enel x

DIGITAL SERVICES

WHAT IS A DIGITAL CITY?

Digitalization has radically changed the way we communicate, buy products and use services. The technologies that underpin this transformation (such as the Cloud, sensors, analytics, the Internet of Things and Artificial Intelligence) incorporate processing potential that will lead to an exponential rise in the speed of **innovation and progress**. Enel X analyses the way these technologies can be applied to the urban environment to make it adapt more quickly to the ever faster pace of social, demographic and climate change.

For Enel X, **Digital Cities** are connected cities, where high-tech information management platforms enable the Internet of Things to connect devices and sensors to each other, automate responses, improve services and equip the urban ecosystem with new functions. The heart of our research lies in identifying **digital value** for society and translating it into **wellbeing for people**.

> **The economic and social value of digitalization over the next 10 years is estimated to be in the region of 100,000 billion dollars.**
>
> ***"World Economic Forum"***

OUR SOLUTIONS

CONTROL ROOM 1

An IoT platform for planning and managing the urban ecosystem.

CITY ANALYTICS 2

A Big Data analysis tool that provides information about flows, attendance and behavior of local people and tourists, with a view to optimizing the planning of services.

MULTI-FUNCTIONAL VIDEO ANALYSIS 3

A video analysis software application with a wide range of uses to support traffic management, safety and urban communication.

1

IoT CONTROL ROOM:
VIEWING AND MONITORING THE CITY

The term "IoT" or "**Internet of Things**" denotes a set of technologies that make it possible to connect any device to the Internet and create a network of physical objects, all connected to each other.
As early as 2020, over **25 billion devices** (from personal possessions such as cars and smartphones, to public sensor systems installed in city infrastructures, such as environmental monitoring devices) will be connected to the Internet and thus generate an ever larger mass of data. The collection, aggregation and analysis of this data generates immense value, thanks to the countless potential applications it has.

To harness this potential, we need platforms that can integrate and organize data from different devices and enable them to communicate with each other to exchange commands and information.

A city that can organize data is a city that can **monitor** the quality and sizing of its services at all times, respond quickly to changes and emergencies and **plan** the use of its resources skillfully and effectively.

Our approach

Enel X has developed an IoT platform that collects and organizes data harvested from any urban device, processes it and makes it viewable on a control panel (or Control Room) designed to facilitate service management.

These are the stand-out features of our solution:

Open and interoperable
An environment that is open to all types of field device, operating in all connectivity situations, capable of communicating with all operating systems and protocols and designed to integrate third-party applications, services, solutions and technologies with ease, by promoting an Open Data and Open Source approach.

Customizable and continuously evolving
Customizable features designed to adapt to the continuously evolving needs of all stakeholders and practically respond to current and future scenarios.

Secure and reliable
Full conformity with cybersecurity and privacy regulations (including GDPR), without impacting on the speed or ease of understanding of the data provided.

We integrate all existing sensors and infrastructures, regardless of their degree of technological evolution.

Control Room

The Enel X **Control Room** is the interface for monitoring and managing sensors and connected systems and obtaining a simple overview of the entire IoT ecosystem.

