SIXTH FRAMEWORK PROGRAMME

POLYCITY- WORKSHOP BASEL SUSTAINABLE TOWN PLANNING AND ENERGY BENCHMARKING OF BUILDINGS

REHABILITATION MEASURES FOR ATC OFFICE BUILDING

Luigi Fazari

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City localization

TURIN

45.1 LATITUDE

Local climate: 2617 DD

Design temperature wintertime: -8 °C

Design temperature summertime: 33.5 °C

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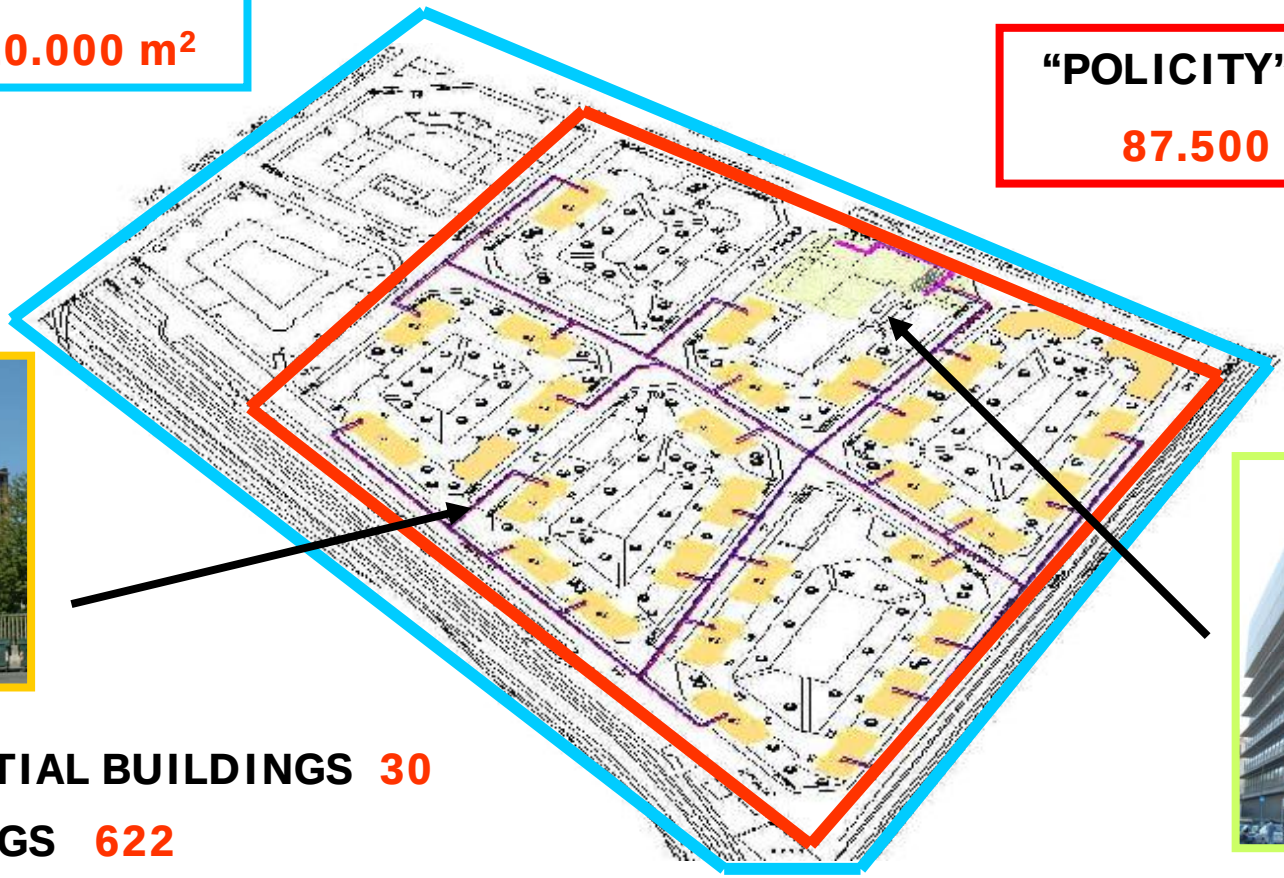
Arquata district project

