

THE PLATFORM AT THE HEART OF  
ENERGY INTELLIGENCE

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# Introduction



## Applying new technologies to energy performance

All of us can see a growing awareness on the part of companies and the state concerning environmental issues. The energy transition is accelerating. Organizations now integrate previously unreachable tools into their approach: automated data collection systems, cloud-based services, algorithmic intelligence, etc. These tools even overturn the roles and methods of historical actors in energy performance : integrators, publishers and consultants are forced to rethink their business models.

Our company started with a very simple statement: companies and local authorities do not have access to their energy data. And when they do, they do not have the tools to analyze and use this data. We propose a set of software and hardware services that enable these organizations to collect, analyze and exploit their energy data to reduce their consumption in a sustainable manner.

On the Energisme platform, the user will find a service for each of his challenges: automated contract management, application dedicated to boiler room monitoring, predictive modeling ... there are many possibilities. Ultimately, the organization has a scalable and intelligent energy management system. It pools and coordinates the skills of its employees for each energy project. It optimizes time, energy and budget.



# 2

## Understanding the needs

Identifying the needs of the client organization is the foundation on which we build each of our projects. Among these needs are those that the organization has already clearly identified and are being resolved, those that the organization has identified but for which it has yet to find an answer, and those that were not yet identified but will nevertheless be real and impacting on its strategy and its evolution. The scalability of our solution will make it possible to meet these different types of needs as they emerge in the organization.



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## Define the objectives

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A dedicated expert evaluates the progress of the client organization on its energy management and identifies ways to improve this management. Thanks to this first diagnosis, we are able to accompany the organization in the definition of his priorities, but also his medium and long term objectives. Then we jointly define a roadmap.

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## Value existing resources

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Once the objectives are set, we list exhaustively the tools and resources already present in the organization. Historical data, patrimonial or operational data, synoptic of installations, CTM, BEMS... are all elements that can be managed on our platform. This unified vision often gives the organization new perspectives on its energy management.

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## Collect the right data

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By centralizing the contractual, operational and sensor data on the Energisme platform, the customer can potentially monitor all his energy consumption on a single interface. But does he really need it? Too often, in organizations, sub-counters, probes and connected objects generate massive but unusable or even unnecessary data.

Our method is progressive: we first centralize the energy invoices and contracts data. This centralization gives the customer a first view of the division of the energy consumption of its sites. He then collects the data from his energy meters, which allows him to obtain a real-time visualisation. Then he eventually decides to deploy a complete sensor solution to be able to follow all its energy uses.

The initial diagnosis thus has two functions: it not only ensures a pooling of resources and skills present in the organization, but it allows a collection and counting strategy adapted to its objectives and its budget.

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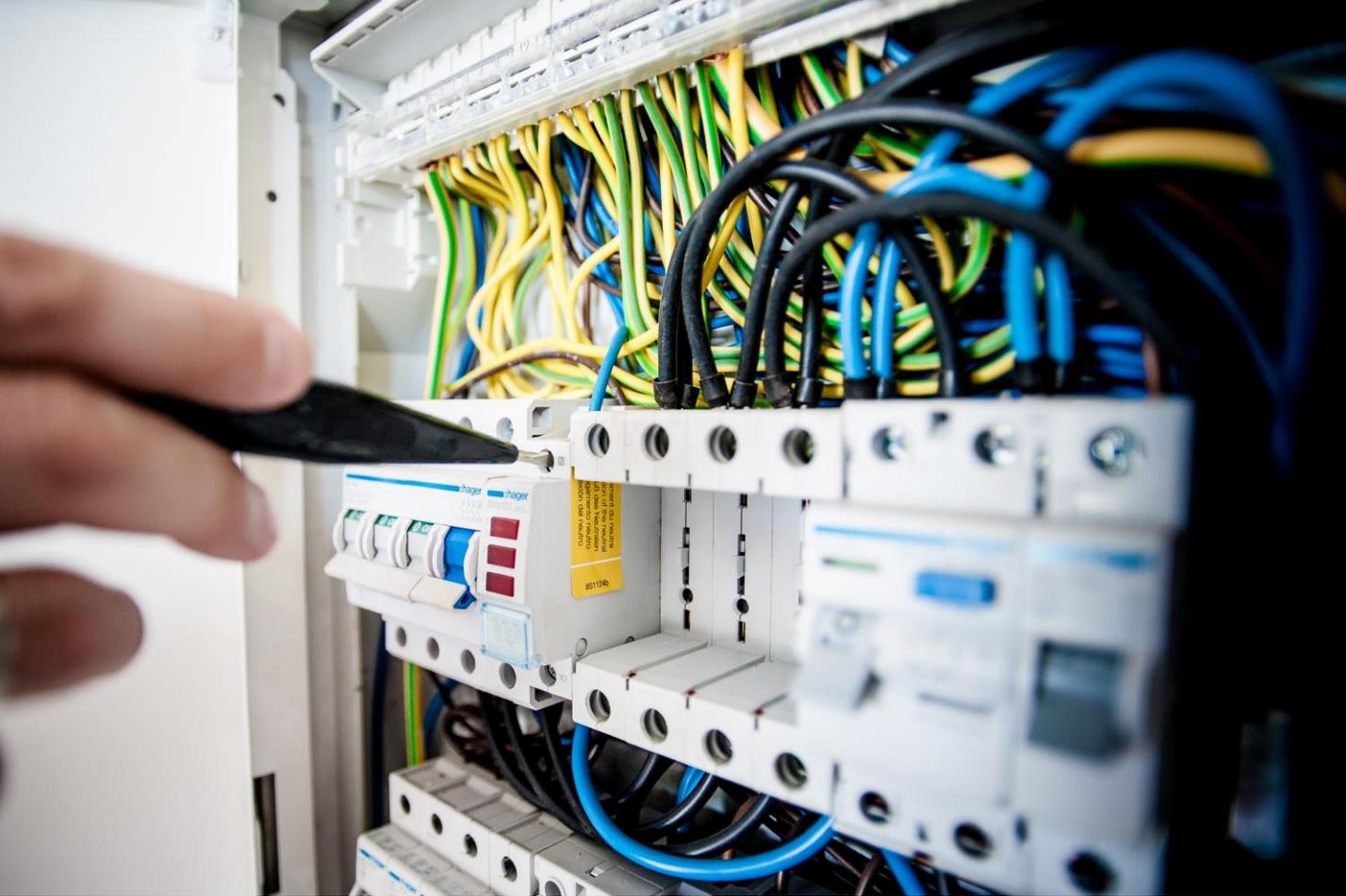
## A digital solution to save energy

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The Energisme platform integrates the expertise of new domains (IoT, IA, Cloud Computing ...) to propose cutting-edge energy performance tools. Whether it is collecting, viewing or analyzing its data, the organization will find a service adapted to its problem, its budget and the working environment of its employees. A new project to manage, and no corresponding application on the platform? We develop it jointly with the end-user, in record time.

In the long-term, the customer has built his own monitoring and energy performance improvement tool. It enriches and reorganizes this system as it evolves from its environment and the new projects he undertakes.





## Data Acquisition

# 3

Once the first audit has been carried out, the organization decides on the level of detail with which it wants to measure its consumption: building, factory, production unit, equipment ? The accuracy of the measurement is directly related to the accuracy of the organization's objectives. It can begin with simple data, then refine its collection, as it discovers new avenues of improvement. Does it lack data on a specific use? We can accompany it in his counting plan. From the simple centralization of its historical to the visualization in real time of its consumption of energy, the customer will find the adapted service.

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## Manual input and imports

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The first step in the deployment of an energy management system is the centralization of all the energy data of the organization on the same tool. Our platform aggregates historical consumptions already constituted (indexes, data heritage, operational ...) and connects them to the corresponding site. CSV, Xlm, source files, virtual IT-flows ... on the platform, all this information is now homogeneous and visualizable.

The user can also export data as reports. Quickly, the sites of the organization are geolocated on an interactive map, and the user can see at a glance the main consumption trends of his park.



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## Invoices and contracts

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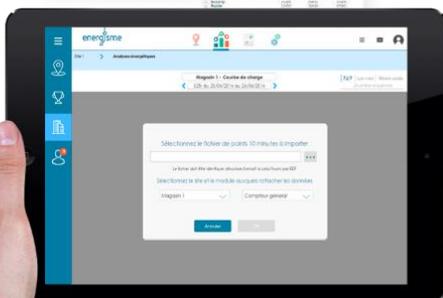
Energisme has developed several mechanisms to automate the input of information coming from invoices and energy contracts :

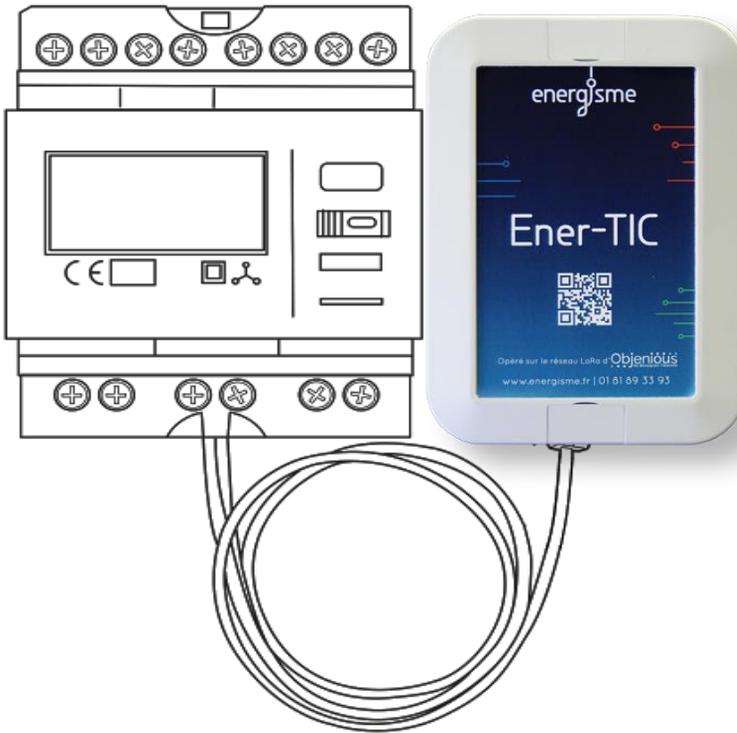
- Recognize the characters of invoices (in native PDF format): the invoice files can be deposited on the platform by simply "drag and drop". Our algorithm deals with extracting and aggregating information relevant to the energy management of the site.

