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 Control Center: An ICT Platform for Smart Cities in Italy

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

Paolo Deidda

Paolo_deidda@it.ibm.com

IBM Italia S.p.A / Italy

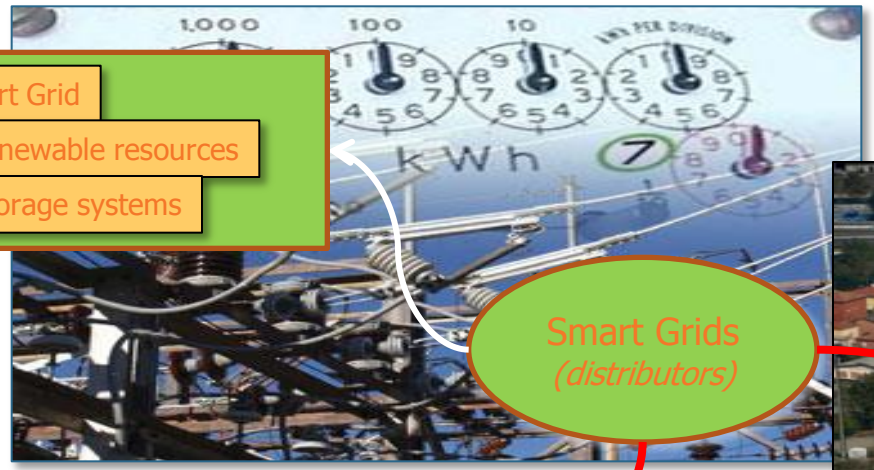
COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

RES NOVAE

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

RES NOVAE Objectives



Smart Grid

Renewable resources

Storage systems

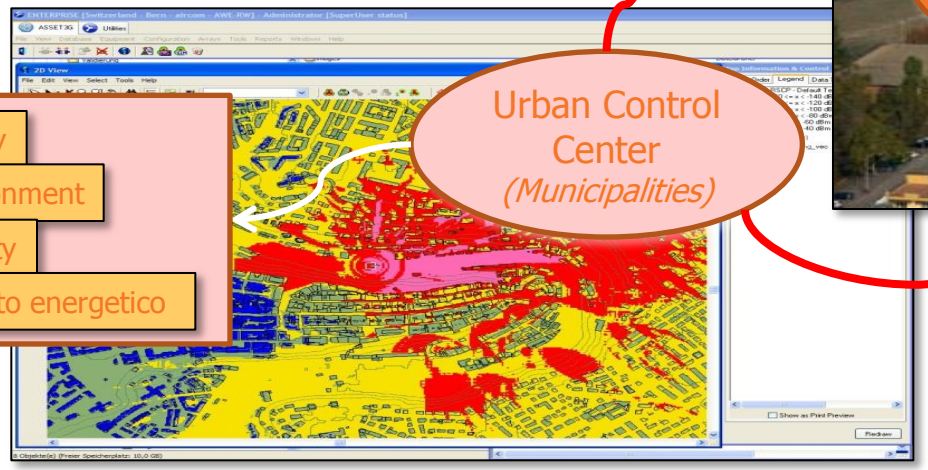
Smart Grids *(distributors)*

Smart District *(aggregator)*

Urban renewables ed ecobuildings

Building Diagnostics & Control

Active Demand Management



Urban Control Center *(Municipalities)*

Energy

Environment

Mobility

Catasto energetico

Smart Street Control

Public Light control

Smart urban objects

Develop an integrated solution in the urban context where the functionalities of energy efficiency and optimization among energy, buildings, streets networks are fully integrated to provide higher added value.

cost

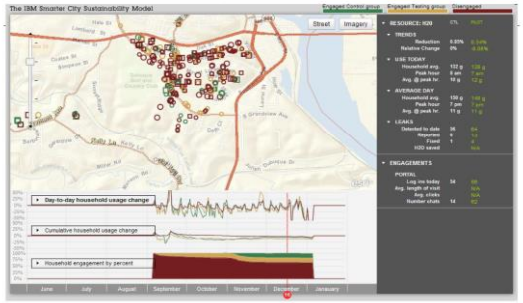
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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

RES NOVAE

Energy Box & BEMs To enable Active Demand

Citizens play central role.



Urban Control Center

New innovative services provided to P.A. And citizens.

Smart Grids To optimize energy flows, RES & Storage

The goal is to provide monitoring and advanced control models of the LV grids

The Bari Show Room and the Cosenza Urban Lab a Cosenza to make aware citizens

Education through postgraduate scolarships and grants for P.A. And citizens

RES NOVAE

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

RES NOVAE Territory

The Bari smart district. RES NOVAE will focus on this area to provide details about the city energy and pollution maps to allow the P.A. to take the best decisions and plan appropriately incentives, interventions and investiments.

Some key Smart City technology

- Growth of smartphones, tablet and their apps.
  - Great interaction
  - Everywhere
  - Timely and friendly access to information
- Growth of open data and instrumented data.
  - P.A. Provides or consumes data
  - Improve citizens' perception of provided services
- Growth of geospatial context
  - Ability to visualize data and info in a geospatial map
- Growth of platform API
  - Growth of REST API from large social platforms such as Google, facebook, Twitter, Amazon.
  - Growth of business application built on those platforms
- Growth of Software as Service
  - Reduced funding especially in P.A.
  - Simplified and faster deployment
  - Improved ROI and more immediate results available

Needs

- Private and public organizations require efficient operational supervision and coordination
- Enable entitled people to make fast, accurate and strategic decisions and track the effect of those decisions.
- Citizens are asking for more transparency in the administration’s decisions
- Awareness on how those decisions may affect their life and
- How they can achieve a better social behavior to improve the quality of life.

Goals

- Get, aggregate and correlate the right information to support decisions
- Build an ICT platform that supports the decision makers in accessing and analyzing the data they need and in coordinating the appropriate city operations.
- Allow the public administration to track and control the city status
- Allow the public administration to share with citizens the planned goals and reached objectives
- Allow pubblic administration to share Open Data via different channels
- Allow citizens to partecipate in the public decisions and collaborate with the public administration to identify issues or intervention or maintenance works

System Context

Use case UCC e KPI definitions in colaboration with:

- **Politecnico di Bari,**
- **ENEL,**
- **ENEA,**
- **Comune di Bari**

City Energy Manager

Citizen

PAES 2020 compliance
Decisions on incentives and investments
Energy and environmental KPI
CO2 Monitoring and control
Energy and pollution maps

Participation and collaboration
City environment and energy awareness

Consiglio Nazionale delle Ricerche

Weather data
Clima data
Weather forecast

Utilities

KPI e OpenData

ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

Pollution data

Urban Control Center

Consumed electric energy
Produced PV and wind energy

Enel Distribuzione

BES Indicators
Environment and energy
Demographic info
District boundaries
Social and economic info

Istat Istituto Nazionale di Statistica

KPI, events
alarms
of public building

Energy efficiency service providers

COMUNE DI BARI

Gas data

Water data

Waste data

Public Transportation data

AMGAS

OPERATION IN S

acquedotto pugliese l'acqua, bene comune

TECHNOLOGY

amtab S.p.A.