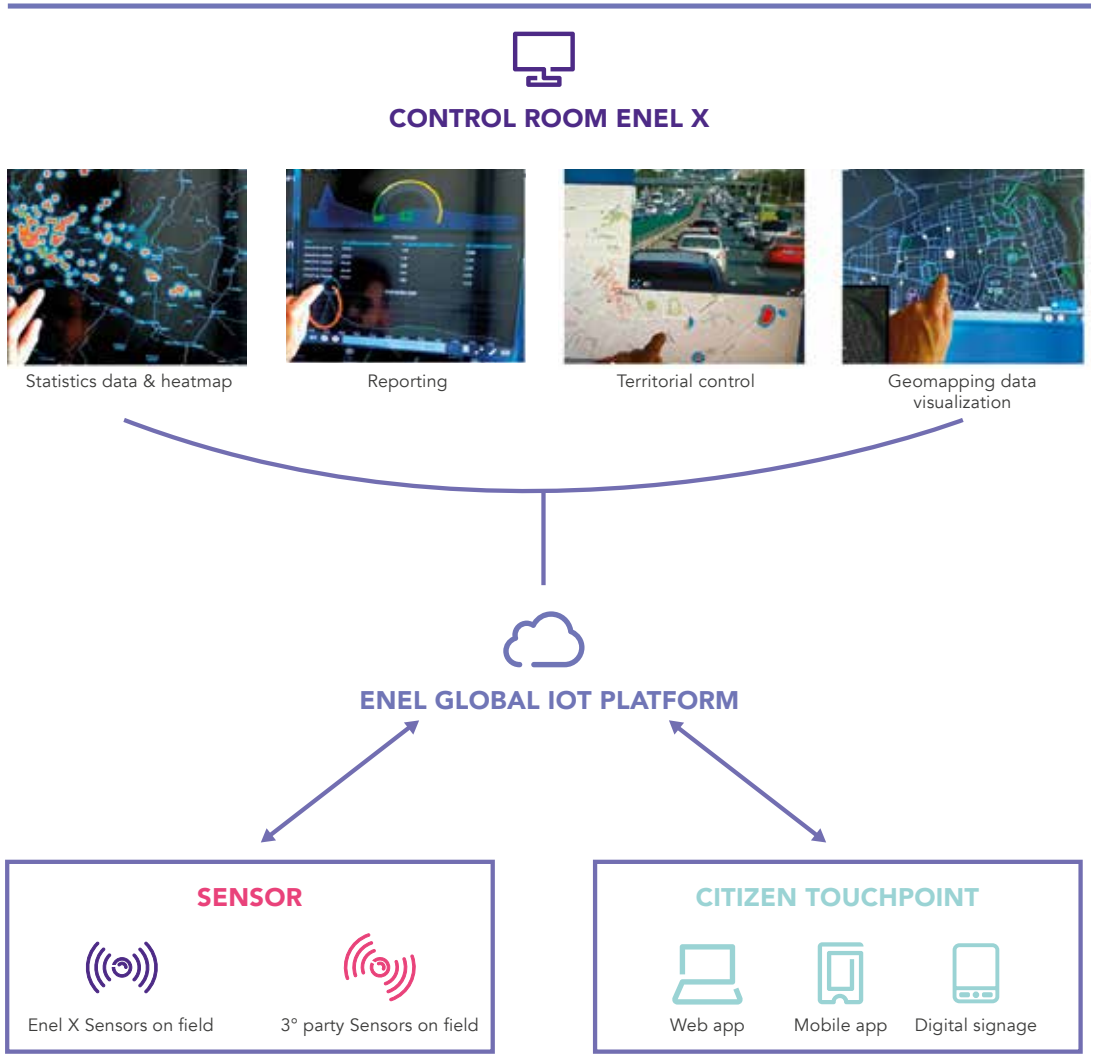
Thanks to Augmented Intelligence, we offer the added value of providing access to the large volume of collected, processed and interpreted data in an **intuitive**, easy-to-understand form, that enables human operators to concentrate exclusively on decisions deemed critical.

It also cuts problem analysis times by 70%.

A simple graphical interface makes it possible to:

- view the **status of field devices** in real time;
- monitor both **real-time and historical information** for each device;
- **access the documentation** associated with field sensors/actuators;
- **work collaboratively** with groups of people on a shared workstation or between multiple terminals connected remotely.

Collaborate simultaneously using multiple control terminals (desktop and mobile).



The advantages

Here are some of the key advantages of our IoT solution:

- the ability to integrate **any device** or third-party system efficiently and at low cost and manage it from a **single platform**;
- **improved decision-making capacity**, in relation to individual services and the city ecosystem as a whole;
- considerable **efficiency gains**, yielding a wide range of savings*:
  - **optimization of teams**: up to 33% less time than is currently needed to monitor and manage the various city systems;
  - **lower training costs**: costs associated with staff training cut by as much as 70%;
  - **shorter response time**.
    - Up to **50%** less time needed to instigate a response, because all the necessary planning information is available directly on the interface.
    - Up to **20%** less time needed to order and implement responses, whether carried out remotely (commands that can be executed directly on the system) or on site, thanks to identification of the exact location in advance and the availability of all the necessary data.

