European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

2nd International Workshop *EuNetAir* on

New Sensing Technologies for Indoor and Outdoor Air Quality Control

ENEA - Brindisi Research Center, Brindisi, Italy, 25 - 26 March 2014

The Urban Networks approach in the EERA European smart Cities Joint Programme

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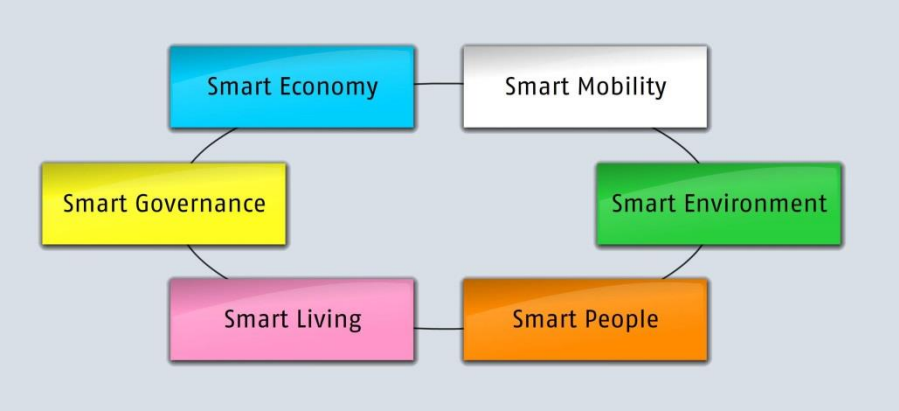
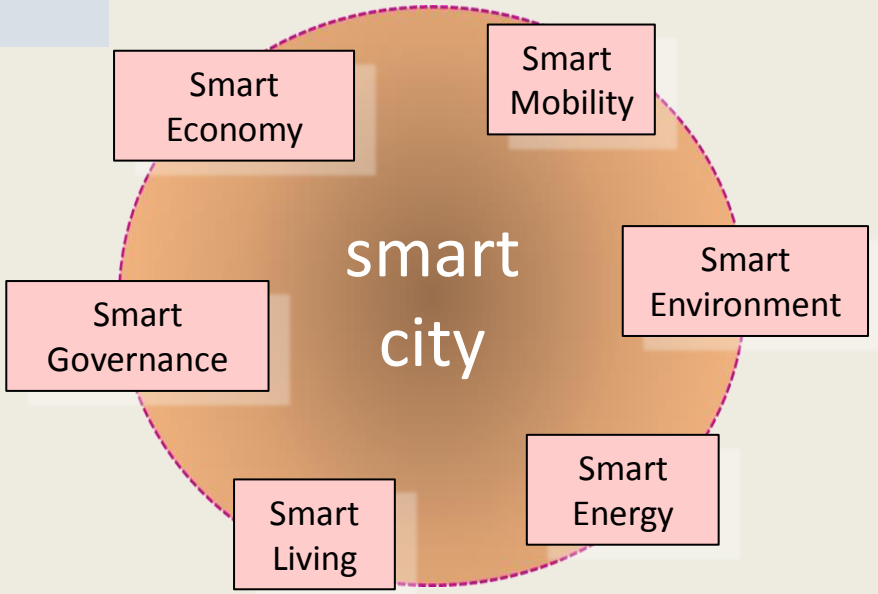
ENEA, Italy

COST is supported by the EU Framework Programme

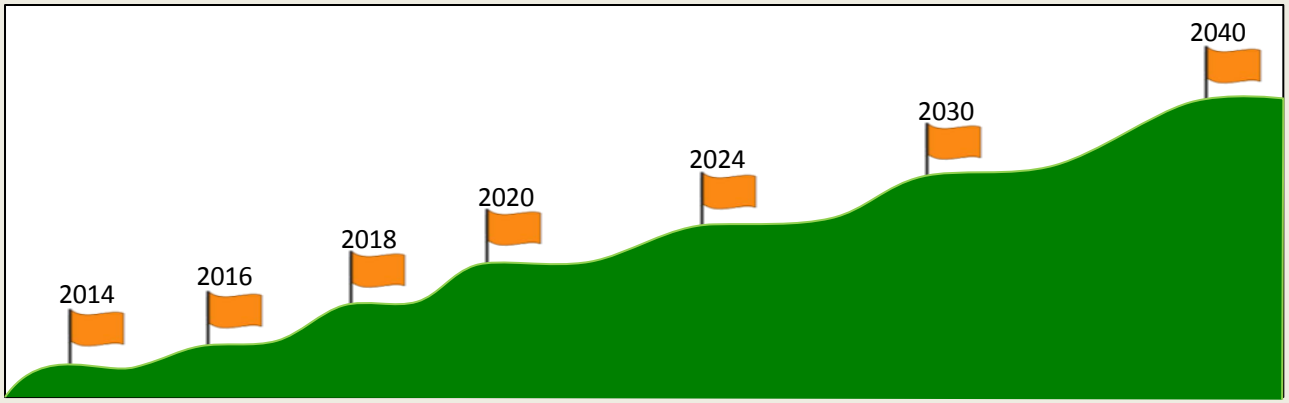
ESF provides the COST Office through a European Commission contract

Smart City


Smart Economy
Smart Mobility
Smart Governance
Smart Environment
Smart Living
Smart People

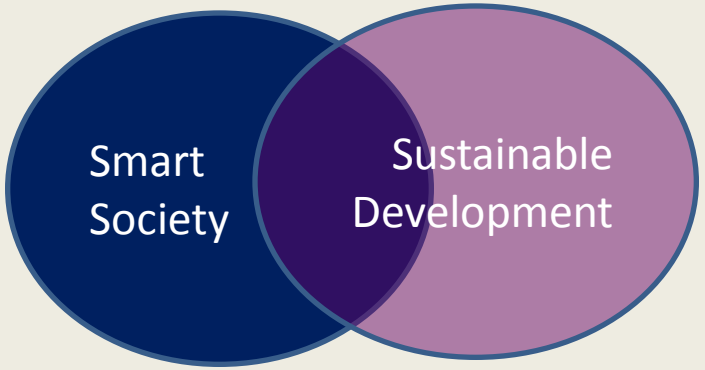

Smart Economy
Smart Mobility
smart city
Smart Environment
Smart Governance
Smart Energy
Smart Living

A SPECIFIC ROADMAP TOWARDS SUSTAINABLE CITIES



- A method for city integrated planning: smart city as a integration roadmap

- Smart cities ->+ smart communities



The European Context

SET plan priorities

EIIs and Joint Undertakings	Budget [Bil €]
European Wind Initiative	16
Solar Europe Initiative (fotovoltaico e termico)	6
European electricity grid initiative	2
Carbon Capture and Storage	11-16
Sustainable bio-energy Europe Initiative	9
Sustainable nuclear fission initiative	5-10
SMART CITIES	**10-12**
Fuel cells and hydrogen	5-6
totale	64-77

SET PLAN → Horizon 2020

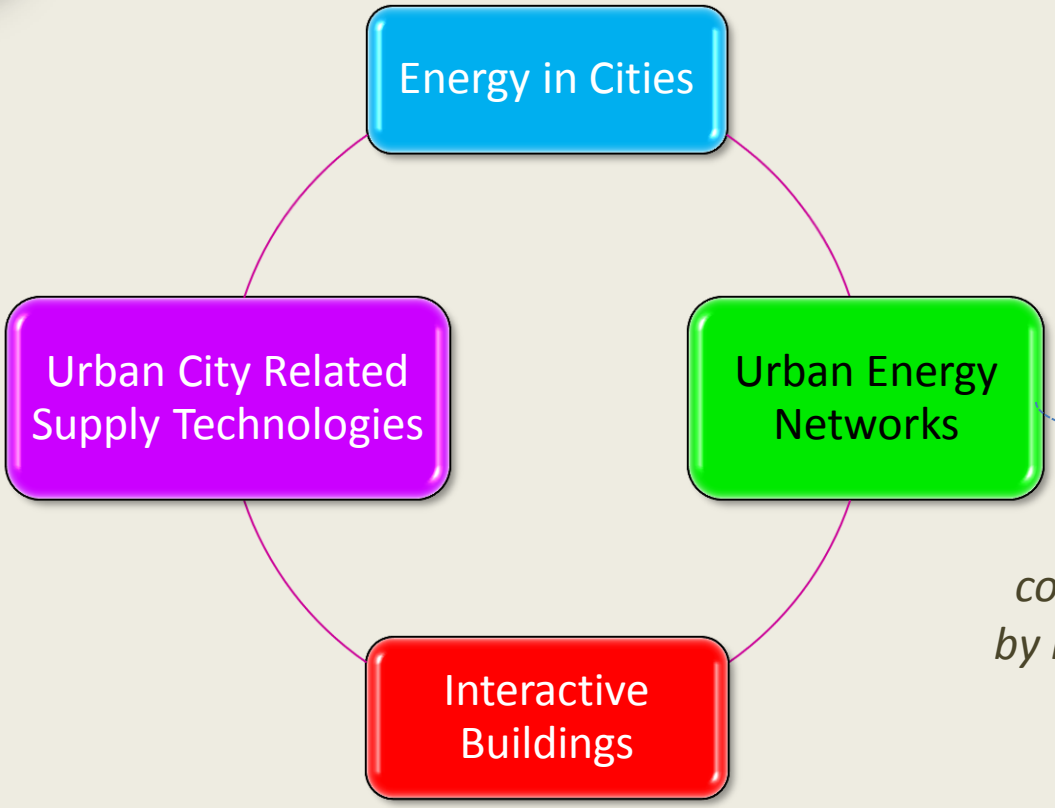
The European Initiatives on Smart Cities

UE 2020
Innovazione
Agenda digitale
Sviluppo sostenibile

Smart City EERA Joint Programme (2012)	Research & Dev
Smart City Stakeholders Platform (2012)	Industry
Smart City Member State Initiative (2012)	Government
Covenant of Mayors (2009)	Municipalities
Urban Europe (2012)	Government + R&D

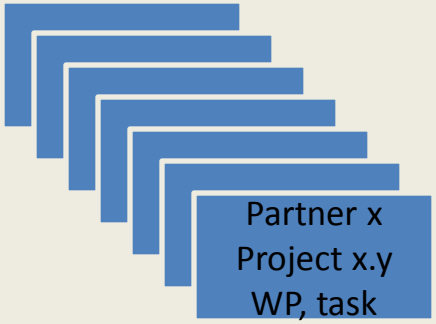
Joint Programme Smart City

27 countries
2012-2015
200 py/y

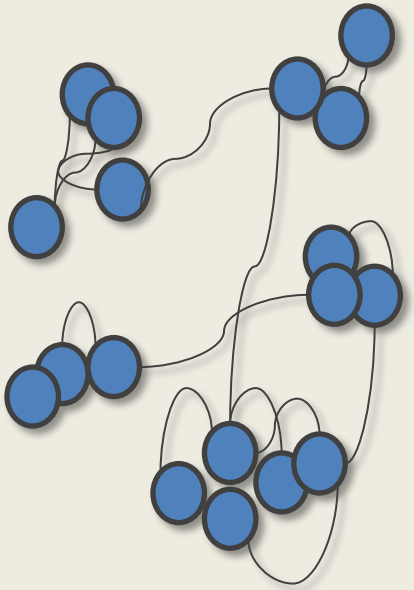


coordinated by Italy (ENEA)

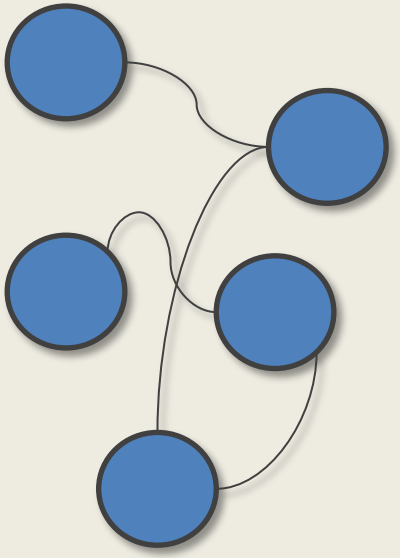
Joint Programme Smart City
Project mapping and linking



List & KPI classification



Mapping, clustering
gap analysis



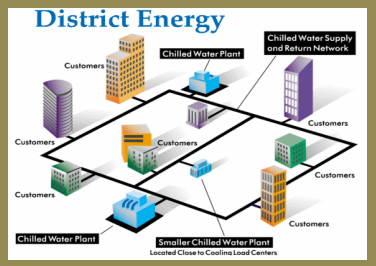
Synergy development,
launch of joint financed projects
- Horizon 2020 -

2012 **2013** **2014-2015**

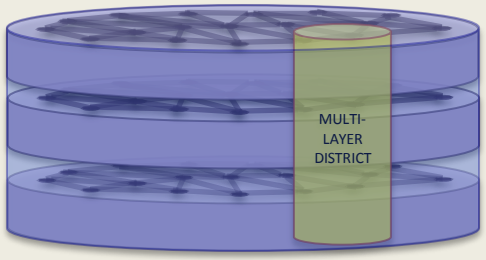
European Smart City Joint Programme

Main Objectives of "Urban Energy Network" Sub Programme

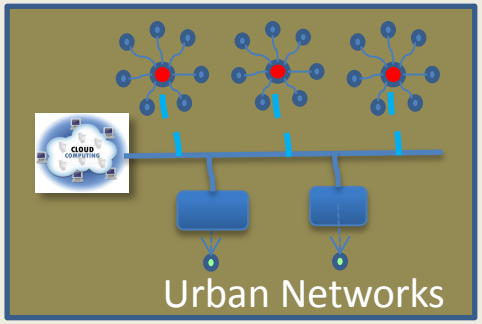
Development an integrated reference architecture for the smart district synchronizing local energy production and distribution with any form of energy consumption.



