

Cities Digital Transition to a Sustainable Future



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Cities have a pivotal role in shaping a sustainable future

Challenges for cities and megatrends

Reduce emissions



Cities account for **70%** of worldwide emissions ⁽¹⁾

Reduce and optimize resource consumption



Cities consume over **75%** of **natural resources**², producing **50%** of **total waste**³

Improve urban resiliency and respond to new citizens' needs



By **2050 68%** of world population will **move to cities** vs 55% of today⁴,

Lifestyles and citizens' needs change rapidly

Reduce spending and find budget for innovative projects



Budget constraints and lack of municipal economic resources for smart city deployments is still one of the key barriers to the green transition ⁵

Electrification

eMobility

Storage

PV

HVAC

District heating

Digitalization

IoT

Artificial Intelligence

Big Data

Cloud

Enel X role in supporting smart, sustainable & digital cities



- Smart Public lighting
- Architectural Lighting
- eBus
- Smart Public Buildings
- Digital services
- Intelligent Traffic System
- Smart Urban Furniture



Government Clients

>3.000



Lighting points (#)

>3Mn



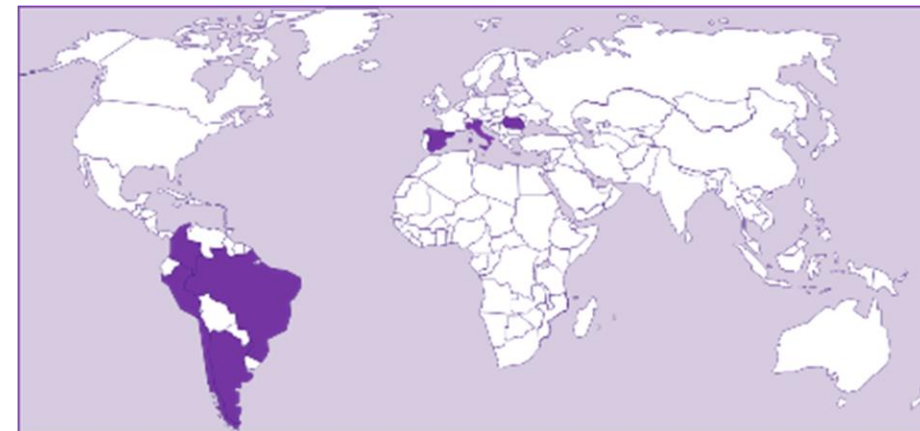
eBus served (#)

>5000



Smart and Efficient Buildings served (#)