*savings calculated on the basis of average market values

Security and data processing

Enel X upholds the **highest security standards** in terms of the integrity and confidentiality of information, and fully meets requirements on data processing and storage and the transmission of data between the platform and other systems (e.g. field sensors or other physical/cloud servers by means of APIs). This policy applies to all vertical services integrated into the Enel X platform, even if they are developed by third parties.

Enel X is **GDPR compliant.**

A practical example: Lighting control system

Enel X remote monitoring system for lighting offers innovative solutions even for one of the most basic and essential public services: public lighting.

Display of all lights under remote monitoring

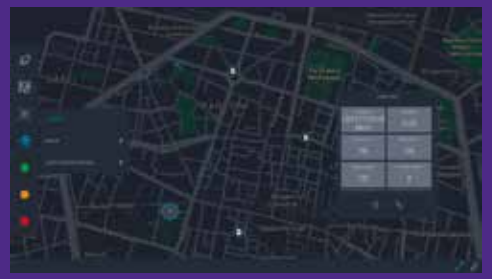
For this solution, the Control Room enables you to:

- **monitor the status of all assets** (lights, meters, sensors) located throughout the territory, flag up any problems immediately and drastically reduce response times;
- **view the associated biographical information** (e.g. make and model of device, installation date, maintenance history);
- **identify the type of fault** (e.g. lamp failed, distribution board circuit breaker tripped, etc.) by means of an on-screen display, and assign the task of solving it to the right group;
- **access real-time data** (such as instantaneous power or lamp dimmer level), historical data and statistical data.

A practical example: charging points

Enel X can equip cities with **standard, fast and ultra-fast charging stations** for use in any private or public environment (e.g. company car parks or public car parks).
Charging points - regardless of type - are smart objects in every respect and communicate via the platform, thus giving rise to a range of additional opportunities.

Charging points and related information in Control Room



The integration of charging points into the IoT platform makes it possible to:

- **monitor the charging infrastructure** by means of the Control Room (location of charging points, operating status and detailed information, such as their time of availability);
- **view detailed information**: the technical details of the model, vacancy status, power output;
- **view data in real time** or in the form of statistical reports produced by the platform.

2

CITY ANALYTICS:
DEEPER UNDERSTANDING, ENHANCED SERVICES

City Analytics is Enel X's innovative digital tool that uses Big Data to enhance your understanding of how people live and move within the local area, so that you can plan your services on the basis of actual demand.

The analyses are conducted on anonymized data from different sources and enable you to estimate:

- the **number of people** present in census areas or other points of interest around the city;
- the **origin and destination of flows** of residents and tourists;
- specific needs of **homogeneous groups** of users (sports fans, theater-goers, visitors to places of cultural interest, electric car users, etc.).

The advantages

The City Analytics solution helps to:

- improve **quality of life** by making it possible to plan and manage services on the basis of actual demand;
- **optimize the cost** of providing services, on the basis of data indicating actual use;
- **maximize revenues**, by making the most effective use of advertising space and city promotion policies (tourism, event-hosting, promoting cultural heritage).

How? City Analytics monitors pedestrian and vehicle flows and displays the numbers of different types of users in the busiest areas of the city.
This makes it possible to:

- **optimize the sizing and location of services** and public infrastructures (e.g. car parks, electric vehicle charging points, refuse collection);
- **organize road traffic** dynamically, on the basis of traffic volumes; make decisions
- on mobility and safety, in preparation for organized events or tourist peakì;
- **monitor tourist flows** and plan ad hoc campaigns to promote the local area and reap value from it;
- install **outdoor advertising panels** to turn high-visibility areas to account and maximize economic returns.

City Analytics provides a useful means of determining the origin of spectators attending organized **events**, so as to enable the public authorities to manage schedules more effectively by planning tourist and mobility services, security and public infrastructures.

The solution

How does City Analytics work?

1 Collects data.

Data is collected under specific agreements with various vendors (e.g. geolocation data from mobile apps, data from Enel X solutions installed around the city, etc.).
Open data provided by the public authority itself can also be used.