System Context – UCC and Service Hub

City Energy Manager

Citizen

Urban Control Center

Energy and sensor building data analysis
Optimization and diagnostics
Energy Sustainability
Facility Management
Asset Management
Space Management
Property Management
Lease and Contract Management
Project Management

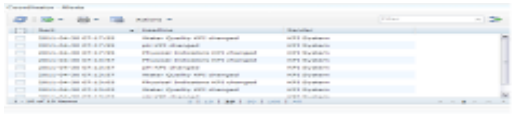
Public building
Real time data

Service Hub

- Bilding Management
- Energy Management
- Facility, space, asset, projects
- Home Energy Management
- Optimization
- Analitics
- Diagnostics
- Data Management
- Topology
- Eventsi
- Control& Automation
- Data Collectioni

Urban Control Center main features

Automatic corrective actions



Event and data correlation

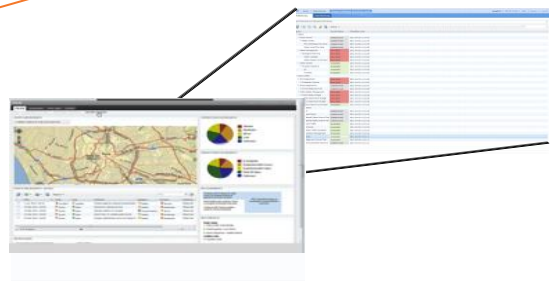
Alarms and Events

Roles and permission

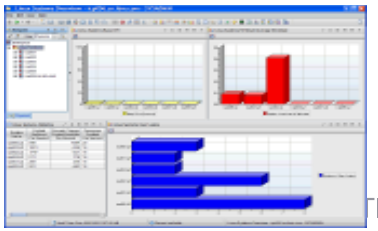
Map based GUI

Urban Control Center

Data drill down

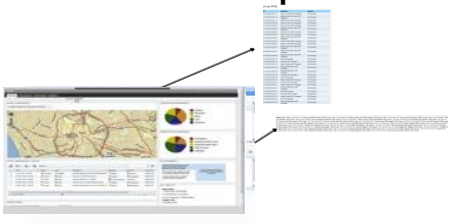


KPI and real time data

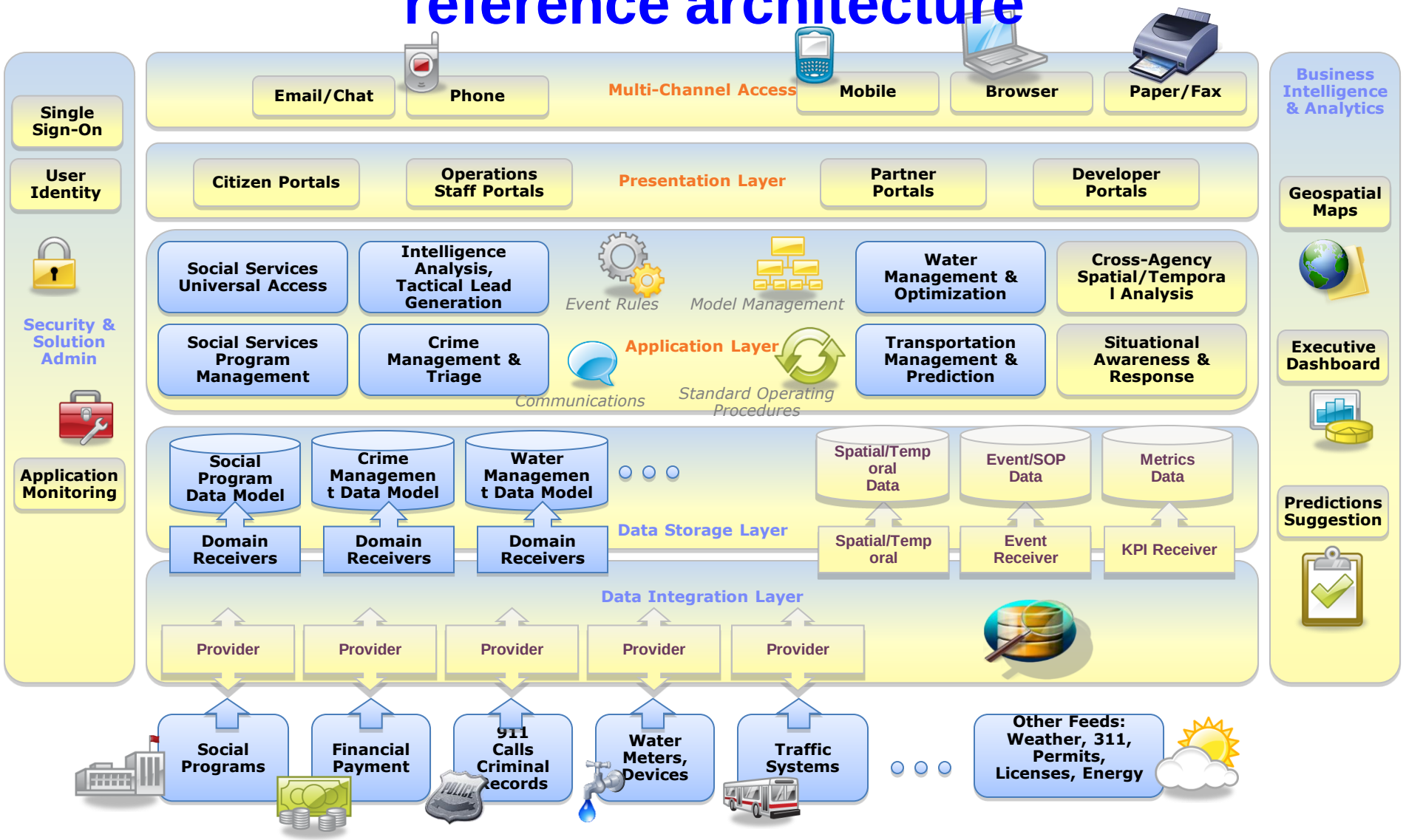


Reporting

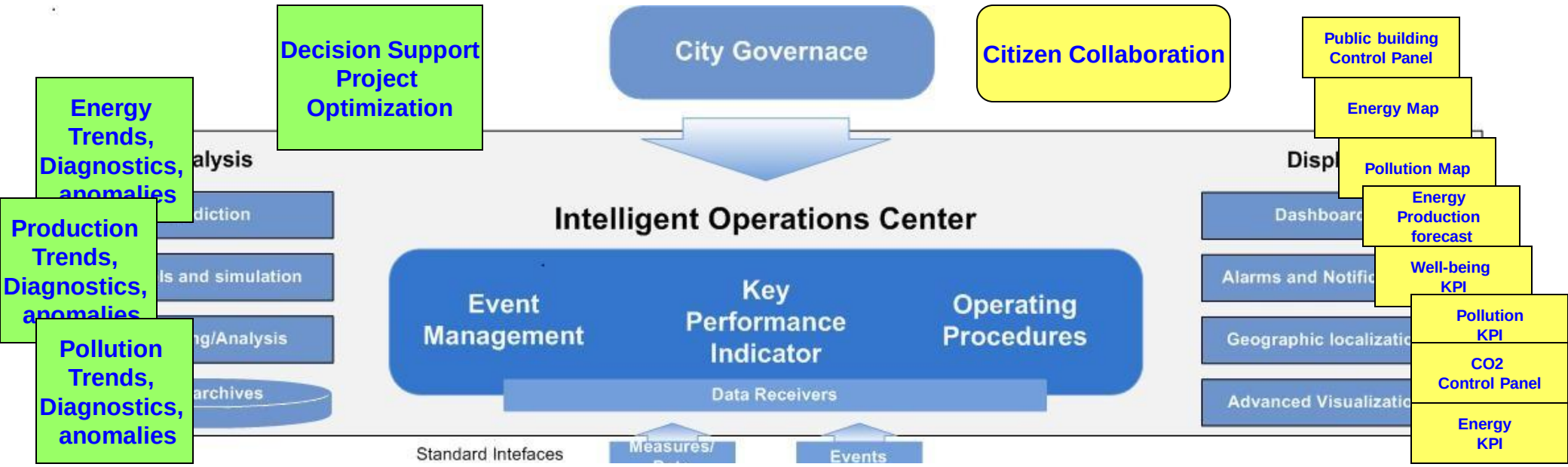
Data Export



IBM Intelligent Operations Center (IOC) reference architecture



Urban Control Center Architecture



Temporal Dimensions | Spatial Dimensions | Energy model | ata collection | Building model | Pollution model

CAP Adapter | HTTP REST Web Services | SDMX Web Services | FTP/CSV | CKAN/ OpenData | CKAN/ OpenData | SMTP/CSV | FTP/CSV