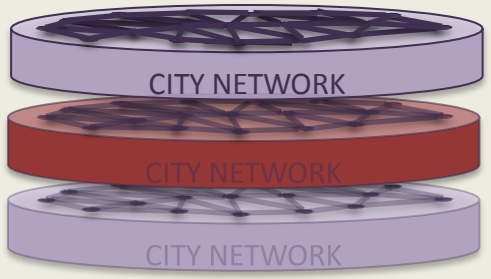
Smart Energy Districts



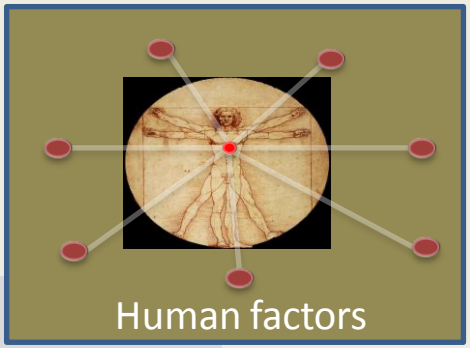
Modelling and development of a concept of urban network integration to enabling the energy-on-demand principle, city adaptation and smart service market



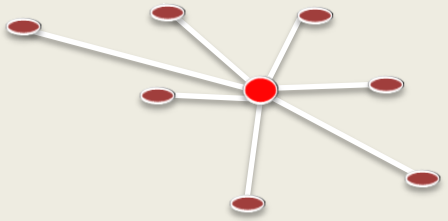
Urban Networks



Focus on the relations among citizen and the urban networks taking account of non-technological factors and human factors

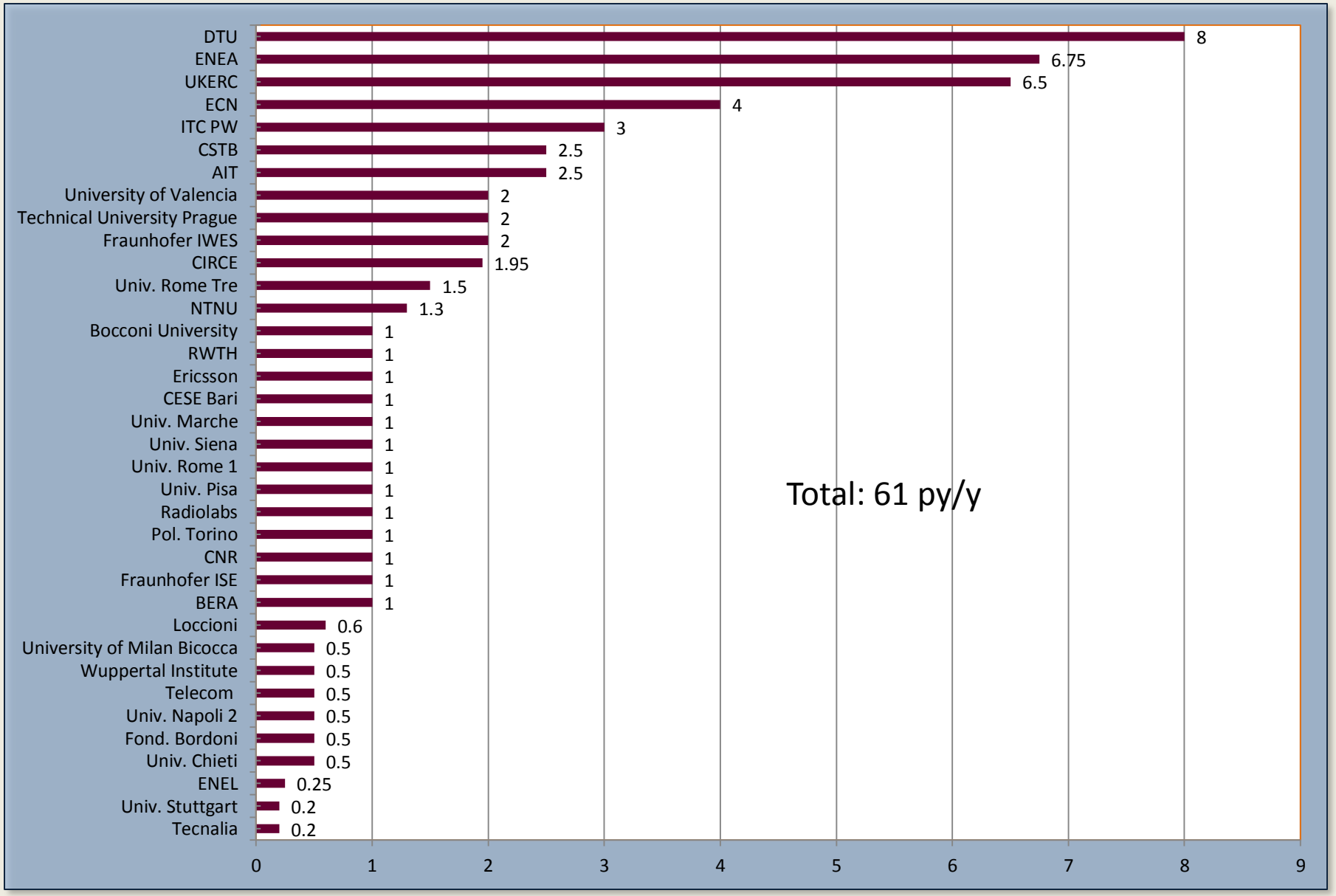


Human factors



European Smart City Joint Programme

Urban Energy Networks Partnership

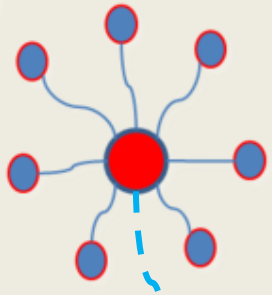


The Smart City paradigm

The Smart City Model

City Government

Living Labs
(planning, crisis, decision...)



Urban Sensor Networks

ICT networks

Buildings

Energy Grids
(electr/termal)

Mobility

Public Lighting

Water Waste

Com
Safety
Healt Food
Heritage
Education
Envir
....

City utilities

Open Data

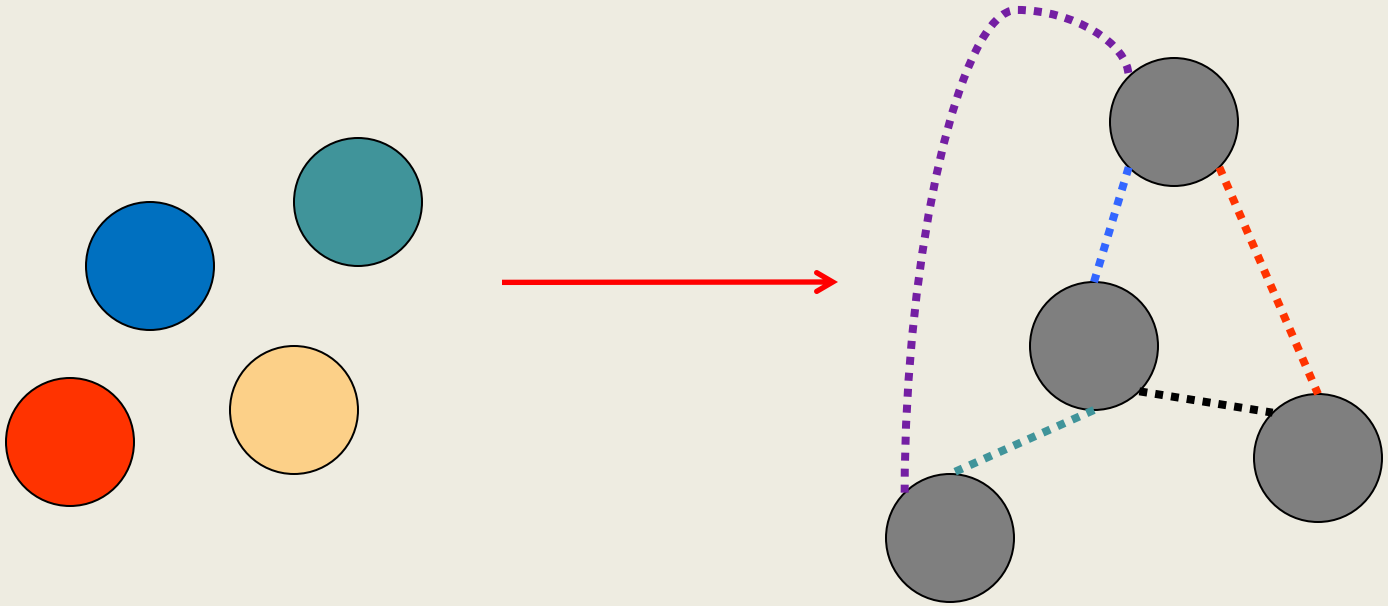
Smart Services

Resources
On demand

Citizen

Spatial vs Relational:
The Relational Approach

FRANCISCO VARELA
the autopoietic organization



…from description of components…

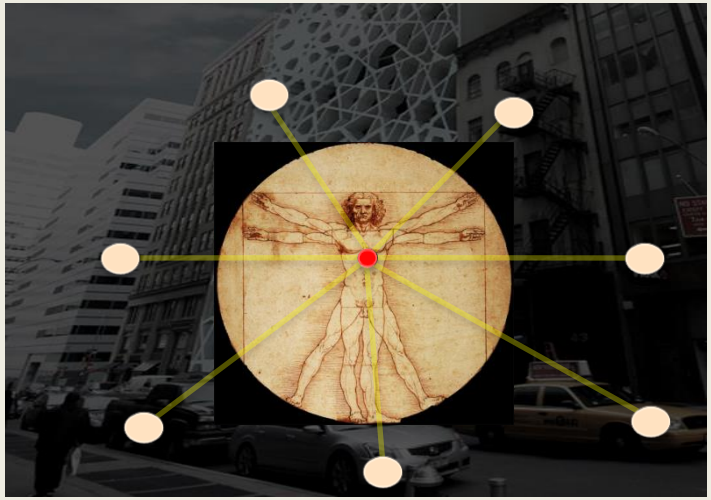
…to description of relations…

City 2.0 : the user-producer city

Adapt the city to the people needs

resource on demand

The Human Oriented Technology



City 2.0 : the enabling technologies

Sensor networks and interactivity

Open data

Flexibility on urban utilities

Computation intelligence

The Smart City Application Domains

Smart City Application Domains

Technologies for City Planning and Government

Urban center: open data, environ. monit, climatic emergences, energy prod/cons, transport, safety, crisis management.
Sanità e scuola digitale

Urban Networks

Energy grids: smart grids (electrical+thermal, active demand, electric/ gas smart meters, citizen consciousness).
Smart Lighting: led, smart poles, remote-management, smart services.
Smart Mobility: infomobility, electrical (fast recharge, elect vehicles, V2G, sharing, mobility on demand, business model).

Smart Buildings

Smart Buildings: public (office, schools, …), mat/comp (heat pumps & solar cooling), automation, residential
Smart homes: smart appliances, micro-generation, domotics, remote connection, smart services.
Building Network Management: monitoring, remote diagnostics, optimization and active demand.

Environmental Resources

Water Management: monitoring, optimization, emergences, water quality, distribution efficiency.
Smart Waste: collection, treatement, ICT cycle monitoring.

Smart Industrial Cluster

Energy conversion: industrial residuals, connection industrial-residential district.
Digital interoperability: industrial district (exchange of matter, services & info).

