



## PERFORMANCE INDICATORS AND MONITORING CONCEPTS

- Energy consumption analysis before Polycity
- DE 3: integration of supply and demand  
DD 3.1: report on supply and demand profiles

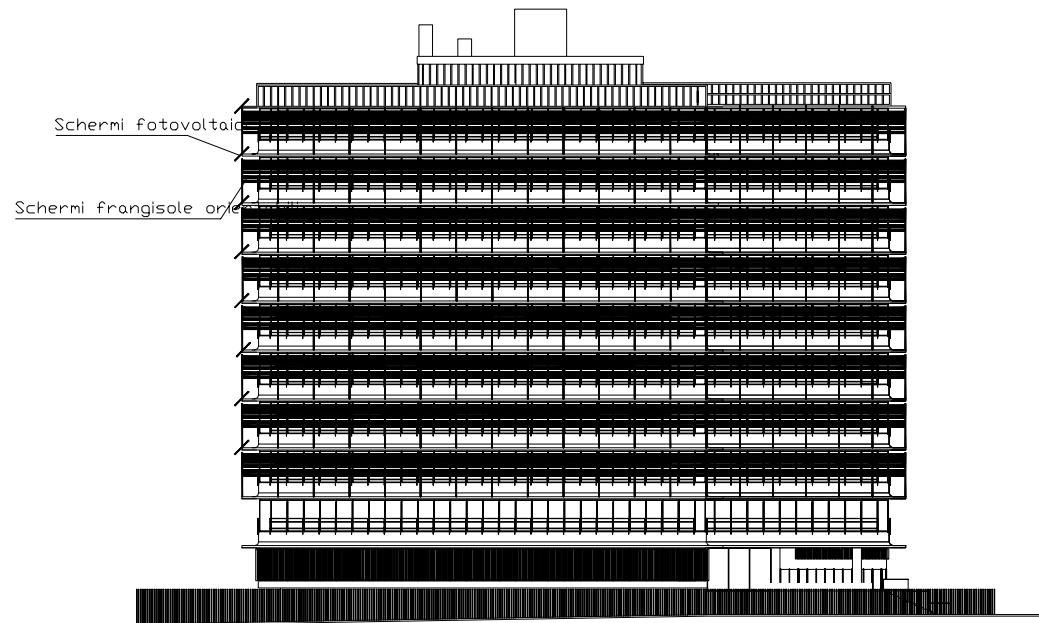


CITTA' DI TORINO



# Electrical Energy consumption analysis before Polycity: the ATC building Electrical energy consumption.

- Available power  
280 kW
- Supply voltage MV  
22 kV
- Contract MV  
business (fixed  
fee)



CITTA' DI TORINO





## Data collection activity

- Electrical bills' collection
- Monthly energy consumption and power
- Time interval: years 2002-2004.

## Electrical and energy data

- Active, reactive power
- Active and reactive energy consumption
- Monthly average energy
- Annually average impedance
- Power factor
- Electrical load profile