Service Hub (building real time Energy data) | ISTAT (national Statistics) | ENEL (Electric data) | Comune di Bari (Gas, Water, Transportation, Waste, City Events and Emergencies | ENEA (Real time Pollution data) | CNR (meteo and energy production forecast)

TITLE="Consumo di energia per i comuni capoluogo di prov">
<sep:Series FREQ="A" IND_TYPE="EE_DOM_XAB" REF_AREA="001272"USO_ENERGIA="1">
<sep:Obs OBS_STATUS="" OBS_VALUE="1171.4348343"TIME_PERIOD="2000" UNIT_MEAS="KWH" />
<sep:Obs OBS_STATUS="" OBS_VALUE="1194.443992"TIME_PERIOD="2001" UNIT_MEAS="KWH" />

inviato da 3208488320
Subject:
ata/ora T1:[C]; T2:[C]; RH1:[%]; RH2:[%]; F1:[Hz]; F2:[Hz];
18/06/12 19:13:00 0.00; 1.00; 2.00; 3.00; 4.00; 5.00;

Main features: Data Sources

STARTDATETIME	ENDDATETIME	LOCATION	NAME	LASTUPDATEDATETIME	TI...	INCIDENT_NUMBER	ADDRESS	PROBLEM	CALL_DISPOSITION
Sep 1, 2012 12:34:00 AM ...	Sep 1, 2012 12:34:00 AM...	POINT(-93.229920 4...	911 Police CAD Details	Aug 12, 2013 3:44:41 PM ...	-360	12-284749	1542-1699 5 ST SE	Walk Through a Building (P)	AOK- All OK
Sep 1, 2012 12:03:00 AM ...	Sep 1, 2012 12:03:00 AM...	POINT(-93.260350 4...	911 Police CAD Details	Aug 12, 2013 3:44:41 PM ...	-360	12-284701	62-85 1 AV NE	Traffic Law Enforcement (P)	TAG-Tagged

Pick your Data Source Type

Libraries of CSV files like data.gov

Extract files from a system of record

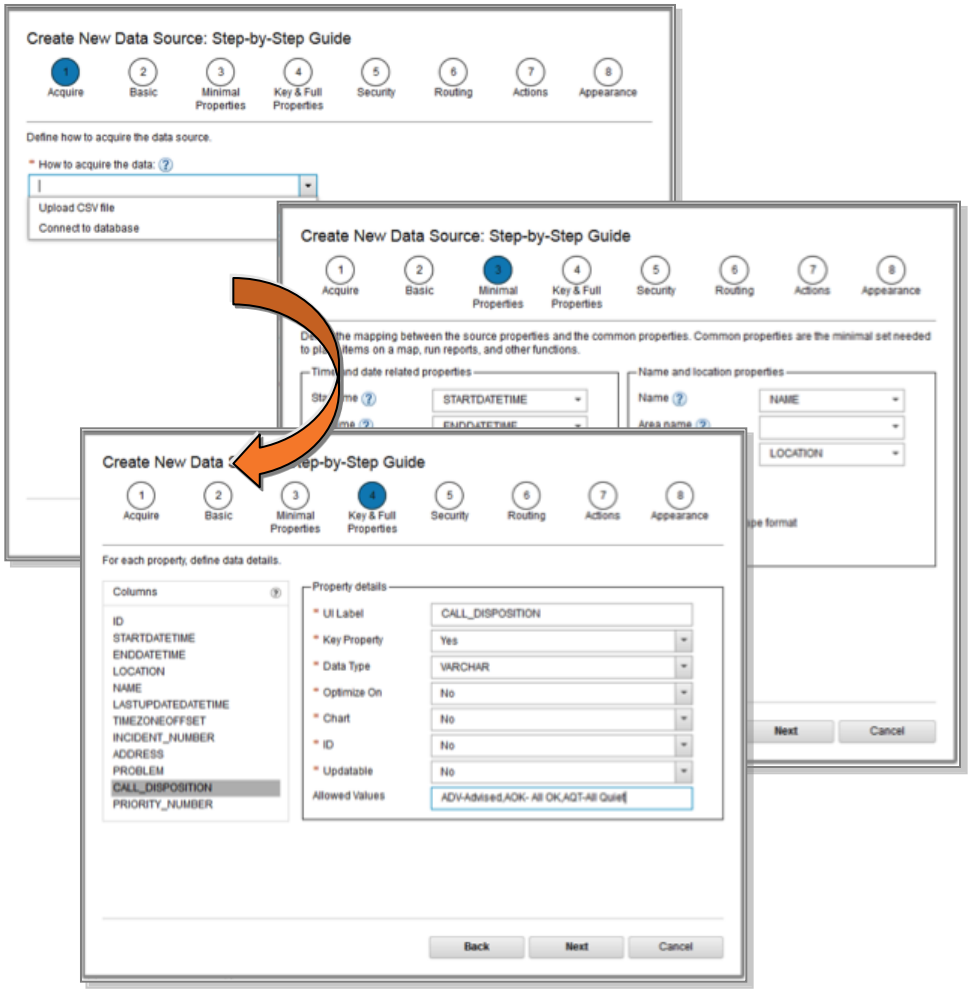
Data stored in staging database

Data Source Definition Wizard

Use this UI wizard to define your data source, pick property names, tell us which properties are important and which ones are metrics used for KPI's or reporting.