2 Aggregates and processes data.

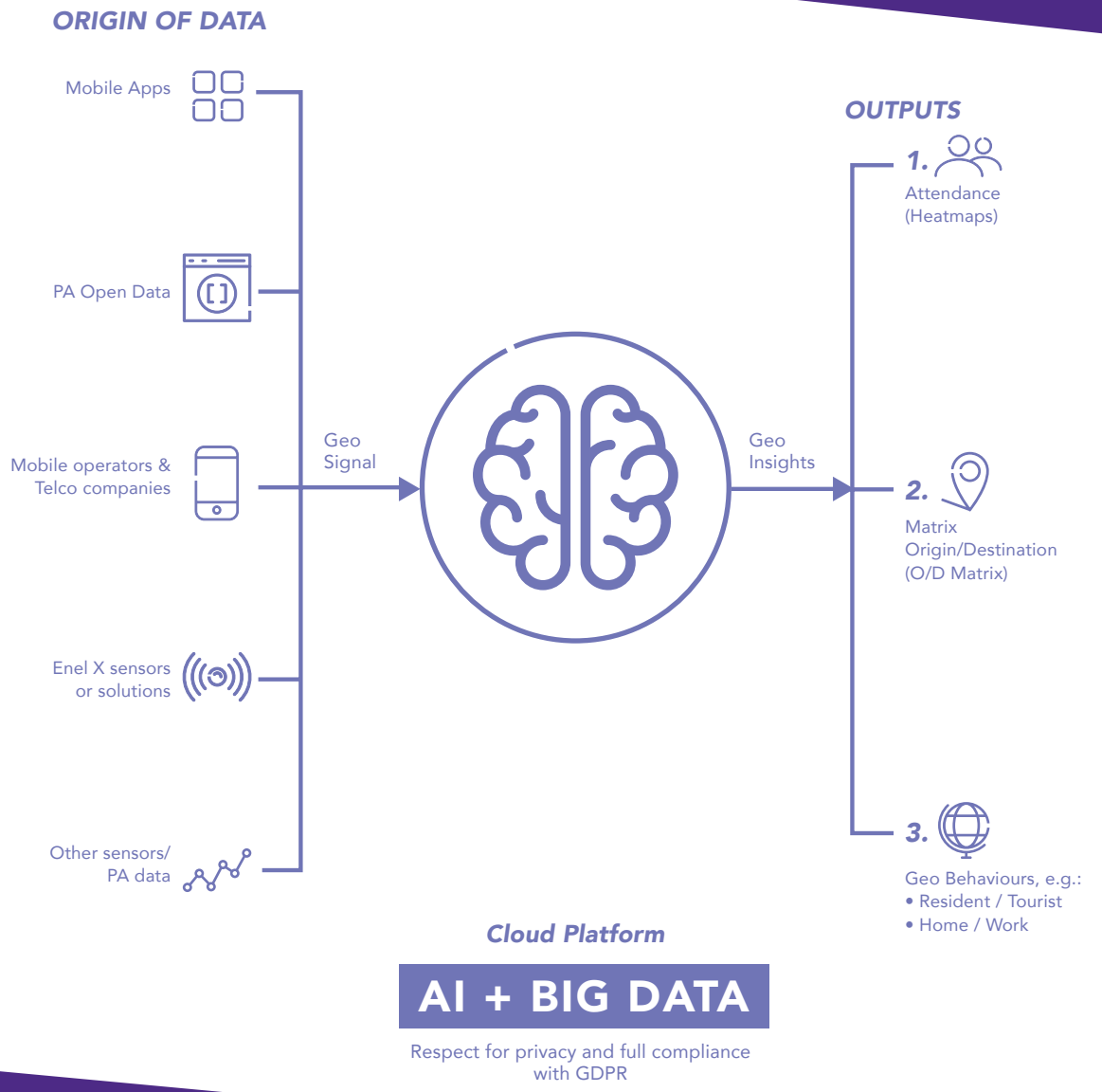
All data is collected in anonymized form and aggregated. Subject to the explicit consent of users (in full compliance with privacy regulations and GDPR requirements), it is then processed in the cloud, using methodologies and data analytics algorithms developed by Enel X.