- Extract the information from the web services of the energy suppliers: the customer informs the identifiers and passwords of the portals of his different energy suppliers and the algorithm directly requests source files (contracts, invoices) to extract billing data.

- Integrate supply IT flows: Some vendors can implement automated IT flows that feed your account with your billing data.

Energisme collaborates with them to extract information.





## Utility meters

Suppliers' energy meters (water, gas, electricity supply points) collect data that is only accessible by the electricity grid operators (Enedis, formerly ERDF) and is not supplied to the customer.

However, when this customer wants to take control of his energy consumption, he needs this information. It is therefore forced to opt for expensive and restrictive solutions: these are mainly "machine to machine" type measuring systems with which the costs of installation, connection to the mains and use accumulate.

Often without technical knowledge, he is completely dependent on the installer for the deployment of his collection system. It also has the ability to read the indexes manually. But if this method is conceivable for one or two buildings, it is hardly achievable for a property inventory.

## EnerTIC installation

- 1 Connecting the EnerTIC sensor to the RJ45 jack
- 2 Download the Enerdevice app on your mobile
- 3 Scan the QR code with the Enerdevice application
- 4 Validate the address of the site where the sensor is installed
- 5 Confirm sensor recording
- 6 7 days after the installation of the box, the EnerTIC services will take in charge the demands of the user

## EnerTIC

The EnerTIC is a sensor that professionals plug into their energy meters to track and reduce consumptions of their buildings.

Its installation is fast because it does not require technical knowledge. Once installed by the customer, it sends the energy data (quantity consumed, amount, period, power reached ...) in real time and continuously on the Energisme platform.

On this platform, in addition to valuing its consumption history, the manager can now follow its buildings in real time. Within a few days, he deployed a complete monitoring system for the energy consumption of its estate.

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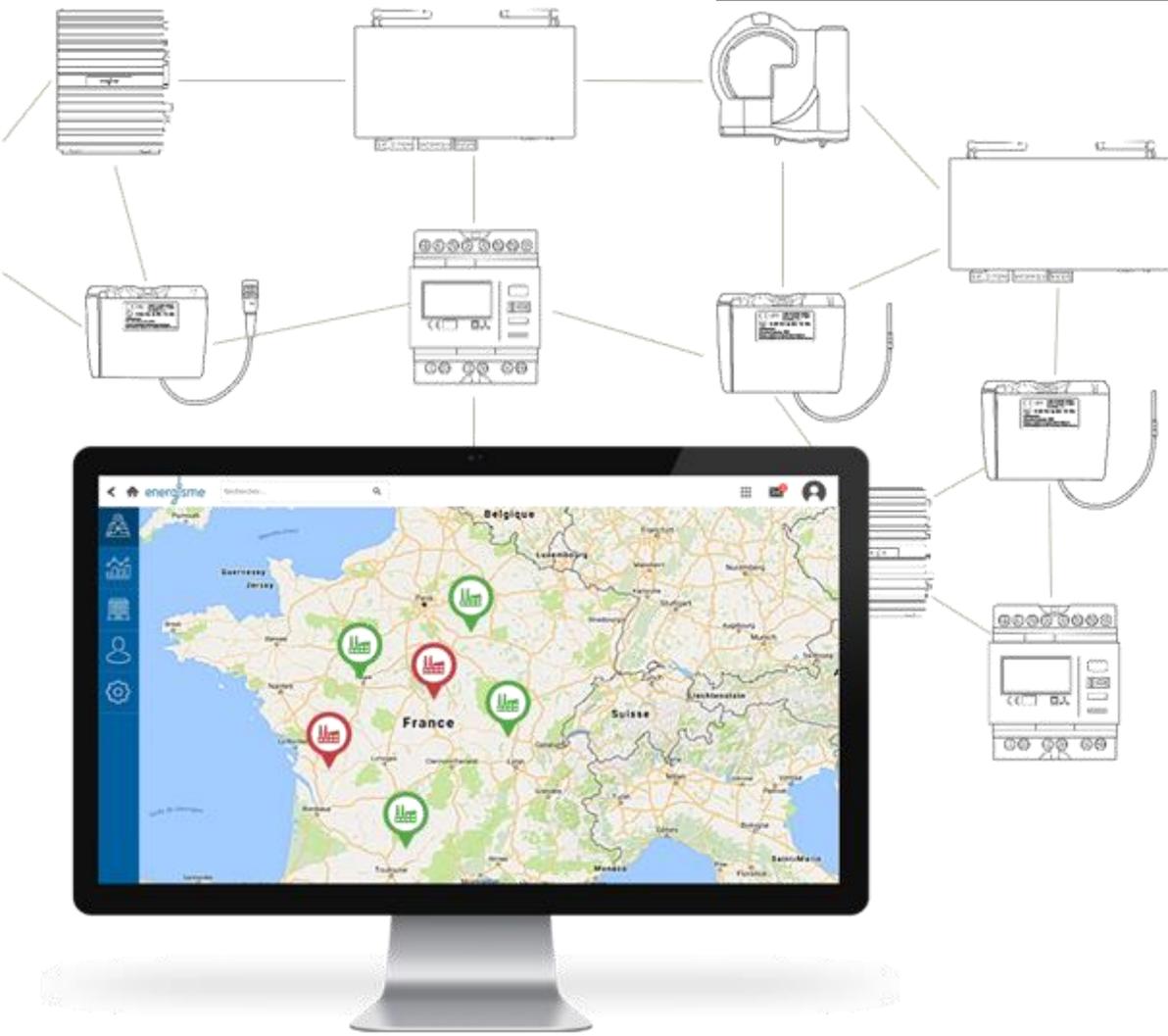
## Sub-meters, sensors and probes

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Sensors, probes, sub-meters... the customer can add more precision in his counting and weight his energy uses (heating, air conditioning, ventilation, steam, lighting, driving force ...), fluids (water, natural gas, compressed air, steam, etc.), energy consumption (electrical, thermal, refrigeration, etc.), but also measure the influencing factors (internal or external temperatures, air quality, presence, volume of manufacture, pressure, level of attendance, etc.).

### Technical Focus

For the communication of the sensors to the concentrators, we use radio or wired technologies (169 or 869 MHz). Our gateways transmit information either by using a SIM card (M2M 2/3/4 G) or via an internet connection available. Depending on the complexity of the needs, the typology of the installation to be realized, the field constraints, we choose one or several gateway solutions (Sigfox, LoRa, NB IoT).



## Monitoring BEMS, CTM, CAPM

Existing systems on customer sites sometimes offer a wealth of information on the energy use of buildings and processes. They provide key data on the consumption profile of a building. However, these systems are limited as part of a comprehensive and coherent multiple sites management. Indeed, their rigid design segregates the management of each building, and prevents any comparison of data between several buildings. To overcome this defect, the client has the possibility to interface GTC, GTB and PLCs with our platform. He will thus benefit from a centralized monitoring of its entire estate.

### Technical Focus : BEMS, CTM

When gathering data from existing building management systems, many informations will be available to the manager :

- Power supply
- Emergency power (generators, batteries)
- lighting
- The vertical flows
- Heating, Ventilation and Air Conditioning (HVAC)
- Plumbing (lifting pumps, tanks ...)
- Access control
- Video Surveillance
- Fire (alarms, extinction)

## M2M & PaaS

M2M networks are destined to take a growing place in organizations. From a set of rules pre-programmed by the user, they allow a partially automated management of infrastructures and installations. And as the processes get more automated, the user takes on a more important role of monitoring and analysis.

By centralizing the data of the different equipments on a single platform, it has operational data for a real-time optimization of the performance of its installations.



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## IoT & Low-Power Wide-Area Networks

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With the emergence of the Internet of Things, low-bandwidth networks are becoming increasingly important. It is these networks that make it possible today to collect continuous data in organizations : sites, infrastructures, processes, installations and these working environments can now be monitored continuously, at an affordable cost.

Thus, with the Energisme platform, the manager is not limited to the management of his energy. It also manages all its connected objects. On the platform, it can :

- configure and monitor its sensors / probes on the network of its choice (LoRa, Objenious, Activity, Orange or Sigfox)
- define a tree of its data points that integrates hierarchical relationships

- To enrich this tree with massive imports of Excel files
- consult the status of each monitored equipment, in two clicks
- be alerted to the status of a sensor.

Among the possibilities offered by these new networks are the real-time supervision of buildings, the triggering of alarms according to predefined conditions, the maintenance of the installations ... The applications are countless, and all lead to better business intelligence.

Once the organization has centralized all of its IoT management, it now has to synchronize the functioning of those objects with each other.

### LPWAN Focus

Low-flow networks are the future of energy data acquisition.

- Low energy consumption : the networks of connected objects are aimed at energy-efficient objects and sensors.

- Long range : low-bandwidth broadband networks correspond to free frequency bands (868 MHz). At this frequency, the range is several kilometers in the open field, at a low rate.

- Low cost : infrastructure costs are drastically reduced compared to operating a 2G / 3G / 4G network.

The use of low-flow networks gives our company a unique metering ability in the energy management market.



# 4

## Data Processing

Volume of data, variety of sources ... the more an organization moves forward in data collection, the more complex the processing and valorization of these data. And if the manager does not want to find himself very quickly with a "data cemetery", he must follow three very simple rules.

The first is the qualification of the data collected. That is, the ability for any user to identify the source and nature of the data he consults.

The second is reliability : we do not build a global strategy on shaky foundations. Timestamping, synchronization of sources on a single time step, data holes management and certification are all components of this reliability.

The third rule is the automation of the data acquisition and processing. This automation should allow the user to concentrate on tasks with higher added value than the manual indexing input or the management of multiple Excel tables ... logically, this rule depends on the first two, because one does not automate a process that has not been previously tested and proven.

These principles form the basis of each new project. Without them, the services added will form a sand castle destined to collapse.



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## A state-of-the-art information system

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Energisme is now the only player in the energy management market to use a NoSQL database managed with the Cassandra middleware. This configuration gives us virtually unlimited capabilities for processing, aggregating, and organizing customer data on the platform. This is why it is used by major groups like Microsoft, Facebook, Ebay or IBM: it is the optimal response to the problems posed by the generation of massive, unstructured data of different natures. If we want to understand what differentiates this basis from other existing tools, we must mention :

**The distribution of data** : the data of a node (designation for an instance of Cassandra) is automatically replicated to other nodes (different machines). Thus, if a node is out of service, the data present is available on other nodes. By calibrating the replication factor, one can change the number of nodes where data is replicated. Another instance of Cassandra is referred to as a cluster: it is a group of at least two nodes. Data centers, for their part, designate delocalized clusters. With Cassandra, replication can be done on different data centers. The individual points of failure are therefore non-existent and the nodes that have fallen can be replaced without unavailability of the service.