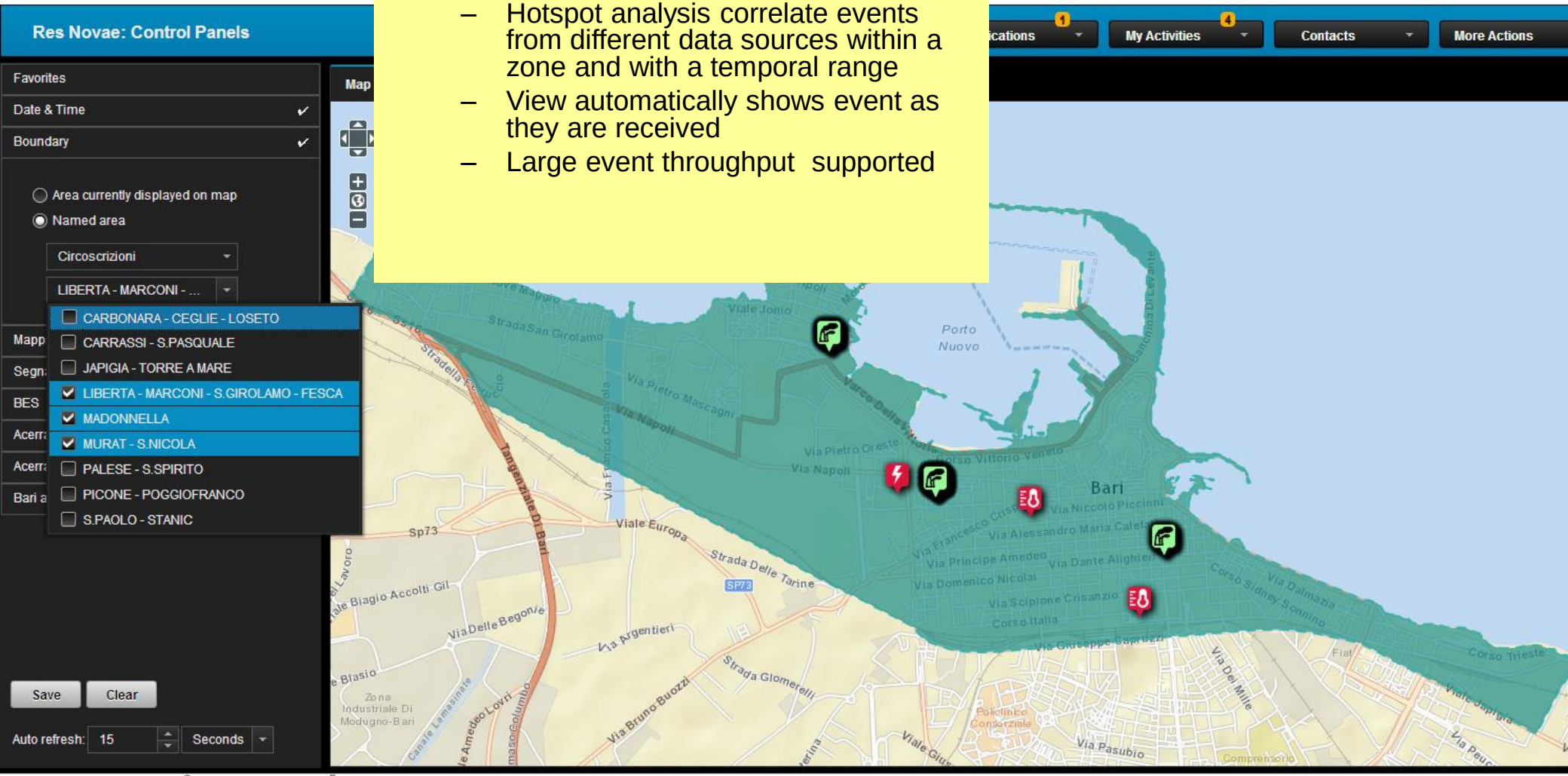
It is generated everything necessary to take data from the source, schedule it, load it, and have it participate in all the product features immediately.

Step 1: *Make data available in CSV or database*
Step 2: *Evaluate properties for identifiers, desired data types, labels, colors, icons, security, and routing.*
Step 3: *Run the wizard*
Step 4: *Verify the availability of the data on the UI*

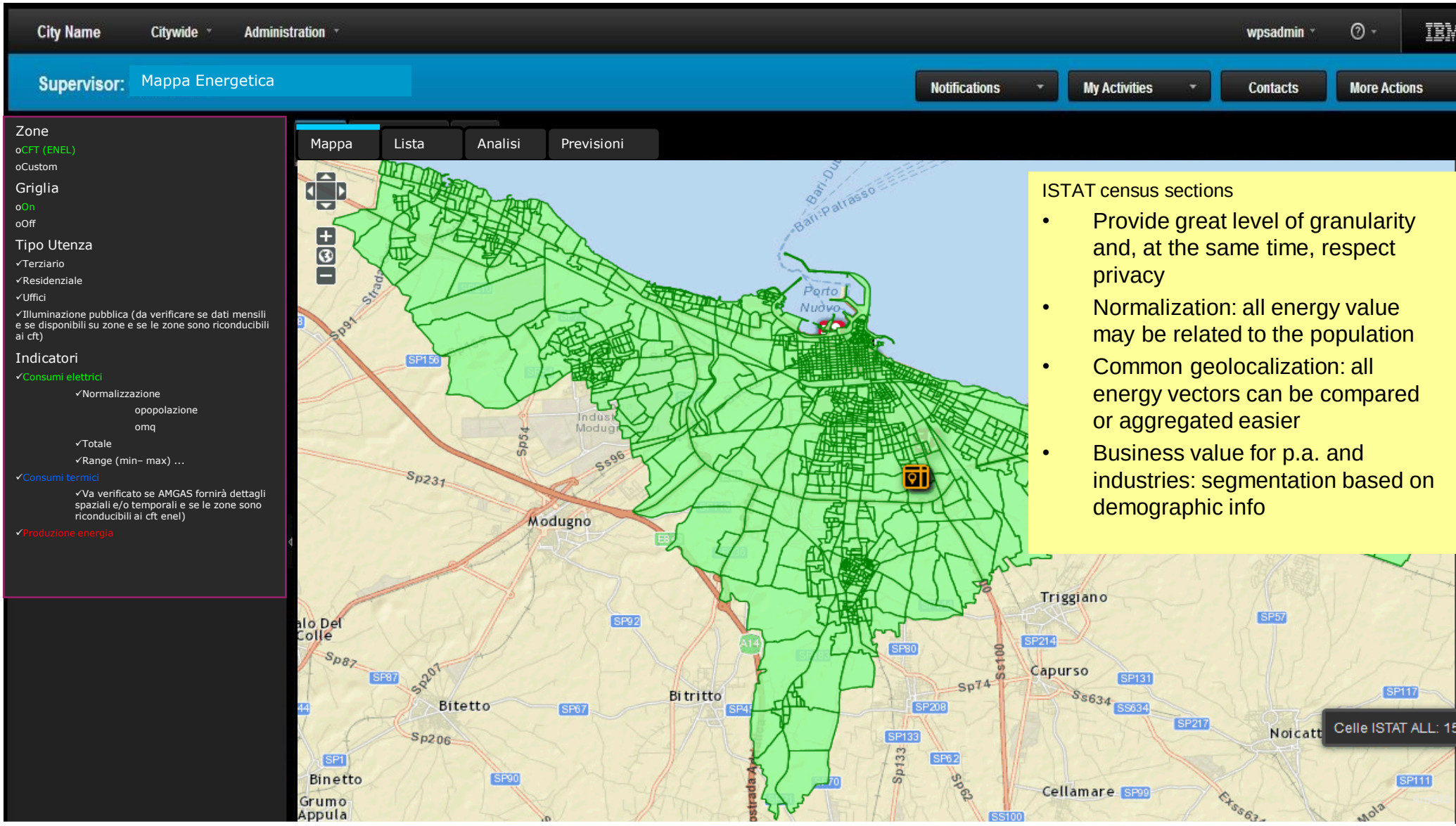


Main features: real time data and events

- Standard CAP protocol supported natively
- Selecting zones only contained events are shown
- Hotspot analysis correlate events from different data sources within a zone and with a temporal range
- View automatically shows event as they are received
- Large event throughput supported