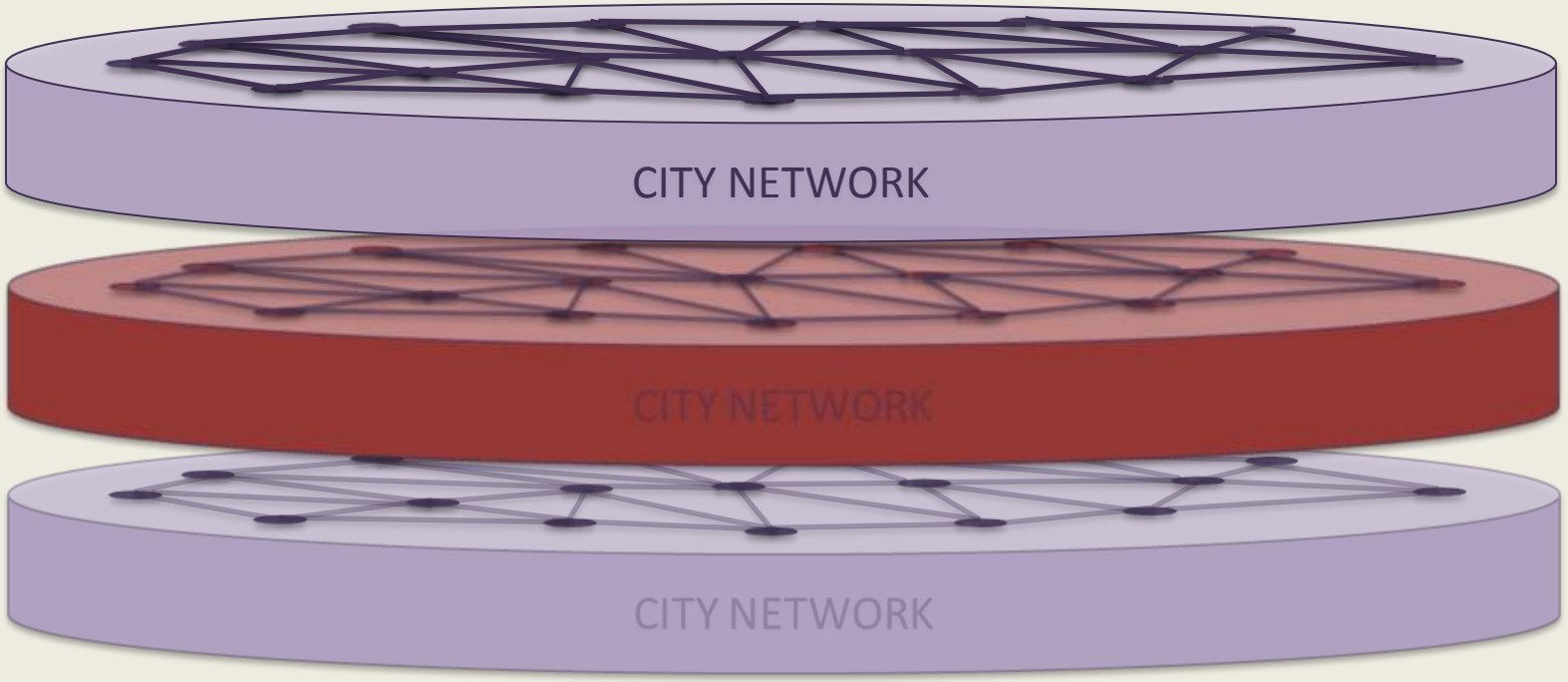
Electric System Efficiency

Electric System Management: Flexibility, Active Demand

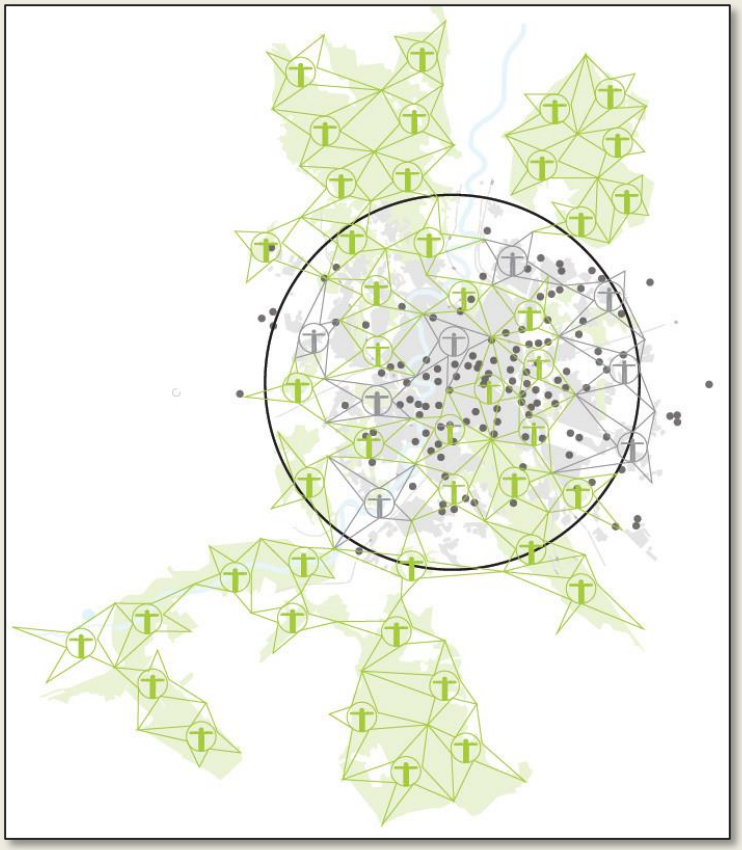
From :Smart Energy Task Force Confindustria-ENEA-RSE

THE CITY AS A CLUSTER OF INTERCONNECTED NETWORKS

HORIZONTAL LAYER



THE CITY-REGION CONNECTED NETWORKS



The smart city approach can be applied for smart territorial networks

CITY government

"Urban Control Center"
(territory control, panning, emergencies management)

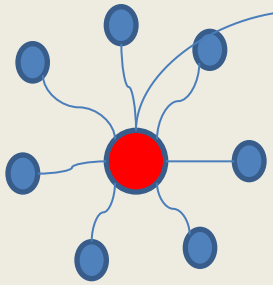
Models

- URBANIZATION DEVELOPMENT
- ENVIRONMENT AND CLIMA EFFECTS
- ENERGY, WATER, WASTE
- MOBILITY AND TRANSPORTATION
- SAFETY
- HEALTH AND FOODING
- CITIZEN-PA DIALOG

CLOUD/OPEN DATA

citizen

SENSOR NETWORKS



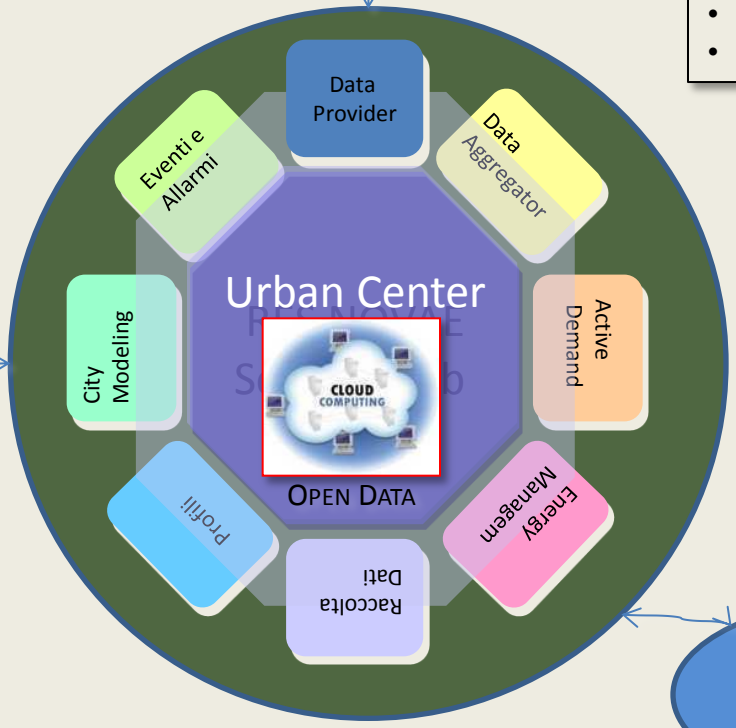
DATA SOURCES

CITIZEN & UTILITIES

URBAN CENTER

City Government

- Planning
- Management of Emergencies
- PA-citizen dialog, transparency



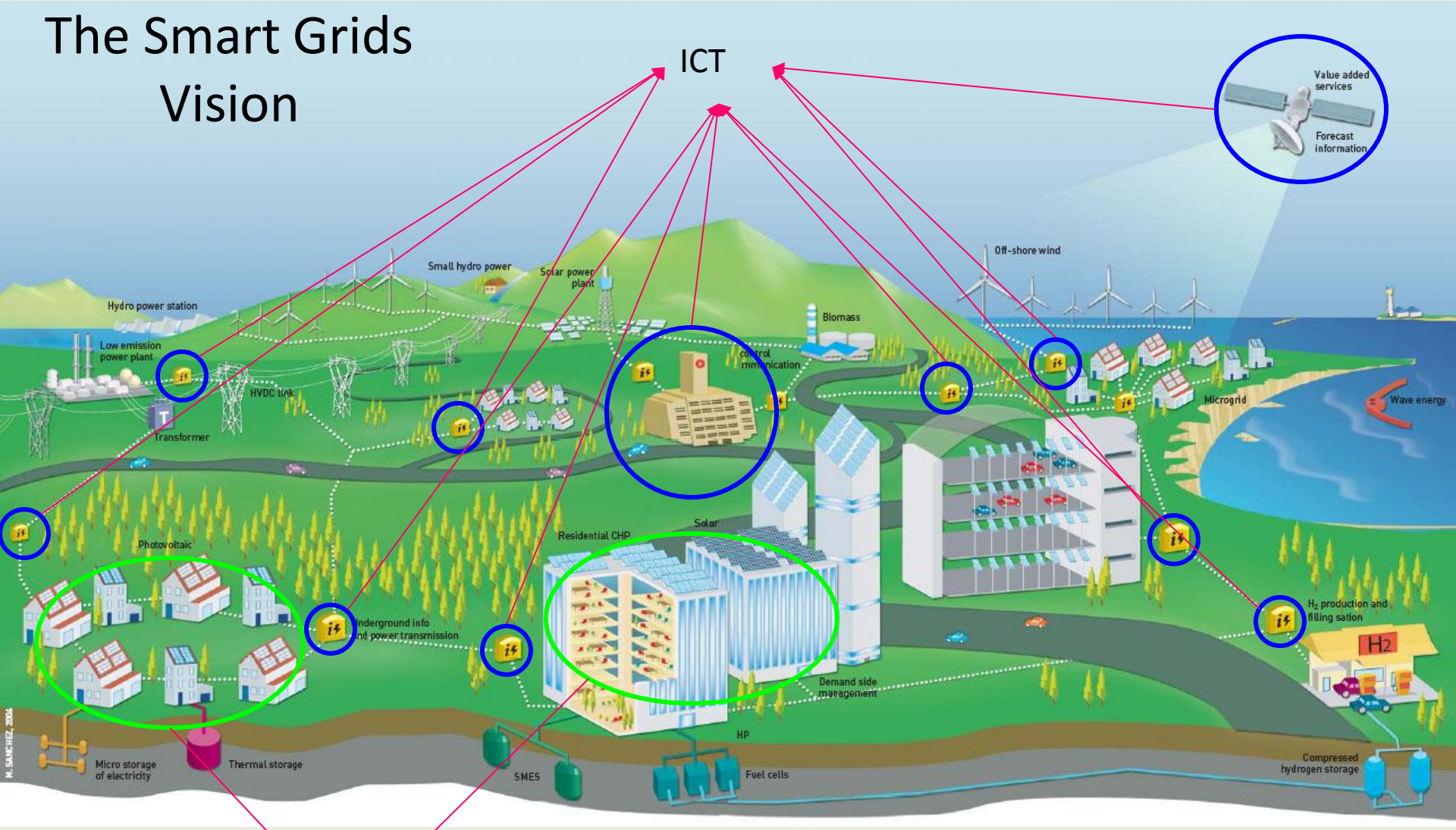
Citizen

- Information access
- Participation to city evolution
- sustainability/community consciousness