**The decentralized architecture** : in a cluster, all the nodes are equal. There is no notion of master, slave, or authority that would be responsible for overall management. This horizontal organization means that the processing of client operations (querying and immediate calculations) is distributed in real time between several data centers, guaranteeing low latency for the end user.

**The elasticity** : the base adapts in real time to the volume of data generated by the organization. It adds nodes in its clusters according to the load rate, without system downtime or interruption of applications. The size, structure and nature of the information are not important: their processing is distributed equally across several clusters. The volume of data increases? Clusters of servers can be added in a few clicks..



### The Data Model :

Cassandra's data model is based on a dynamic schema, with a column-oriented data model. This means that, unlike a relational database, it is not necessary to model all columns since a row potentially does not have the same set of columns. Columns and their metadata can be added by the application when necessary.

In fact, Cassandra's data model has been designed to address distributed data issues and is completely different from a traditional relational database model where data is stored in tables that are, in most cases, in relation to each other. Moreover, in a relational model, the data are generally standardized. In order to avoid redundancy.

Joins are made between tables on common keys to satisfy queries. In Cassandra, the keyspace is the data container of the application (much like a database or schema for a relational database). In these keyspaces are one or more column families (which correspond to relational database tables).

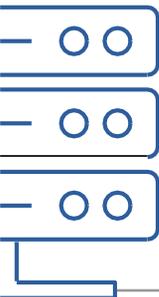
These column families contain columns and a set of related columns that are identified by a line key. Also, each row in a family of columns does not necessarily have the same columns as another row. Finally, Cassandra does not impose relations between the column families in the sense of relational database: there are no foreign keys and the joins between families of columns are not supported.

In short, each data family has its set of columns intended to be consulted together to satisfy application-specific queries.

Hai Tran, Technical and Innovation Director at Energime:

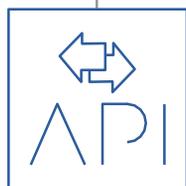
“ We put the agility and power of the cloud at the service of the energy performance of organizations. ”





## A MULTI-TENANTS CONFIGURATION

This database is easily partitionable, allowing us to adapt our software to the specific storage needs of the customer, but also to the needs of indirect customers or customers of indirect customers. A user wants to change the color of his interface? Change the business rules and formulas that dictate the return of its data? We give him access to a part of our own software, which he can customize to envy (but he will never have access to the source code of the platform). In the same way, the use of a NoSQL database under Cassandra will allow it to query its data with the criteria of its choice. The agility of this IT architecture enables us today to propose customized human-machine interfaces adapted to the user's working environment, whether it be a social landlord, a hospital director or a factory manager.

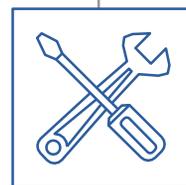


## AN OPEN ARCHITECTURE

Our platform is designed on an open model, ensuring complete interoperability with the customer's IT systems. During the initial configuration, it can integrate its operational data into its energy management interface, or add its energy management to the applications already used by its organization (CRM, ERP, accounting software). Depending on the expectations of its company and the existing applications, the client will also have the choice between a private cloud, public or hybrid.

## MAINTENANCE

On the platform, the user is not only limited to the management of his energy. He oversees its entire data collection and processing infrastructure in real time. It manages its systems of measurement with continuous analysis on the source of the data and the statutes of those sources. He detects and resolves equipment failures before they occur. This monitoring also prevents fraudulent operations ... in case of abnormal behavior, he will be immediately alerted. Until the end of its contract with Energisme, the customer benefits from a maintenance in operational conditions of all its infrastructure (sensors, servers, applications ...).



## SECURITY

### -Iso 27001 (certification in progress)

This standard sets out the different aspects of computer security in the organization. At the end of its implementation, the company benefits from an information security management system. Currently deployed across our infrastructure, this device minimizes the risk of incidents by creating evaluation indicators at each stage of the chain. These indicators will reduce the level of risk continuously, guaranteeing high standards of computer security.

### Premium Support

As a Gold partner of Microsoft, Energisme offers its customers maximum security on their cloud infrastructure. Microsoft protects this infrastructure, monitors the service for anomalies, and provides protection against denial-of-service attacks, as well as detection of fraud and abuse. The principles of this security are divided into three categories: the first is protection, which covers components such as identity, access and vulnerability management. The second is detection, which covers auditing, logging, monitoring and intrusion testing. The third category is the reaction: this covers the confinement of the breaches and the customer notification.

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## Quality

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### IPMVP : the international standard for energy efficiency

The IPMVP is a measurement and verification protocol. It allows an assessment of the energy-saving potential in terms of the cost to implement it. The final objective is to determine the return on investment of an energy improvement operation carried out on a site. Savings are determined by comparing measured consumption before and after a project, while making adjustments to account for changes in conditions.



Measurement and Verification activities include some or all of the following:

- Installation, calibration and maintenance of meters;
- Data collection and processing;
- Development of an acceptable calculation method and estimates;
- Performing calculations with measured data;
- Monitoring, quality assurance and verification of reports by a third party.

This protocol is already integrated in all the stages of our project management, from the data collection to the generation of useful and exploitable reports.

### ISO 9001 (Certification in progress)

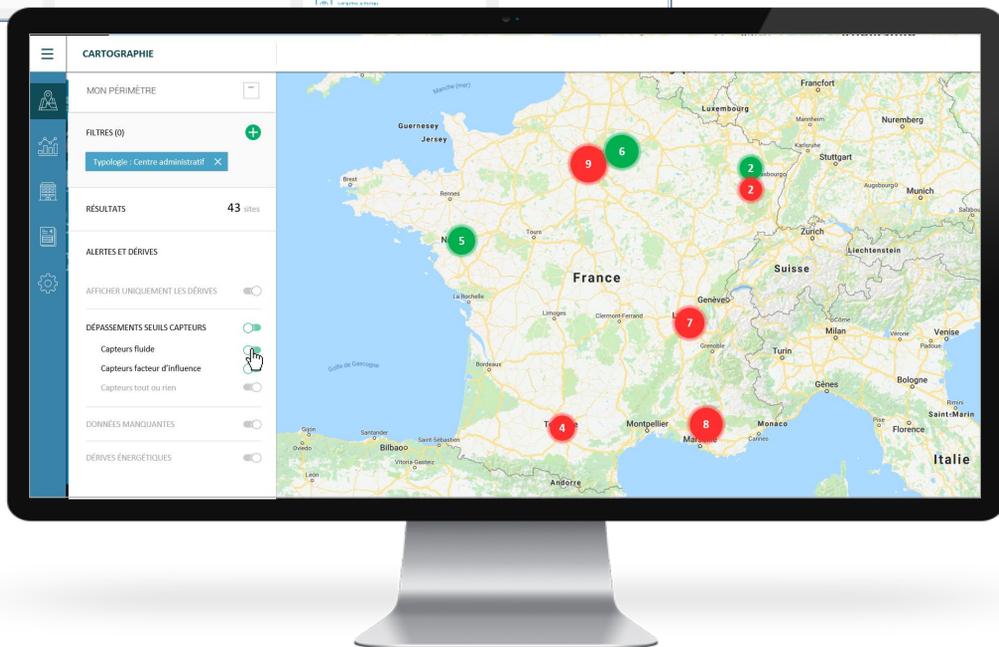
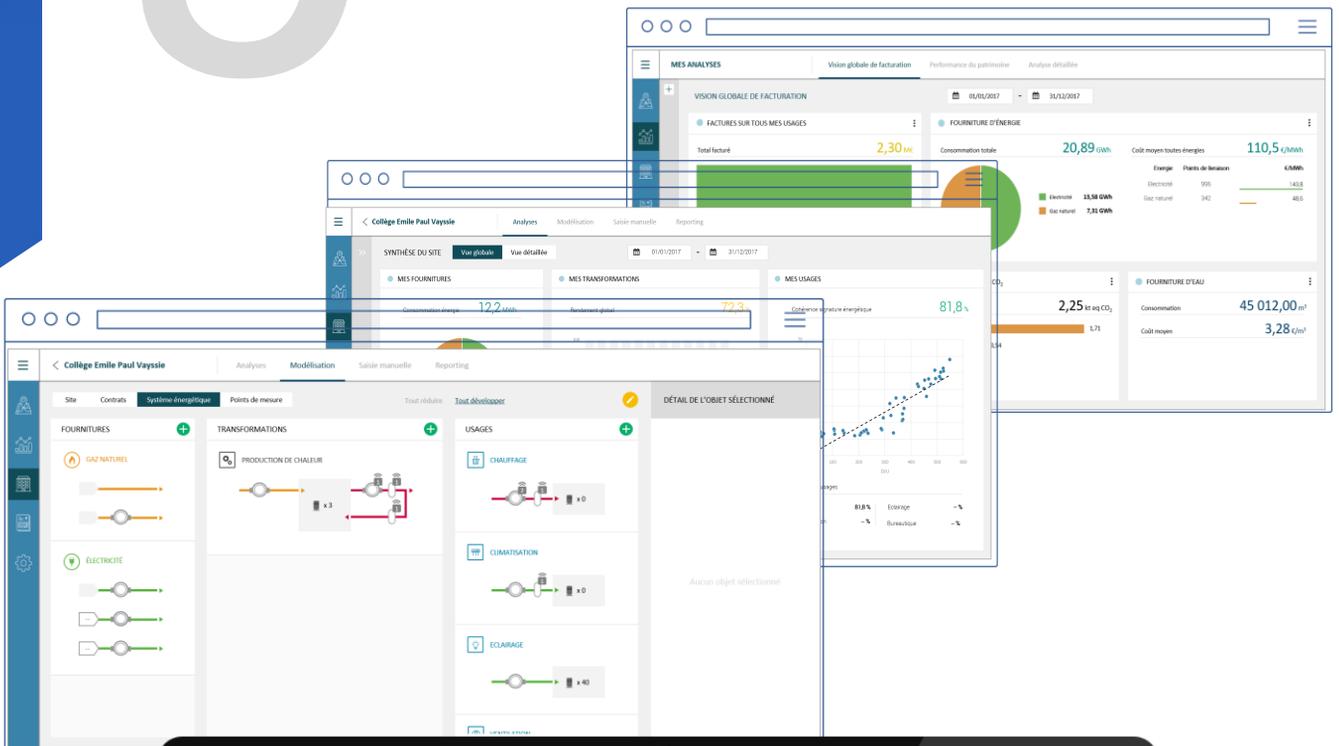
This standard defines the criteria for a management system in place to guarantee optimum quality of the service delivered to the customer. To be fully efficient, it requires unilateral commitment from management. It puts the customer at the center of the improvement process.