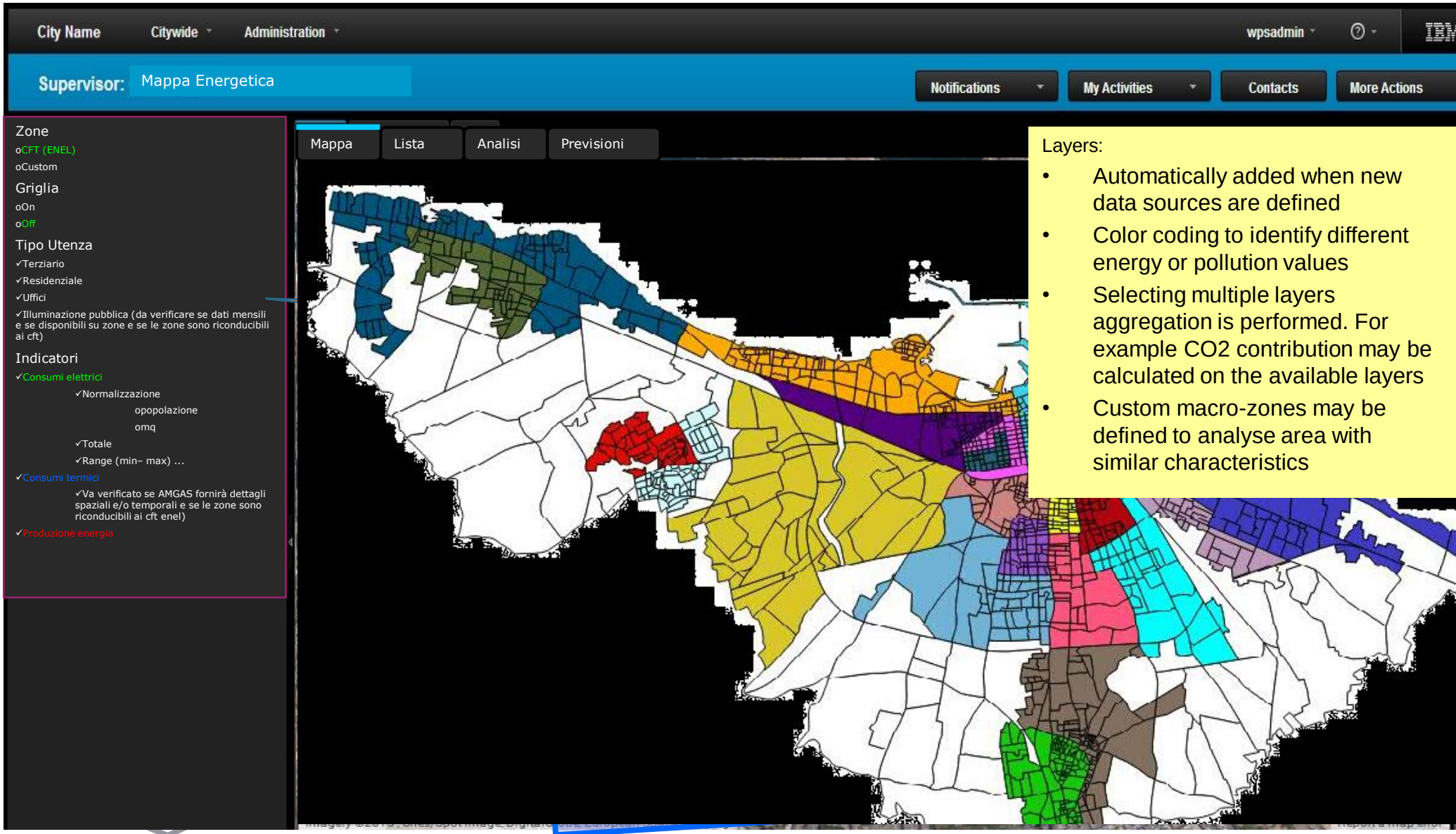
Main features: Map based GUI



ISTAT census sections

- Provide great level of granularity and, at the same time, respect privacy
- Normalization: all energy value may be related to the population
- Common geolocalization: all energy vectors can be compared or aggregated easier
- Business value for p.a. and industries: segmentation based on demographic info