CITTA' DI TORINO





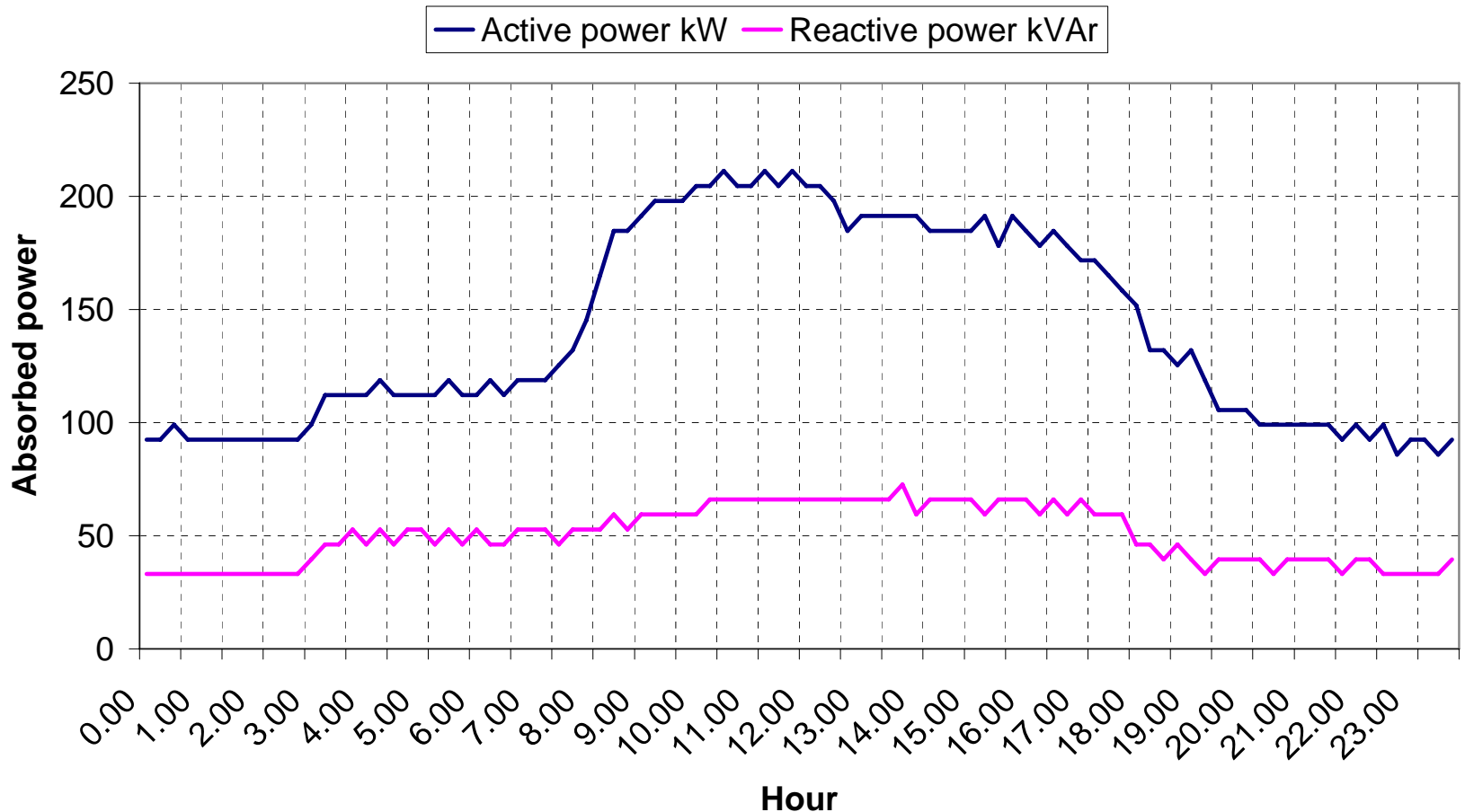
CITTA' DI TORINO



# ATC BUILDING

## Electrical load profile – week day

Tuesday 03/01/06

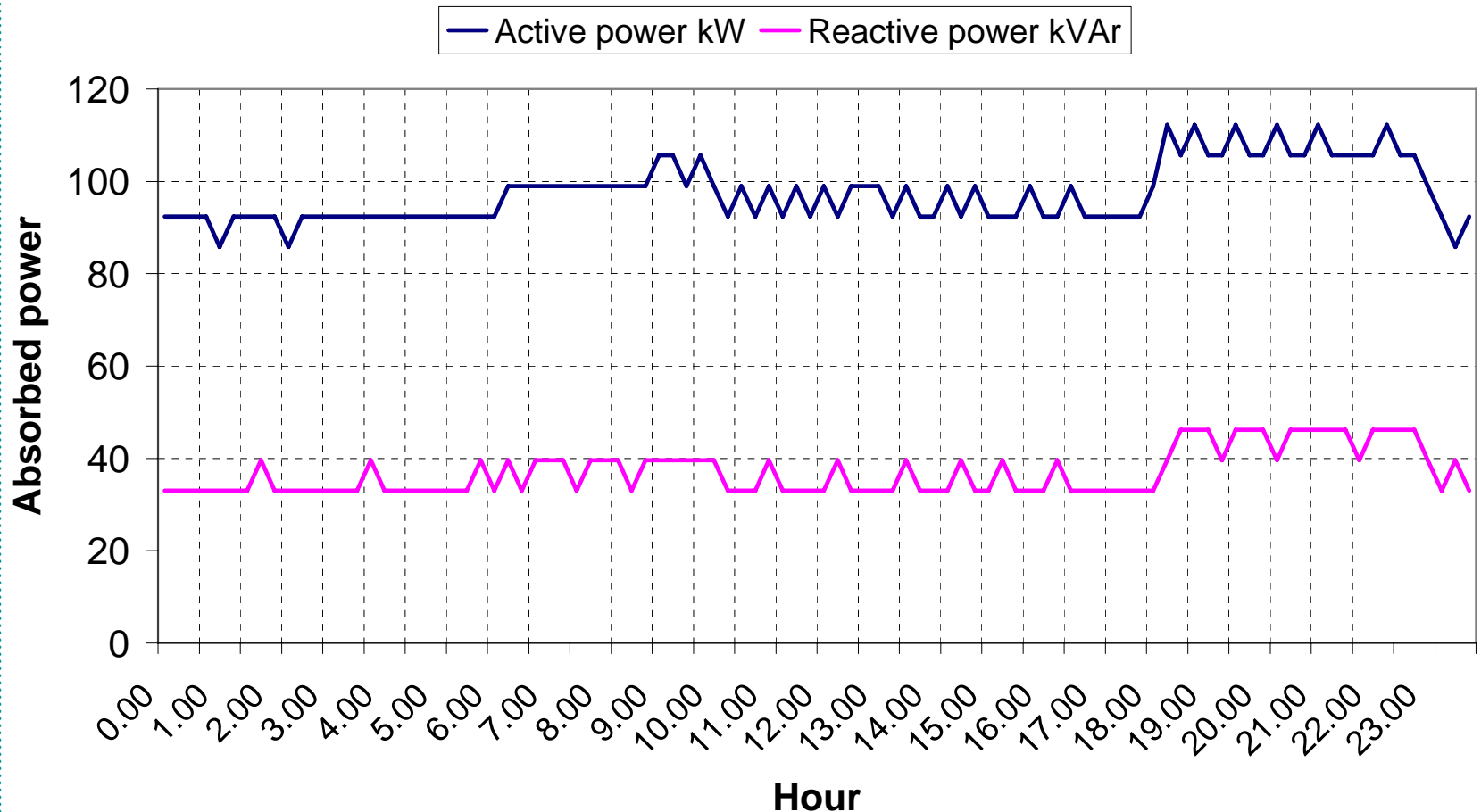




# ATC BUILDING

## Electrical load profile – weekend day

Sunday 08/01/06



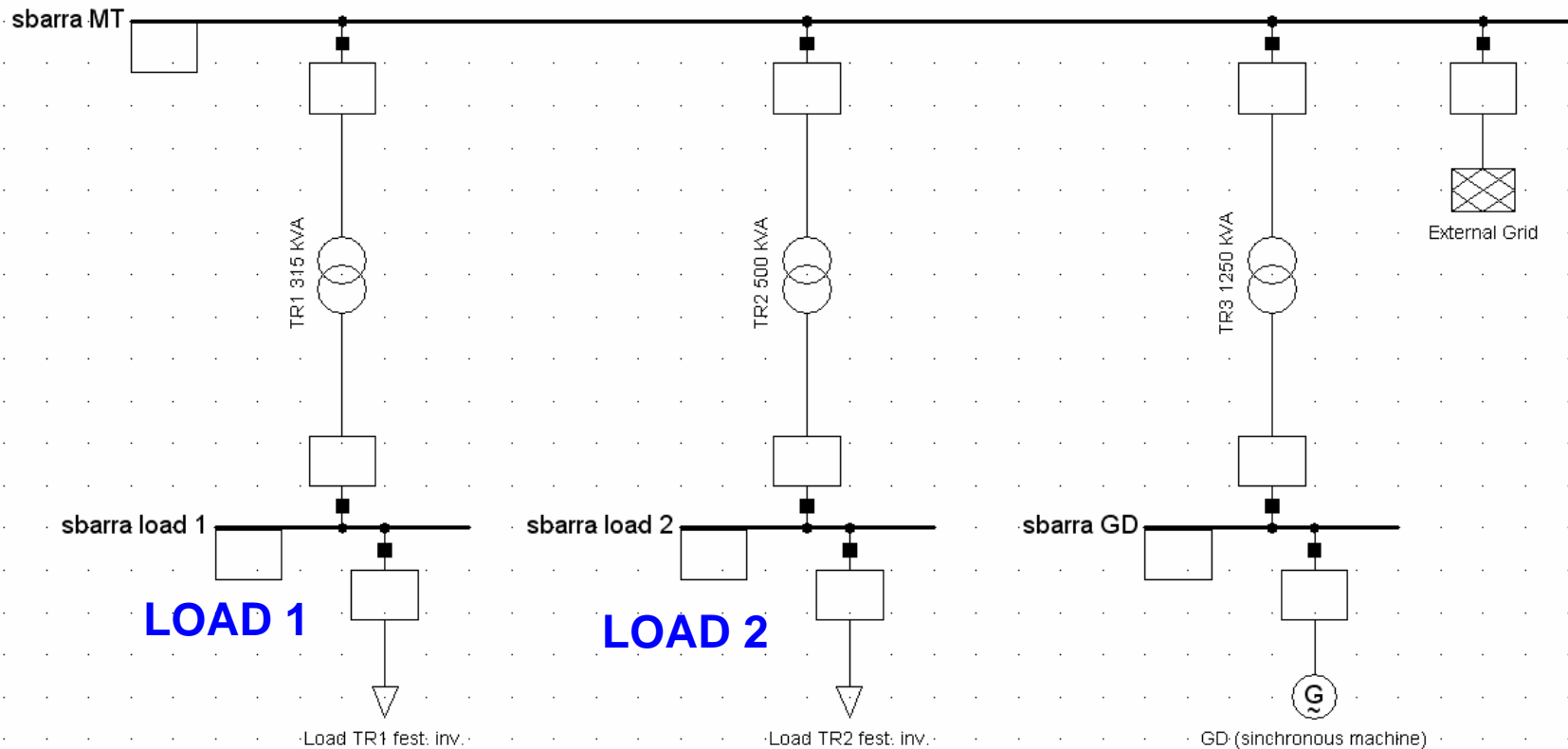
CITTA' DI TORINO





# ATC OFFICE BUILDING COGENERATION PLANT

*DlgSILENT: simulation software of electrical network*

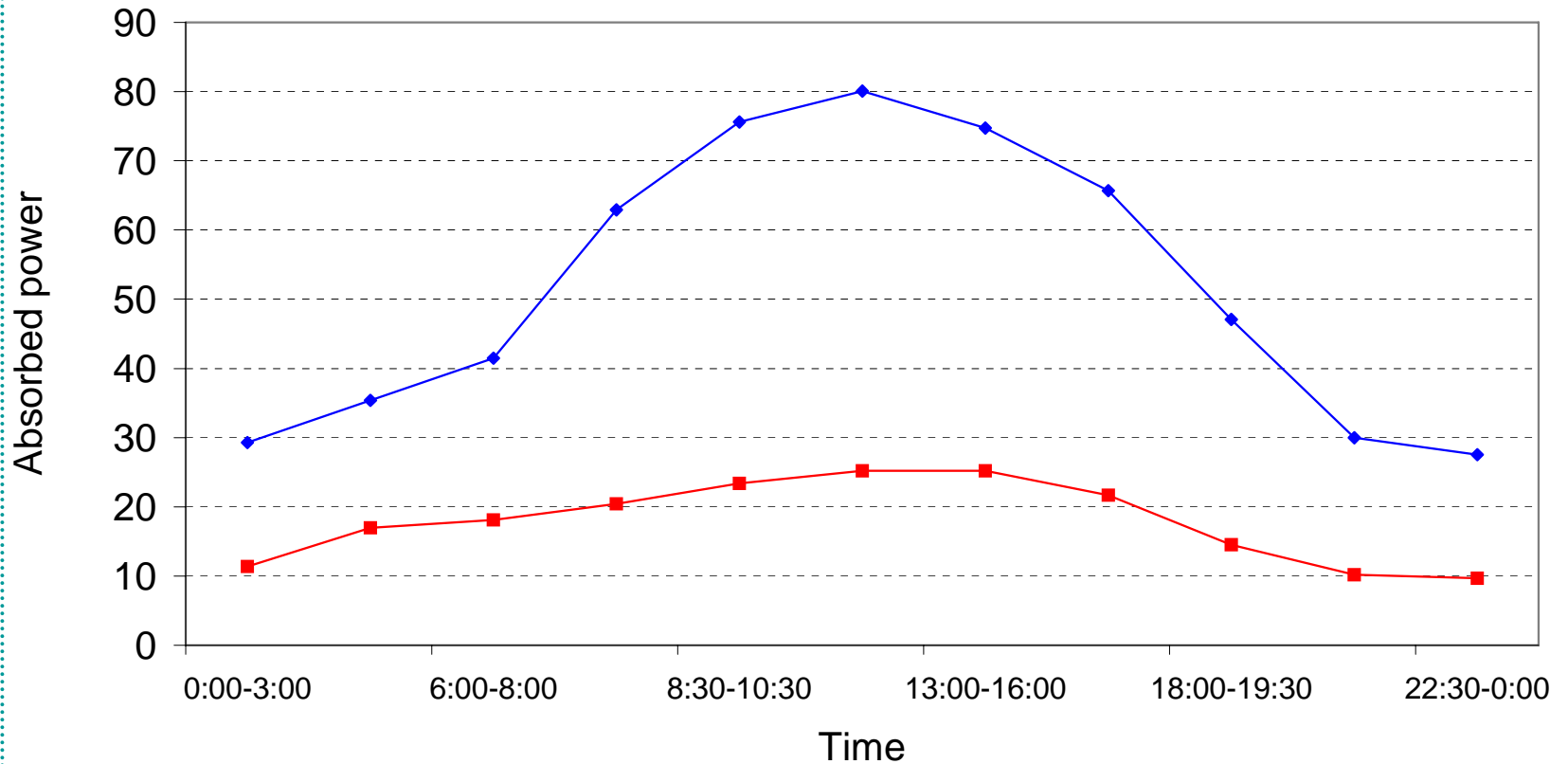




# INPUT DATA (working day)

Electrical load profile - Load 1

◆ P [kW]  
■ Q [kVAr]



CITTA' DI TORINO

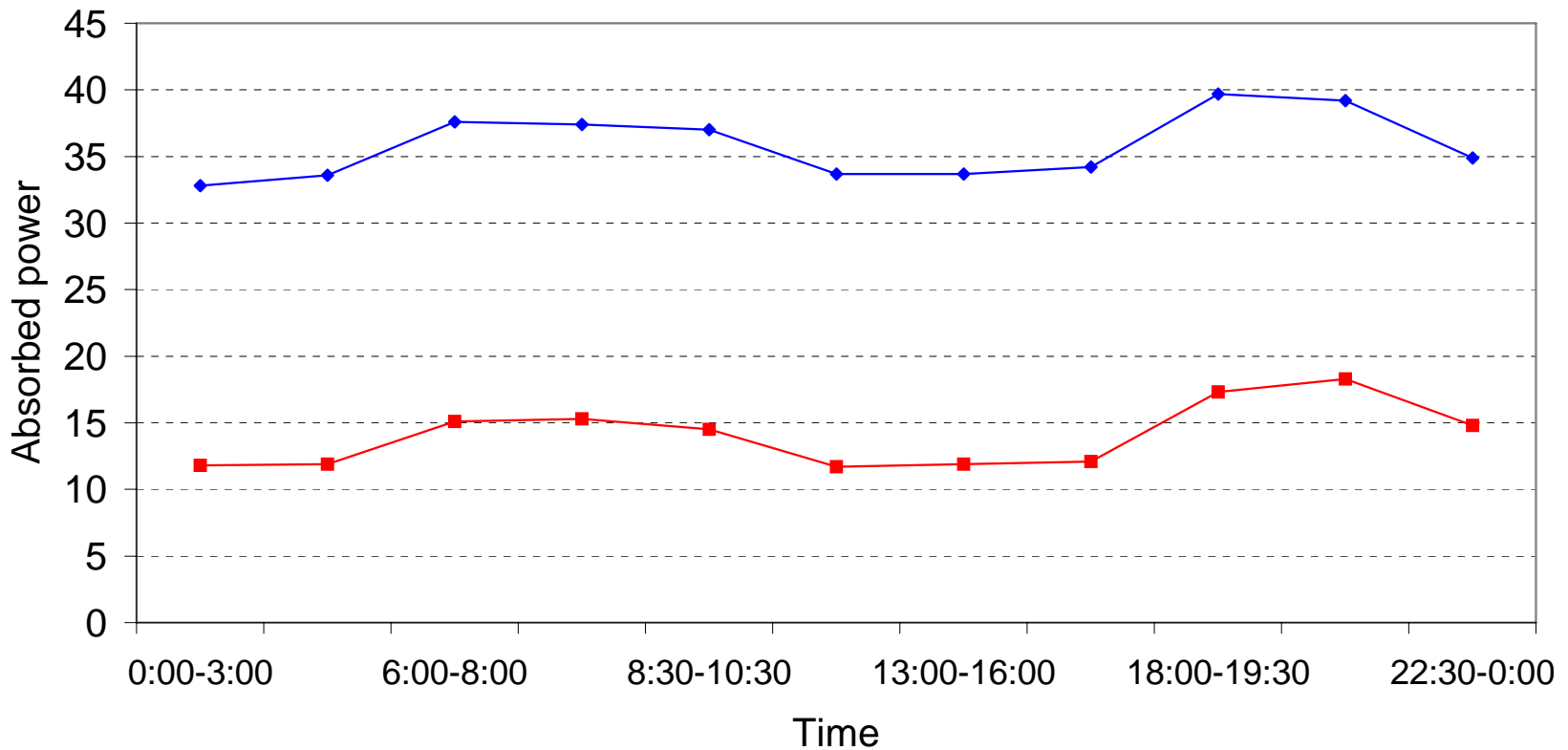
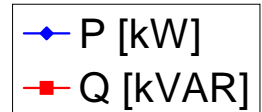
CENTRO RICERCHE FIAT