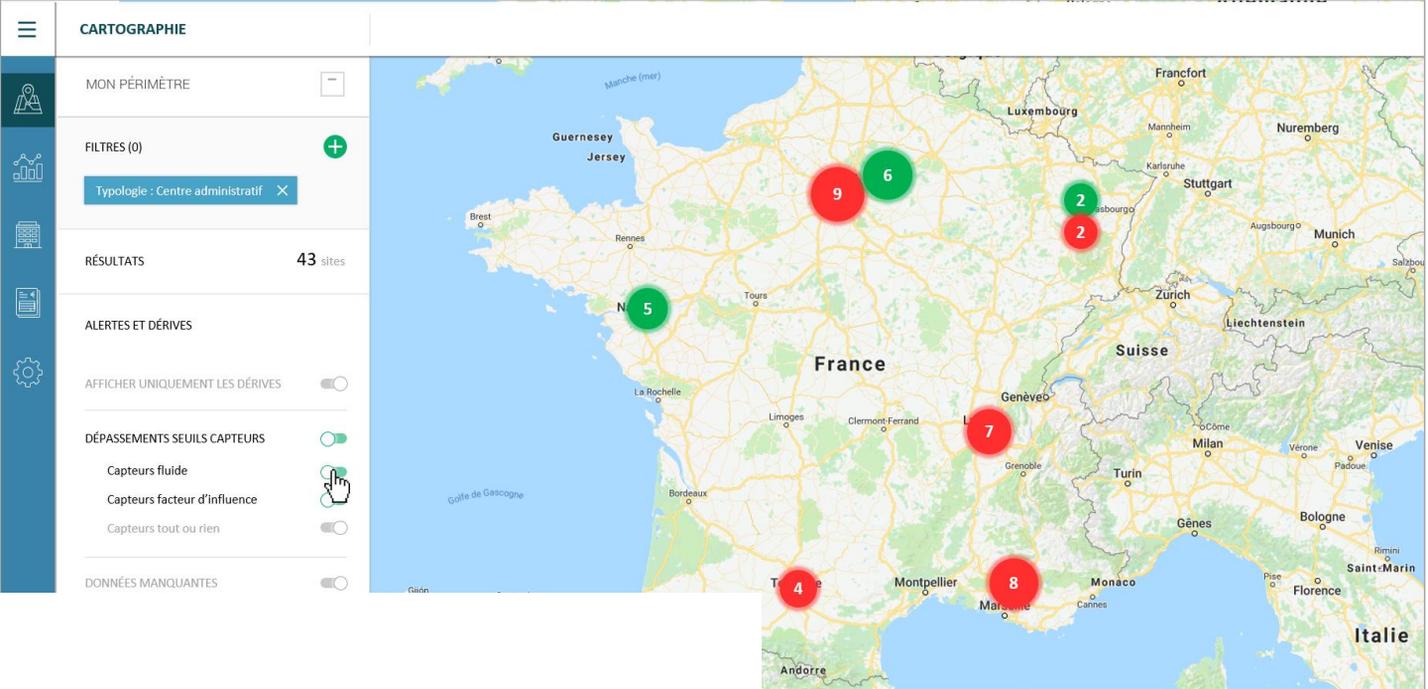


It also requires a careful approach to the organization's business processes. Far from being a decorative label, the Iso 9001 is integrated into every aspect of our business. It allows us to continuously improve our interactions with the customer, from the first commercial contact to after-sales service.

# 5

## Using energy data





## Dynamic Mapping

This feature allows you to access the geolocation of the sites on an interactive map. A list of icons is used depending on the type of site. The icon color can be modified according to the needs expressed.

In this mapping, the client will be able to appreciate a macro view of the different states of the sites via a change of colors of the icons as soon as alerts or anomalies of consumption will be observed.

## A collaborative tool

Energisme has the will to meet the requirements of all the stakeholders of its customers, namely purchasers, accountants, Energy Manager, directors, operators, ...

For end users (operators, tenants, ...), Energisme is able to create playful and didactic visuals. On one tool, all the stakeholders of the organization thus pool their skills to carry out the projects. The software environment, simple, user-friendly and ergonomic, allows each user to get an optimal grip.

The layout of the pages and the scale of the graphics are automatically managed by the software to adapt to the size of the screen.





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## Management of energy supply contracts

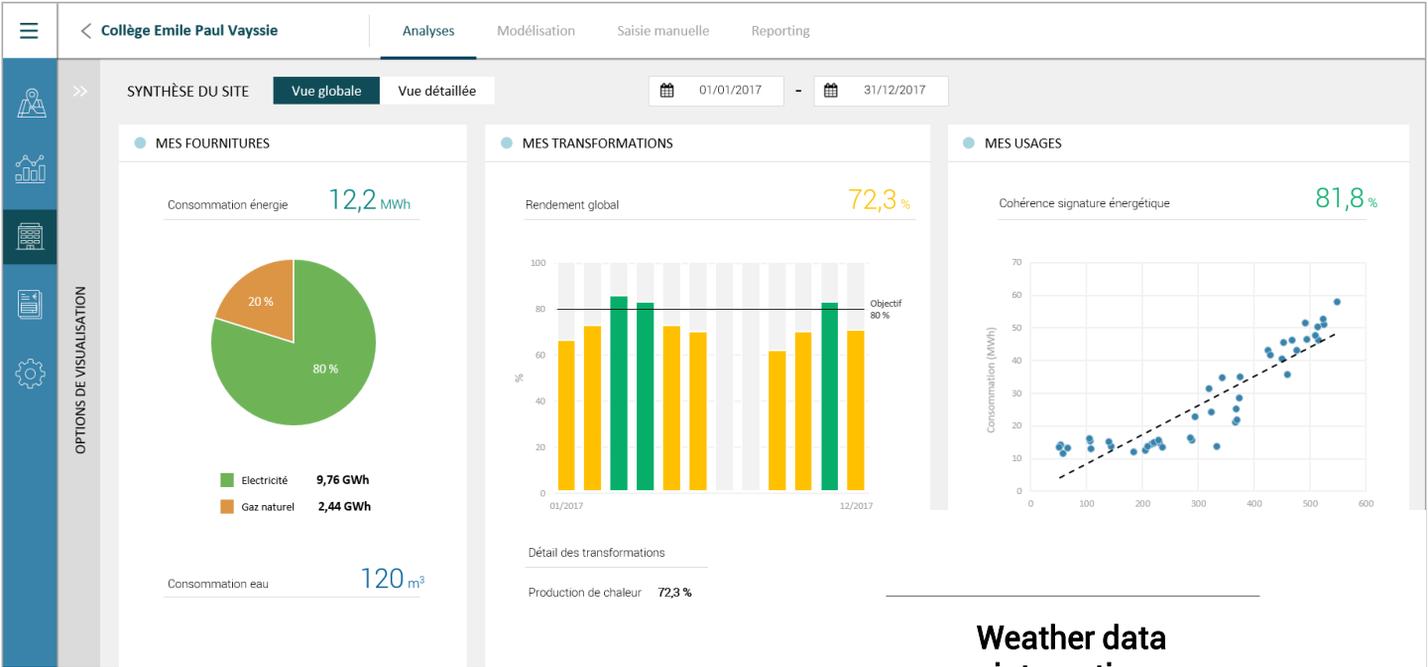
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Energisme offers simple or complex refunds according to the customer's needs in order to follow the suppliers contracts in time. For complex organizations, CSR reports are simplified because Energisme platform can consolidate consumption data and CO2 emissions over a given period of time.

The energy buyers then have global information according to the different suppliers or lots in their portfolio. It is therefore easier for them to compare and negotiate because they can see at a glance the financial sums and critical stakes. Having all the information on the invoices also reveals a quite different advantage, that of detecting drifting contracts.

Energisme has developed an algorithm that highlights contracts in default. The contract manager has only to focus on these, for a better optimization of his time. It will also have routing calculation tools (TURPE) to assess the savings due to an optimized power subscription.

An adjustment to the energy contract is the first step in achieving a tariff economy.



## Weather data integration

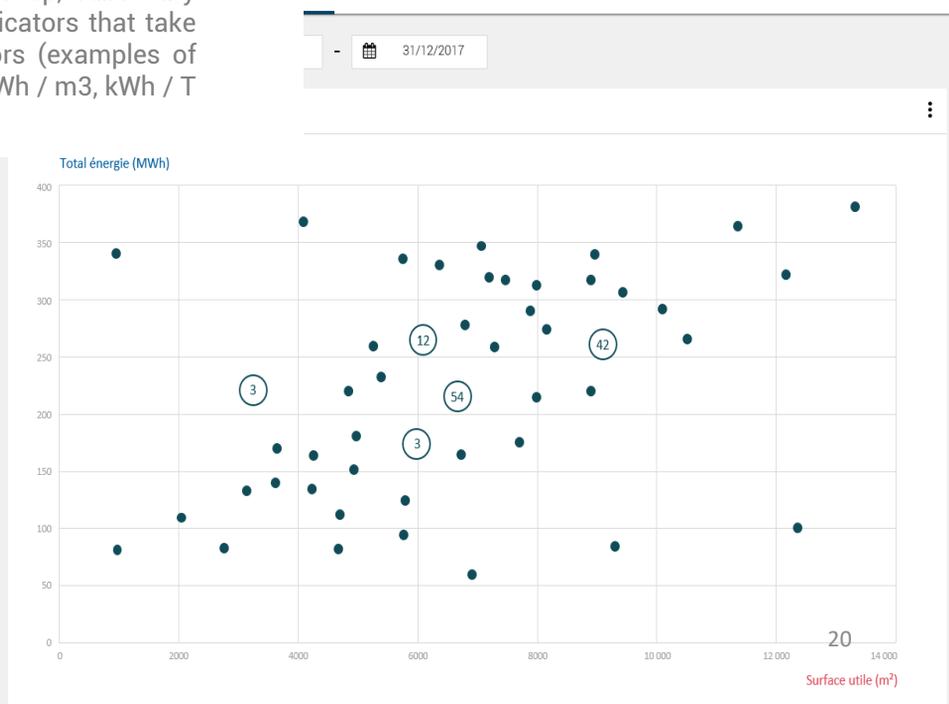
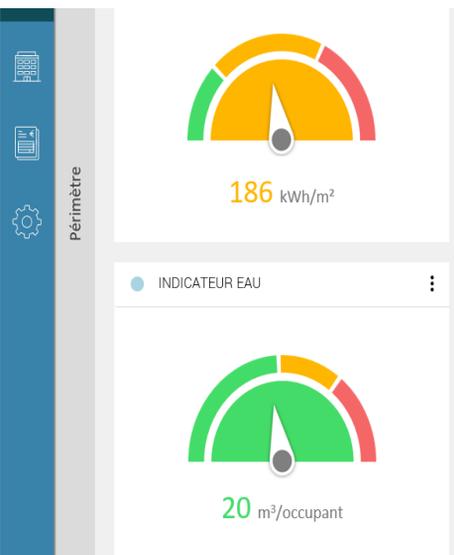
## Multiple sites benchmark