3 Shares insights.

Processing gives rise to three different types of analysis:

- estimate of the **presence of users** in predefined areas;
- analysis of the **mobility flows** of the population, with an indication of the origin/destination of users and identification of key routes;
- macro-analysis of behavior and **user profiling**, in order to define groups of users with homogeneous interests and recognize their specific needs (e.g. tourists, commuters, residents, etc.).

The results of the analyses can be displayed on an **interactive dashboard**, thus facilitating their communication and sharing both within the public authority and with external parties.



Security and data processing

City Analytics is based on the aggregation and analysis of data. Our priority is not only to ensure full compliance with privacy regulations, but to go one step further by adopting an even more conservative approach according to the principle of "privacy by design". In other words, the process of developing the solution concerned was built around data security.

For City Analytics, we designed a **two-level security system**.

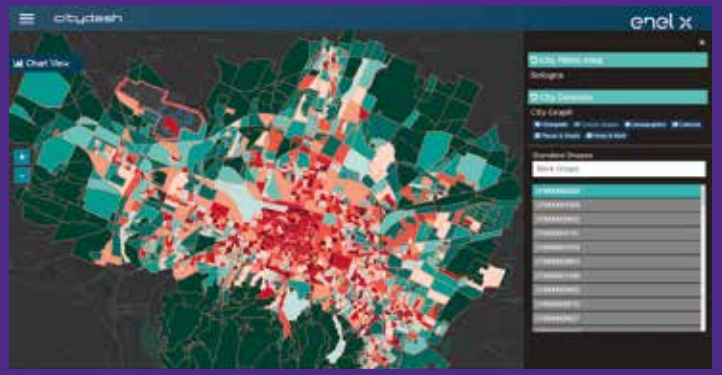
- **Privacy protection by means of:**
  - the user's free, explicit, informed consent to collect their data;
  - collection of geo-location data only, thus excluding any personal or sensitive data;
  - data anonymization, i.e. the irreversible alteration of any link between data and individual. This makes it impossible to trace a path back to the data subject, either directly or indirectly.
- **Protection against cyber attacks by means of:**
  - protected environments for saving and storing data, in full compliance with the rules and requirements of cyber security imposed by Enel on all its suppliers.

Here are a few case-studies of its use.

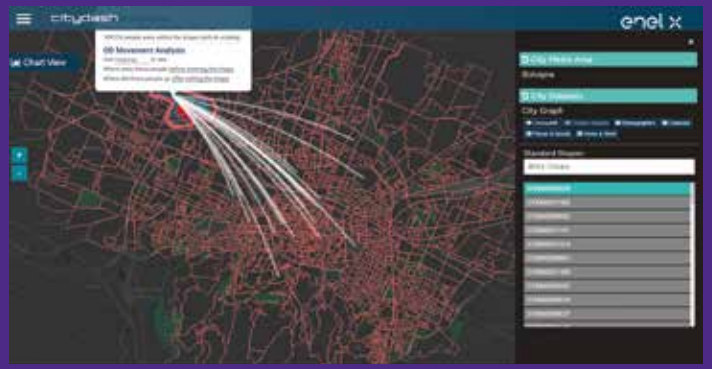
PUBLIC DEPARTMENTS	USE	BENEFITS	EXAMPLES
Town planning	Monitoring of activities within the territory for urban redevelopment projects.	**Reduction of planning costs** and the possibility of making **data-driven decisions**.	Where should you build schools? Hospitals? Public parks?
Tourism	Monitoring **tourist flows**.	Optimization of the management of **tourist services** and **better promotion** of the local area's resources.	Where should you locate information points? Where should you hold a given event?
Transport	Planning and dynamic management of **public transport** services and **road networks**.	Optimization of resources by providing more **efficient mobility services** to citizens.	How should you change the frequency of public transport services? What alternative routes should you offer?
Public billboards	Optimization of the location and sizing of **public billboard** services.	Giving **maximum visibility** to messages by assessing numerical flows of pedestrians and the qualitative profiling of the audience.	Where is the best place to locate advertising panels? And what should their content be?