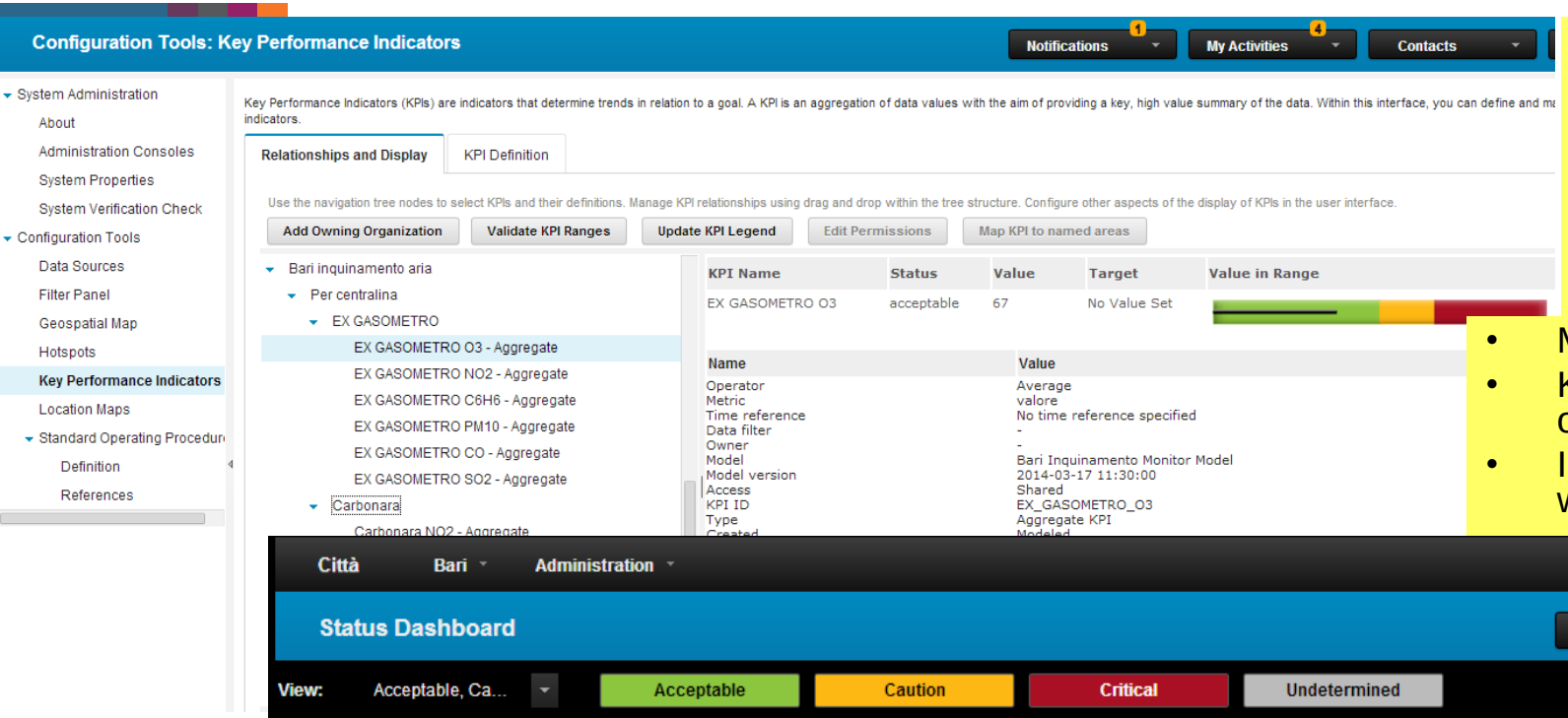
Main features: Map based GUI



Layers:

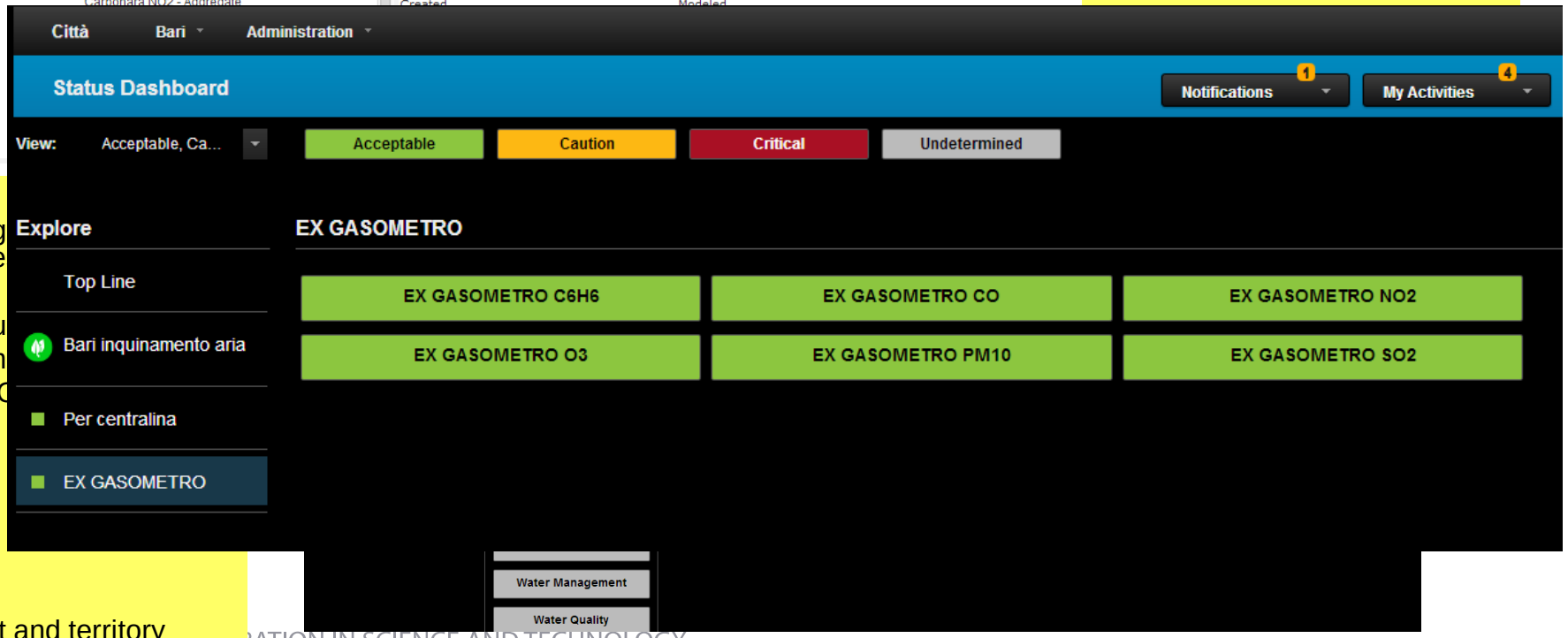
- Automatically added when new data sources are defined
- Color coding to identify different energy or pollution values
- Selecting multiple layers aggregation is performed. For example CO2 contribution may be calculated on the available layers
- Custom macro-zones may be defined to analyse area with similar characteristics

Main features: KPI



- KPI are elaborated on raw data
- Target
- ranges
- rollup- functions

- Multilevel KPI
- KPI as aggregation of other KPI
- Indicate the status vs well-defined goal



Examples
- P.A. Building performance
- Pollution
- Water consu
- Gas consum
- Produced C
- Well-being

Future
- Economics
- Social
- Education
- Health
- Environment and territory

Main features: some KPI

- Well-being KPI*
- Span across different domain
- Require different type of data to be collected
- Selected KPI among others

- * The KPI model is contribution of Politecnico di Bari

Indicatore	
Co2 equivalente da trasporti	**Mobilità Sostenibile (MS)**
Tempo dedicato alla mobilità.	
Passeggeri/km-anno TPL.	
Consumi di energia per trazione da fonti alternative.	
Qualità dell'aria.	
	Efficienza energetica (EE
Emissioni da edifici residenziali.	
Emissioni da altri edifici (commerciali, industriali,…).	
Consumo medio di gas sul territorio comunale.	
Consumi energetici PA.	
% smart grid sul totale	
	Uso Razionale del Territorio (UT
Spazi pubblici aperti urbani per kmq.	
Aree sottoposte a tutela per kmq.	
Consumo di suolo	
Greening urbano (n. alberature su suolo pubblico per kmq)	
Insoddisfazione per la qualità del paesaggio nel luogo di vita	
	Risorse Naturali (R)
% raccolta differenziata	
Produzione di rifiuti per abitante	
Perdite % tecnica idrica	
Capacità di consumo idrico potabile	
Capacità depurativa	
Acquisti verdi della PA	