City utilities

- Optimization & control
- Resource on demand/flexibility

The Smart Grids Vision



Power Parks

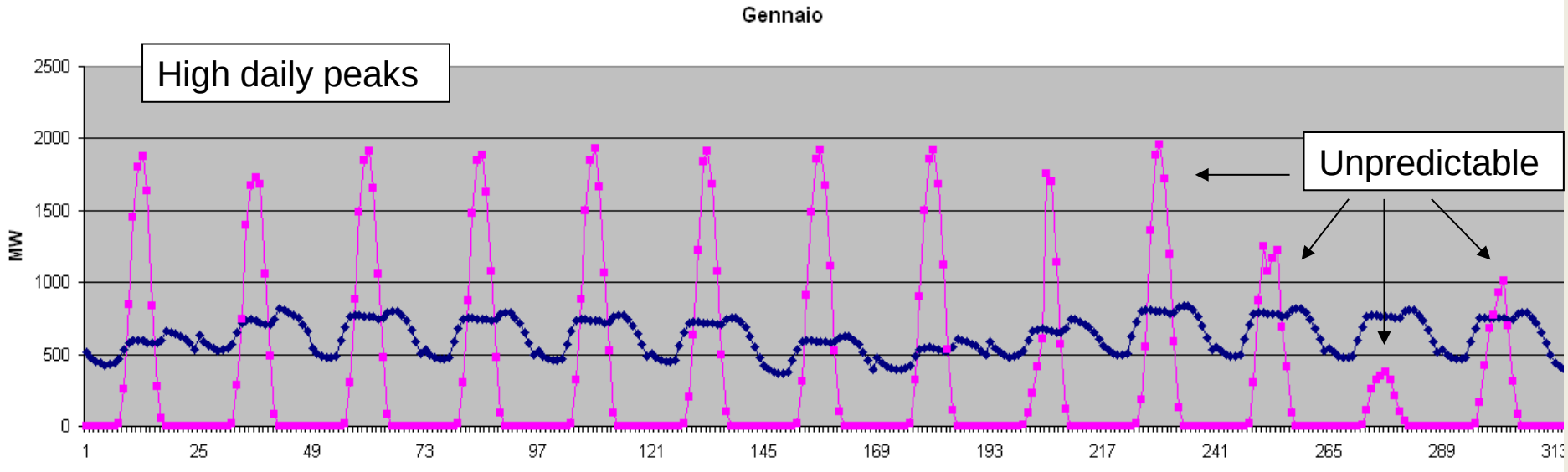
Ecobuildings, DG, Renewables

Smart Grids

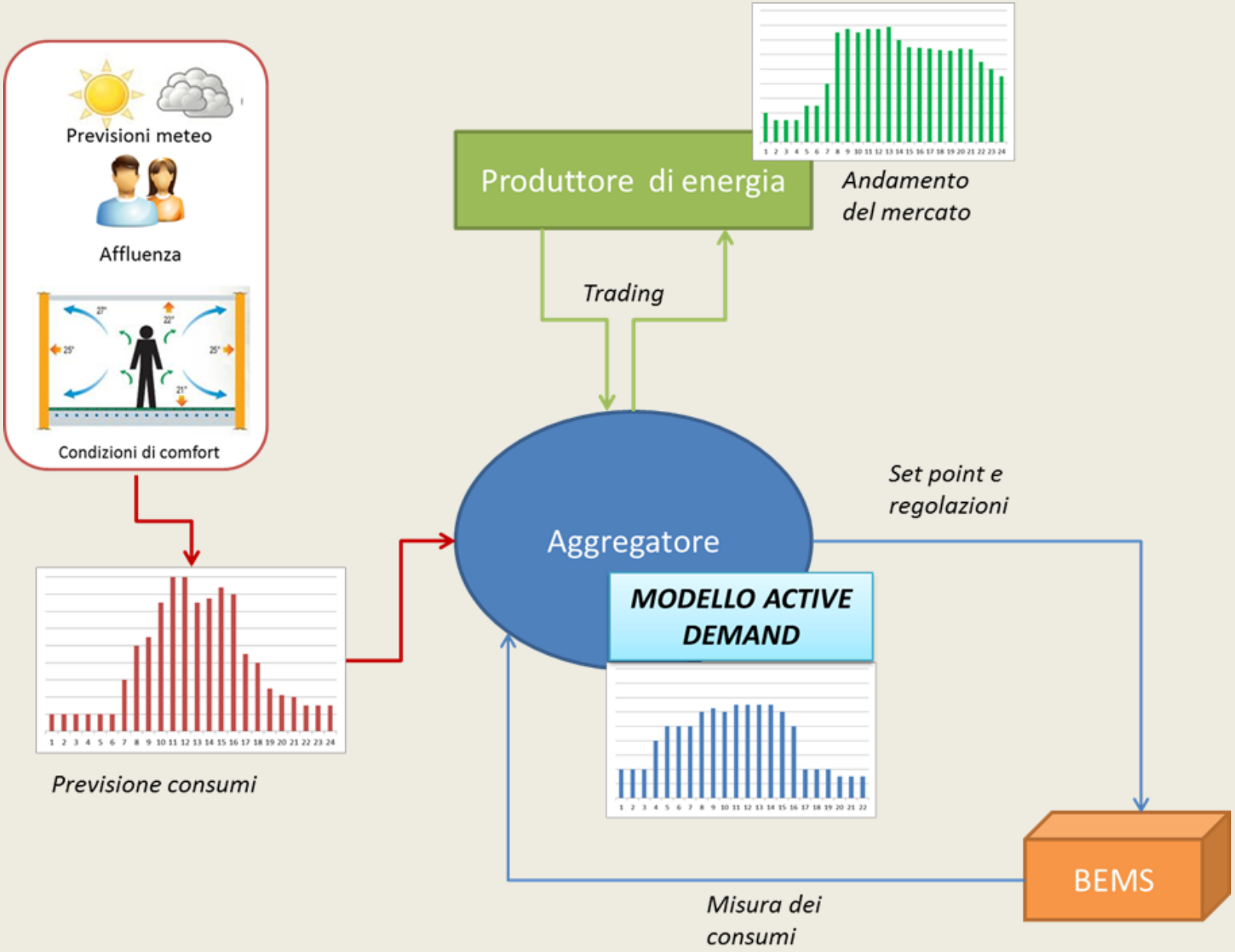
Motivation

- Future Networks
- Grid Flexibility

  daily high variation -> High costs
  unpredictable renewables production
  in-out to the cities -> smart scada



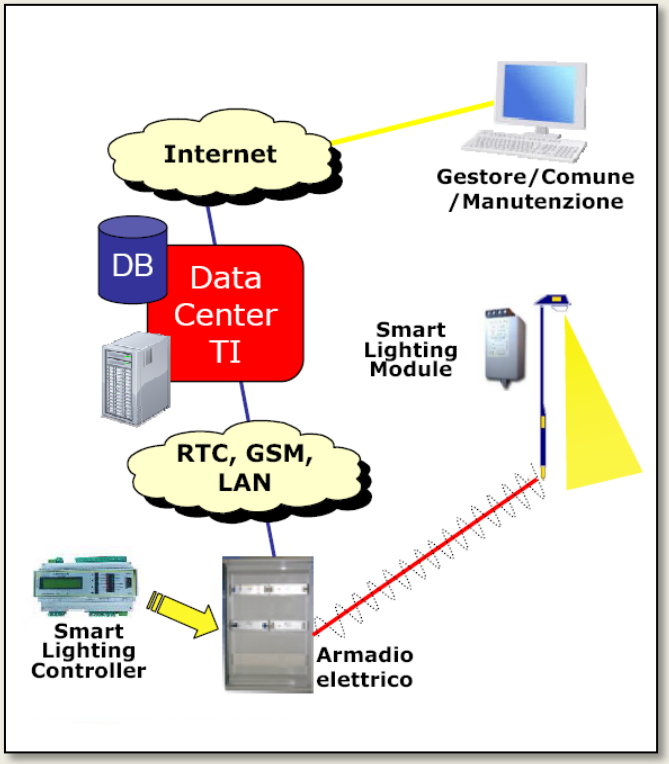
The «Demand Response» mechanism



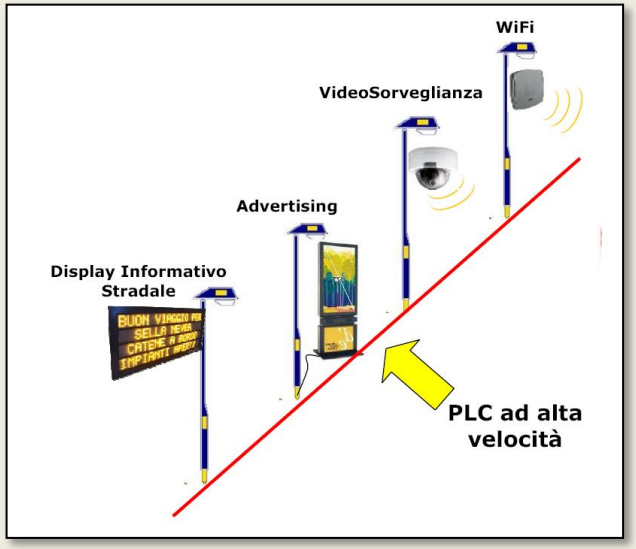
Smart Lighting

LED

Remote Management



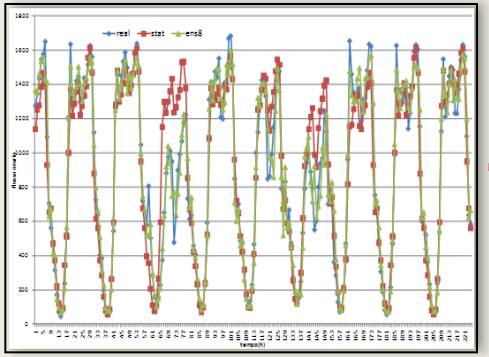
Smart Services



ADAPTIVE LIGHTING

TRAFFIC AND PEOPLE MONITORING

MODELLING & HOURLY PREDICTION

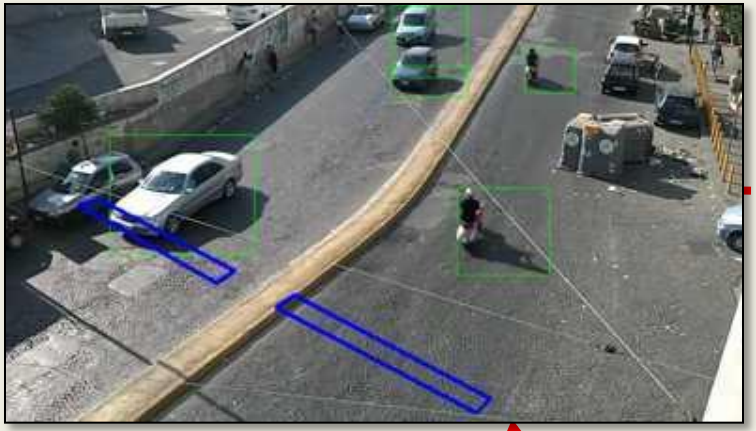


LIGHT CONTROL - ENERGY ON DEMAND -

30-40 % ENERGY SAVING, INCREASING SAFETY !