>500

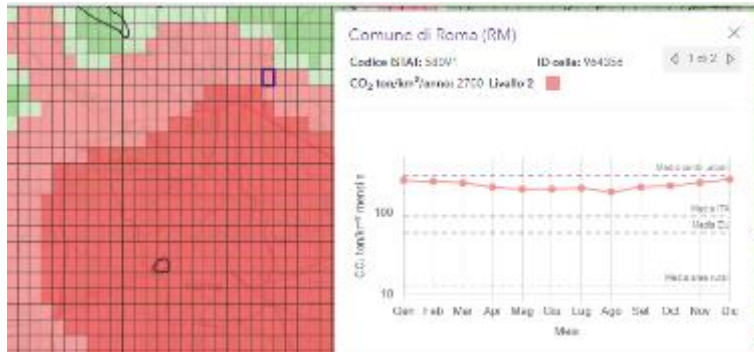


Enel X Open Data Program 4 Smart Cities

actionable insights to build smarter & sustainable cities

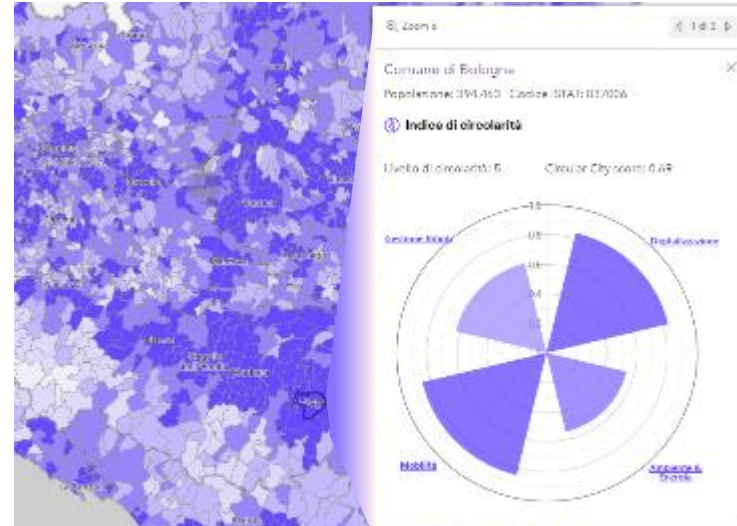


Decarbonization



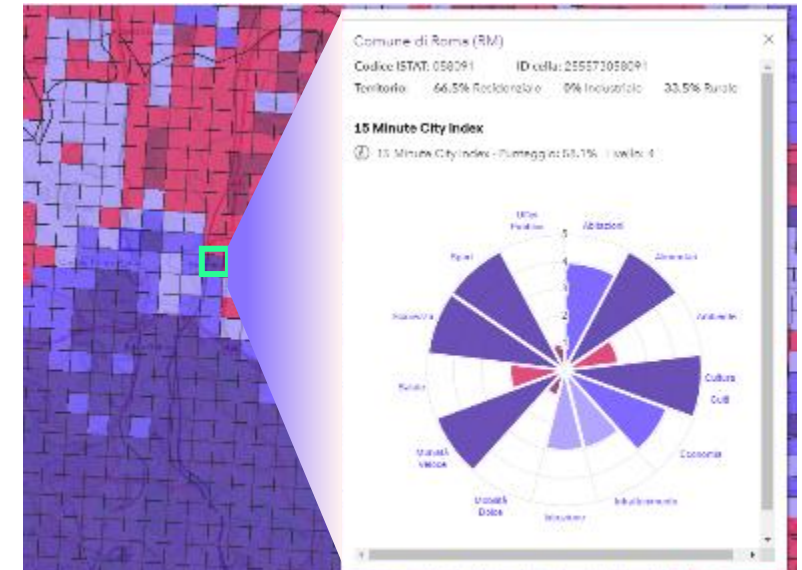
CO2 City Index

Urban Circularity



Circular City Index

Citizen Centricity



15 Minute City Index

 100% powered by Open Data

 Scientifically validated

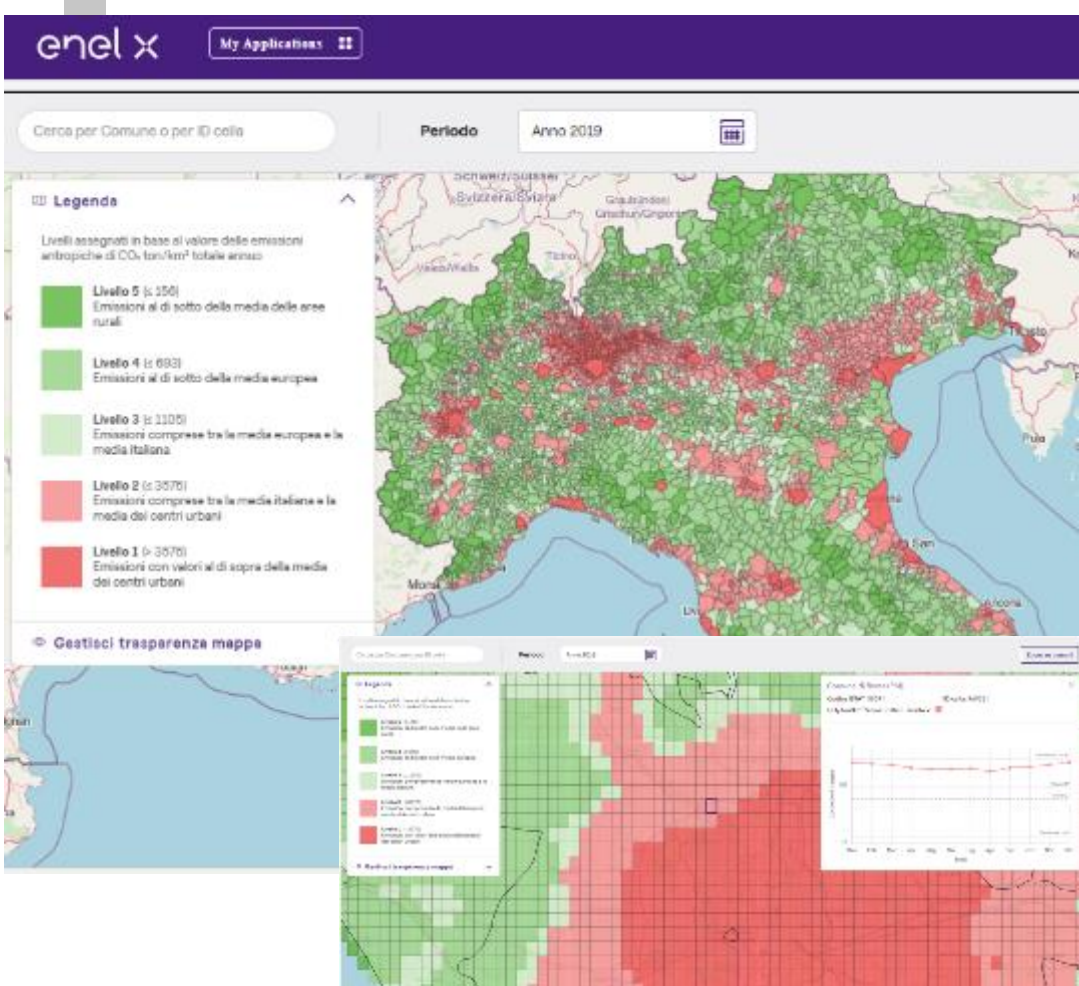


Available in Enel X
YoUrban Portal for all
Italian Municipalities

 Free

CO2 City Index

data to support cities decarbonization



CO2 CITY INDEX KEY ELEMENTS



100% based on Open Data

Correlation between institutional open-sources on CO₂ (ODIAC, EDGAR) and Italian census open data (munis shape, population, land usage)



State-of-the-art & open-source models

Leveraging on models of Open-Data Inventory for Anthropogenic Carbon dioxide (ODIAC) by National Institute of Environmental Studies JP (NIES)