TOTAL AREA
110.000 m²

"POLICITY" AREA
87.500 m²



No. RESIDENTIAL BUILDINGS 30

No. DWELLINGS 622

PEOPLE INVOLVED 2.500/2.600

ATC OFFICE BUILDING

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ATC Office building

The building

Glazing surface: 2900 m^2

Total exterior surface: 5800 m^2

Volume: 34050 m^3

Total area: 11.350 m^2

Height: 3 m

Material

Concrete

Thickness 15 cm

Conductivity 1.91 W/m K

Specific Heat 920 J/kg K

Double glass

Thickness 4+12+4 mm

Conductivity 3.8 W/m K

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Office Building Rehabilitation Project

The following measures will be implemented on the ATC building

- An internal combustion gas modular cogenerator (960 kWel, 1150 kWth);
- Installation of photovoltaic modules on the SW and SE facades for a total peak power of 50 kW

PV Modules SW SIDE

PV Modules SE SIDE

NE FACADE

Insulation of the ne glazed facade using low-emission and thermal control glazing.

CITTA' DI TORINO
CENTRO RICERCHE FIAT
atc Torino
AEM Torino

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Studies for building modification

In collaboration with Energetics Department of Politecnico of Torino, we are studing the best measures (substitution of glazing, elimination of thermal bridges, etc.) to resolve the problems of loss of heat how anderlined in the Turin meeting on July 2005 too .

The dynamic energy evaluation of ATC office building will be made by a software called Energy Plus ® .

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Energy data

For basis simulations we have this start data:

Heat demand	=	846 MWh/y
Electricity demand	=	899 MWh/y
Cold demand	=	291 MWh/y

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atc Torino

Internal gains

- 300 people
- 45 pc and 10 others devices (printer, photocopier,..) for each floor
- Artificial lighting: average 10 W/m2

U - Values

- Wall (concrete mixed structure) = 1,2 W/m2K
- Roof = 0,8 W/m2K
- Ground floor = 1,0 W/m2K
- Window (glass + frame) = 3,4 W/m2K

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Building calculation methods

1. **Asset rating**: to compute a standard energy use that not depend on occupant behaviour, actual weather and other actual conditions.

2. **Operational rating**: based on the delivered energy

3. Method to improve confidence in the building calculation model by comparison with actual energy consumption, to assess the energy effectiveness of possible improvements

In the study of the ATC building
we use the last method

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The software: energyplus capabilities

- Fully integrated building, HVAC, plant simulation program;
- Based on best features of the two simulations programs (BLAST and DOE-2 plus)
- Dynamic simulations:
  - Conduction through building surfaces calculated with conduction transfer functions
  - Heat storage and time lags
- Simulation of air flows and heat exchange among zones.

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Output meters of the software

- Energy supply – resource types – in order to determine the environment impact and the value of the primary energy:
  - Electricity, gas, gasoline, diesel, water, steam, energy transfer (coil and equipment loads)
- Energy demand – end use types – in order to find a strategy for the possible reduction of the energy use
  - General light, electric equipments , fans, pumps, heating, cooling, heat rejection, humidifier, cogeneration

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Benfit to the simulation method to achieve the our target

Possibility to carry out an integrated study between thermical flux, energy supply and demand, allow an effective comparation between different solution of design.

That allowed to evaluate the best solutions in order to the energetic, economical and environmental necessity.

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Cogeneration system

- This data was made on 2003, redefinition on 2004.
- The finally report will be defined at short time.
- Cogeneration system will be realized to service a new tele - heating net system on Arquata district (Arquata street, Pagano street, Frugarolo street, Roccabruna street, Solero street and Rapallo street).
- The cogeneration system will be installed on the second floor underground of the ATC office building.

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Thermal energy requirements

Arquata's thermal load	6.670 MWht/year (*)
Peak thermal power load	8,2 MWt

Installation of 1 group of cogeneration and 3 boilers

- They will supply heat and electricity for the requests of the buildings

- The electricity production exceeding the ATC consumption will be sold to the grid

(*) with 3 new clients installed last months (old request = 6.089 MWht/ y)

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Cogeneration system

No. 1 CH4 engine :

electrical power	960 kW
thermal power	1150 kW
electrical efficiency	> 0.38
thermal efficiency	> 0.45
CH4 consumption (esteem)	265 m3/ h
hours of functionally engine	5.000 h/ year

emissions NOx	< 250 mg/Nm3
emissions CO	< 300 mg/Nm3
noices to 10 m	< 50 dB

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Boilers

No. 3 CH4 boilers

thermal power	2* 2.600 kWt +1* 900 kWt
thermal efficiency	>0.90

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Absorption chiller

An absorption cooling system will be implemented in the ATC building for the climatisation of the offices.
A single stage 234 kW unit, supplied by the waste heat of the co-generator, will be installed.