SMART SERVICES

TRAFFIC/PEOPLE/SAFETY MONITORING



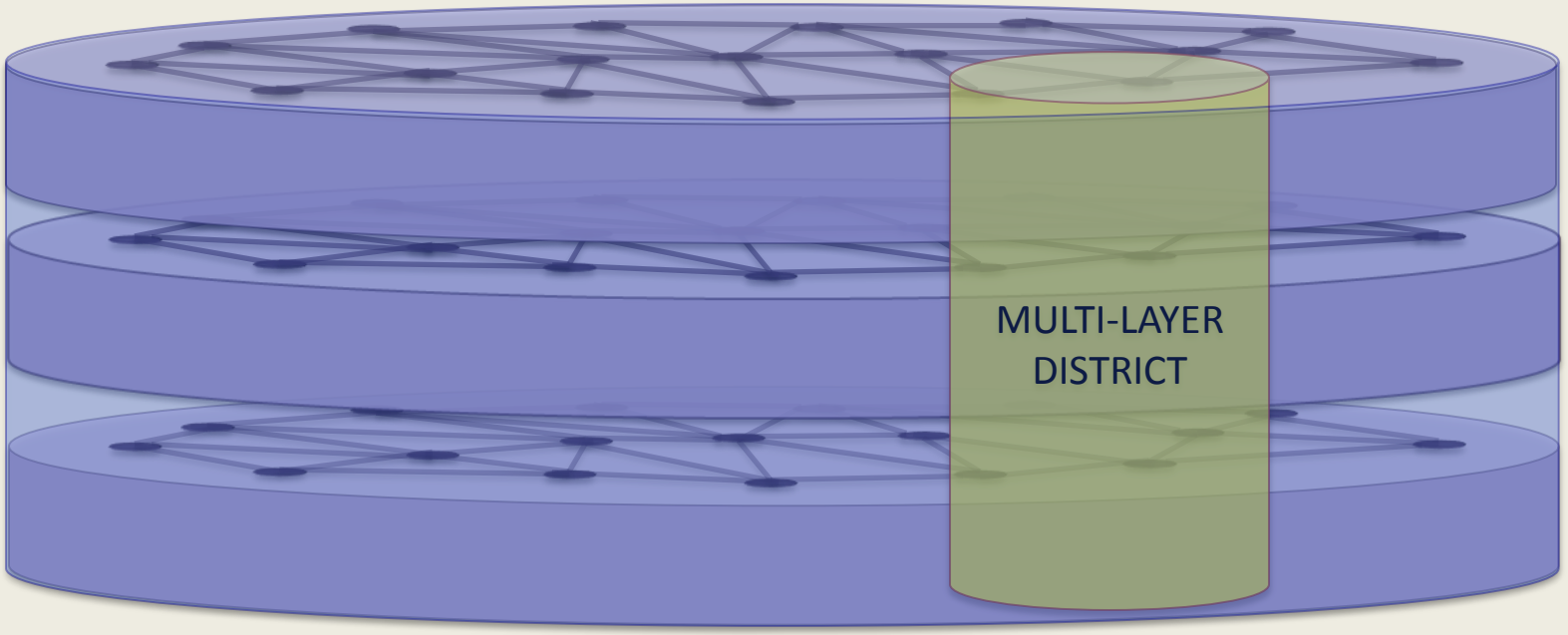
CITY CONTROL ROOM

INFOMOBILITY
AIR QUALITY

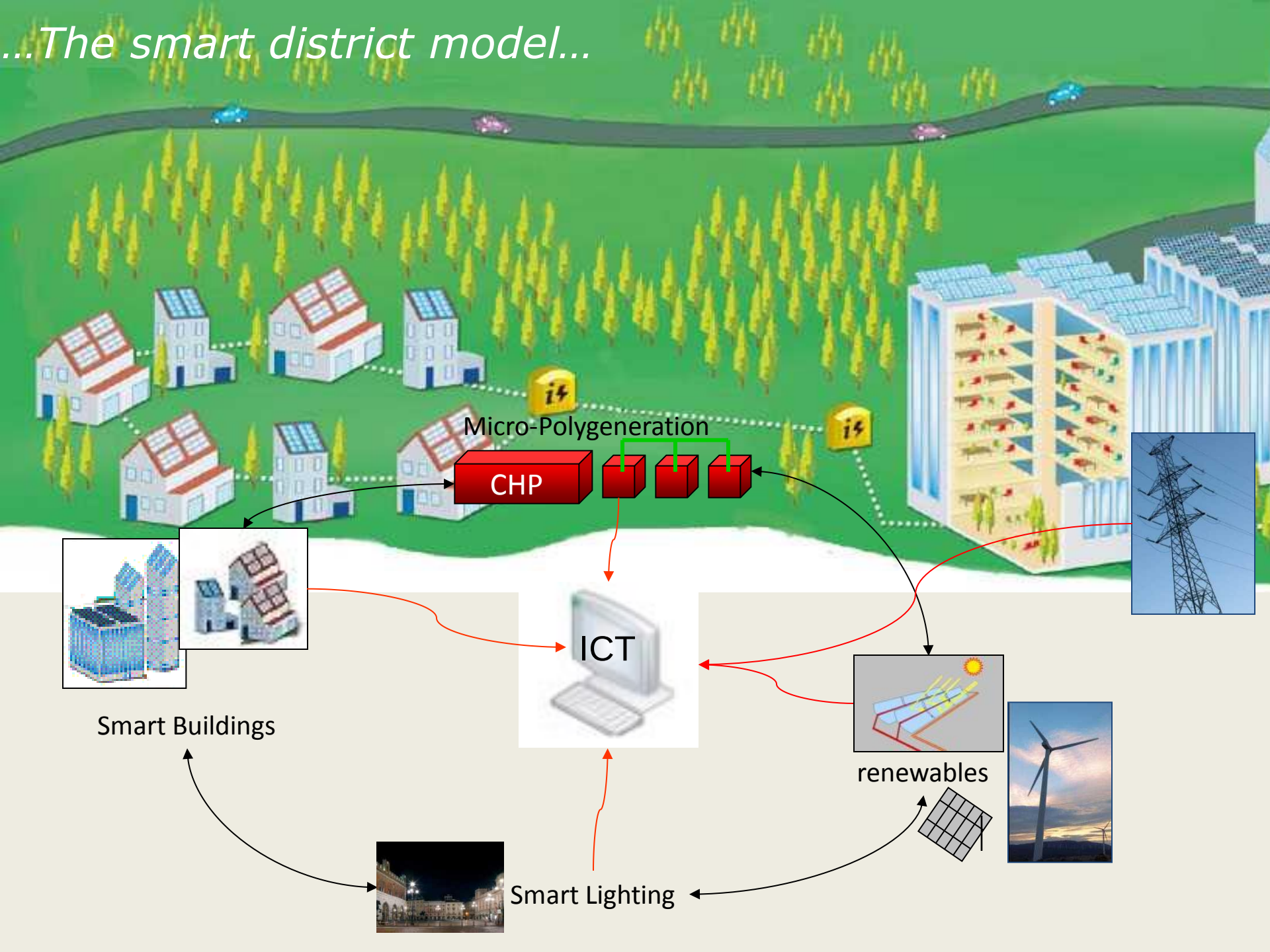
SMART PUBLIC BUSES AS A - CITY MOBILE SENSOR NETWORK -

THE SMART DISTRICT

VERTICAL SPOT



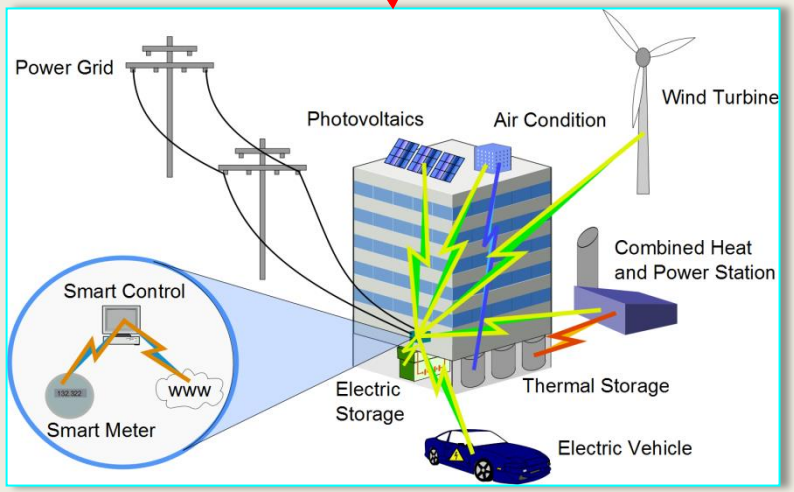
...The smart district model...



Tertiary Sector: offices

Conventional Building

Passive Building (new)



Smart Building – Interactive Buildings (new + existing)

Active building (new)

Building Network Management

NETWORK SUPERVISORS

MANAGMENT OPTIMIZATION

REMOTE MONITORING

Network Intelligence

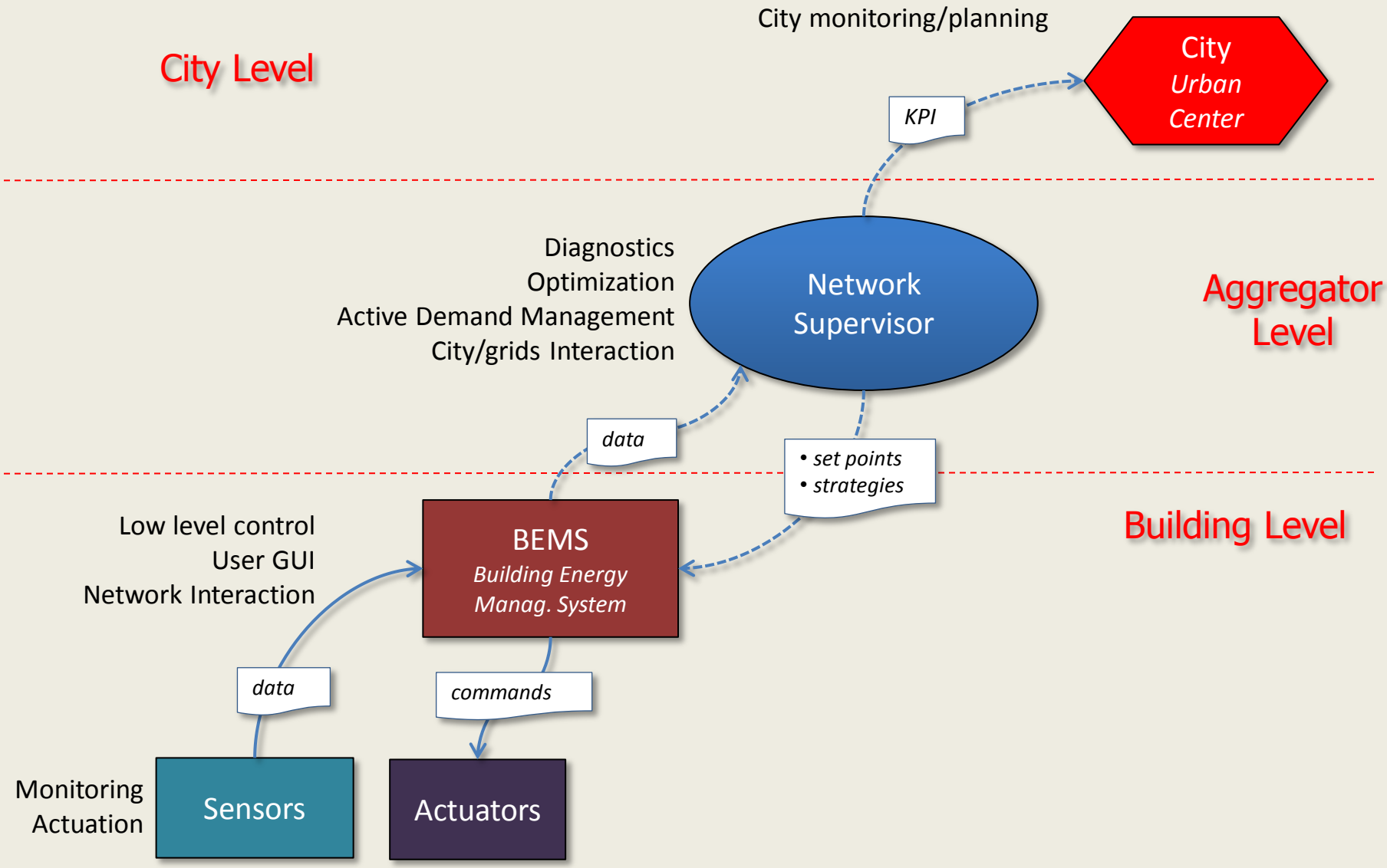
Cost/Energy Optimization

Diagnostics intelligence

Active Demand Management

GRID DISTRIBUTOR

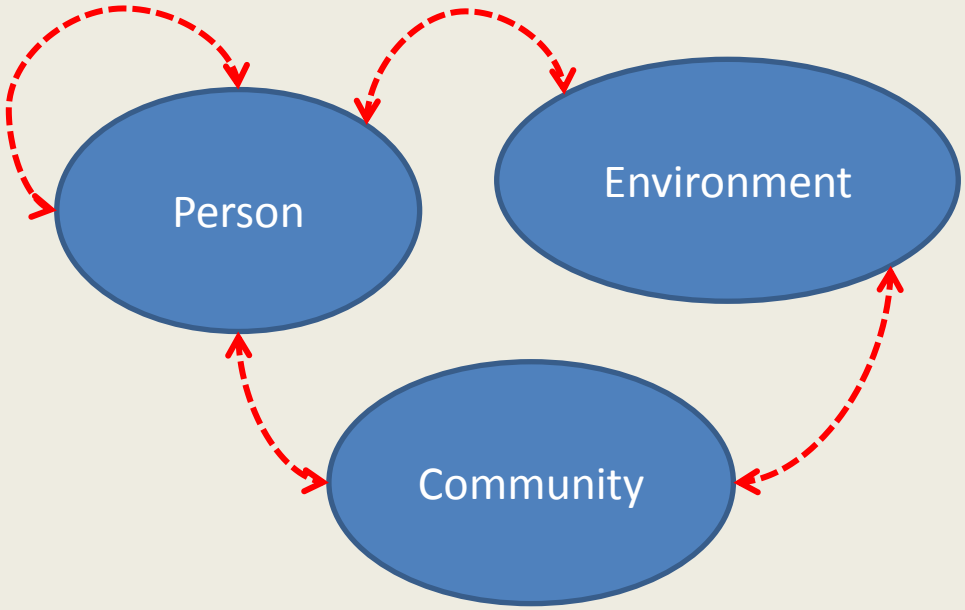
Building Network Management: the enabling technologies