A practical example: application on the city perimeter

Heatmap of crowd density in the territory of Bologna (displayed on dashboard)



Mapping of destination flows from Bologna Airport (displayed on dashboard)



3

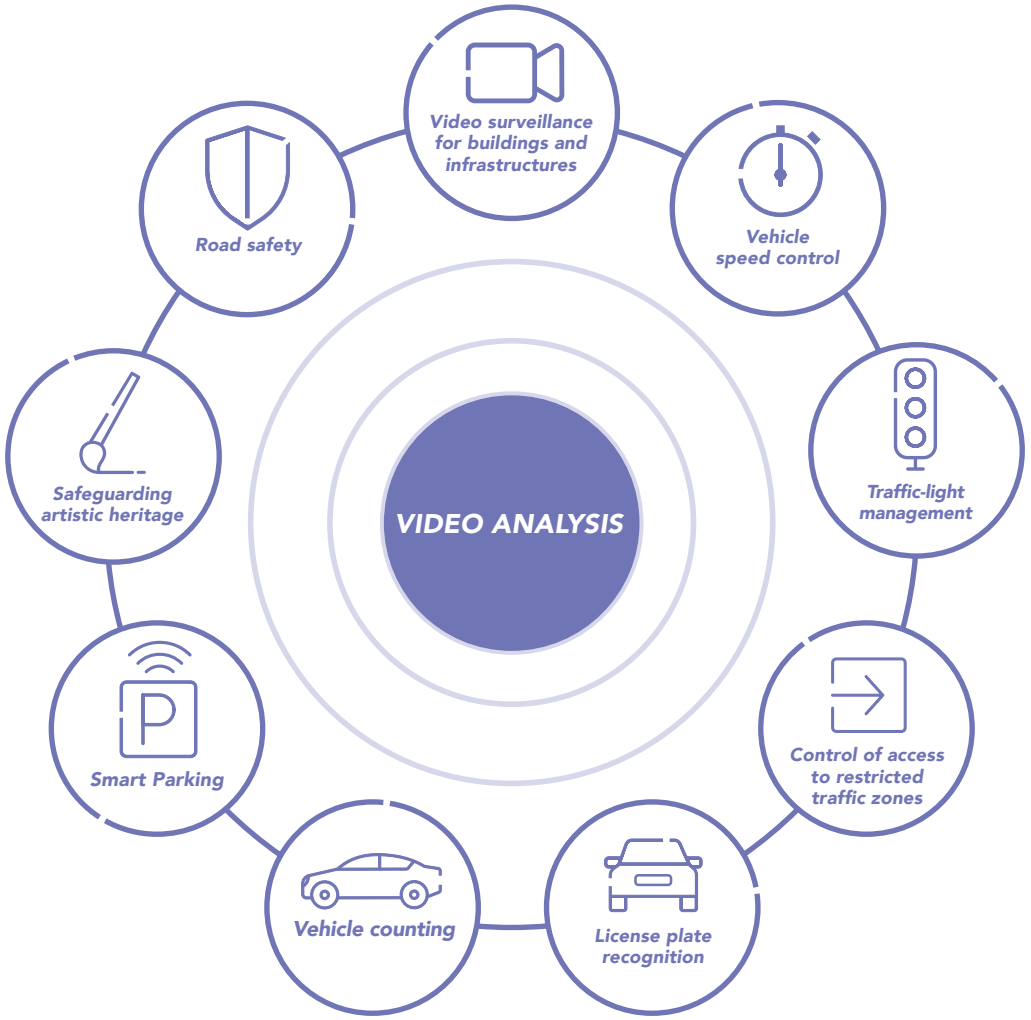
MULTI-FUNCTIONAL VIDEO ANALYSIS:
A 360° VIEW OF THE CITY

A wide range of public services these days are based on the **use of video cameras**: protecting public safety, managing traffic, monitoring entry to restricted traffic zones and safeguarding places of interest and artistic heritage. Monitoring multiple video streams in real time, using **traditional technologies**, takes up large amounts of human and economic resources. But technological innovation is opening up new possibilities on this front too.