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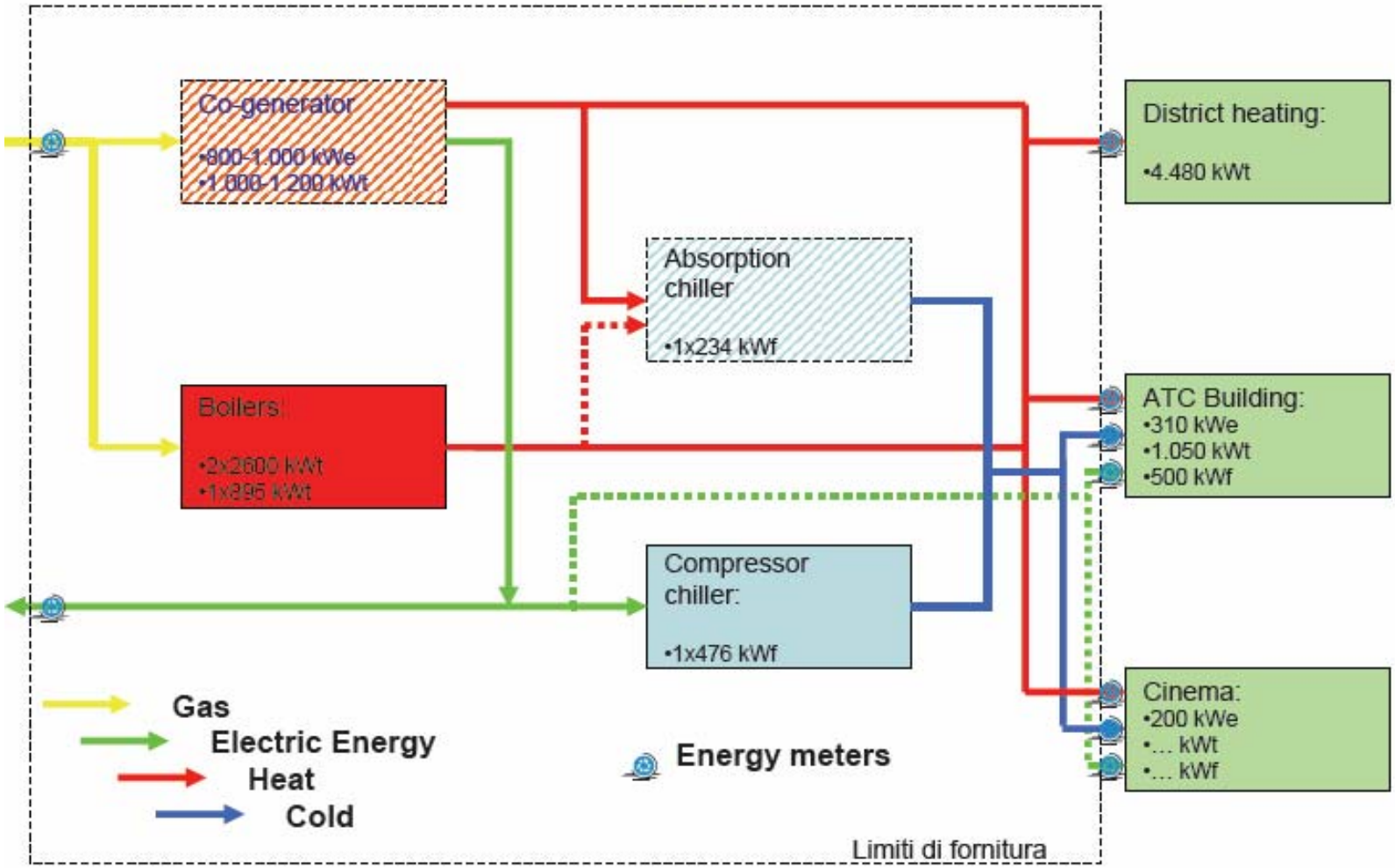
Co and Tri generation scheme



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thank you for your attention

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