# INPUT DATA (week-end)

Electrical load profile - Load 1



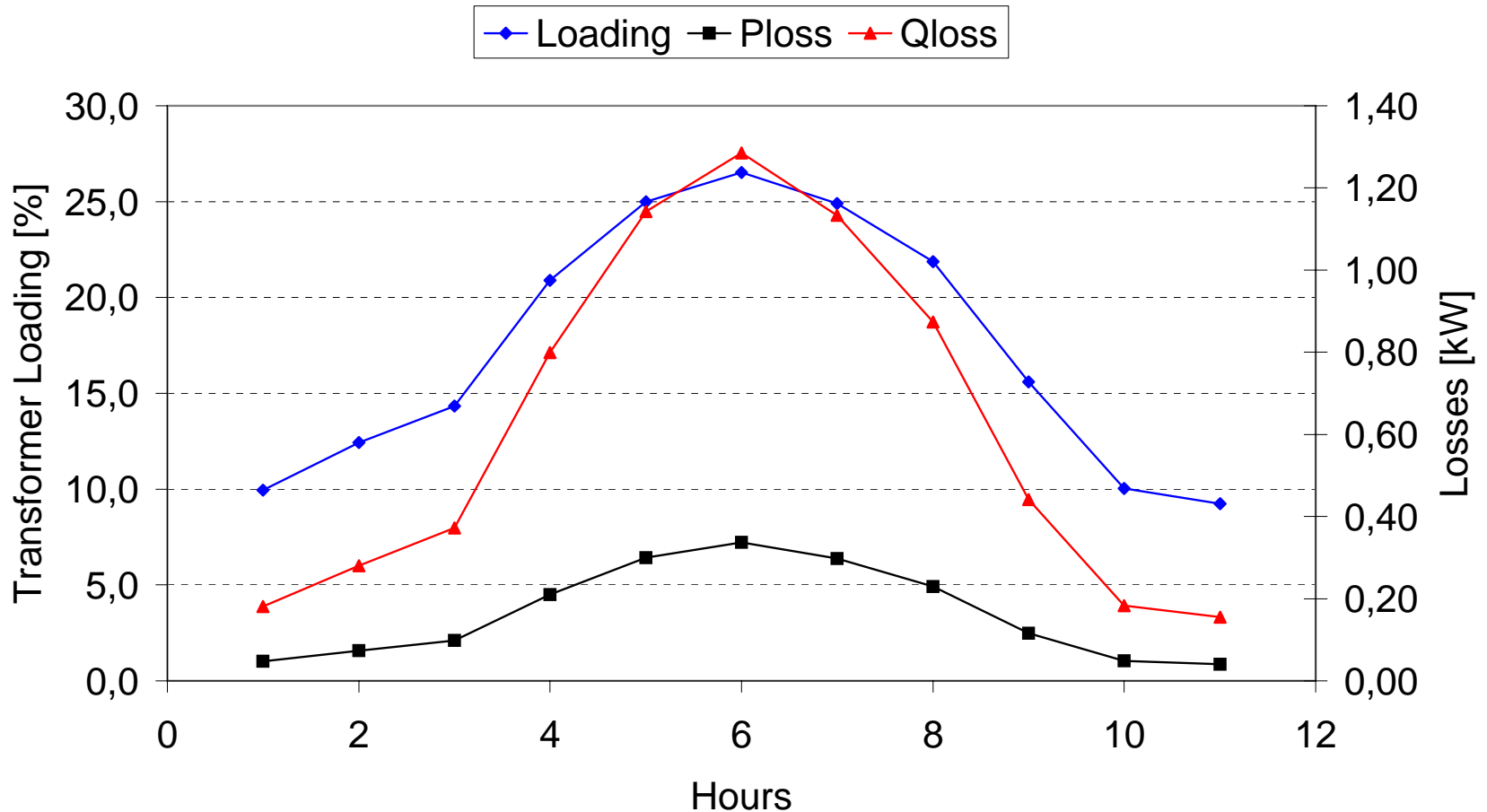
CITTA' DI TORINO



# SIMULATION RESULTS: without cogenerator

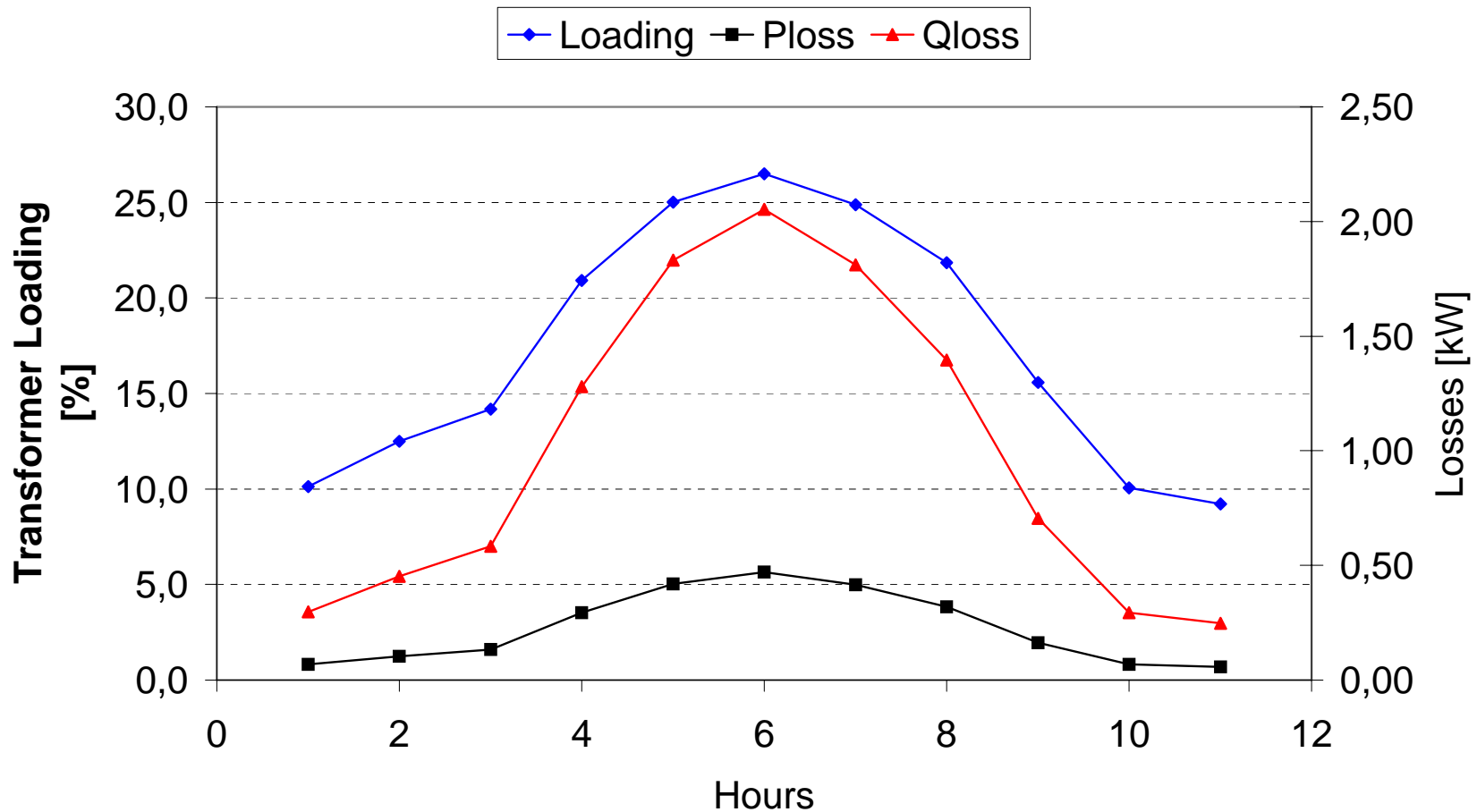


Loading - Losses - TR1





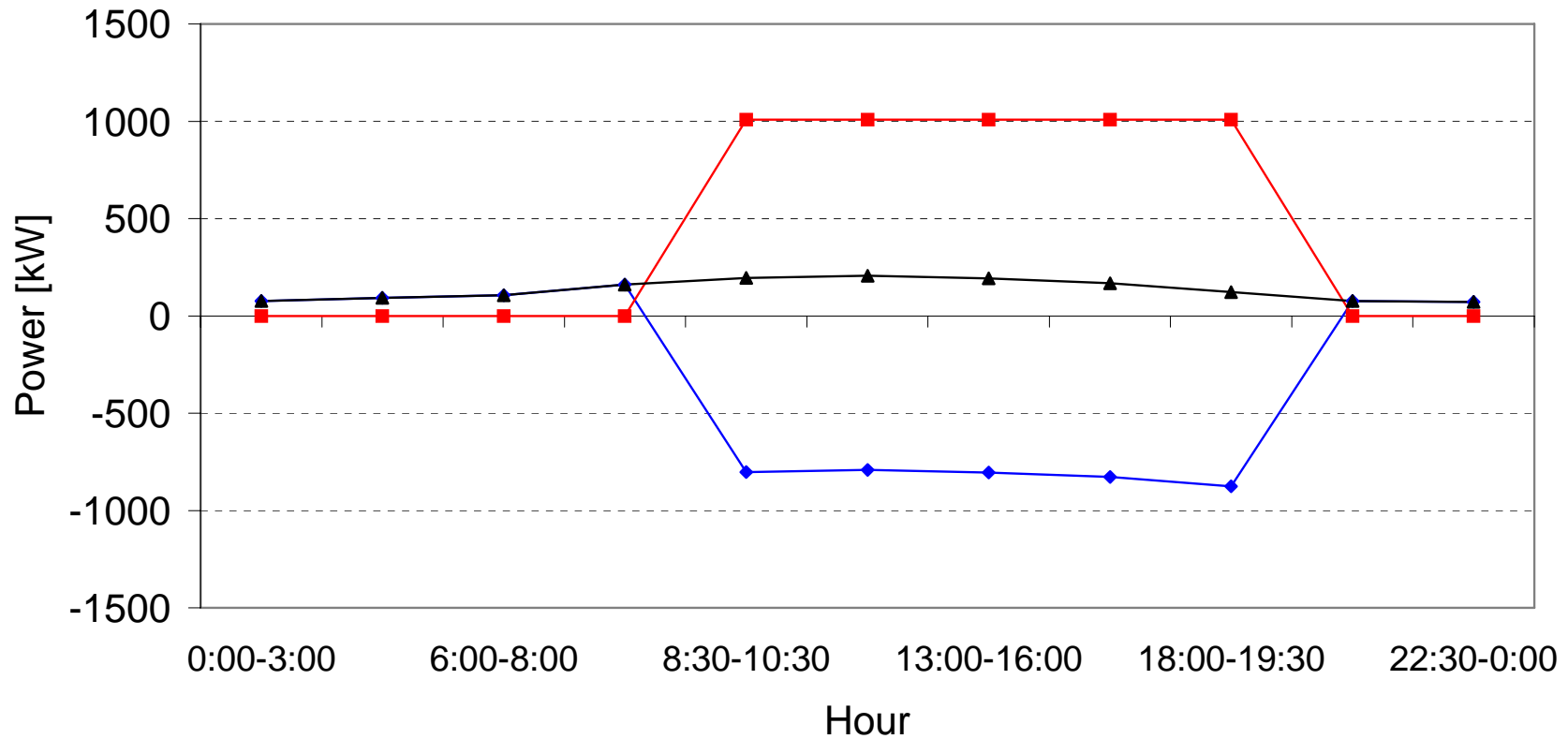
Loading - Losses - TR2



# SIMULATION RESULTS: with cogenerator

Cogenerator 100%

◆ Pslack    ■ Pcog    ▲ Pload



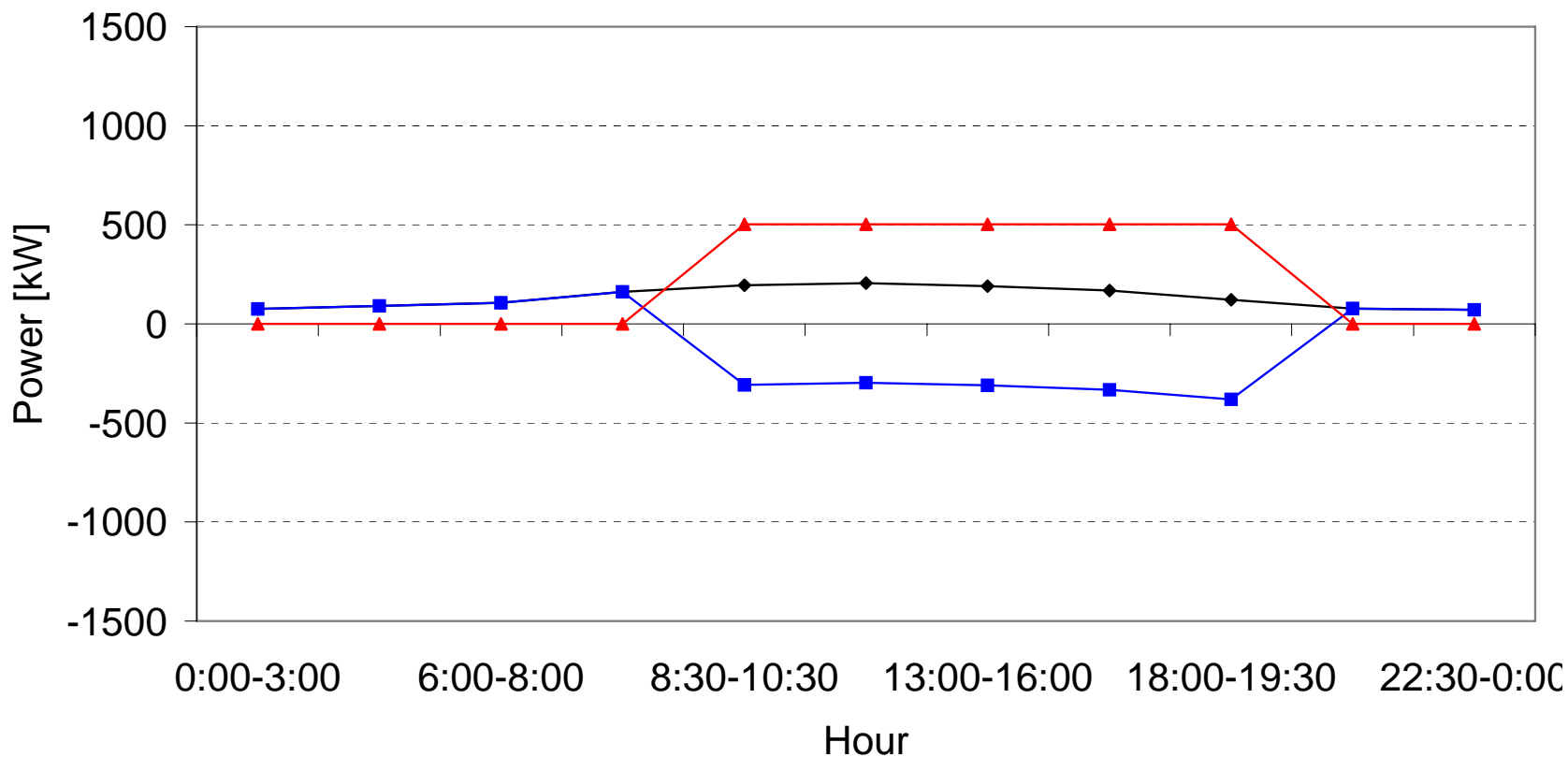


CITTA' DI TORINO



Cogenerato 50%

◆ Pload    ■ Pslack    ▲ Pcog



# Electrical Energy consumption analysis before Polycity: Arquata district

1. Time interval: 1995 – 2005
2. Analysis of buildings where PV systems will be installed
3. Consumption data at different period of time