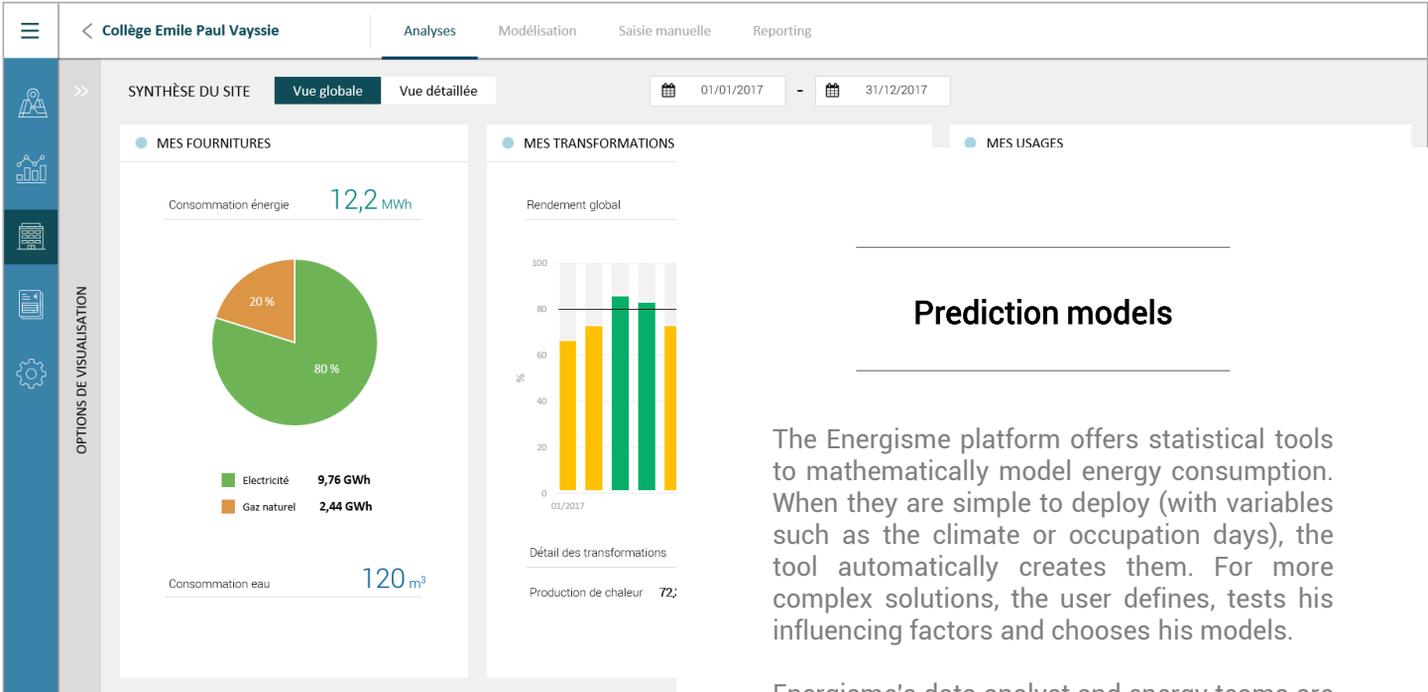
Once set, the tool generates benchmarks on all the sites or per group of sites. These allow to have a macro vision of the buildings very quickly and to point the sites presenting glaring discrepancies.

Energisme has developed a set of dashboards relevant for the analysis of multi-site data, depending on the fluid concerned and/or the season, with possible cross-checking between measured data and data collected via invoices. The platform offers the possibility to visualize and exploit information in the form of graphs, tables and visuals, by type of energy, energy use, site, group of sites, workshop, subsidiary .... It also monitors simple indicators that take into account influencing factors (examples of simple indicators: kWh / m<sup>2</sup>, kWh / m<sup>3</sup>, kWh / T ...).

The DJUs (Unified Day Degrees), commonly used by Energisme, are calculated by the COSTIC, a body recommended in the General Technical Clauses (CCTG) of Public Heating Operations Markets. Other data sources can be integrated depending on the requested functionality and specific constraints.

Energisme is also able to recover open source weather data at hourly intervals. This additional functionality makes it possible to have day degrees calculated day by day but also of degrees hours, which is a very interesting notion to integrate when modelling the heating needs.





## Prediction models

The Energisme platform offers statistical tools to mathematically model energy consumption. When they are simple to deploy (with variables such as the climate or occupation days), the tool automatically creates them. For more complex solutions, the user defines, tests his influencing factors and chooses his models.

Energisme's data analyst and energy teams are in a position to assist you and offer specific support. These analyzes are based on intelligent self-adaptive algorithms. They will assist you in calculating return on investments.

## Dashboards

The software interface allows the user to display multiple curves, graphs, pie charts, tables. Dashboards can be defined and parameterized. The visualisation is fully customizable and can :

- Display data in 10-minute time on daily, weekly, monthly, seasonal,
- Choose the time step and the type of display of the multi-fluid consumptions and the temperatures,
- To display a graphic or set of default charts.

- To display comment tooltips indicating the data when the cursor is hovering (timestamp, power, value, ...),
- To display full and hollow hours,
- To display in versus mode two graphs to allow a quick comparison between two sites or group of sites,
- Display multi-site and multi-fluid graphs,
- To organize benchmarks according to units of works,
- To appreciate complex recovery such as energy signatures.

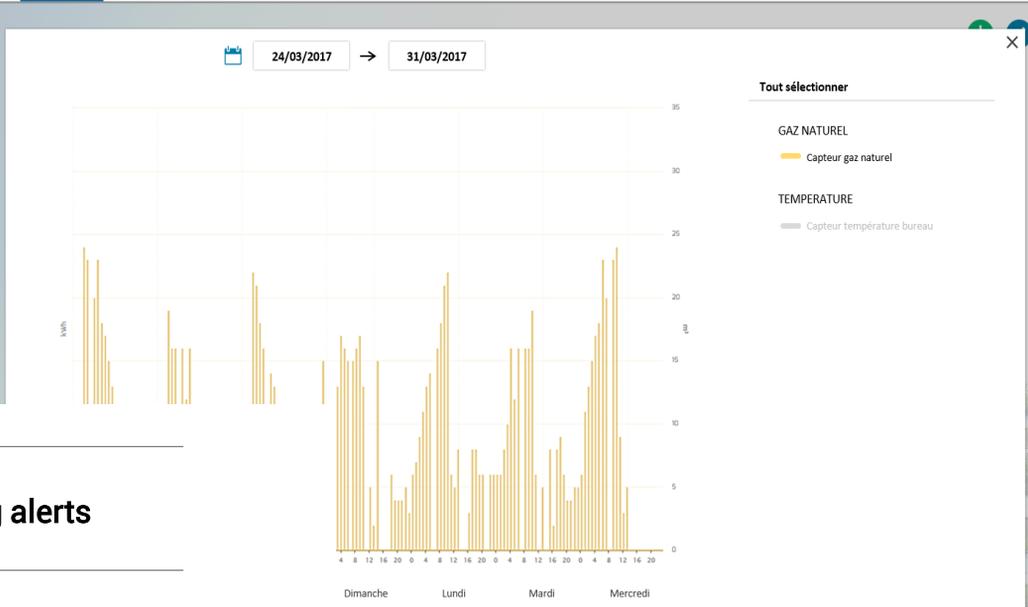
The energy expertise team will guide you towards the pre-parameterization of the ratios and indicators in order to achieve a tangible interpretation of the indicated consumption.

This analysis thus gives elements of decision support to the user enabling him to optimize his energy consumption either directly by interpreting the evolution of indexes as a function of time, or via the programmed ratios.



### Capteur gaz test

Numéro de série: TEST0001  
 Référent:   
 Type de capteur:  Réel  Virtuel  
 Marque:   
 Modèle:   
 Opérateur:   
 Compteur parent: Compteur gaz naturel  
 Mise en service:   
 Désinstallation:   
 Index de pose: 1 254 m³  
 Fluide: Gaz naturel  
 Unité: m³



## Drifting alerts

The Energisme platform offers you to set up operating alarms. These will be sent via e-mail or SMS to the designated internal or external contacts. All recorded events are archived and the history can be consulted.

- Three levels of alarms are implemented:
- Threshold violations, whether high or low, an alert is implemented at the crossing of a value,
  - Differences to a ratio, according to an energy label or an incentive contract,
  - Derivatives comparative to a predictive model (the desired sensitivity will be defined).

The alarm settings are accessible via a user-friendly and intuitive interface.

## Improvements actions follow-up

The energy consumption monitoring tool provides information on the efficiency of improvement actions. Each action is described and has implementation dates. It is then possible to quantify the savings generated by the action, relative to the reference situation. Thus, over the long term, it is possible to measure the benefits of one or more successive actions.

◀ Périmètre / Lot2 Site1 / PDL - 07247725

#### Information du point de livraison

IBAN : FR76 1670 7000 0111 1111 1111

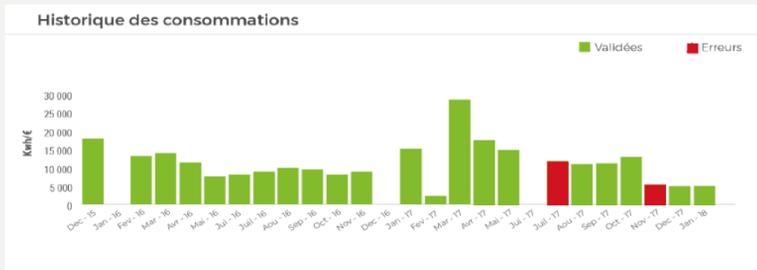
Numéro de point de livraison : 458965712596845  
 Numéro de contrat : SKI3UHG  
 Fournisseur actuel : EDF Prélèvement automatique  
 Date de début de contrat :  
 Titre : 5/10/2017  
 Energie : Electricité

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**Montant réalisé**

7 010 €

Préliminal 7 110 €



#### Commentaires

Justin Depegil | 14 juin 2017  
Objet : Demande de modifications de puissance de fournisseur

Alice Verneulle | 14 juin 2017  
Objet : Demande d'explications au fournisseur sur facture d'avril 20

Thomas Alix | 14 juin 2017  
Objet : Vérifier la facture d'avril

#### Abonnement

	Option tarifaire d'acheminement	Puissance souscrite (KVA)					Coût	Economie
		POINTE	HPP	HCH	HPE	HCE		
Actuelles	Moyenne utilisation	0	216	216	216	216	3 003	
Réalisée	Moyenne utilisation	0	45	45	20	20	2 200	
Proposée	Moyenne utilisation	0	54	54	54	54	5 240	2500

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## Reports Edition

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The Energism platform allows the editing of reports.

