LC Districts

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European Union
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Developing and testing an innovative methodology for energy audit and energy efficiency for public buildings

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Objective: Methodology of analysis for energy efficiency in public buildings

Previous work

MARTE EU project → Target: healthcare buildings

Provide a flexible methodology for:

- Energy analysis;
- Energy efficiency scenarios;
- Economic evaluation;
- Environmental impact.

Present work

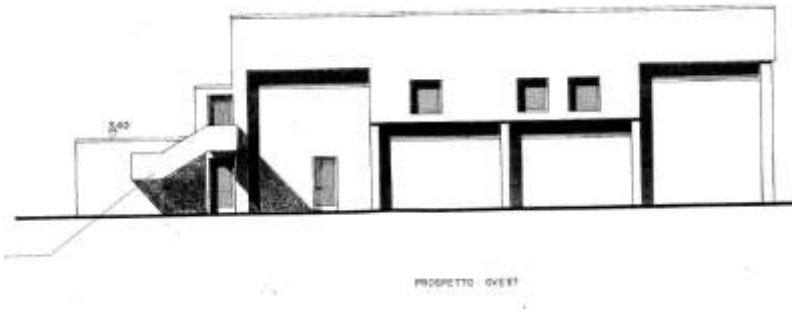
Replicate the MARTE project's methodology and adapt the approach in other sectors and with local authorities

Public buildings analyzed: primary and secondary schools (under municipal control), sport halls.

- State Elementary School, Via Dante Alighieri, Macine-borgo Loreto AN;
- Castelplanio Macine primary school, Viale dello Sport, 1, Macine-borgo Loreto AN;
- Monte Roberto Pianello primary school, Via Trento, 56, Pianello Vallesina AN;
- Mario Martarelli Sport Hall, Via Walter Tobagi, 20, Castelbellino Stazione AN.

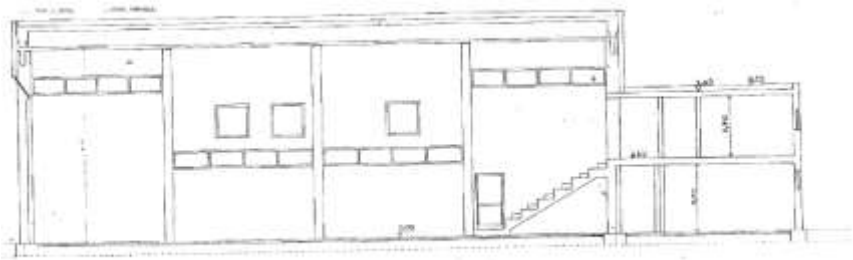
Workflow

First step: analysis of the case study



Acquisition of the building projects:

- Plans;
- Elevations;
- Sections.

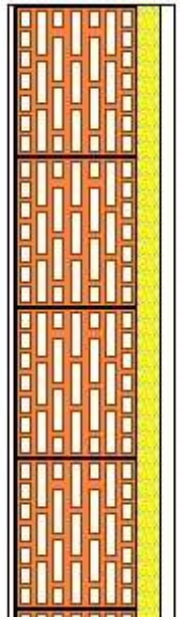


- Structure stratifications.

Information about thermal and electric plants:

- Sources (size, technical manual);
- Distribution;
- Terminals.

Previous energetic audits.



Bills of the last five years:

- Thermal (natural gas or others);
- Electric.

Inspections

- verify consistency between documents and building;
- check the operation of the devices.

Software

Implementation on the software

Mc4Software

- Definition of the indoor and outdoor climate conditions;
- Reproduction of 3D buildings;
- Implementation of structures stratifications (wall, windows, doors, floors and ceilings);
- Verification of thermal peak losses and dynamic consumptions.

Possible scenarios

Envelope measure:

- thermal coat;
- windows substitution;
- Ecc..

HVAC measure:

- Condensing boilers;
- Chillers;
- Cogenerators;
- Heat pumps;
- Terminals substitution;
- Pipes insulation;
- Ecc..

Lighting measure:

- Lamps substitution;
- Lighting control (presence or irradiance sensors).

Other systems: renewable sources (photovoltaic).

Code attribution for each improvement measure
(O1, GL1, L1, ecc..)