4. Aggregation to an annual period data
5. Elaboration of the aggregation data



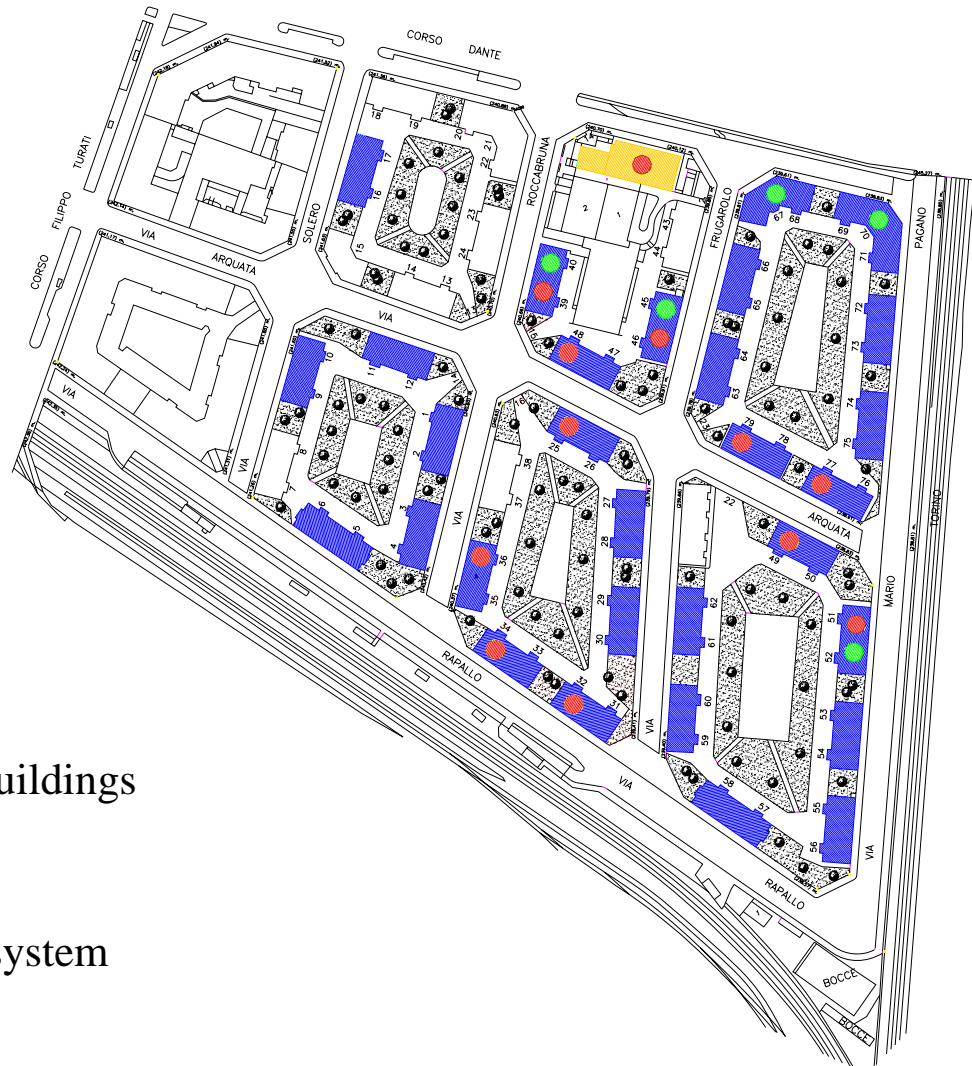
CITTA' DI TORINO



# “ARQUATA” DISTRICT, HOTOVOLTAIC SYSTEMS



CITTA' DI TORINO



- ATC building
- Involved council buildings
- Building with lift
- Building with PV system

## “ARQUATA” DISTRICT, PHOTOVOLTAIC SYSTEMS

- A 50 kW<sub>p</sub> PV system for the ATC office building
- A 100 kW<sub>p</sub> PV system installed on 11 district buildings



About 9 kW<sub>p</sub> for each PV system

- It is worth noting that only three buildings with the PV system have the lift too.
- One expects a building common load consumption lower than the PV generation for most of the time.