Enel X video analysis software generates specific alerts associated with given events. These alerts can be automatically redirected to the relevant personnel, thus reducing the time and cost involved in reporting and resolving the issue, or they can trigger automatic responses by the system, such as adapting public lighting or synchronizing traffic-lights.
The system is also capable of transmitting real-time video streams on request. This function is particularly important for the provision of security and surveillance services, for example.
In other words, with video analysis, **video cameras cease to be passive image recorders and instead become active sensors** that can be integrated into the urban IoT platform. For a safer, more efficient city.

Video analysis software turns video cameras into active sensors.

Video analysis



The advantages

Enel X video analysis solutions offer numerous advantages.

- Effective, efficient management of **urban security**, by promptly detecting abnormal behavior in streets, squares and in the vicinity of points of interest (e.g. schools and monuments).
- Optimization of urban **traffic flows** and time taken to find **parking** spaces.
- **Reduction** in the human and economic **resources needed** to monitor video streams.
- **Automation of urban management** processes by means of alerts that trigger executive responses.
- **Respect of people's privacy**, thanks to smart video analysis done locally by the camera itself, with recording of video streams confined to specific, predefined cases, for security reasons.

Offering

Our video analysis software is aimed at four macro-areas of services.

SERVICE	DETECTION
Video surveillance	• Smoke and flames • Tampering and damage to objects, buildings and infrastructure • Intrusion • Suspicious activity, such as loitering • Suspicious objects
Traffic management	• Direction, speed and related irregularities • Vehicle counting • License plate recognition
Smart parking	• Occupation of parking spaces • Parking space payment • License plate for remote monitoring of infringements
Crowd Control	• Counting passersby • Passersby falling and/or fainting • Abnormal behavior such as climbing, vagrancy, etc.ecc. • Suspicious gatherings of people

Enel X video analysis solutions are **end-to-end, customized** and capable of meeting the needs and unique features of every city. Based on close analysis of the current status of urban assets and local needs, our offering can involve the supply of software only or a combination of hardware+software.

Our approach

Our approach comprises 7 phases.

1 **Defining scope.**
A team of experts works with the public authority to identify the specific needs of the city and define areas of intervention.

2 **Identifying positioning.**
The parties define the ideal and critical locations for the installation of cameras, and the use of tools for studying urban flows, such as City Analytics.

3 **Audit of current situation.**
Our software is compatible with a wide range of cameras. It is therefore essential to make an inventory of the assets already available in the area concerned, so as to maximize use of existing resources. It is also possible to arrange for the processing of data originating from the existing fleet of cameras, by means of gateways.

4 **Design proposal and technical/economic assessment.**
The proposal can also be integrated into a broader project financing solution linked with increasing the efficiency of the public lighting system, with a view to paying off the initial investment through the energy savings it generates.

5 **Installation and updating of cameras.**
Enel X's work is not confined to installing video cameras, it also updates them on a continuous basis.

6 **Staff training.**
Our offering includes training for the personnel assigned to manage the video analysis software.

7 **Maintenance and updating of assets and software.**
Automatic software updates and maintenance of the installed video cameras will also be provided on a regular basis.

Security and data processing

Any data collected by means of the video analysis service is processed in full compliance with the applicable laws on privacy and personal data security.
Furthermore, since the video is analyzed automatically by the Enel X software, there is no need to record and view the video streams unless otherwise directed by the public authority for security reasons. No video surveillance service therefore offers greater privacy for citizens than the one provided by these smart video analysis solutions.

One instrument, lots of potential

Video analysis maximizes the potential of a video camera.
The same infrastructure support can be used to activate a range of services relating to security, mobility and safeguarding artistic heritage.

Thanks to continuous software updates, furthermore, investing now prepares the city for the future, by equipping the urban habitat to meet new needs that cannot yet be foreseen.

