<th>Net ZEB primary</th>
<th>Net ZEB strategic</th>
<th>Net ZEB emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMARY ENERGY</td>
<td>PRIMARY ENERGY</td>
<td>Whenever metric desired</td>
<td>EMISSION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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</table>

**Symmetry**

<table>
<thead>
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<th>Nearly Net ZEB</th>
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<th>Net ZEB strategic</th>
<th>Net ZEB emission</th>
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<tbody>
<tr>
<td>SYMMETRIC</td>
<td>SYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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<td>SYMMETRIC or ASYMMETRIC</td>
<td>SYMMETRIC or ASYMMETRIC</td>
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</table>

**Time dependent accounting**

<table>
<thead>
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<th>Nearly Net ZEB</th>
<th>Net ZEB primary</th>
<th>Net ZEB strategic</th>
<th>Net ZEB emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATIONAL/LOCAL ENERGY REQUIREMENTS ARE FULLFILLED</td>
<td>NATIONAL/LOCAL ENERGY REQUIREMENTS ARE FULLFILLED</td>
<td>NATIONAL/LOCAL ENERGY REQUIREMENTS MUST BE FULLFILLED</td>
<td>NATIONAL/LOCAL ENERGY REQUIREMENTS MUST BE FULLFILLED</td>
</tr>
</tbody>
</table>

**Energy efficiency**

<table>
<thead>
<tr>
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<th>Net ZEB primary</th>
<th>Net ZEB strategic</th>
<th>Net ZEB emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON SITE GENERATION DRIVEN BY ON/OFF SITE SOURCES</td>
<td>ON SITE GENERATION DRIVEN BY ON/OFF SITE SOURCES</td>
<td>ON/OFF SITE GENERATION DRIVEN BY ON/OFF SITE SOURCES</td>
<td>ON/OFF SITE GENERATION DRIVEN BY ON/OFF SITE SOURCES</td>
</tr>
</tbody>
</table>

**Energy supply**

1.32  1.32
<table>
<thead>
<tr>
<th>ITALY</th>
<th>Source (law)</th>
<th>Method for energy calculation</th>
<th>Envelope</th>
<th>Load</th>
<th>Final Energy demand</th>
<th>Primary energy demand</th>
<th>Energy Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>UNI/TS 11300-1:2008</td>
<td>X</td>
<td>Space Heating kWh/(m²/year)</td>
<td>Space Cooling kWh/(m²/year)</td>
<td>Space Heating kWh/(m²/year)</td>
<td>Space Cooling kWh/(m²/year)</td>
<td>Space Heating kWh/(m²/year)</td>
</tr>
<tr>
<td>National</td>
<td>UNI/TS 11300-2:2008</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>National</td>
<td>UNI/TS 11300-3:2010</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>UNI/TS 11300-4:2012</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>National</td>
<td>DPR59/09</td>
<td>X</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
</tr>
<tr>
<td>National</td>
<td>DECRETO LEGISLATIVO 3 Marzo 2011, n. 28</td>
<td>X</td>
<td>(Define minimum values)</td>
<td>(Define minimum values)</td>
<td>(Define minimum values)</td>
<td>(Define minimum values)</td>
<td>(Define minimum values)</td>
</tr>
<tr>
<td>National</td>
<td>ISTAT: Energy balance, 2009</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Province of Bolzano</td>
<td>Resolution decree of the Province of Bolzano n.362 of 4th March 2013</td>
<td>X</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
<td>(Limit values depend on GG and ratio S/V)</td>
</tr>
</tbody>
</table>
## Existing energy performance evaluation tools

<table>
<thead>
<tr>
<th>AIDA Partners</th>
<th>Country</th>
<th>Tool name</th>
<th>Is an Energy certification tool?</th>
<th>Is the certification mandatory?</th>
<th>Calculation approach</th>
<th>OUTPUT</th>
<th>InterOperability (file format)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EURAC IT</td>
<td>IT</td>
<td>XClima (CasaClima)</td>
<td>x</td>
<td>Province of Bolzano (IT)</td>
<td>Static simulation</td>
<td>x</td>
<td>Contribution of PV-Solar panel-Geothermal</td>
</tr>
<tr>
<td>EURAC IT</td>
<td>IT</td>
<td>DOCET</td>
<td>x</td>
<td>Italy</td>
<td>Static simulation</td>
<td>x, x</td>
<td>Contribution of PV-Solar panel-Geothermal</td>
</tr>
<tr>
<td>EURAC IT</td>
<td>IT</td>
<td>PHPP</td>
<td>x</td>
<td>Static simulation</td>
<td>x</td>
<td>x</td>
<td>Contribution of PV-Solar panel-Geothermal</td>
</tr>
<tr>
<td>EEG, TU Wien</td>
<td>AT</td>
<td>Gebäudeintegration</td>
<td>Static &amp; Dynamic simulation parts</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>PV, Solar thermal, heat pump, wood pellets, district heat</td>
</tr>
<tr>
<td>AEE INTEC AT</td>
<td>AT</td>
<td>GEQ</td>
<td>x</td>
<td>Austria</td>
<td>Static simulation</td>
<td>x, x, x</td>
<td>Contribution of PV-Solar panel-Geothermal</td>
</tr>
<tr>
<td>AEE INTEC AT</td>
<td>AT</td>
<td>PHPP</td>
<td>x</td>
<td>Static simulation</td>
<td>x</td>
<td>x</td>
<td>Contribution of PV-Solar panel-Geothermal</td>
</tr>
<tr>
<td>IREC ES</td>
<td>ES</td>
<td>LIDER/CALENER</td>
<td>x</td>
<td>Spain</td>
<td>Static simulation</td>
<td>x, x, x</td>
<td>solar thermal for hot water and PV contribution. Other RES are difficult to introduce</td>
</tr>
<tr>
<td>IREC ES</td>
<td>ES</td>
<td>TRNSys (sketchup + Cranbuild, type 56)</td>
<td>x</td>
<td>Dynamic simulation</td>
<td>x</td>
<td>x</td>
<td>None</td>
</tr>
<tr>
<td>IREC ES</td>
<td>ES</td>
<td>Dialux</td>
<td>Dynamic simulation</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</tbody>
</table>
Cases Studies