Smart Communities

"**smart** communities"

Defining a system of relations between person, community and environment

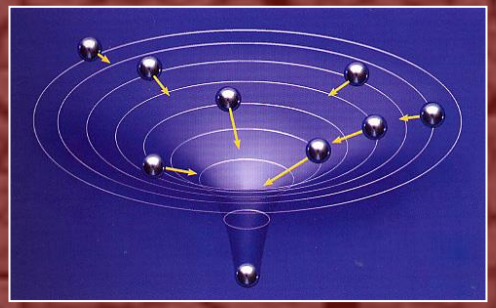


- Sustainability
- Participation
- Life quality
- Social Capital / Social Network

Technology human oriented *Approach:*
Define target of community improvement

Identify **enabling technologies** necessary to reach the targets

The hybrid society



Virtual Social Network

Virtual City

hybrid city

Physical City

Real Social Network

Smart Home

City Digital Infrastructure

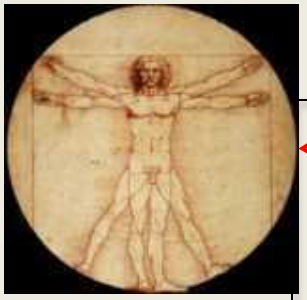
Urban hub

Smart Appliances

Smart Gatway

Direct Remote support

Remote Diagnostics & Control Services



Dialogative support

THE HUMAN ORIENTED TECHNOLOGY

Conclusions

Strategic Key: smart communities, social feedback

Enabling Technologies: resource on demand, connectivity, flexibility, intelligence

Start up scale: smart district

Realization: multidisciplinary approach, stakeholders dialogue, roadmap evaluation

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Thank you for attention !

mauro.annunziato@enea.it

Two examples of smart city Projects

The Res Novae Project:

The collaborative urban networks

Budget: 23 ML euro
Duration: 10/2012 – 10/2015
Partners: ENEL, IBM, GE, Asperience, Elettronika,
ENEA, CNR, Politecnico Bari, Univ. Calabria
Scientific Coordination: ENEA

The project target

Development an integrated solution for some urban network:

- Smart Grids
- Building Network Management
- Smart Streets
- City Data Management

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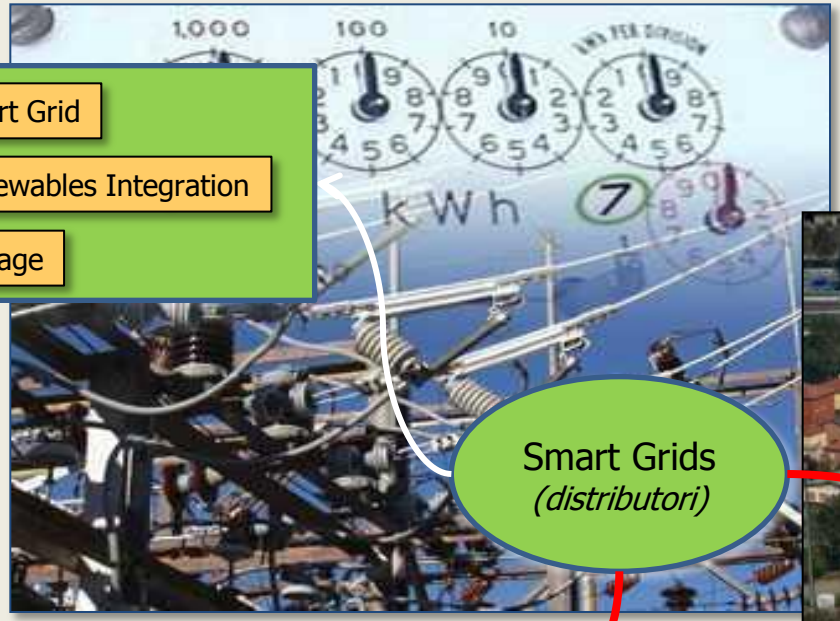
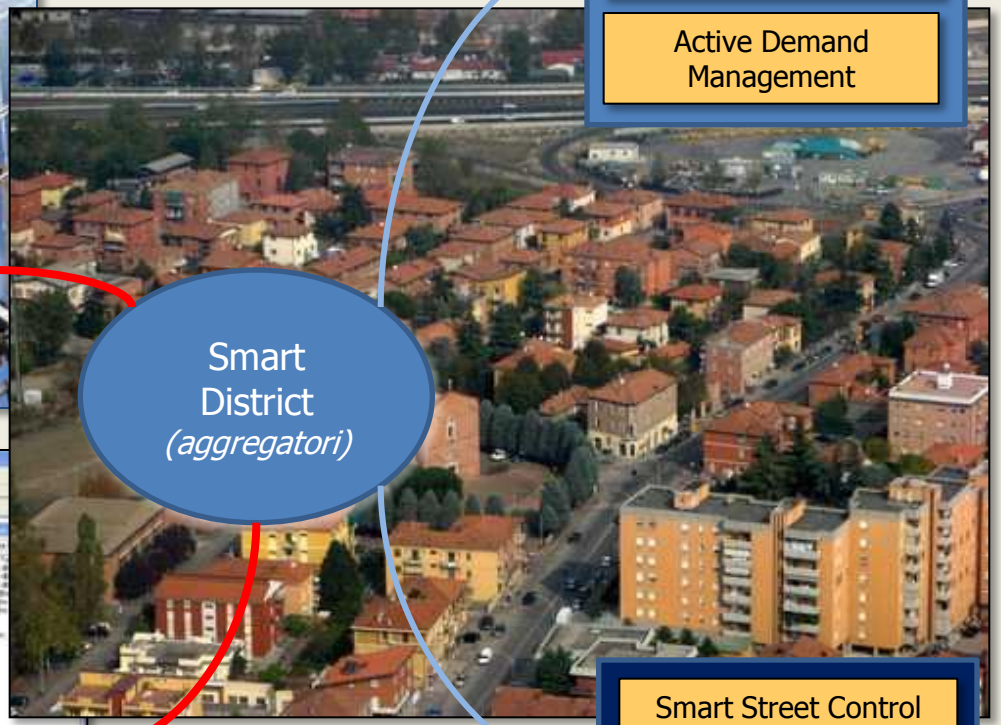
THE COLLABORATIVE NETWORKS



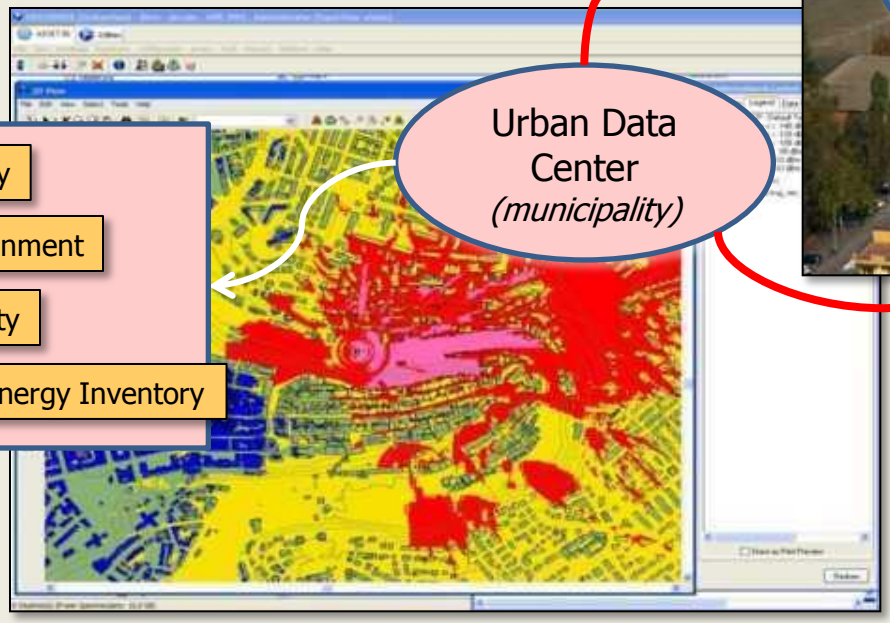
- Smart Grid
- Renewables Integration
- Storage

Smart Grids *(distributori)*



Smart District *(aggregatori)*

- Urban renewables ed ecobuildings
- Building Diagnostics & Control
- Active Demand Management



Urban Data Center *(municipality)*

- Energy
- Environment
- Mobility
- City Energy Inventory

- Smart Street Control
- Public Light control
- Smart urban objects

SMART DISTRICT

Renewables

Sensors & actuators

Interactive people

BEMS

Building Level

Smart District Management

District Level

Building Network

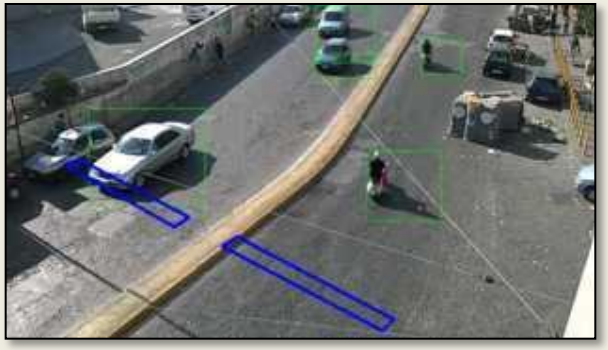
Diagnostics, Optimization, Active Demand

Energy Hub

Optimal Mix distributed renewables

Urban Scene

Lighting, connectivity, smart urban objects



Energy Vendor

DSO Electrical Grid

Municipality Urban Data Center

City Level

PON Ricerca e Competitività 2007-2013

RES NOVAE

Reti Edifici Strade Nuovi Obiettivi Virtuosi per l'Ambiente e l'Energia

A Smart District in **Bar**i: buildings (residential, office, school), secondary cabins, mobility, urban utilities, Urban Control Center

PON Ricerca e Competitività 2007-2013

RESNOVAE

Reti Edifici Strade Nuovi Obiettivi Virtuosi per l'Ambiente e l'Energia

A «Urban Lab» in **Cosenza**: smart street – smart objects

Two examples of smart city Projects

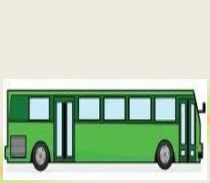
City 2.0: A Smart Ring at L'Aquila

The integration between energy and social sustainability

Budget: 3.5 ML euro
Duration: 5/2011 – 5/2014
Partners: ENEA, Universities + Companies
Scientific Coordination: ENEA