3 Metrics / 20 years trends - emission breakdown in 10 Sectors for 20-21 Munis & 1km² district granularity

Metrics: Total Tons, Tons/Km², Tons/Inhabitant – 2000/19 trends



1st step to raise cities awareness on decarbonization topic

Door opener for Enel X decarbonization projects

Starting point to identify decarbonization policies & actions and set priority at districts/Munis level

CO2 City Index

emissions sectors breakdown



Methodology

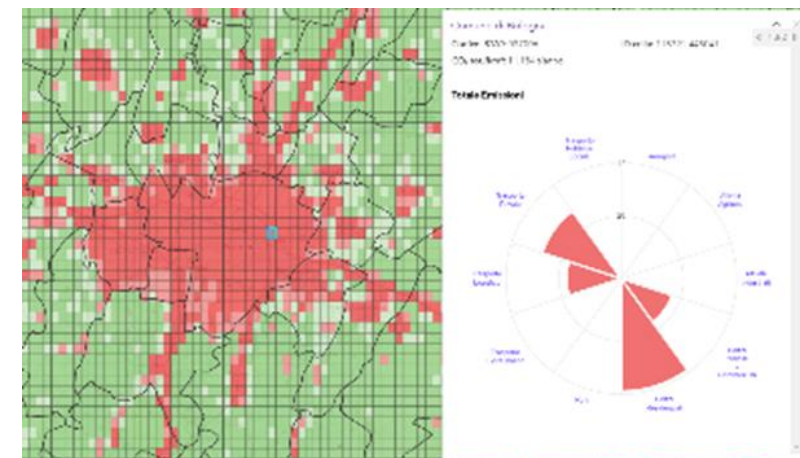
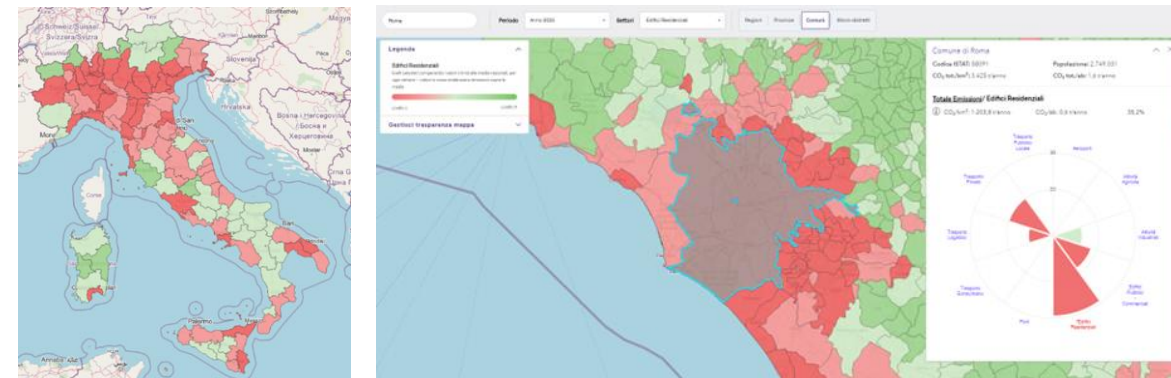
- 2000-2019 – used the ODIAC (Open-source Data Inventory for Anthropogenic CO2) model based on nightlight satellite acquisitions.
- 2020-2022 - model identified ISPRA/UNFCC primary sources with additional institutional source correlation for breakdown and provincial downscaling on sectors.
- Used additional proxies (OSM tags, Corine Land Cover) for municipal and 1Km2 downscaling.