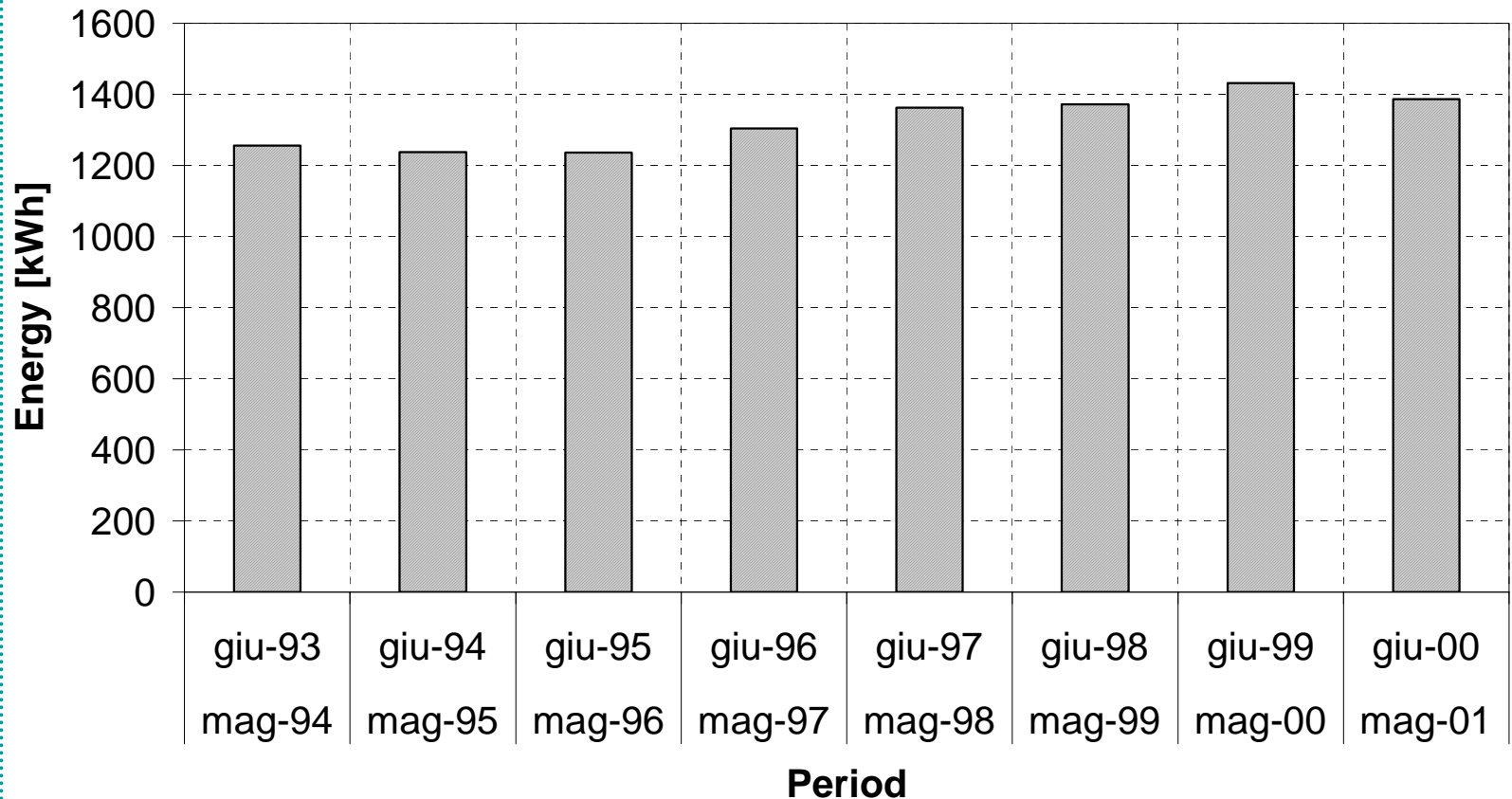
CITTA' DI TORINO





## Arquata district: Energy consumption per year before Polycity

Arquata 16 (25-26) - Average of annual consumed energy - private use

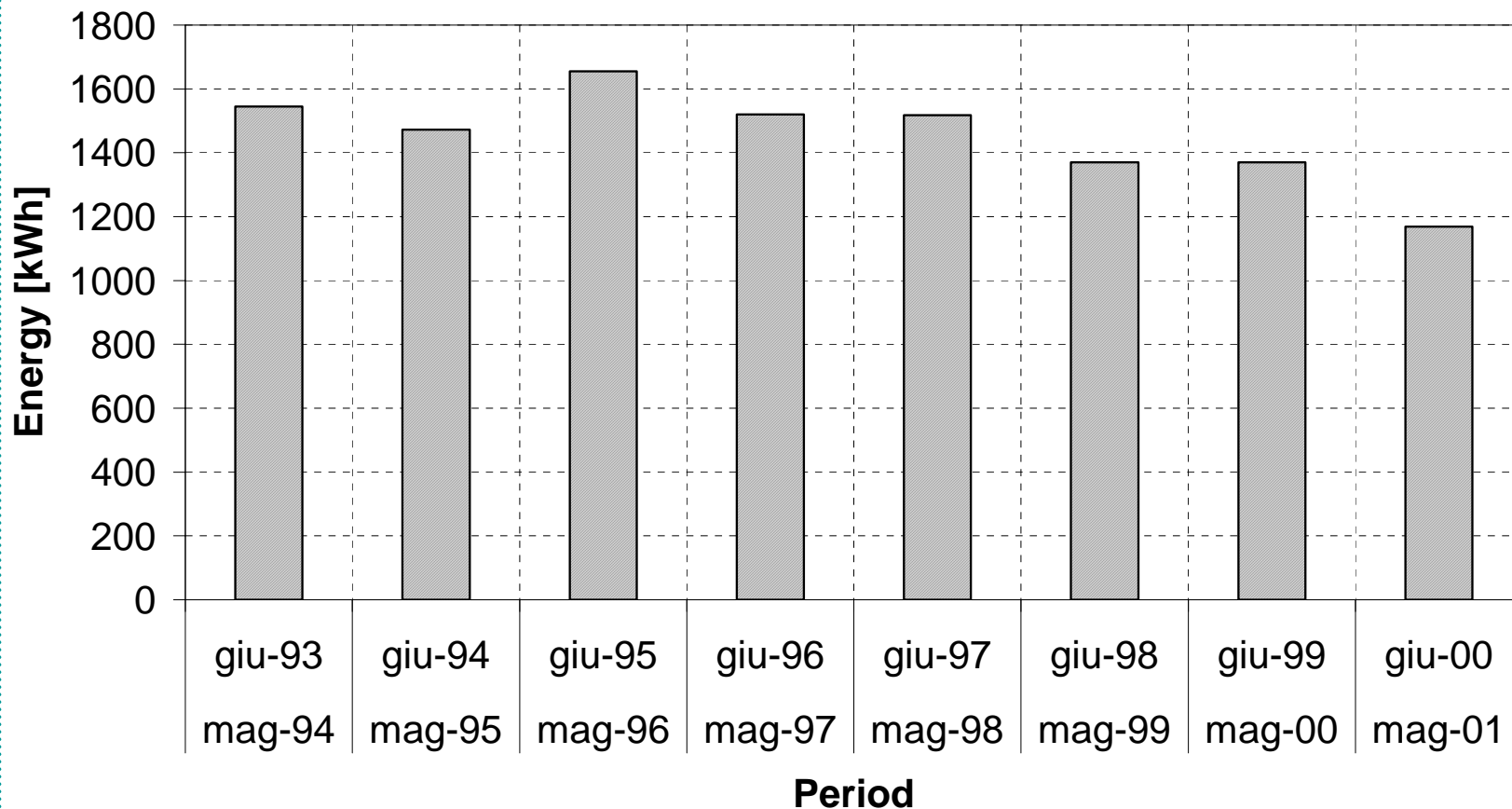


CITTA' DI TORINO





Arquata 16 (25-26) - Average of annual consumed energy - common use



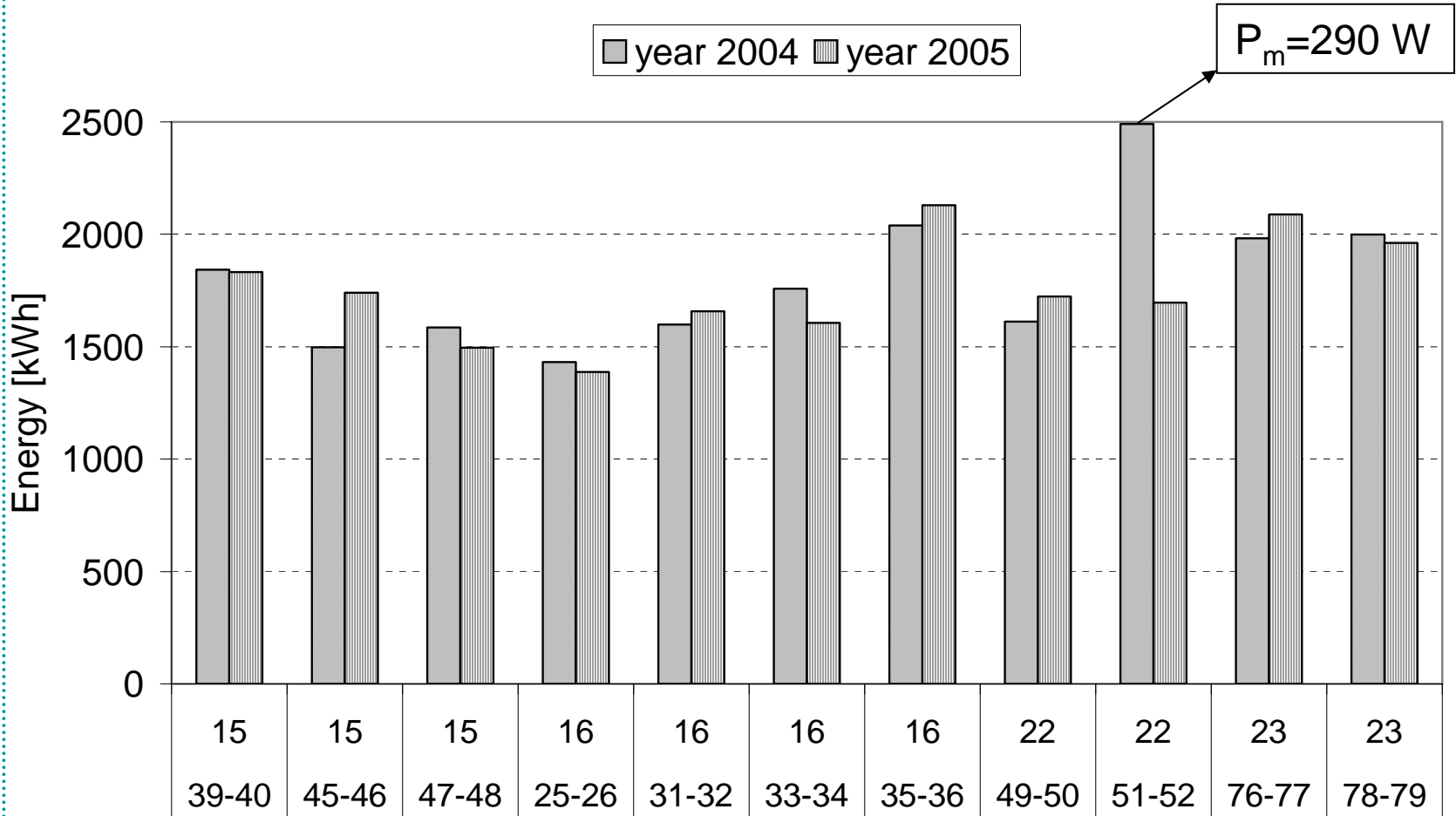
CITTA' DI TORINO

CENTRO RICERCHE FIAT





Average of annual consumed energy in the last two years - private use

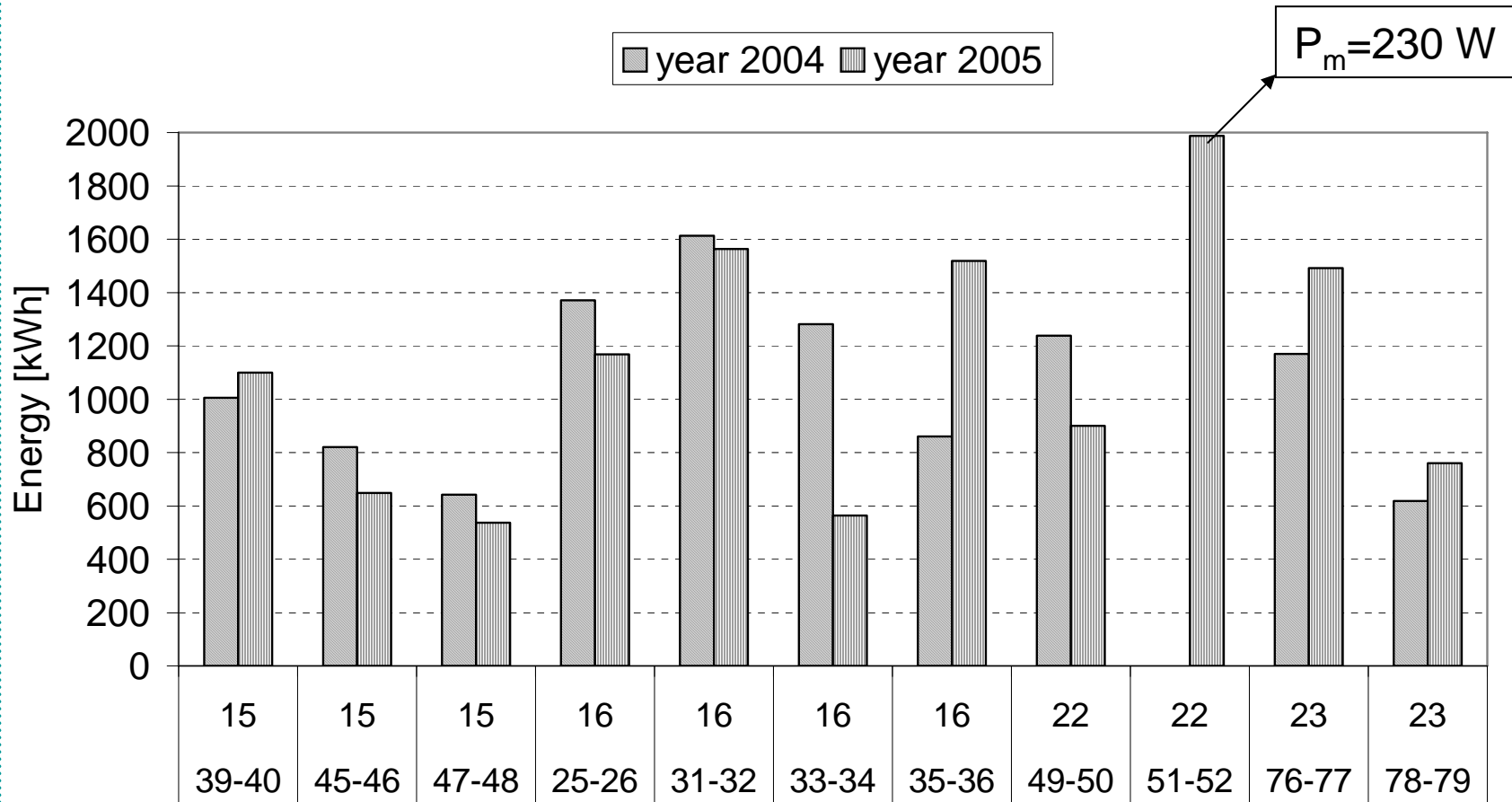


CITTA' DI TORINO





Average of annual consumed energy in the last two years - common use