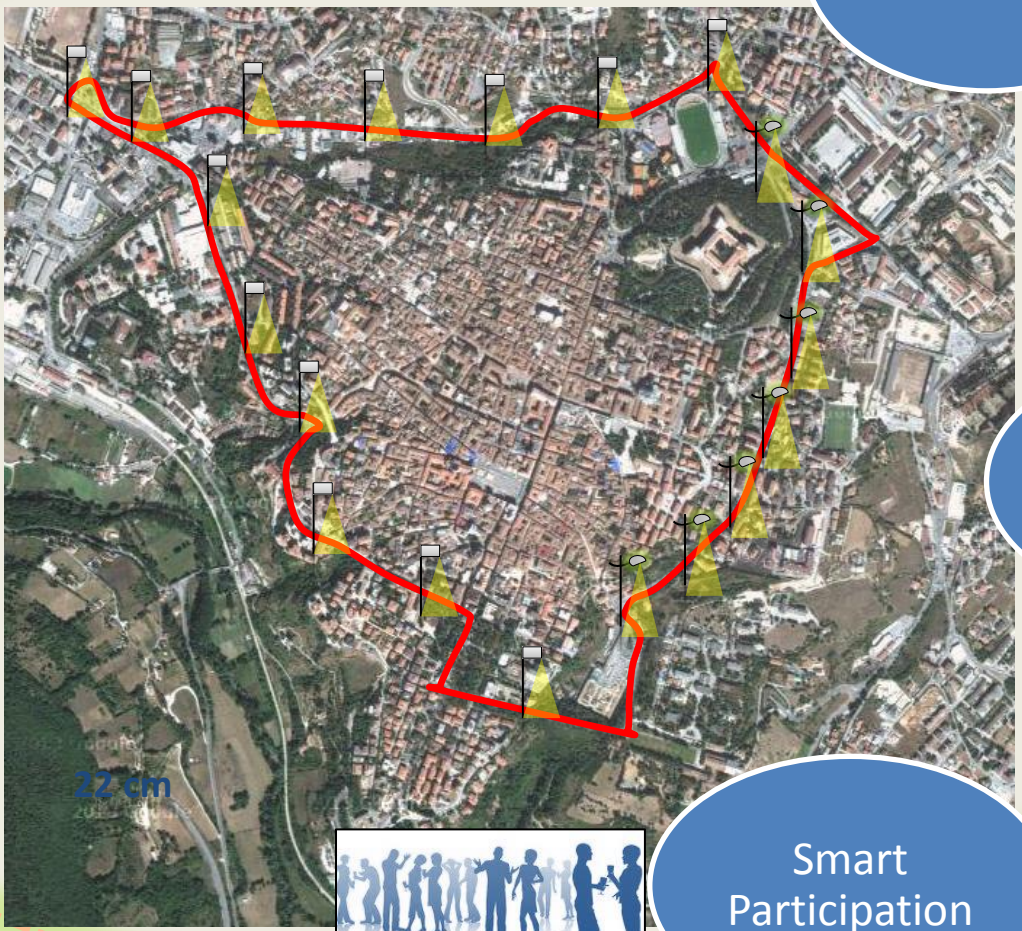
Smart Ring at L'Aquila

Smart Ring at L'Aquila



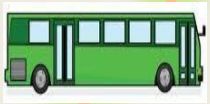
Smart Buildings

Smart Mobility



Smart Enviroment

Smart Lighting



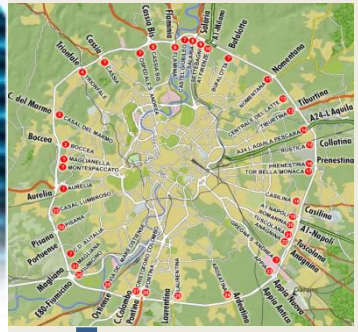
Smart Participation

Smart Lighting- Mobility

SmartEye

Smart sensors – smart poles

Data Fusion

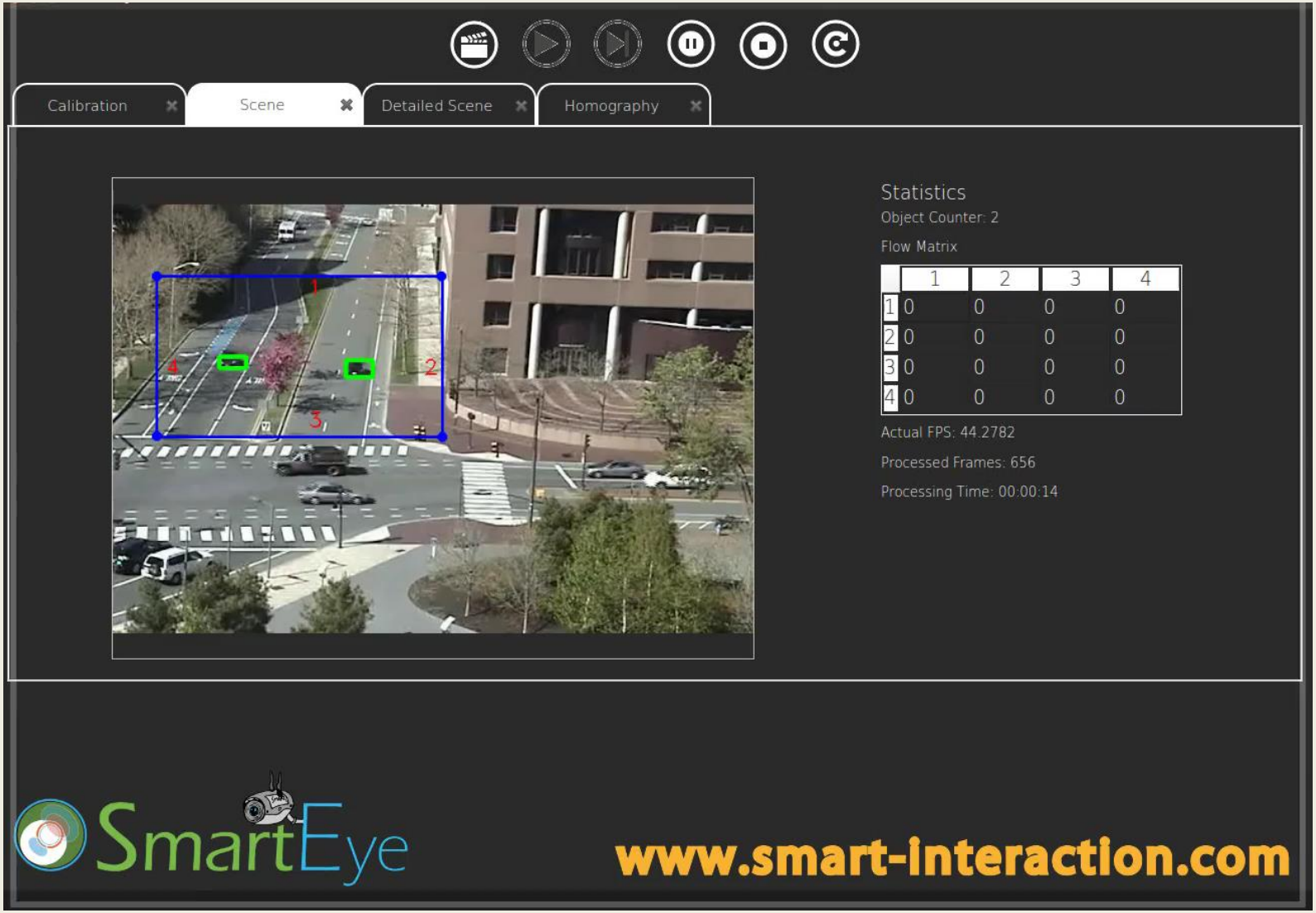


- Traffic monitoring
- Video surveliance
- Clima/Sismic/Traffic emeergency monitoring

Adaptive dimmering of public lighting

SmartEye

Smart sensor for real time analysis of th urban scene



Smart Buildings Networks

Control room

Municipality offices

School

Smart environment:

ENEA MOBILE AQC SENSOR-SYSTEM

GSM Modem

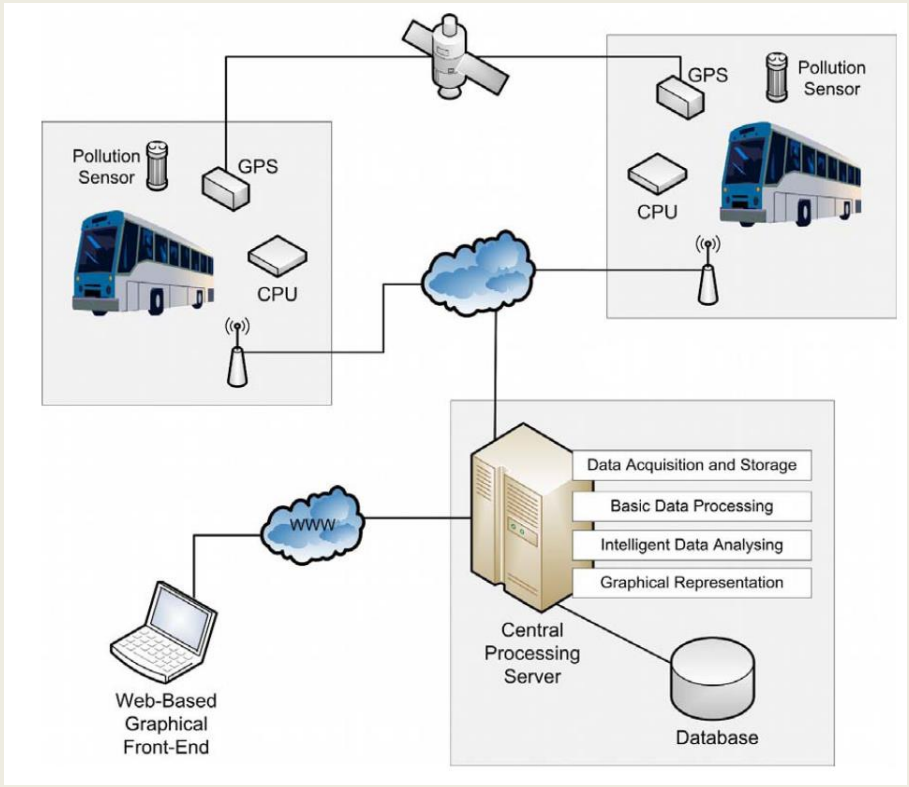
ELECTRONICS

Display

GAS SENSORS

SENSORS CELL

Mobile gas sensor for urban monitoring:
Low-Cost Wireless Sensor-System for Air Quality Control

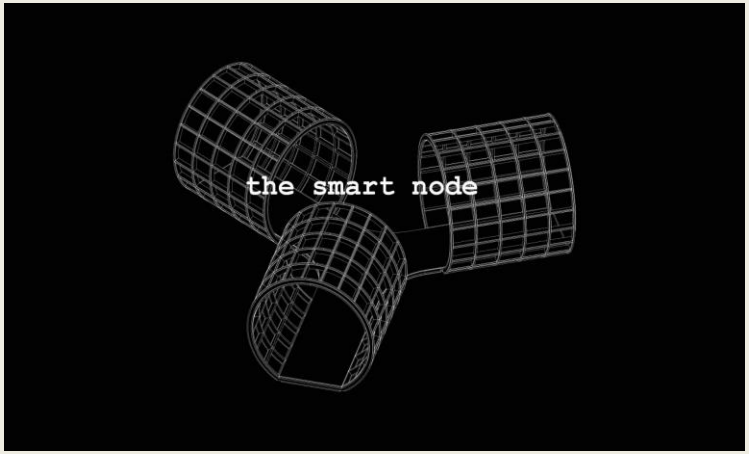


Smart Urban Network

Social Network
creativity and cultural identity

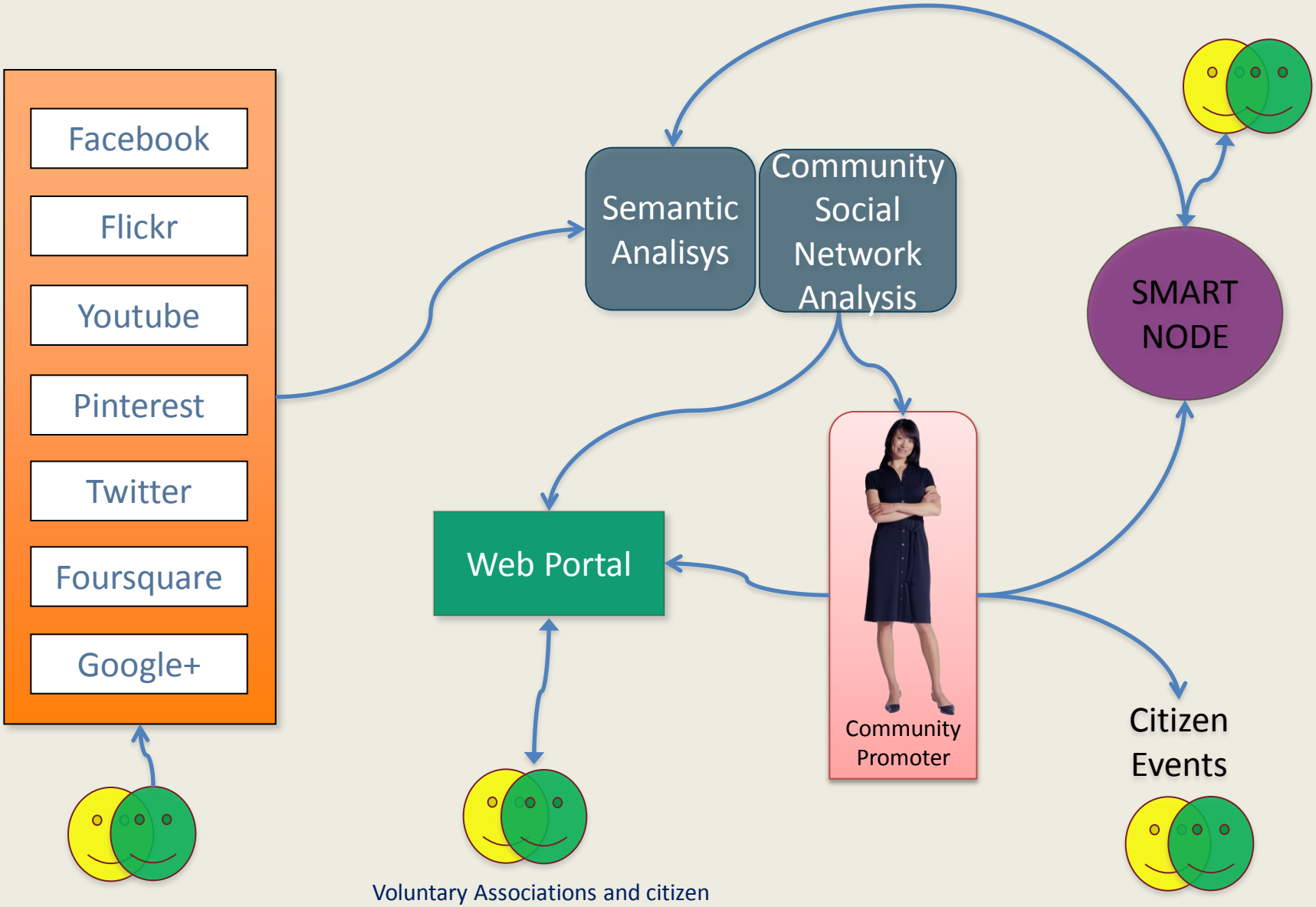
Semantic Analysis

Web Portal
Cultural Heritage – Cultural process



Smart Nodes
interactive urban installations

Social Urban Network



The social indicators

Derive social analisys from social networks exchange

SN Indicators

- Exchange Intensity
- Connectivity, topology
-Topics
-Emotional clustering / sentiment analisys