Target Emission Sectors

1. Industries
2. Private Transport
3. Logistics & Commercial Transport
4. Urban Local Public Transport
5. Suburban Public & Collective Transport
6. Ports
7. Airports
8. Residential Buildings
9. Commercial & Public Buildings
10. Agriculture

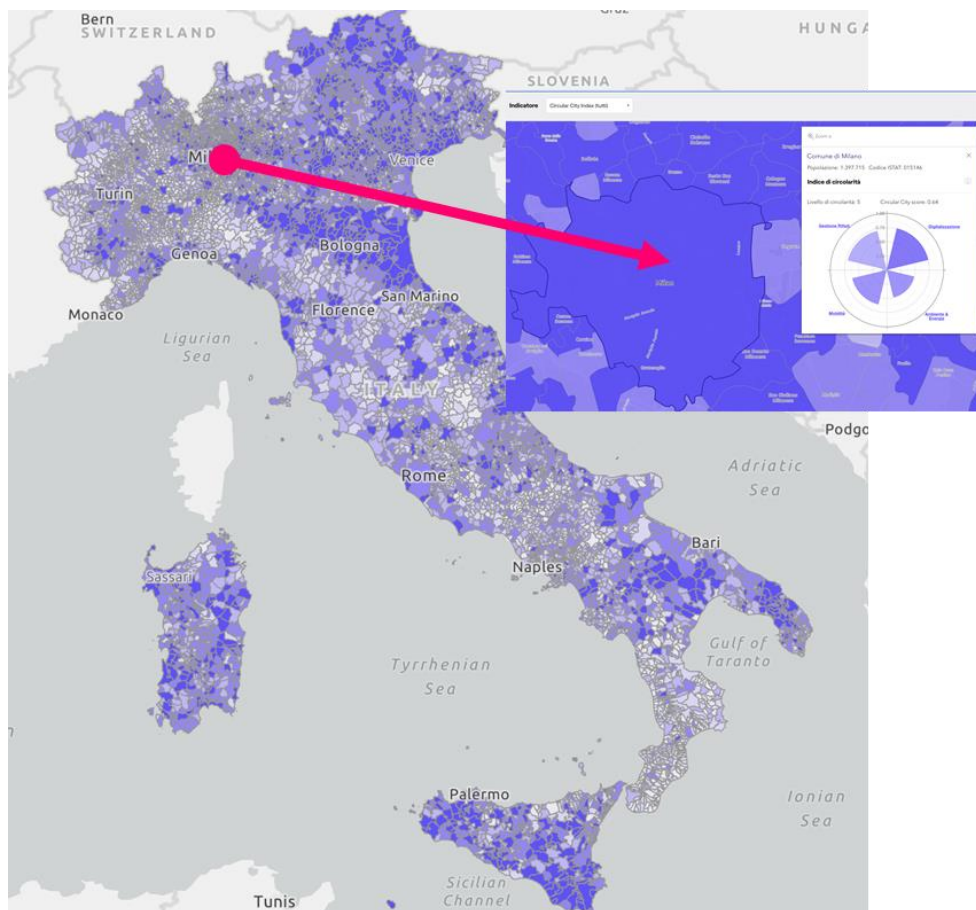
Impacts

- Increase Munis awareness on decarbonization topic
- Generate more detailed insights for preliminary project analysis



Circular city index

data to make our cities more sustainable & circular



CIRCULAR CITY KEY ELEMENTS



100% based on Open Data

Massive discovery addressed at National Level, in order to enable the analysis on all the 8K Italian Munis



Ad hoc models & certified threshold

Models developed in collaboration with University of Siena and IMT Lucca, to define «objective» ratings – based on Global, European or Italian norms & policies