Combination of improvement measures

Definition of a list of retrofit packages

Package	Envelope Measures		Lighting Measures		HVAC measures		
	Thermal Insulation	Glazing Systems	Lamp Types	Lighting Control	Boiler	Chiller	Radiant Floor
P1	O1	GL1	L1	L3	–	–	–
P2	O1	GL2	L2	L3	–	–	–
P3	O1	GL3	L2	–	–	–	–
P4	O2	GL1	L1	–	–	–	–
P5	O2	GL2	L2	L3	–	–	–
P6	O2	GL3	L2	–	–	–	–
P7	O3	GL1	L2	L3	–	–	–
P8	O3	GL2	L1	–	–	–	–
P9	O3	GL3	L1	L3	–	–	–
P10	–	GL2	–	–	H1	H3	–
P11	–	GL3	–	–	H2	H4	–
P12	O1	GL2	L1	L3	H2	H4	–
P13	O1	GL3	L2	L3	–	–	H6
P14	O1	GL2	–	–	H2	H4	H6
P15	O1	–	–	–	H1	H3	–
P16	O1	GL3	L2	L3	H2	H4	H6
P17	O2	GL3	L1	–	H2	H4	–
P18	O2	–	L2	–	–	–	H6
P19	O2	GL3	–	–	H1	H3	H5
P20	O2	–	L1	L3	H2	H4	H6
P21	O3	GL2	L2	L3	H2	H4	–
P22	O3	GL3	–	–	H1	H3	H5
P23	O3	GL2	–	–	H2	H4	–
P24	O3	GL2	L2	L3	–	–	H6
P25	O3	–	L2	–	H2	H4	H5
P26	–	–	L1	L3	H2	H4	H6
P27	–	–	–	L3	H1	H3	–
P28	–	–	L1	–	–	–	H6
P29	–	–	L2	L3	H2	–	H6
P30	–	–	L2	L3	–	H3	–
P31	–	–	L2	–	H2	–	–

Results

Comparative analysis of each packages:

Economic evaluation (Pay-back period and Net Present Value index)

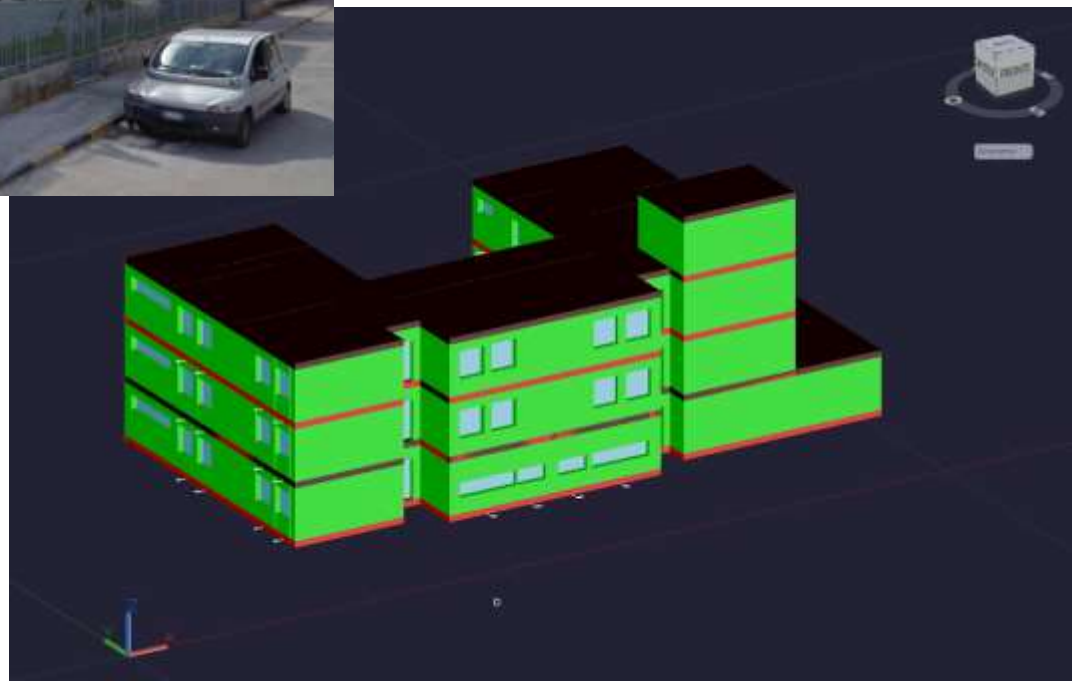
Environmental impact (CO_2 emissions)

Energy saving

Choice of the best solution

- Minor PB;
- Major NPV;
- Major CO_2 emissions avoided;
- Best solutions related to other needs (structural measure, painting, ecc.)

Current state



Implementation step

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Thank you!

Questions welcome

Project smedia