It automatically provides simple reports. When the needs are specific and unique for a given customer, Energisme is able to develop dedicated reports.

Reports can be customized for a user or group of users and can be automated. They are directly, searchable, printable and exportable in Word (.doc), (.PDF), (.csv) or (.xls) format depending on the user's access rights.

The reports produced by the Energisme software and enriched with more than 10 years of experience in the field have become indispensable tools to accompany a reduction of consumption and their carbon footprint.

The platform allows the automatic and periodic distribution of personalized reports (by email) to the various users (managers, operators, workshops, etc.) and to all hierarchical levels (via a distribution list).

The data returned follow the codifications and references defined by the customer. They include the possibility of establishing all sorts of balance sheets, classifications and correlations between consumption, indicators or units of work according to adjustable periods.

MES ANALYSES

Dashboard Mes rapports

Périmètre de sélection

Recherche rapide

Tout sélectionner

Filiale 1  
SEG gennevillers  
Site 1

Filiale 2  
Filiale 3  
Filiale 4  
Filiale 5

Édition du Rapport

Période de visualisation du rapport  
01/06/2014 → 01/09/2015

Paramètres de mise en page  
Arial 12

G I S A

Saisissez votre texte...

Modèle de graphiques

Modèles pré-enregistrés

Type de rapport :

Rapport de production journalié  
Détail de production journalié  
...

Générateur de Rapport

Titre  
Sous-Titre

commentaire / Légende

commentaire / Légende

commentaire / Légende

commentaire / Légende

Date de génération du rapport : JJ/MM/AAAA page 1

PDF XLSX

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## Data Services

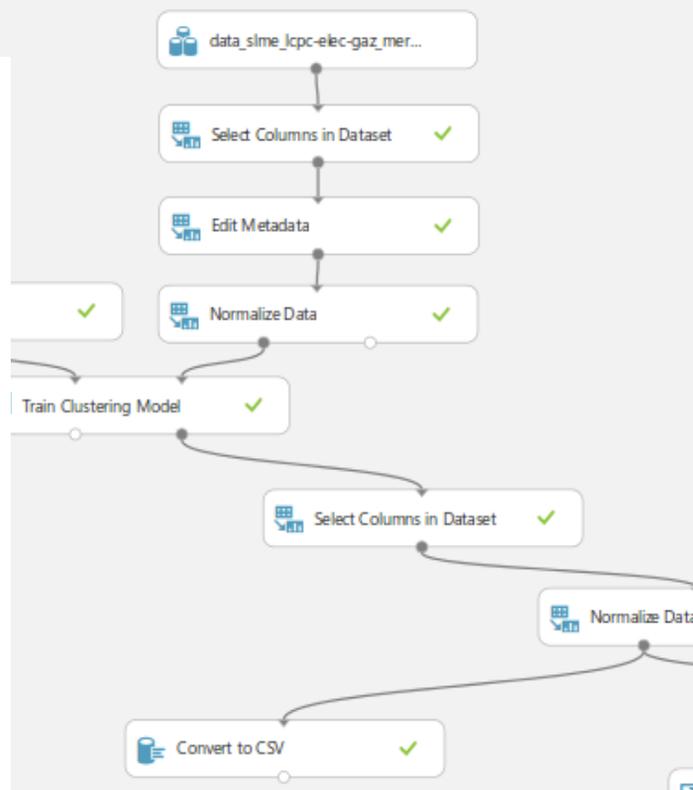
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As we have just seen, on the platform, the data collected by the client can be requested and can be exploited using a standard set of tools. The Data Services brick provides a library of algorithms for the exploration of energy data. Among these algorithms, we can quote the following examples:

- **Classification algorithms** that provide one or more discrete variables, depending on the other attributes of the dataset. These algorithms are used, for example, to classify a building below or above a reference consumption.

- **Regression algorithms**, integrating one or more continuous variables influenced by other attributes of the dataset. These algorithms make it possible, for example, to identify the level of correlation existing between an influence variable and the consumption level of a site.

- **Segmentation algorithms**, whose role is to distribute data in clusters of elements with similar properties. This type of algorithm can be very useful for classifying its sites or facilities according to their consumption profile.



- **Association algorithms** look for correlations between different attributes of a data set. They will be used, for example, to identify silent variables that have a significant impact on the total consumption of a building.
- **Sequence analysis algorithms**, which synthesize frequent sequences or episodes in data, as a series of events occurring in a log and preceding the maintenance of a machine. Once this type of series is identified as a recurring principle, it becomes easy to predict the next series of events.

On the platform, a tutorial guides the new user in choosing the correct algorithm. Existing models are not suited to its purpose? He can assemble a new algorithm from the bricks we put at his disposal.

Does the client organization already have a team dedicated to data mining? This team can launch its own analyzes with its algorithms. Or combine a library algorithm with its own code.

With this tool, data scientists take a leading role in the energy management strategy of the client organization.

# 6

## Microservices



## Invoices Application

In organizations, it is not uncommon for building managers to manage the consumption of their sites on an Excel spreadsheet. Creating and updating this table with the relevant data is repetitive and time-consuming... and the input time increases with the volume of documents. Not to mention the analysis: how can one exploit the data collected from several hundred bills of electricity, water, gas, coming from a dozen different buildings?

After subscribing to the Invoices Application, invoices and energy contracts hosted on the customer's various accounts (water, gas, electricity) are automatically sent to his account Energisme.

From there, the algorithms recognize the information fields of the documents in order to extract the pertinent data. These data can then be consulted by type of energy purchased, building type, period, energy provider ... The visualization options are almost unlimited.

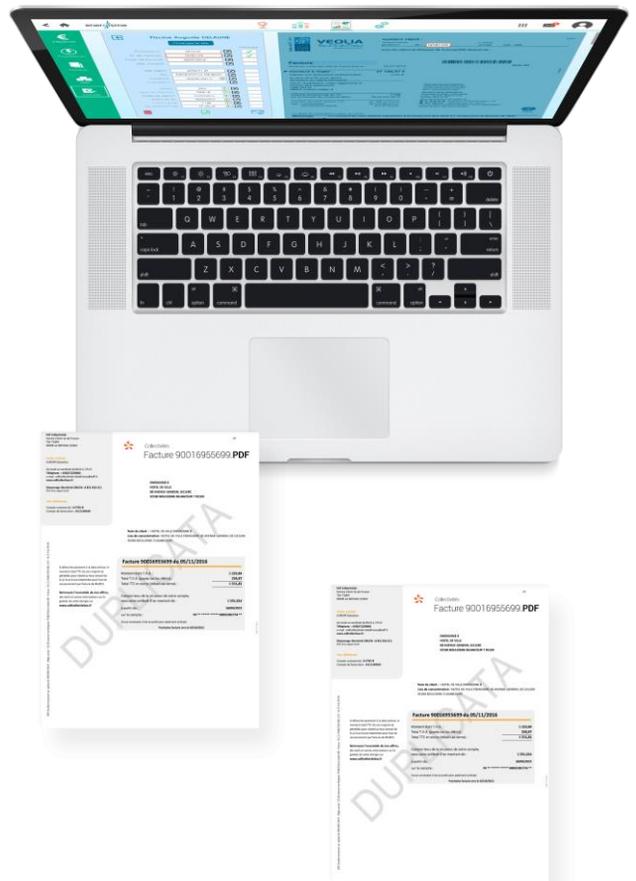
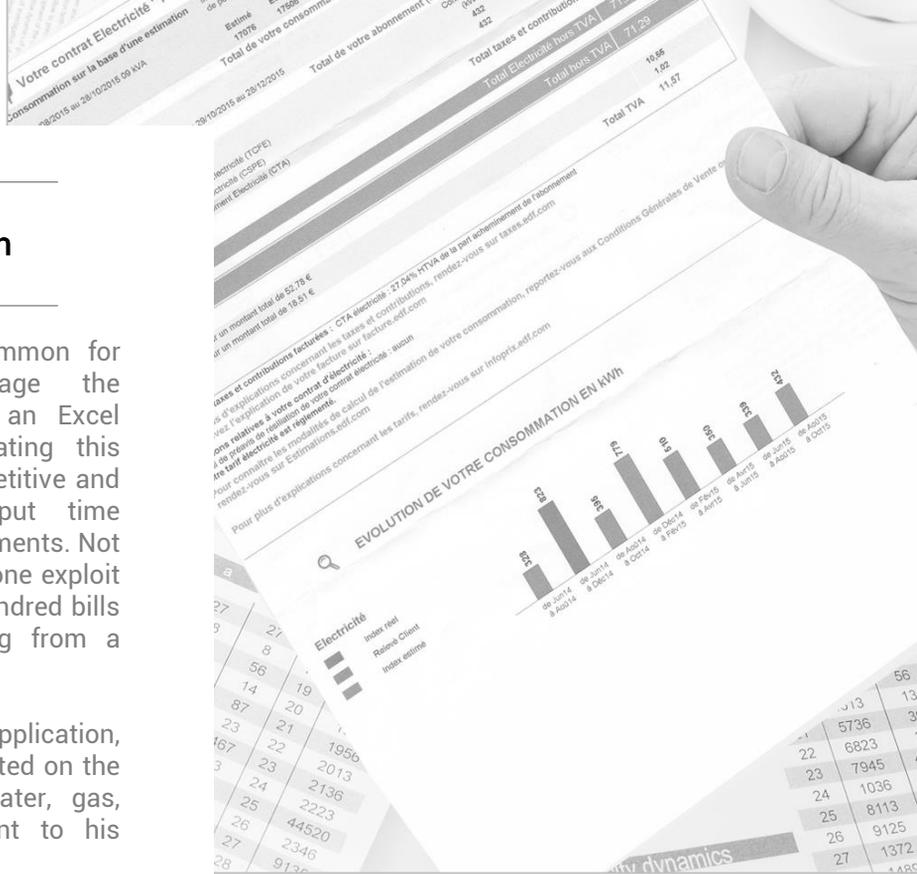
All the buildings are assembled on an interactive map. A problem on one of them? The customer receives a notification, and accesses the detail of the site in two clicks. But the platform does not stop with simple visualization: very quickly, the client knows the amounts that he spends for each use. It can define its intervention priorities, identify contractual anomalies and be automatically notified when a consumer item is drifting. It adjusts its contracts to its real energy needs, it optimizes its budget and optimally manages its calls for energy offers ... there are many possibilities.