Main features: some KPI

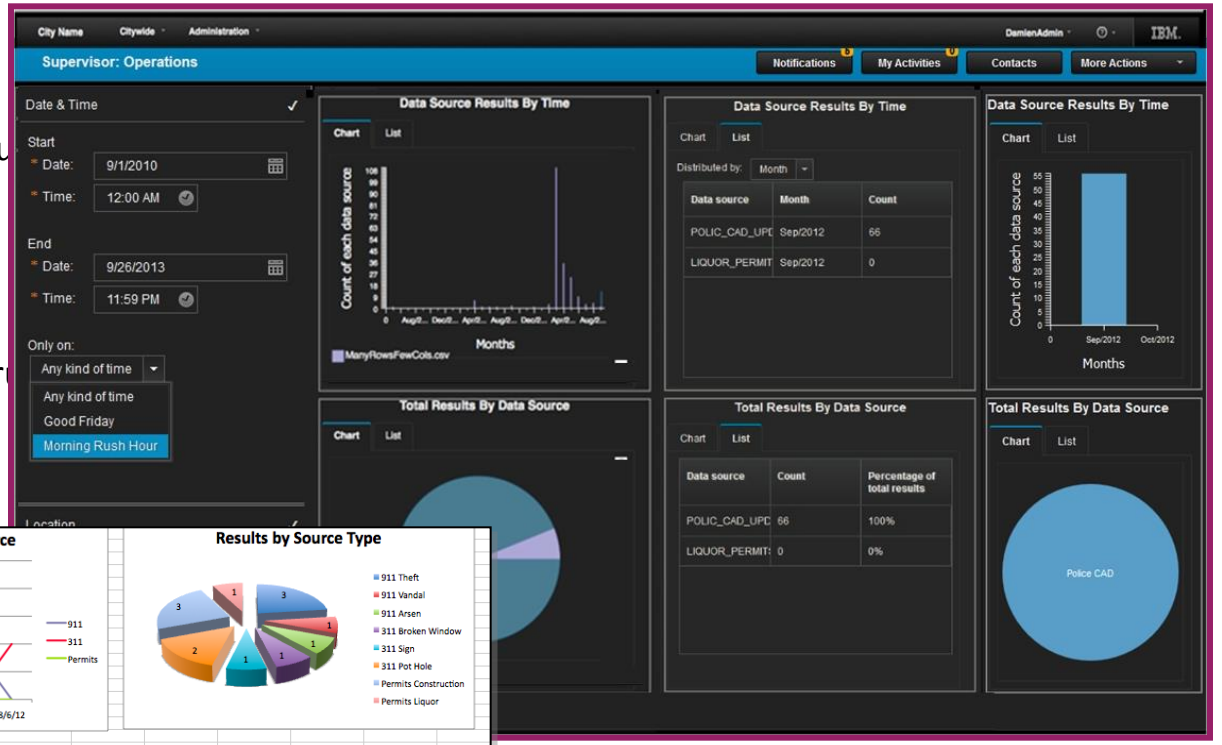
- Pollution KPI*
- Real Time
- 8/10 sensors in the city
- 2 mobile sensors

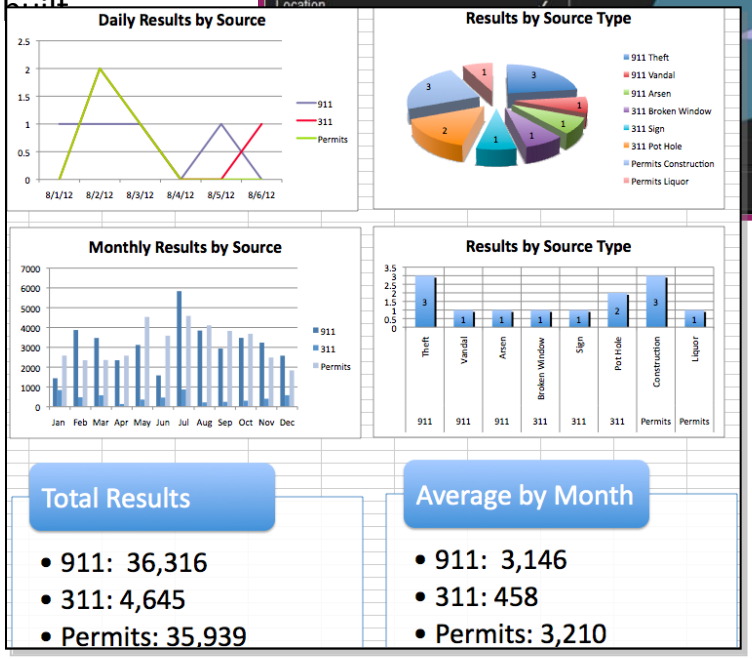
Data summary		
measure	**Sampling frequency**	**Upload frequency**
PM10 – Particulate 10	From 1 minute to 15 minutes	15 minutes
CO – Carbon monoxide	=	=
C6H6 – Benzene or VOC	=	=
NO2 - Nitrogen dioxide	=	=
O3 - Ozone	=	=
SO2 – Sulfur dioxide	=	=
temperature	=	=
Relative humidity	=	=

Main features: Reporting

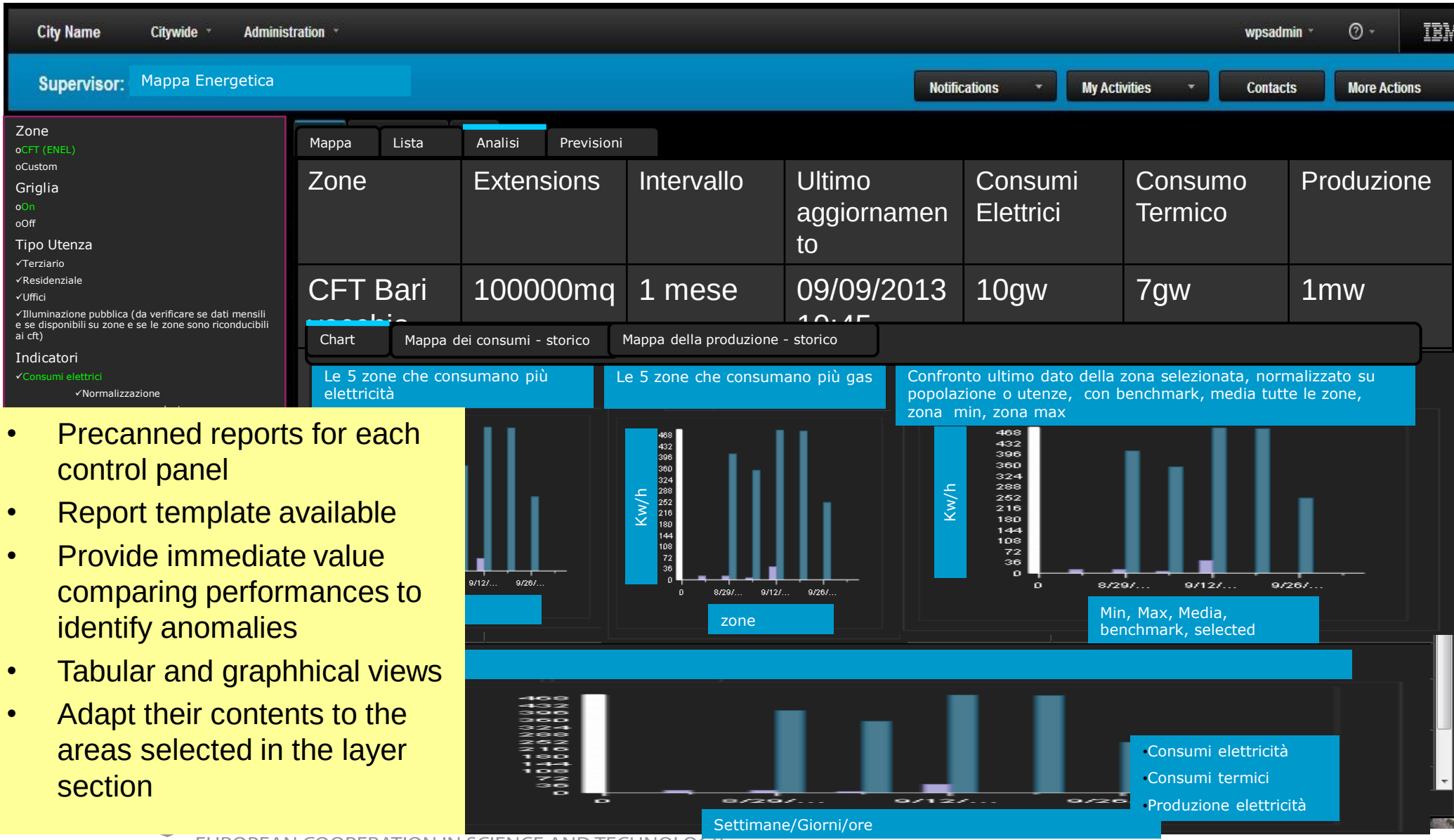
- Automatic graphs that match the current map resu
- Change the search criteria and the graphs change immediately to match.