CITTA' DI TORINO

CENTRO RICERCHE FIAT





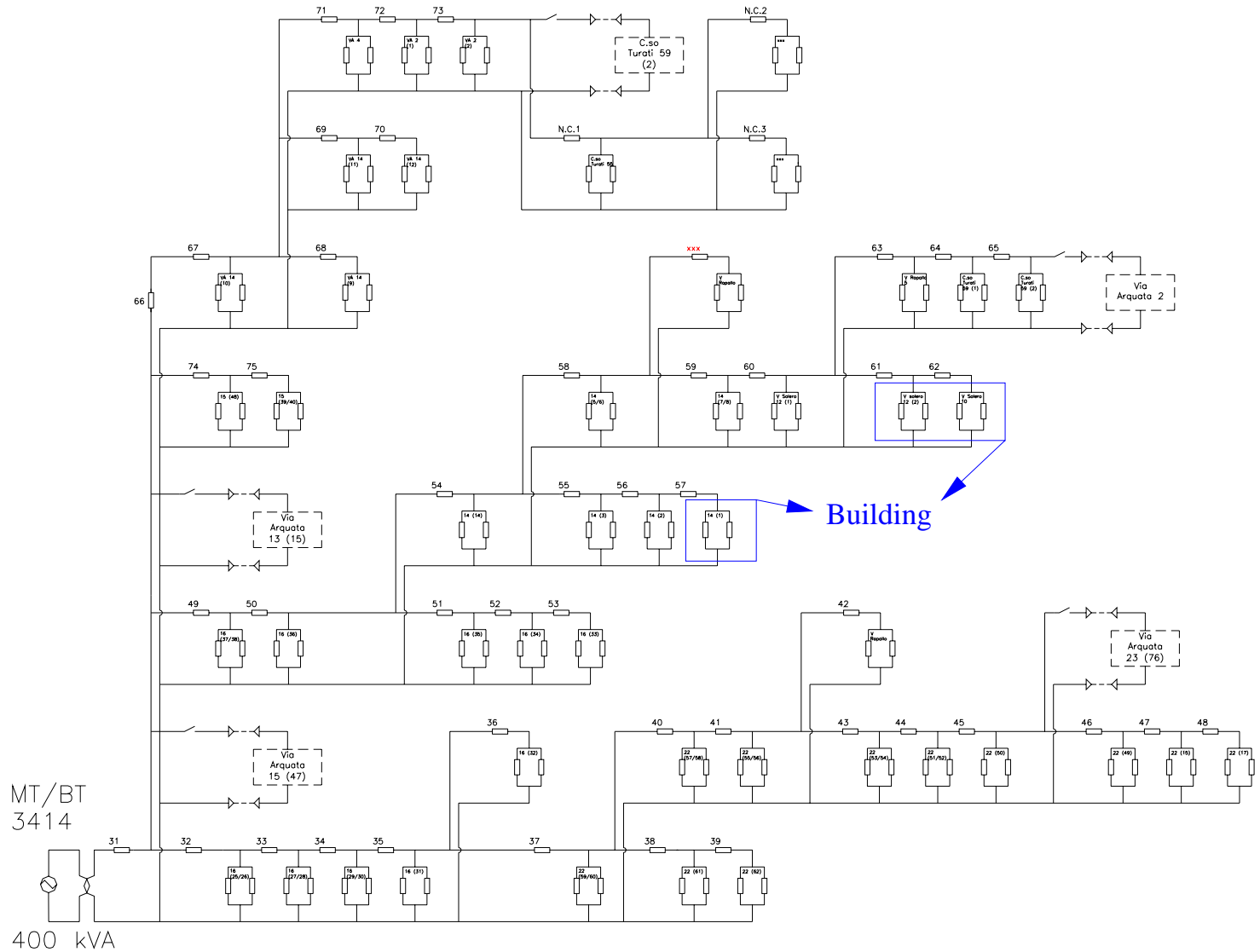
CITTA' DI TORINO

CENTRO RICERCHE FIAT

atc Torino

AEM Torino

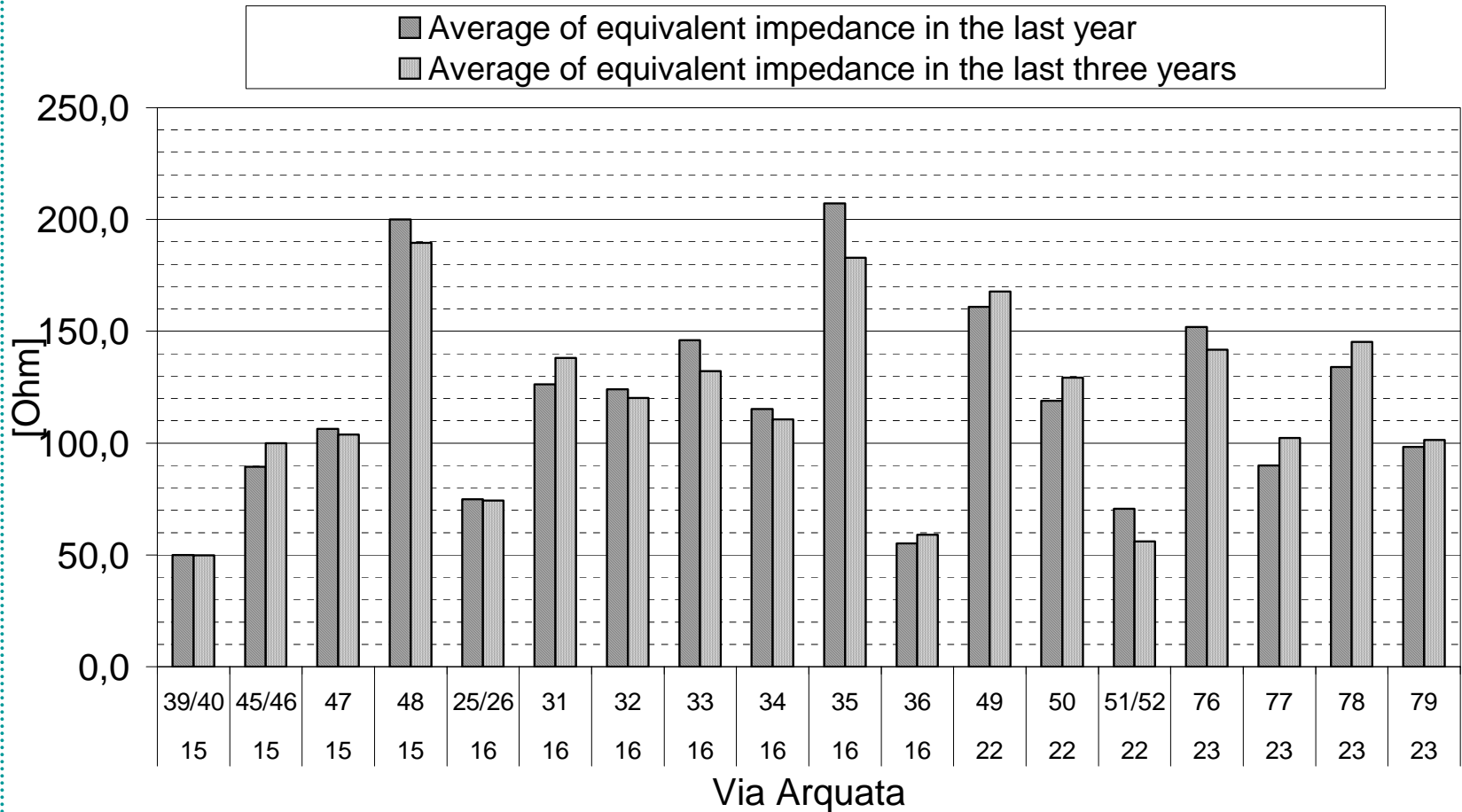
# SIMULATION





# SIMULATION

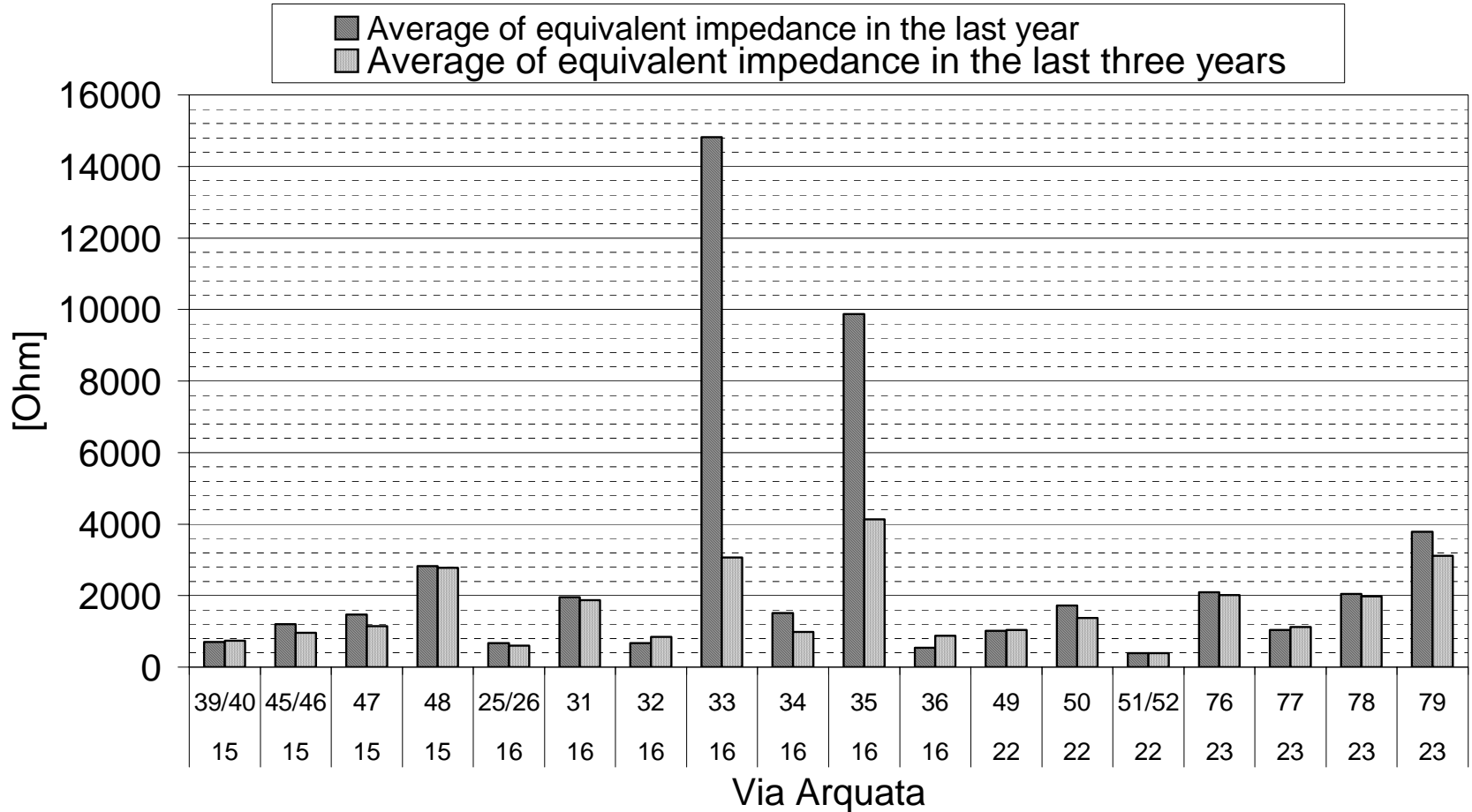
Private use





# SIMULATION

Common use





## Gas and heat analysis: ATC+Arquata District

### 1. Bills' collection (Oct 2002 – Apr 2003) :

Low accuracy because of:

- predicted evaluation of gas consumption
- final balance gas consumption after a true reading