- Public design tender for three new mountain huts ➔ Province of Bolzano
- Negotiated tender for a design service of the new elementary school ➔ Merano Municipality

<table>
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<tr>
<th>Typology of Italian public tender</th>
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<tbody>
<tr>
<td>Concept design tender</td>
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<td>Concept design tender</td>
<td>Concept design tender</td>
</tr>
<tr>
<td>- first site new construction</td>
<td>- building concept</td>
<td>- executive design tender</td>
<td>- executive design tender</td>
<td>- executive design tender</td>
</tr>
<tr>
<td>- scale of building plans: 1:200</td>
<td>- details (1:20 scale)</td>
<td>- materials and costs</td>
<td>- scale of building plans: 1:100 or 1:50</td>
<td>- scale of building plans: 1:100 or 1:50</td>
</tr>
<tr>
<td>Negotiation</td>
<td>Negotiation</td>
<td>Negotiation</td>
<td>Negotiation</td>
<td>Negotiation</td>
</tr>
<tr>
<td>Public tender to choose the designer (by evaluation of the design team's experience and lowest price proposal)</td>
<td>Public tender to choose the enterprise for the building construction (priority by lowest tender price)</td>
<td>Public tender to choose the enterprise for the building construction (priority by lowest tender price)</td>
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<td>Public tender to choose the enterprise for the building construction (priority by lowest tender price)</td>
</tr>
</tbody>
</table>
Design tenders for three new mountain huts.

Owner: Province of Bolzano
Collaboration: Province of Bolzano, Tenants, EURAC

Elaboration of energy guidelines (to be included in the tender) about energy concept and minimum energy performance requirements.
Development of two simplified tools to quantify:

- energy performance (based on software KlimaHouse Pro for ECPs)
- the share of energy consumption covered by energy production from renewable sources (Excel spreadsheet created by EURAC).

- CasaClima pre-filled Excel sheet, to calculate the heating energy demand

Excel sheet to calculate the energy production from renewable sources (from PV and solar thermal panels)
Winner projects

Benefits
Since the design concept phase the design teams have considered energy efficiency issues, in order to guarantee:

- Reduced heat losses (compact building envelopes)
- Use of renewable energy sources for the production of thermal and electric energy (wide roof surfaces)
- High integration of energy generation systems (landscape integration)
Winner projects

Critical aspects

• Planning mistakes: orientation, misunderstanding of compact shape
• Localization of emission (generation) heating system.

• The energy concept development was no mandatory, because there were no award criteria for energy requirements achieved → some design proposals had no energy strategy.

Ponte ghiaccio / Edelrauthütte
Arch. Matteo Scagnol
Arch. Sandy Attia

Vittorio Veneto / Schwarzensteinhütte
Arch. Helmut Stifter
Arch. Angelika Bachmann

Pio XI / Weisskugelhütte
Arch. Höller & Klotzner
Negotiated tender for design service for a new elementary school in Sinigo.

Owner: Municipality of Merano
Collaboration: Municipality of Merano, Tenants, EURAC

State of the Art
The Municipality of Merano needs a new elementary school and will select the design team through a negotiated tender. The design team should be able to develop the preliminary, definitive, executive design and to manage the building construction phase.
The goal was to support the Municipality to introduce energy requirements in the public negotiated tender.

**Done**
Workshops to present the nZEB concept (definition, energy balance calculation method, building system boundary, weighing system…) to the municipality members involved into the project.

**Result**
A close collaboration with the Municipality team to develop:
- Guidelines on energy efficiency requirements of the new building
- Mandatory rules for IED approach application.
Energy concept guidelines to support design teams in developing energy strategies for the new school in Sinigo (IT)

Legislative framework towards zero energy buildings → DP 362/2013

Energy performance efficiency: building envelope with heating load lower than 30kWh/m²y (CasaClima A)

- nZEB definition
- Physical boundaries of the building system
- Balance items
- Balance calculation
- Balance metric and weighting factors
- Integrated Energy Design (IED)

Integrated Energy Design (IED)

Competitors requirements
Il vostro edificio ad energia quasi zero riduce costi di gestione e sarà un positivo esempio per la comunità e i limitrofi comuni!

Il progetto AIDA supporta i liberi professionisti e le amministrazioni pubbliche di tutta Europa nella progettazione di edifici a bilancio energetico neutro (ZEB). AIDA offre ad ogni componente (offerta) su misura per ciascuna delle domande (chiedi) varie, come studi e sviluppo (innovazione), esperienze di successo (discessi), introduzione a strumenti di calcolo e supporto attivo per il Comune.

Partecipa anche tu!

FOR ARCHITECTS and MASTER-BUILDERS
FOR MAYORS, MUNICIPAL REPRESENTATIVES and LOCAL AUTHORITIES

Assistenza nello sviluppo del concetto ZEB nella pianificazione urbanistica locale per i comuni aderenti al Parco dei Sistemi.

Orientamento nell'uso di diversi software per la progettazione energetica integrata di edifici a Bilancio energetico neutro.

Aggiornamenti sugli ultimi sviluppi e lo stato dell'arte.

Viaggi studio nazionali e internazionali con visita agli edifici innovativi ad elevato prestatore energetiche.

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Thank you for your attention!!

Arch. Giulia Paoletti

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