- historical reports are easier to create, and they'll r considerably faster.
- reports across data sources that match on time or common dimensions can be easily built





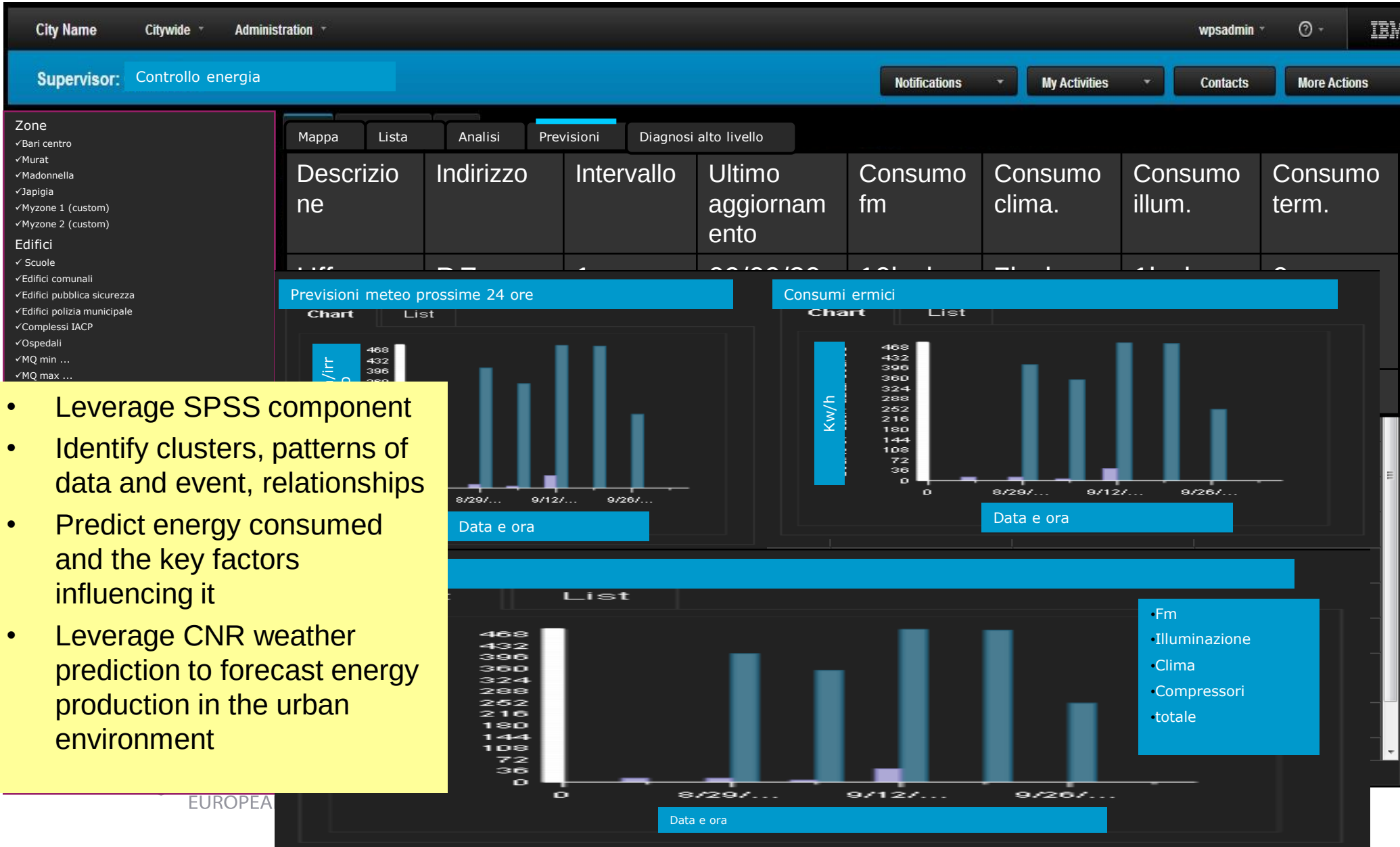
Main features: Reporting



- Precanned reports for each control panel
- Report template available
- Provide immediate value comparing performances to identify anomalies
- Tabular and graphhical views
- Adapt their contents to the areas selected in the layer section

Main features: forecast and statistical predictions

(to be confirmed)



- Leverage SPSS component
- Identify clusters, patterns of data and event, relationships
- Predict energy consumed and the key factors influencing it
- Leverage CNR weather prediction to forecast energy production in the urban environment

Main features: Mobile support

Touch screen interaction, optimized for different devices

Support big tablet, small tablet, smart phone, or laptop computer

Apps such as Citizen Collaboration

UCC provides all the foundational features for the development of mobile UI's.

Conclusions: (planned) achievements in RES NOVAE

- Riusability: applicable to other cities
- Concrete: use real data of real buildings or zones to have clear, automated, continuous status of urban energy and environment status
- Semi-industrialized solution: tools adopted by energy manager to support strategic decisions
- Citizen involvement: instrumentation of IACP apartments, citizen awareness
- Develop ecosystem: encourage data providers and consumers to build new business, added values services, social and public services
- Extensibility and flexibility: easily extend the platform to new domains with new data collectors, KPI, analitics and control panels. Examples: health, traffic, security, surveaillance, social, economic
- Usability: friendly UI available to non-expert people
- Integration: provide interfaces and data to internal and external applications
- Easy deployemnt: Cloud is the preferred infrastructure platform

Conclusions: Challenges

- Challenges
  - Data eterogeneity: data may have very different nature in terms on how it is generated, how frequent, how it is localized, etc. : it need to be reconcilied
  - Data geolocalization: data is often logically geo-localized (i.e. By means of addresses) which makes difficult correlation
  - Data quality & certification: using or producing opendata is good but ....how it has eleaborated?
  - Data privacy: need to protect privacy to not publish individual citizen data or aggregated data from which may be derived citizen data.
  - Municipality business application integration (API, WS, Open Data, etc.): data and application need to be integrated with a variety of protocols, API, models
  - Data licenses: certain licenses may make legaly difficult exporting or using data
  - Many others will come ....

Thank You!!!