### 2. Daily reading of a heat meter (Nov 2004 – Sep 2005)

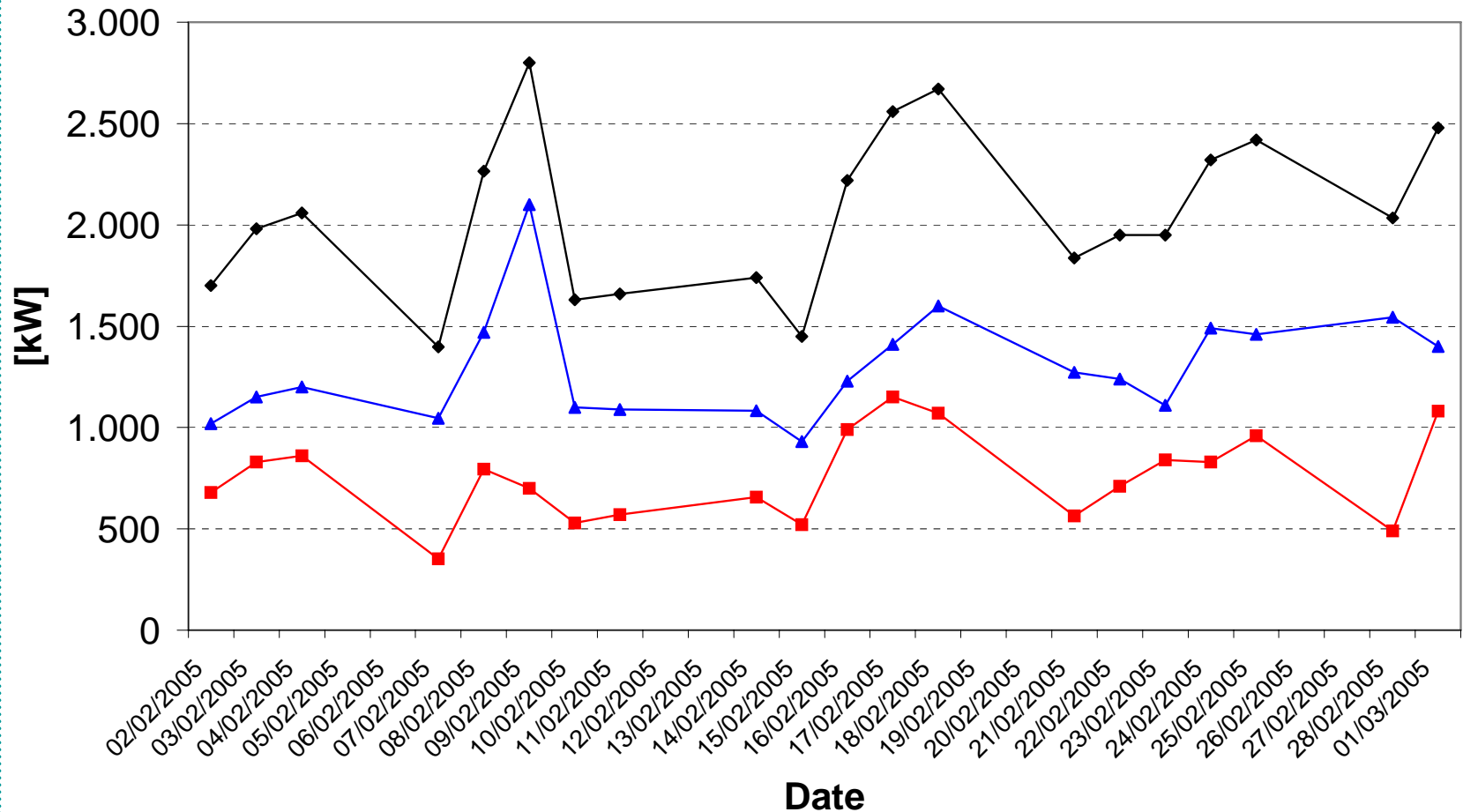


CITTA' DI TORINO



# Average thermal power (Feb - 10h)

—◆— Daily thermal power in February, working hours    —■— For Atc    —▲— For Arquata district



CITTA' DI TORINO





# Arquata District

Synthesis of Arquata district heating situation:

- 405 flats (of Arquata district) are connected to the district heating network
- hot water heating is distributed in 222 of these flats
- actual volume connected to the district heating network is  $60487 \text{ m}^3 \ll$  assessed volume  $112000 \text{ m}^3$ : only the 54%.