Sociological Indicators

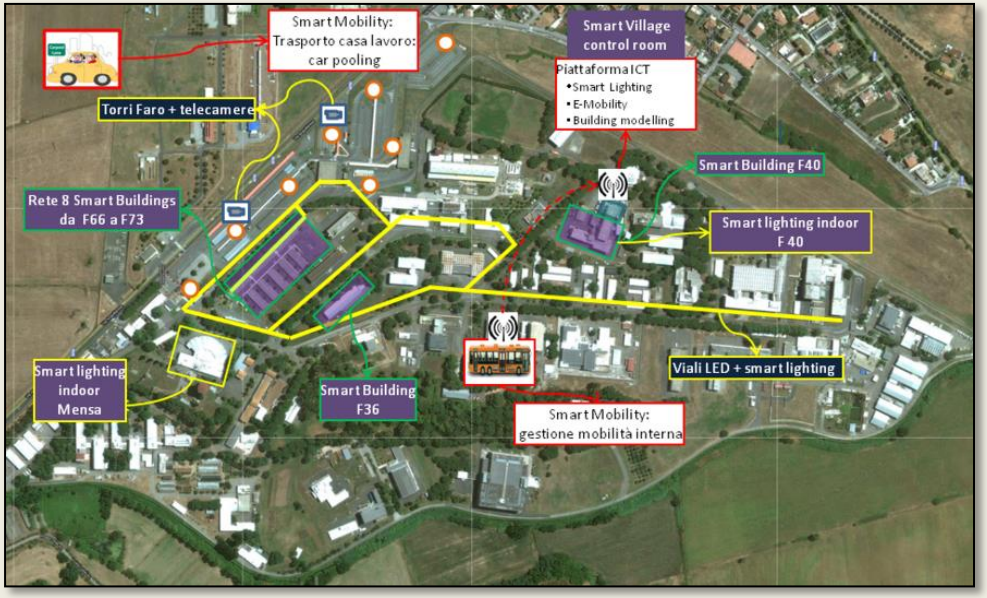
-Trust
-Solidarity
-Aggressiveness
-Opening
-Wellness
-Discomfort
-Exchange
-Isolation
-Respect
-Recognition
-Welcome
-Exposure
-Social cohesion
-Creativity

The Casaccia “Smart Village”

A Smart District Model

Budget: 2.0 ML euro
Duratio: 5/2011 – 5/2014
Partners: ENEA, Universities - Companies

Smart Village



Smart agents

Smart Village GUI

Village cloud

Distributed Energy

Building Network

Outdoor Lighting

Mobility

Communication

← Intelligence level

buildings, sensors, low level control, local GUI

lamps, remote management, dimmering, local GUI

Data fusion from distributed sensor network

Smart sensors

ICT Platform

LED

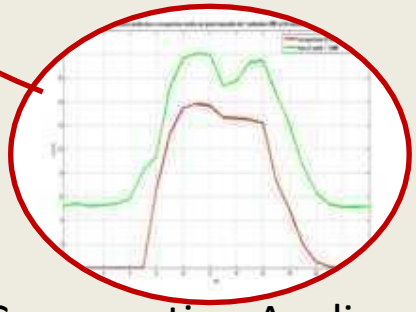
Badge

DATA FUSION

Active demand control

Presence sensors

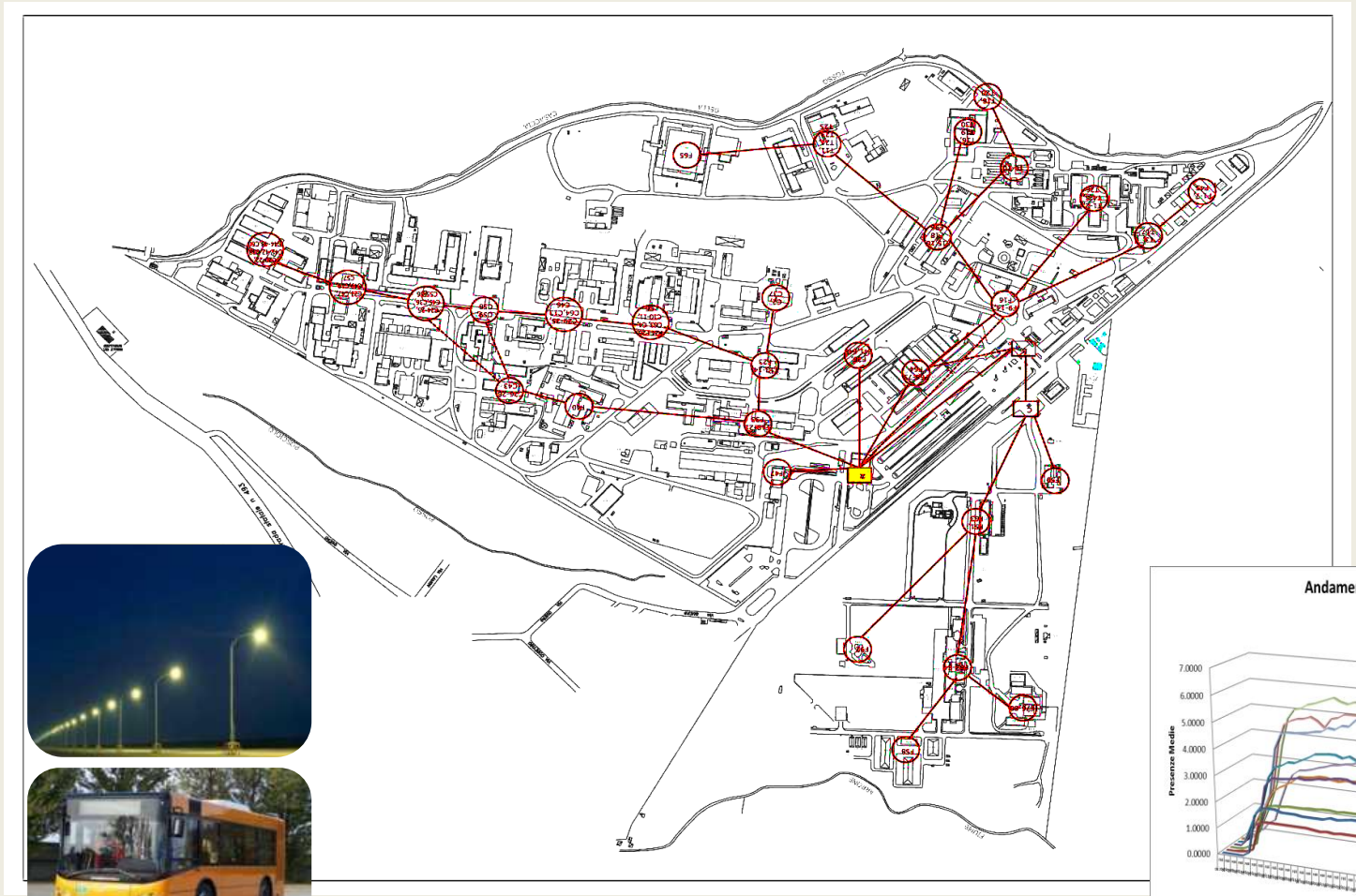
Control and Optimization Strategies

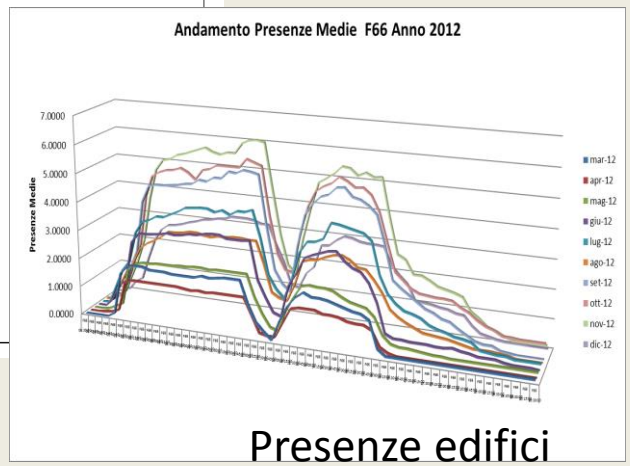


Consumption Analisys

Analisys of demand dynamics

badge

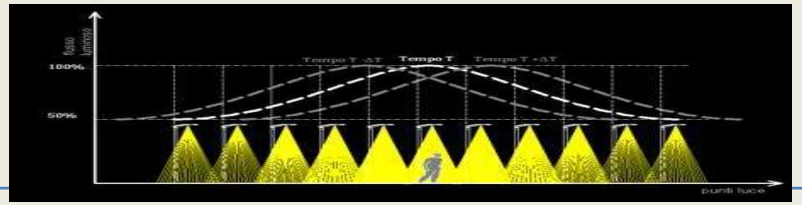




Presenze edifici

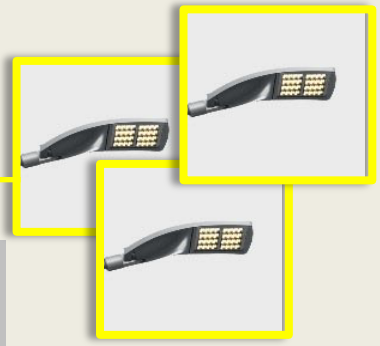
Flussi pedonali per mobilità elettrica ed illuminazione esterna

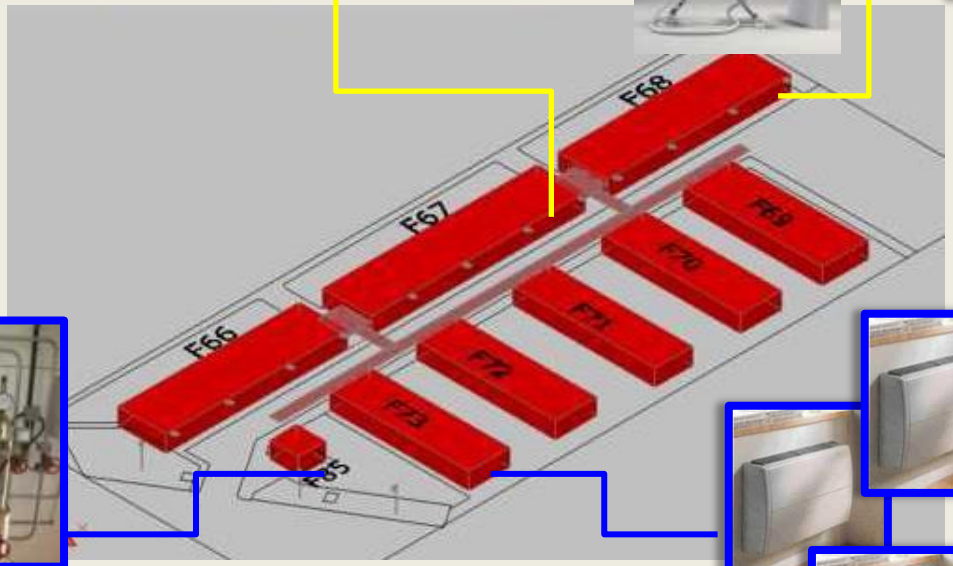
Smart Street



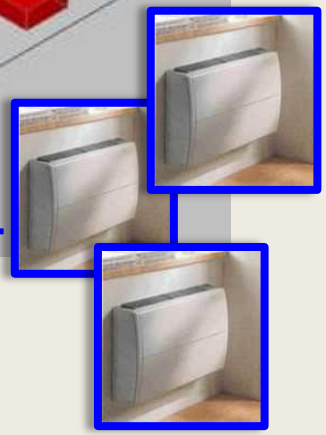
Buiding Lighting.

LED Responsive Lighting:the light wave





Buiding Climatization



Heating & Cooling Network Oprtimization