

SUSTAINABLE BUILT ENVIRONMENT TOWARDS POST-CARBON CITIES

# ENERGY EFFICIENCY IN A LARGE UNIVERSITY: THE UNITO EXPERIENCE

Dario Cottafava in collaboration with M. Baricco, P. Gambino, A. Tartaglino Università degli studi di Torino



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Dario Cottafava

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## INTRODUCTION: UNITO AT A GLANCE



#### **UNITO's Building Stock**

#### Period of construction

- Rettorato (1713)
- Palazzo Campana (1675)
- Physics Department (end of XIXth)
- Palazzo Nuovo (1966)
- Grugliasco (1999)
- Campus Luigi Einaudi (2012)

#### Functions

- <u>Administrative Offices (EX:</u> Palazzo degli Stemmi)
- <u>Humanities Departments (</u> EX: Palazzo Nuovo) close at 8:00 PM
- Hospitals: (EX: Molinette)
- <u>Science Departments:</u> (EX: Biotech, Physics, Chemistry) host several laboratories working 24h/24h
- Botanical Garden, Museum, libraries, ...





Building Annual Absolute Consumption (KWh)

## A GENERAL APPROACH: SCATTER METHOD ANALYSIS



Annual Normalized Consumption

Consumption per square meters (KWh / m2)



Building Annual Absolute Consumption (KWh)

## A GENERAL APPROACH: SCATTER METHOD ANALYSIS



Annual Normalized consumption

Consumption per square meters (KWh / m2)









#### A CASE STUDY: CAMPUS LUIGI EINAUDI SUB OPTIMAL HVAC SCHEDULES



#### A CASE STUDY: CAMPUS LUIGI EINAUDI GENERIC ELETRIC LOADS



2 PC Consumption







F3: 30.4 %

### ONLINE TOOLS & WEB APPLICATIONS: MAPS & BUILDING CONSUMPTION

**UNITO Building Sites** 

- ×





A useful tool to visualize historical consumption and/or real time data, allows for quick comparison between different buildings and years. This approach makes easier consumption anomalies detections.

#### **ONLINE TOOLS & WEB APPLICATIONS: COMFORTSENSE RESEARCH PROJECT** SBE2016 TORINO ENVIRONMENT PARK Parco Scientifico Tecnologico per l'Ambiente Pro Logic 00( TELECOM Screen MODELWAY Sinbit Informatica 99 **Mobile App** Allow users to send Comfort Feedback & to Visualize historical data **Meshlium and Fixed Sensors &** Ibeacon Wearable Occupancy sensors and Temperature, Humidity Indoor Geolocalization and Co2 Concentration 2 1 1 22:08 Sei in: Sala Studio (CLE)



INTERACTIVE MAPS Indoor Geolocalized Data visualization Quick identification of anomalies Example: Feedback on Comfort (1-5) Average users' rate = 1.75 (discomfort) STOCKCHARTS <u>Multiple Data Comparisons</u> Quick identification of correlations and trends <u>Example</u>: Occupancy VS Co2 Concentration Co2 sensors able to predict room Occupancy



## CONCLUSION

#### **General Problems**

- 1. Inhomogeneity of datasets
- 2. Absence of monitoring equipment in historical buildings
- 3. Lack of tools for data visualization & analysis
- 4. Inadequate awareness for sustainability

Some of these problems we found are typical of a large italian Public Organization, where attention to the responsible use of energy has traditionally been low. The approach and the tools we have presented may contribute to reverse this.