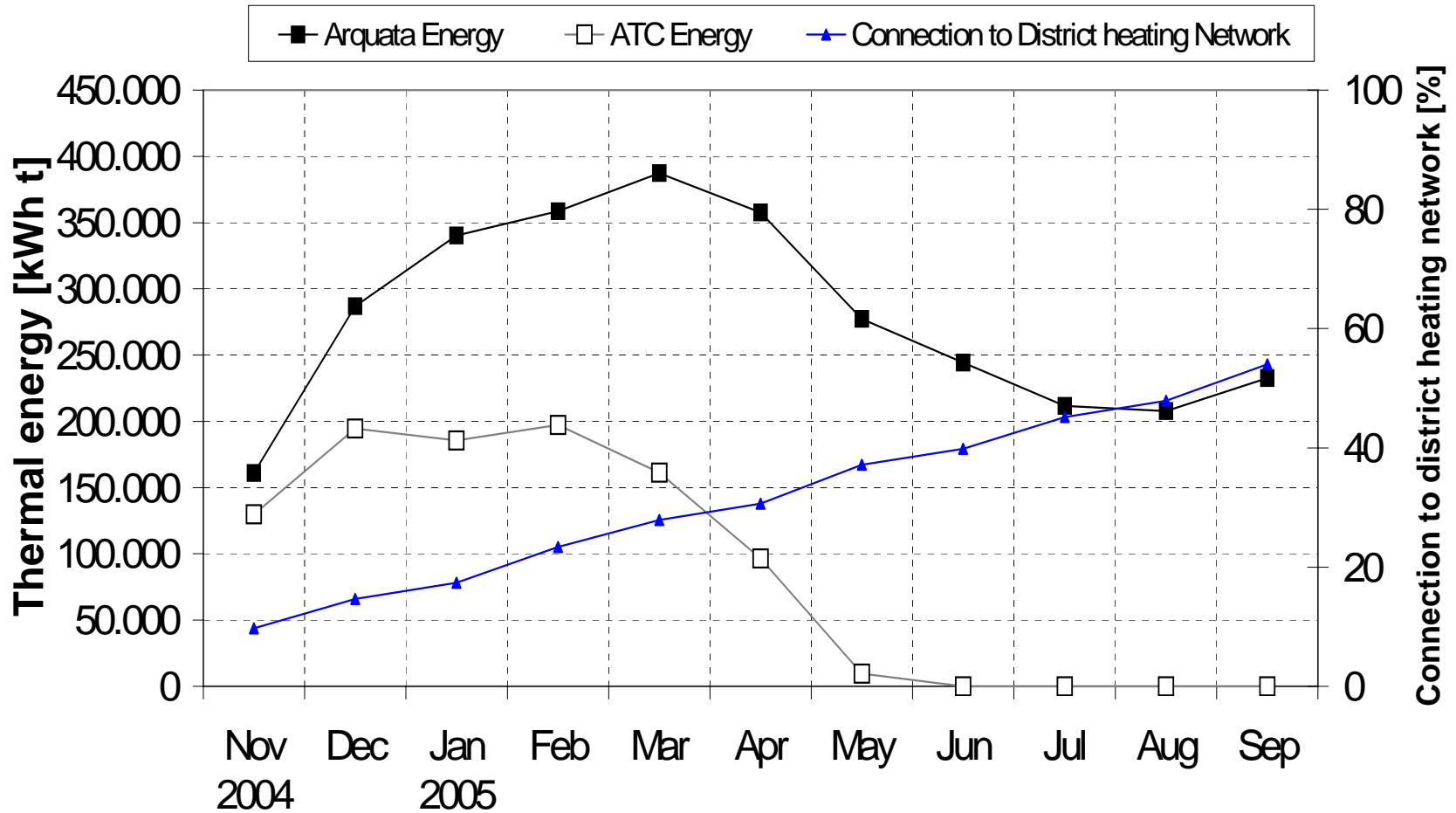


CITTA' DI TORINO





# Monthly thermal energy



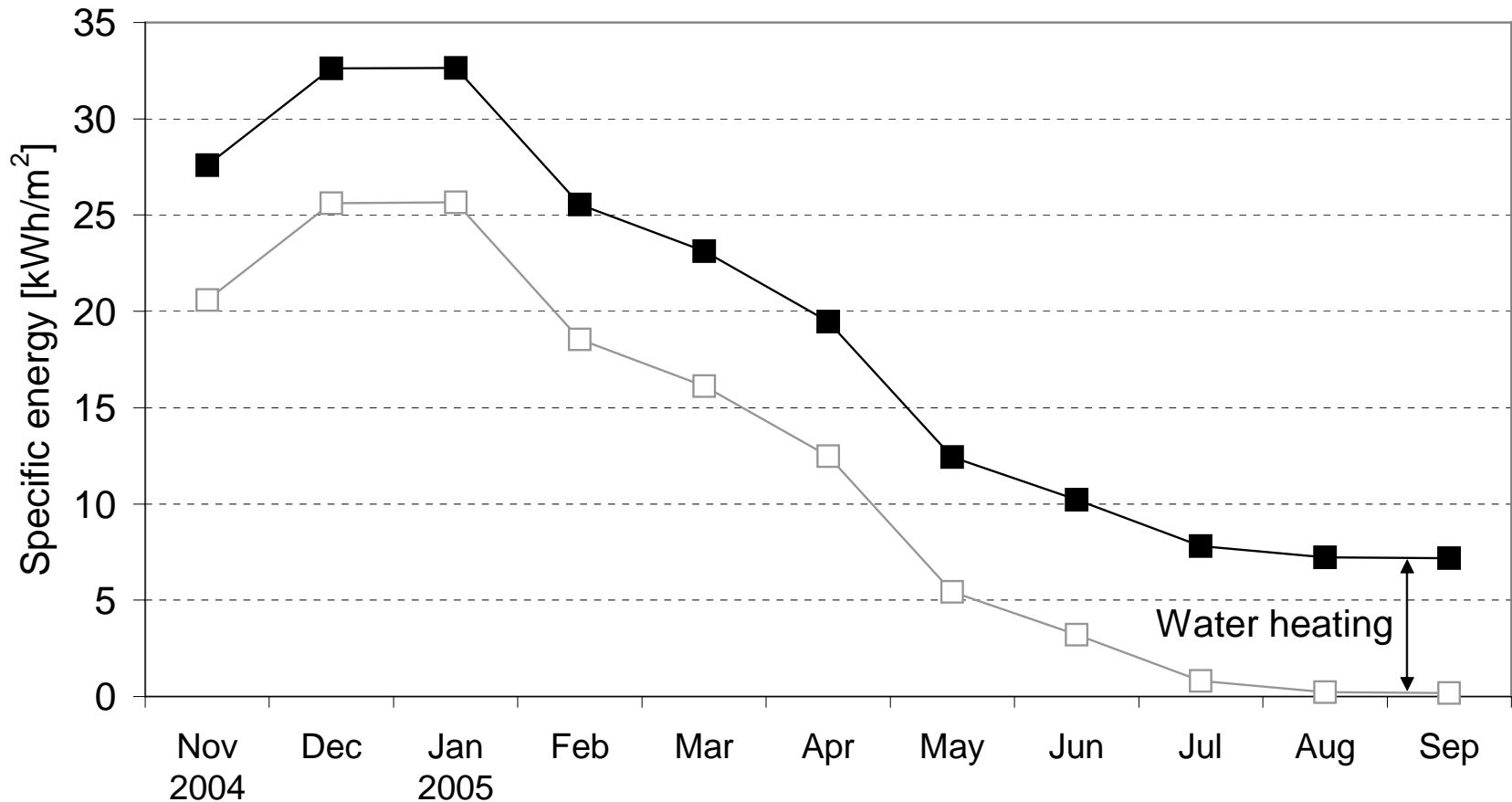
CITTA' DI TORINO





# Monthly specific thermal energy : Arquata District

Thermal specific energy for Arquata



CITTA' DI TORINO

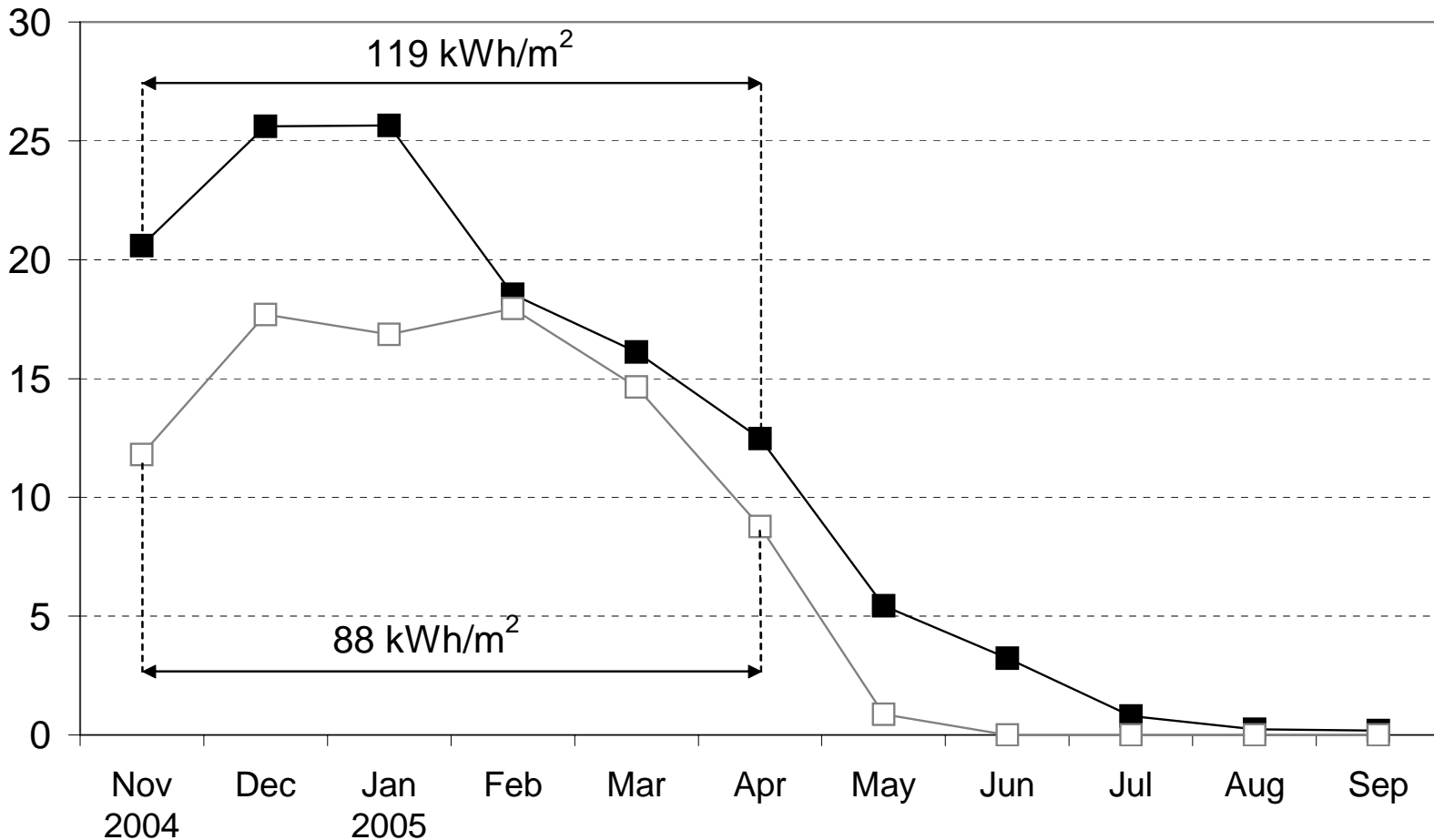


# Heating: monthly specific (1) thermal energy consumption



■ Arquata specific energy □ ATC specific energy

Specific Energy (1) [kWh/m<sup>2</sup>]



CITTA' DI TORINO

CENTRO RICERCHE FIAT

atc Torino

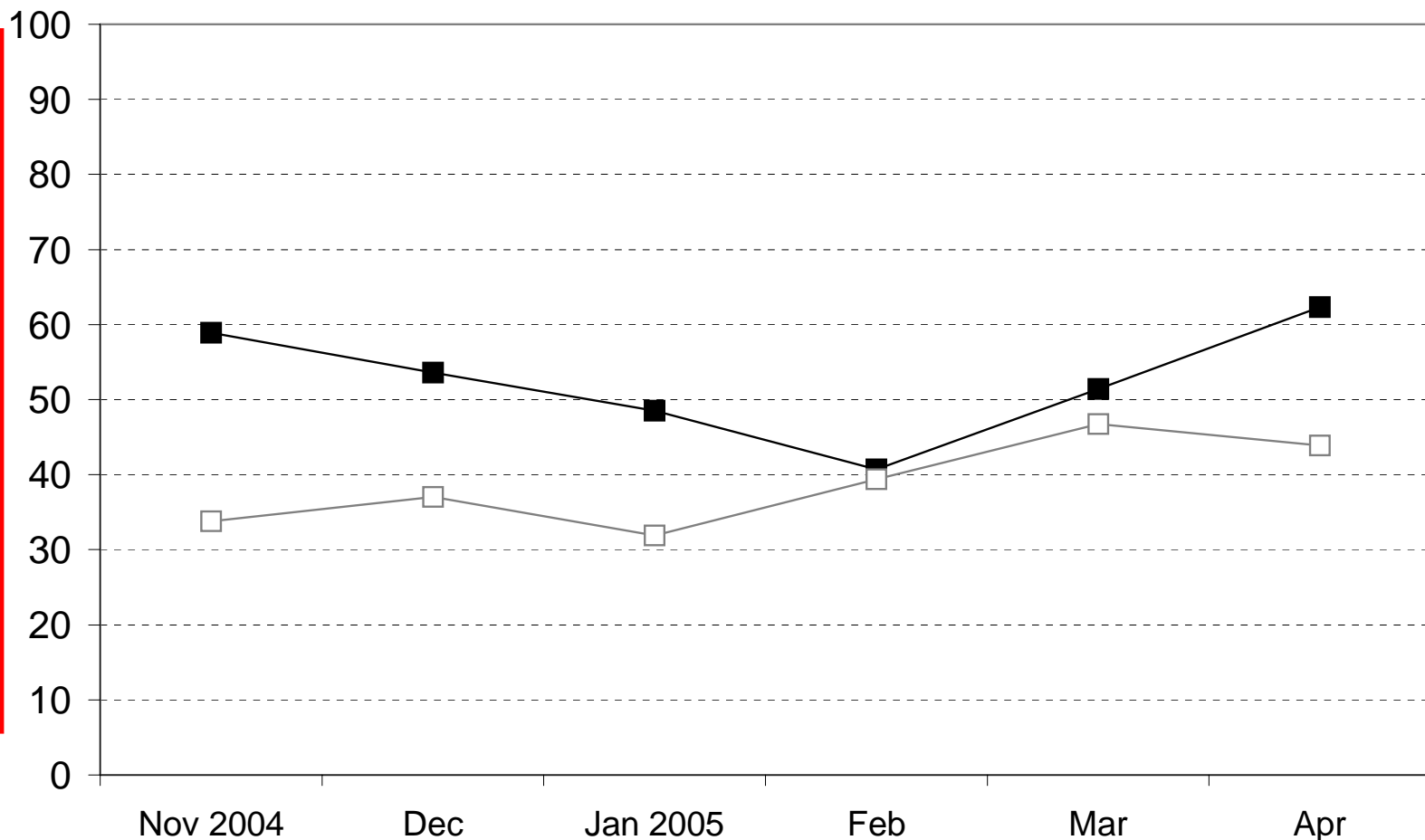
AEM Torino

# Heating: monthly specific (2) thermal energy consumption



■ Arquata □ ATC

Specific Energy (2) [Wh/m<sup>2</sup> DD]



CITTA' DI TORINO

CENTRO RICERCHE FIAT