1 macro / 4 sub-indexes – munis granularity

Dimensions: Digitalization, Mobility, Environment & Emissions, Waste



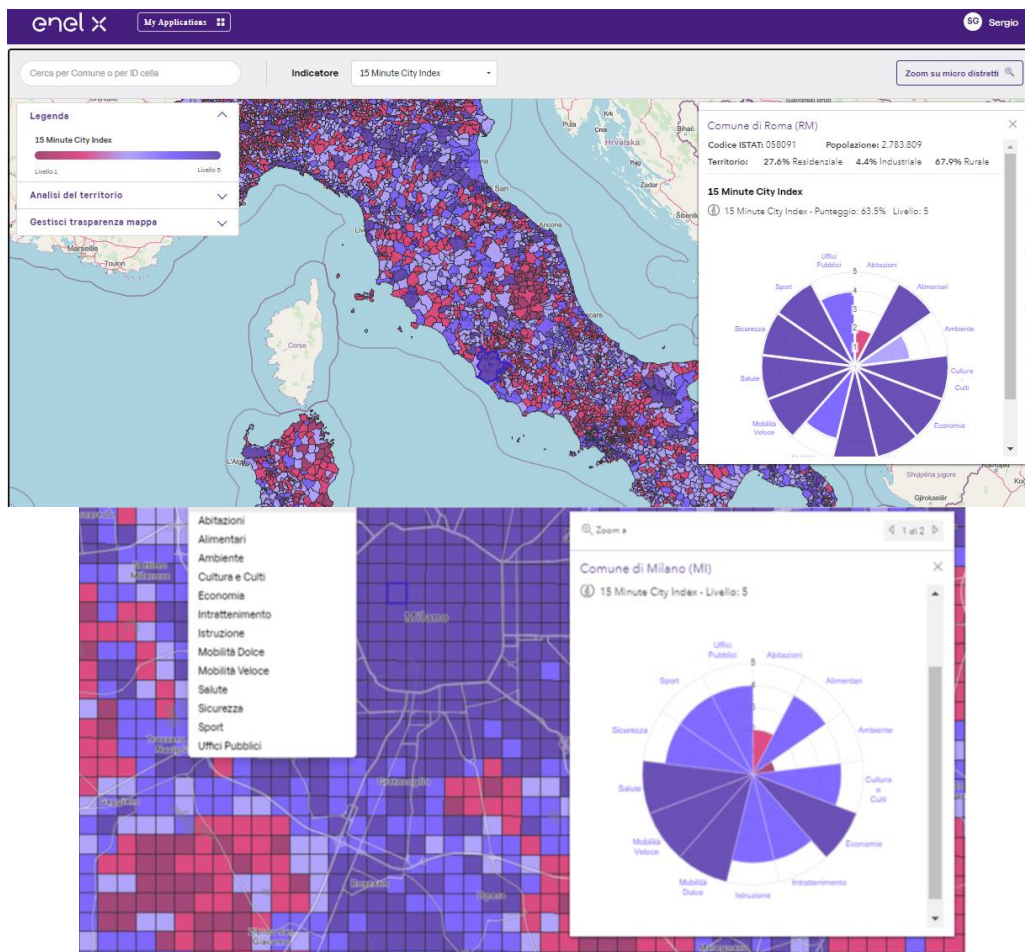
1st step to discover Circular Economy readiness

Starting point to discover Enel X Circular world and boost reports (city wide or site level) in depth assessment

A concrete support to increase PA awareness of Circular Economy principles

15 Minute City Index

starting point to assess service availability & boost urban planning by proximity



15 MINUTE CITY KEY ELEMENTS

100% powered by Open Data

Massive discovery addressed at National Level, in order to enable the analysis on all the 8K Italian Munis



Ad hoc models & certified threshold

Models developed in collaboration with University of Florence, to define «objective» ratings – based on Global, European or Italian norms & policies



1 macro / 13 sub-index – district granularity

Dimensions: Environment, Economy, Housing, Health, Food, Education, Mobility (slow & fast), Gov Services, Security, Culture, Entertainment, Sport



Huge impact in post-pandemic planning

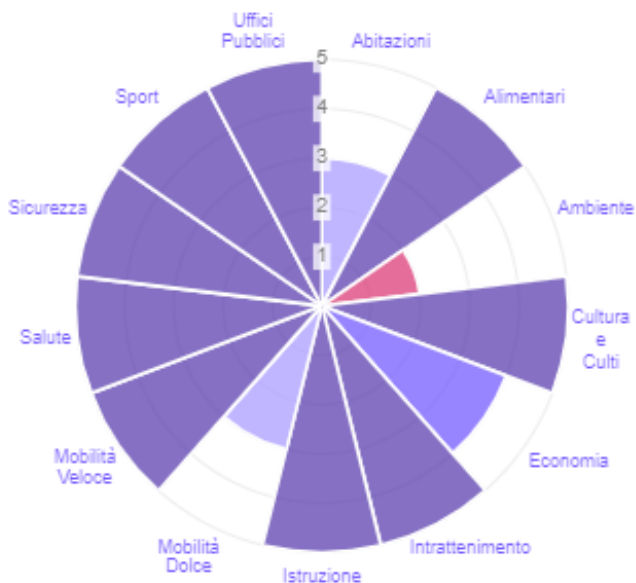
Analysis aligned with DUT Framework, designed to support PAs to address sustainable city transformation by increasing resiliency



Aligned to European Commission guide-lines for Sustainable City Planning

15 Minute city Index

How it is calculated?