### Bordeaux Metropolis

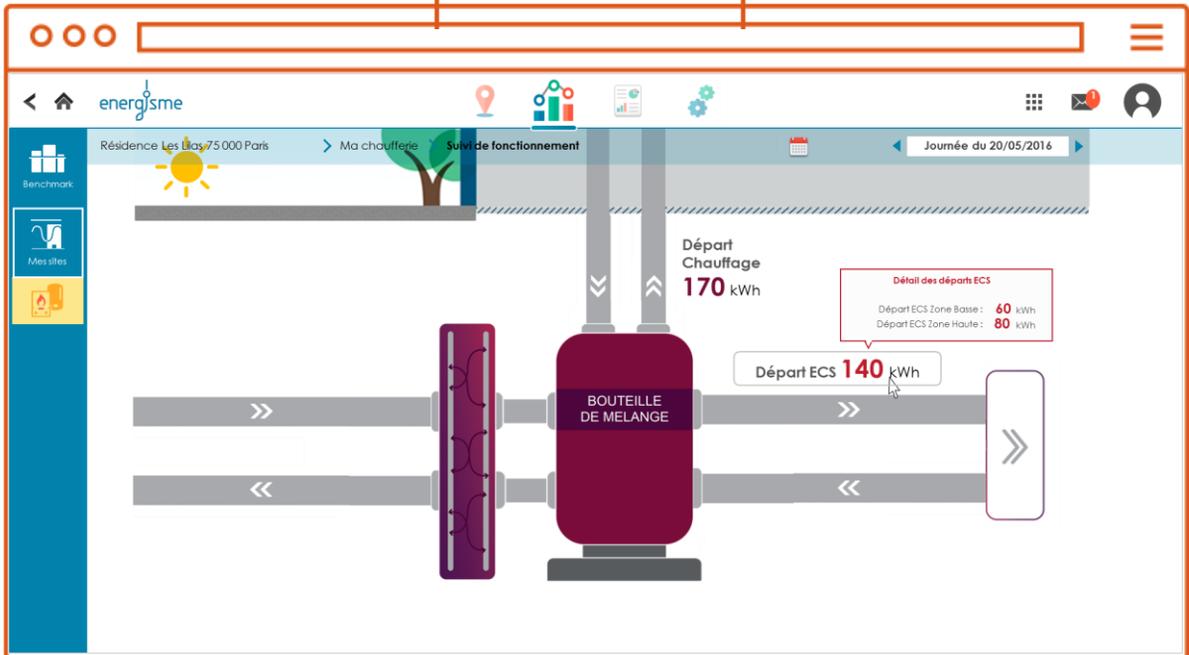
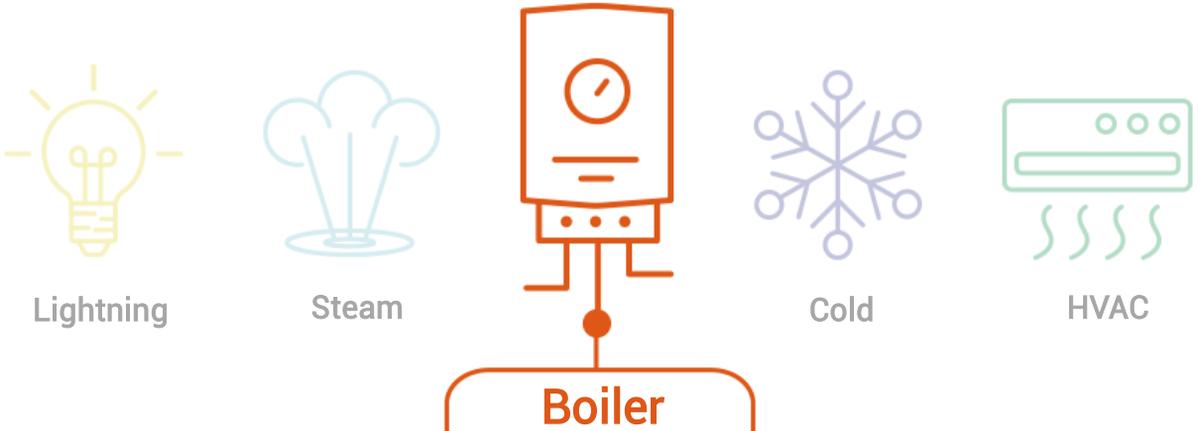
**Context** : +/- 1000 sites, 40 000 annual invoices, one team dedicated to energy management

**Result** : an immediate deployment, an automated energy contract management

**Objectives by the end of 2017** : deployment of multiple energies sensors on 100 sites



## Business applications



### Interview with Clément Metzger, Energy Efficiency Manager at Energisme

The Energy Efficiency Manager of Energisme talks with us about the «Boiler Application», an application that allows to monitor, analyze and understand the energy performance of the heat production systems of buildings.

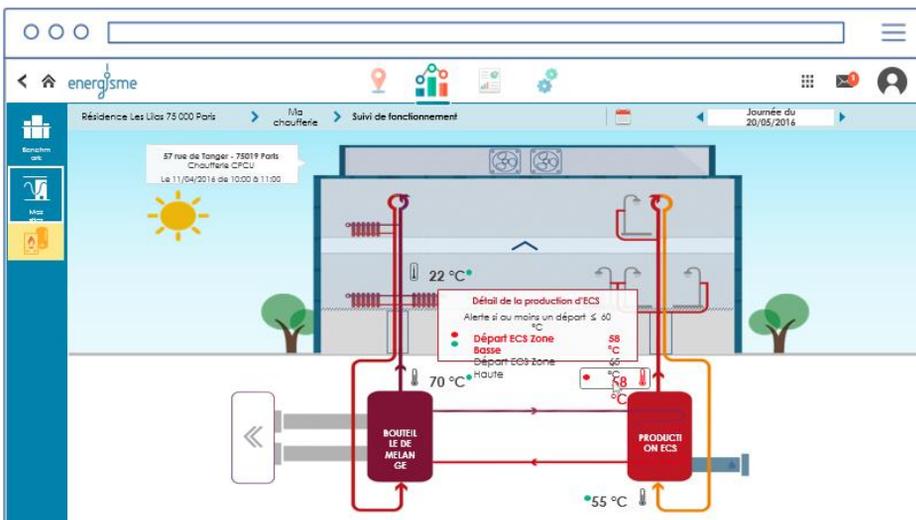
## Why create an application specifically for boiler rooms ?

Energisme has always developed its services based on a field survey. It is by interacting with stakeholders on concrete projects and issues that we get to know what they really need. The Boiler Application is therefore the result of a research and survey work with the actors of the building, the challenge being to bring a solution as complete as possible and which allows an almost immediate control by the whole actors.



## How does the deployment of this service take place at your client?

The first step is what we call in-house "pre-analysis". It is a first audit of the on-site equipment, the operation of the building, the data already collected by the customer and potentially exploitable ... it is to know the energy maturity of the manager. It is this maturity that will dictate the way forward : interfacing with existing equipment, counting plan to install new measuring equipment, training users ... the application will be able to adapt to different contexts. Whether the user simply wishes to centralize his existing data (consumption histories, equipment characteristics, etc.), to monitor the real-time performance of his instrumented boilers, or to use statistical models to evaluate the performance of an energy renovation, the application will allow it.



**Context** : 300 housing, 1000 tenants, 6 employees in charge of energy management.

**Result** : 2500€ in setup costs, 1000€ of monthly subscription, equivalent of 10000€ in energy savings on the first year.

**Long-term objectives** : 900 boilers to monitor in the Ile de France region, automated management of energy contracts

**Do you have any examples of the application functionalities ?**

One of the basic features is the tracking of consumption profiles. For example, the sensors we use will allow the user to visualize the production temperatures for heating or DHW heating. With this first tool, preventive maintenance is improved: anomalies are identified as soon as they occur. For example, regulations impose limit temperatures on the DHW network, and we provide adequate monitoring.

Comparing consumption profiles between different sites is a second approach. By setting up energy benchmarks, the user can prioritize his reflection. Rehabilitation actions will be based on actual energy performance. After having instrumented the inputs and outputs of boiler rooms, the application analyzes the performances and offers intelligent and adapted restitutions. Thus the owner can appreciate the rate of charge or the performance of his equipment over time. He will know the intensity of use of his boilers and will be able to resize the heating elements adequately if he decides to replace them. The energy signature will qualify the consumption according to the external parameters (temperature and m3 of DHW mainly).

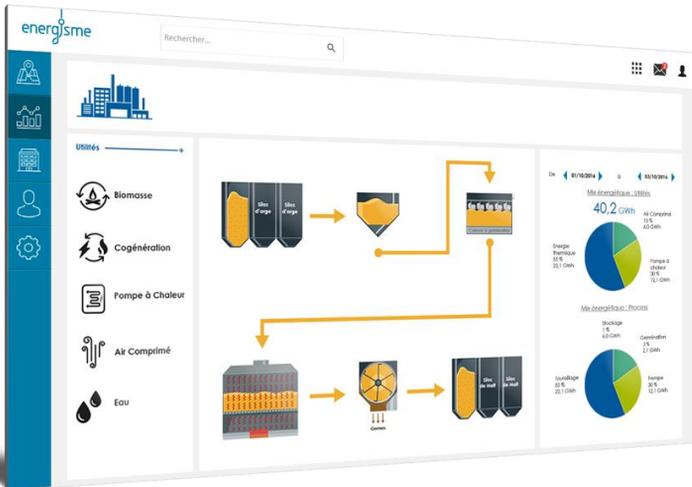
It is a very interesting tool to appreciate the good regulation but also and especially to quantify the energy savings generated by an action. When an external service provider makes performance commitments vis-à-vis the owner, for example 5% savings, it is necessary to have tools to validate them. Otherwise how can we ensure that the consumption has decreased thanks to the mandated company? Other events, independent of the service provided, can vary consumption: more responsible behavior on the part of tenants, decreasing attendance, renovations on the building ... In some cases, the efficiency of the service is widely overestimated by managers because they did not integrate these other variables into their model. And beneficiaries' interest in savings is not always well founded. With the energy signature, the owner thus knows the share of responsibility of the service provider in the reduction of consumption. He is even able to know what his boilers would have consumed if he had decided not to change anything. As part of an Energy Performance Contract, it has all the tools in hand to monitor, evaluate and judge the actions of the provider.