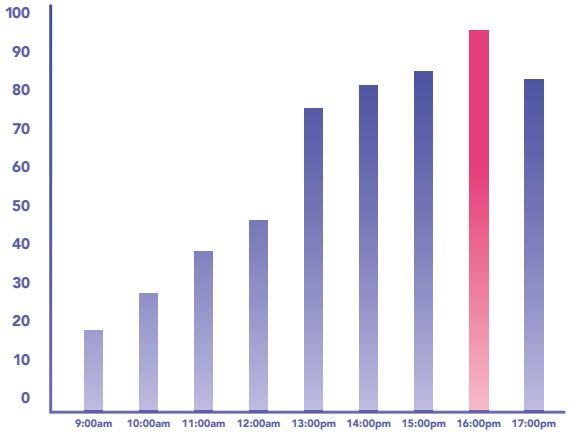
It's an investment that evolves in step with the city.

ROME E-PRIX

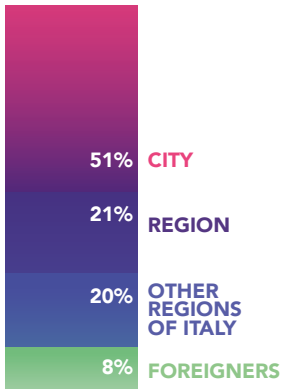
City Analytics provides a useful means of monitoring attendance at events and determining, for example, the origin of the spectators, so as to enable the public authorities to manage schedules more effectively by planning tourist and mobility services, security and public infrastructures.

City Analytics was applied during the E-Prix single-seater electric motor racing championship held in Rome on April 13th 2019, to study attendance and mobility flows connected with the event in the capital's EUR district.

Using geo-located data from different sources (such as mobile applications, ad servers, open data) it was possible to estimate:

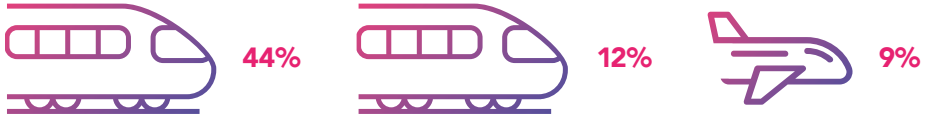


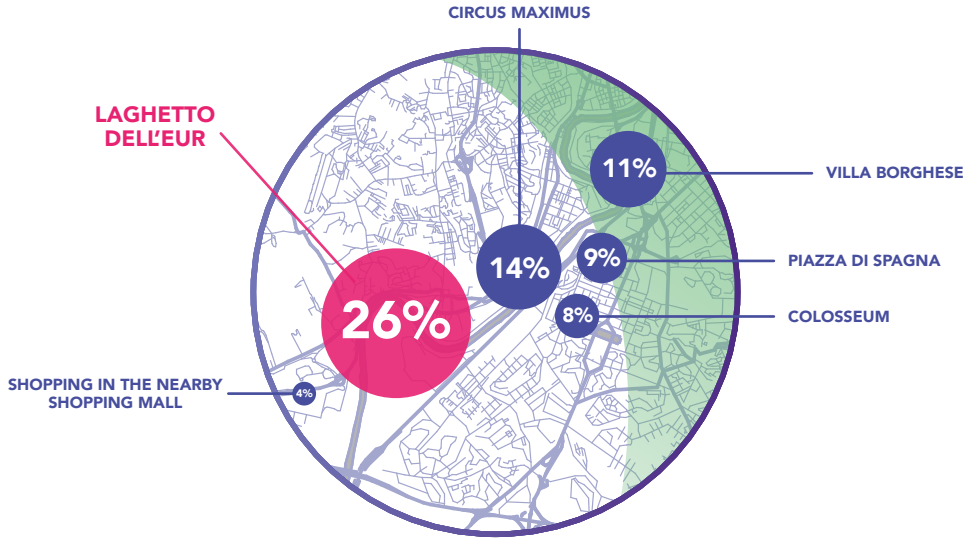
Attendee numbers and attendance peaks on an hourly basis.



The origin of the spectators.

The most widely used means of transport.





Other points of interest visited on that day.

Average accuracy 90%

Thanks to the reports provided by City Analytics, the next edition of the Rome E-Prix will be able to offer optimized transport and security services and attract more visitors and income for the city, as a result of more accurately targeted marketing and tourism support plans.

For further information visit the section dedicated to City on our website **www.enelx.com**