49
sub-components

13
dimensions

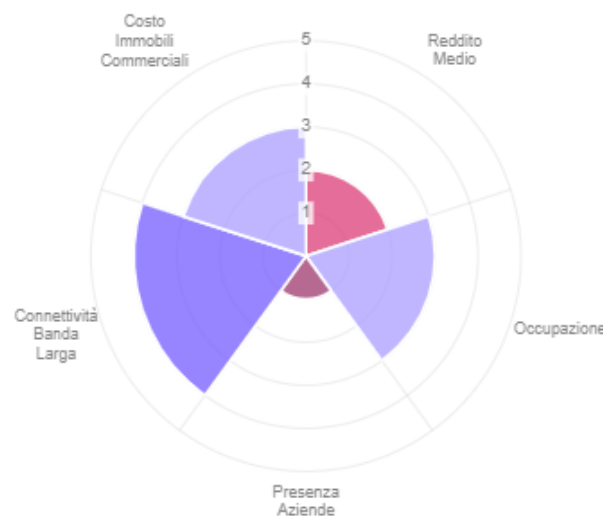
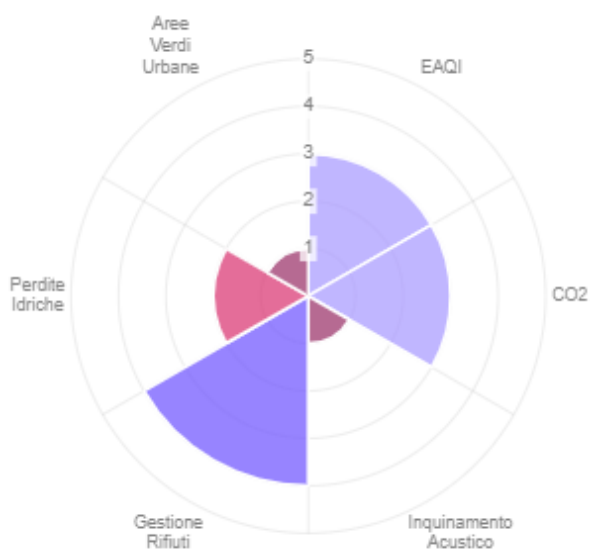
Each sub-component have a **score** at the **micro-district level of 15 minutes**, which assesses the **municipality's adherence to ITA/EU norms, guidelines or good practices** and the demand for certain services based on the **resident population**.

With ad-hoc models the sub-components are aggregated into **13 Dimensions**:

Housing, Food, Environment, Culture and Cults, Economy, Health, Sports Entertainment, Education, Sweet and Fast Mobility, Safety, Public Offices

1 synthetic indicator

Produced by aggregating all the 13 dimensions by considering the land characteristics taken from open data satellite source



LEVEL

Scale 1 - 5.

Clustering that classifies the micro-districts into homogeneous groups, in a comparative logic at the national level

SCORE

Score

on a 0 -100% scale

Absolute value achieved by the Municipality

AI & Satellite 4 Public Lighting Mapping

increasing efficiency and safety in lighting census



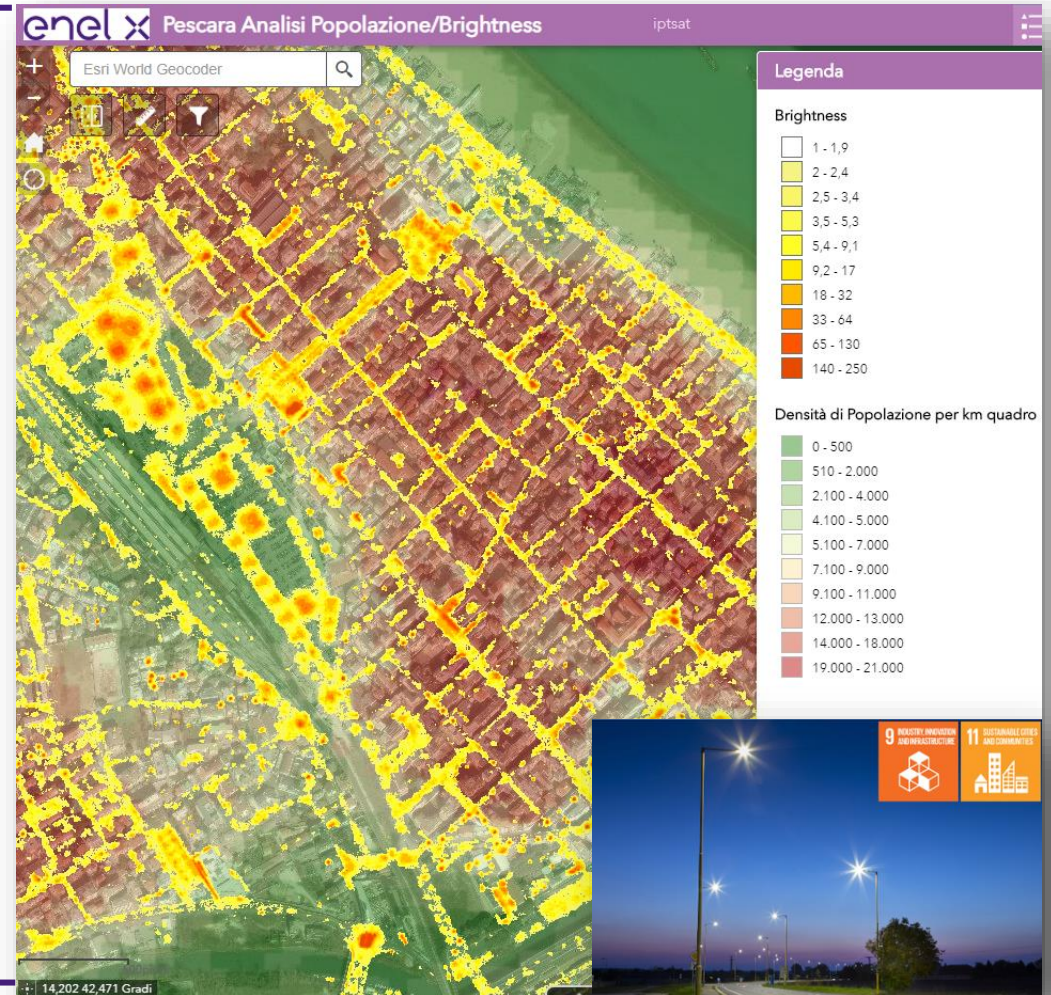
Project Overview

Design of machine learning algorithms & satellite imagery analysis to

- Boost **efficiency and effectiveness** of Public Lighting **Census**
- **Safety** increase, no human operation on-field are required
- Detect relevant districts to focus **planning of new lighting poles** (Low brightness in high density population district)

Main achievements

- **-75% operational costs**
(compared to traditional tools)
- **-89% timing**
(compared to traditional tools)
- **132K Poles censed in 12 weeks**
(+843% LPs mapped compared to ones achievable in same time with traditional tools)



Adaptive Lighting

AI as energy efficiency & city resiliency enabler

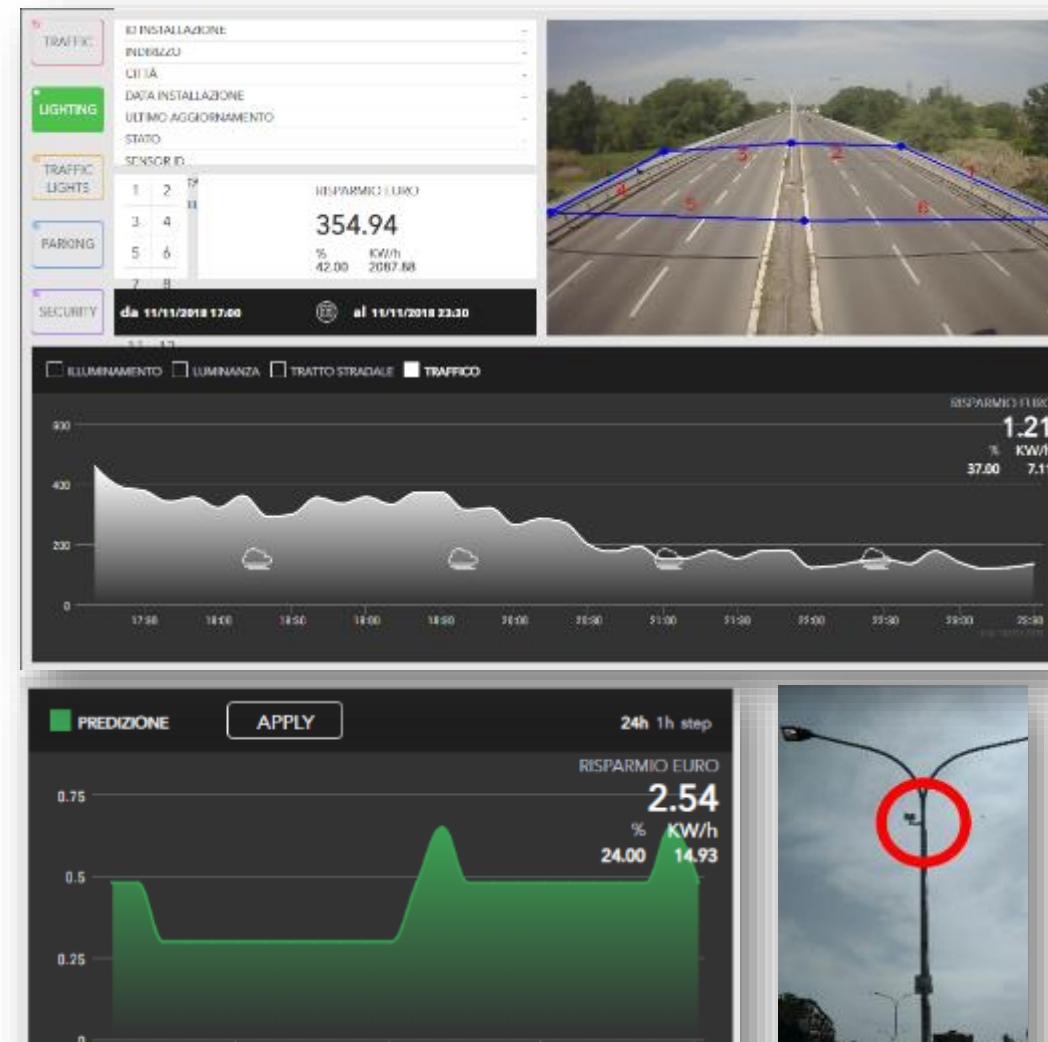


*Increase
energy
efficiency*

*Improve safety
on streets*

*Enabling smart
traffic planning*

- **What:** Automating street lighting dimming by evaluating real time traffic, light intensity and weather conditions
- **How:** Integration of Public Lighting Remote control solutions with Connected IP Cam with pre-processing capabilities and computer vision/ neural networks algorithms
- **Results** collected in field tests:
 - Incremental **36,3% energy saving** on already optimized **test lighting plant** (M3 street category)
 - Around **11%** estimated energy saving at **city level**
 - The same video-analysis solutions installed for adaptive lighting can enable relevant synergies also in increasing **street security** (ie. incident detection) and **traffic monitoring** capabilities



**Enel X Adaptive Lighting awarded by World Economic Forum:
listed as one of the most impactful Global Innovations from the Energy Sector in 2010-2020**

Adaptive lighting

the smartest frontier of lighting



BASE
CASE

1.0

EVOLUTION 2.0: ADAPTIVE LIGHTING

SIMPLE
LED

...

REMOTE
CONTROL

...

REMOTE CONTROL

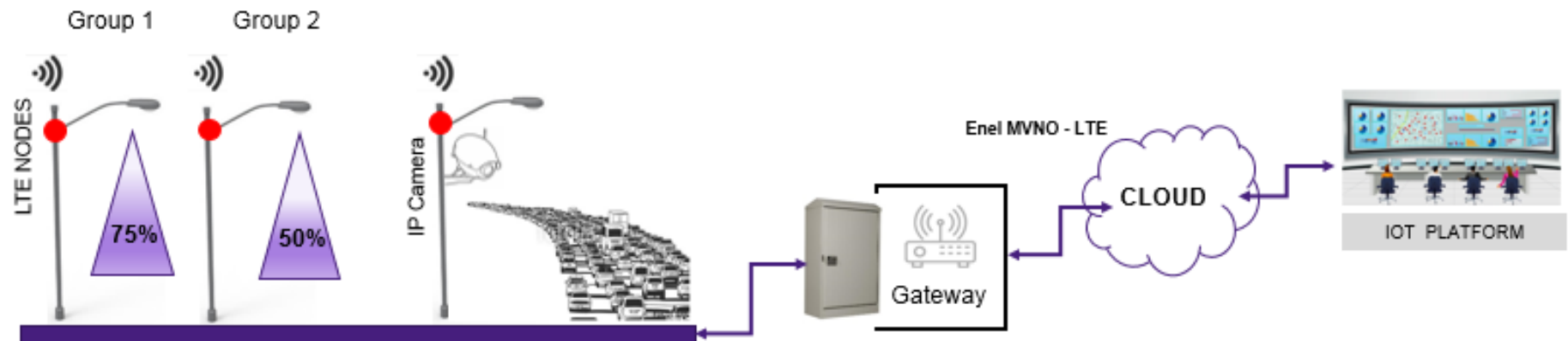
Exact monitoring of lighting points status, consumption and faults/issues detection, allowing quicker reaction times, higher street safety and service quality

CAMERA

- Automating street lighting dimming system evaluating real time traffic (TAI) or traffic plus light intensity and weather conditions (FAI)
- Traffic Monitoring with video analysis potentially as an **additional competitive product**, substituting traditional wired sensors (more expensive) for mobility urban plans

X-CITY PLATFORM

Accurate and flexible management system enables overall **O&M optimization** and **predictive interventions**





Thank you