## Customized Application

In the chronology of the deployment of a solution to a client 'Grand Compte', we can distinguish two phases :

- **The initial configuration**, which requires agility: the initial specifications, the specificities of the user's working environment, the internal structure of the organization, the design of the interface in accordance with the charter Graphic of the customer (dashboards, reports, menu, etc ...) are all factors to take into account in the roadmap.
- **The industrialization**, which requires scalability: taking into account the computer architecture described above (see Part "Data processing"), the massification of the deployment is easy, regardless of the volume or nature of the data collected.



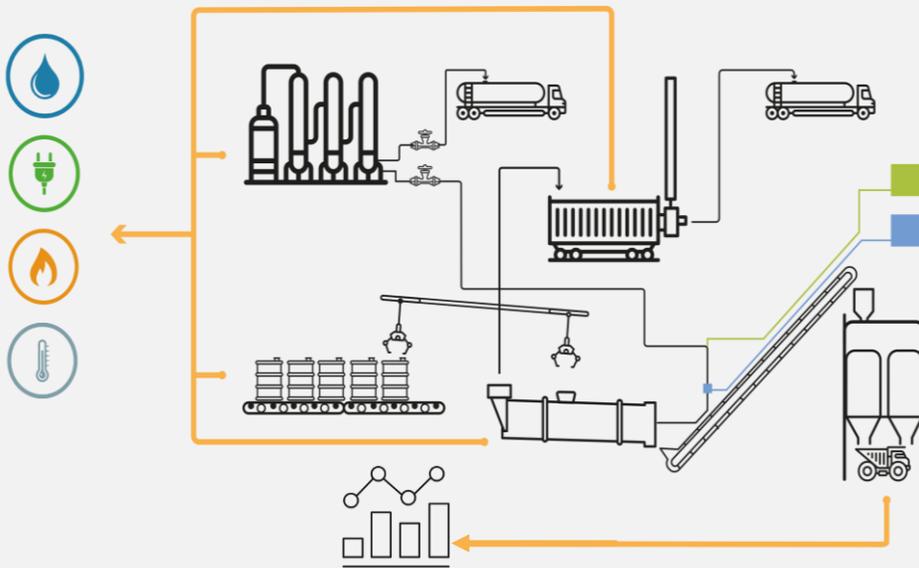
## Colas Group Application

**Objective :** Colas aimed to monitor the production and consumption of energy in its asphalt stations around the world. The group therefore needed a centralized energy management system integrated at all hierarchical levels of its organization. To meet this demand, Energisme has designed, developed and implemented a customized application, integrating monitoring and analysis tools that meet the specific needs of each employee in the organization.

**Results :** Today, in the Colas posts, postmasters have a consolidated production report. In case of abnormal temperature, they are alerted in real time. Regional managers can compare the consumption of their jobs and thus establish energy performance rankings that will allow them to prioritize their improvement actions. In addition, monthly reports are sent to management, which continuously monitors and improves the savings plans deployed at the sites of each subsidiary.

For the group, this application is both a competitive advantage and a tool to improve its environmental impact.





## Machine Learning as a Service

Thierry Chambon, CEO, Energisme :

“ We have standardized the application of Machine Learning on more than 100 Colas plants ”

In the Colas factories, the head of post has an end-of-day report on the number of tonnes of asphalt produced. This report provides a history of how the channel operates throughout the day, but is limited to a description of past events. The objective was to give Colas headmasters a real-time view of the level of production of their positions.

### Modeling variables

Energisme was already collecting a number of data on Colas' production environments: the electricity, gas, water and temperature consumptions of the substations were recorded in real time by an industrial PC. The next step was entrusted to our data-scientists team: they had to model the production of asphalt mix according to the data collected on the environment of the plant. In other words, by creating an algorithm that combines different data processing methods, and then by feeding this algorithm in real time with the data of a station, Colas would be able to deduce in real time the production level of this station.

### One algorithm, several uses

The algorithm used combines heuristic models and learning models (array of artificial neurons). Initially trained with one year of data (all end-of-day reports of one year), he was

then to be deployed on all the factories by adapting to the specific data of each environment. So

Deployed, this type of algorithms has many uses.

### Prediction

Once the correlation between consumption and final production is correlated, the user can predict his production based on future data ... but also predict his energy needs according to the expected production level!

### Error detection

This correlation also makes it possible to identify events that can not be detected by the human eye. Let us assume, for example, that the energy consumption of a process increases progressively over the months, all other things being equal. At first insignificant, this overconsumption can very quickly become impacting on the expenses of the company. The algorithm is therefore able to prevent and identify long-run drifts. Moreover, once the algorithm is deployed on several sites, a reference consumption is defined. This reference will evolve according to the data returned by each post, allowing an evolutionary benchmark of the Group's sites! A position does not fit the standards? The subsidiary manager is notified in the monthly report sent by the Colas application.

### Repairs

Once the predictive model has been tested, the user can implement predictive maintenance on his stations. The data collected by the sensors, coupled with the equipment history (frequency of maintenance, number of failures over the last 3 months) are analyzed by the system. If the user identifies a potential risk, the user will also receive a notification.



## Blockchain as a Service

Traditionally, when an organization wants to run a web application, it uses its own servers. It centralizes user data, but users do not have access to it:

- The organization operates the registration and validation of transactions taking place on its application
- The organization defines and updates the operating rules of the application
- The organization ensures the robustness of the system set up: if the main node it uses to host the application crashes, there is no more application.

With the blockchain, everything changes. This database, previously managed and updated by a central organization, is now hosted in all nodes of the network, at each user. A new transaction occurs between two users? This transaction is processed and validated by the network before being updated in each registry: all users then have a complete history of system transactions.

When blockchain technology is applied to energy, the impact is phenomenal.



## Lyon Confluence Project

During the last Microsoft Experience Days, Energisme presented its demonstrator of a blockchain applied to energy.

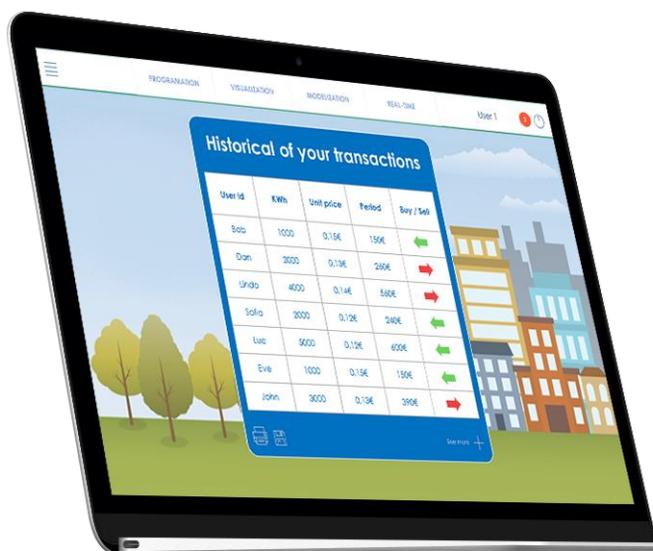
The objective of the project? Enabling energy self-sufficiency at the level of a neighborhood by bringing producers and consumers directly into contact. The energy produced by the photovoltaic panels placed on the roof of a building is redistributed to the occupants of the building.

An overflow of energy produced on a building? The blockchain is used to certify real-time redistribution to neighboring buildings.

Thus, a Smart Grid network supported by a blockchain ensures an optimal local relationship between production and consumption of renewable energy. In the long term, one can imagine a system in charge of the connection between buildings, neighborhoods, electric cars, storage facilities and businesses, where each consumer can become a producer.

**Olivier Sellès, Head of Innovation and Smart City of Bouygues Immobilier:**

“ We want to allow the inhabitants of an eco-neighborhood to benefit from certified local energy from the photovoltaic panels in the neighborhood. We hope to equip a building at the beginning of 2017 in Lyon and then in other eco-districts in France as soon as the pilot has demonstrated all his possibilities. ”



# 7

## Ecosystem



“ Our philosophy is to federate a dynamic ecosystem, at the crossroads of Big Data and energy. By pooling all the necessary skills, we structure and accompany the digital transformation of our customers.

Pierre VIDAL, Associate Director at Energisme

”



## References





## IT Partners





## One Team. Several expertises.

The Energisme platform is the result of a research and survey work carried out among the building actors, the challenge being to provide a solution as complete as possible and which allows an almost immediate control by all the actors of the building. This is made possible by the joint work of energy efficiency experts, user experience designers and data-scientists. Their different expertise complement each other and allow the design of a relevant, simple and scalable tool.

### Energy Management



### IoT

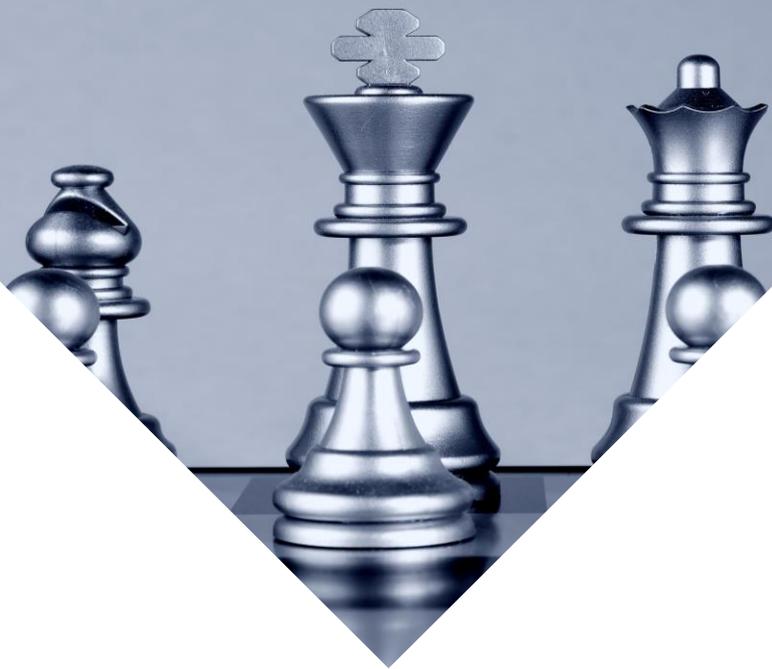


### Informatic Development



### Data Science





## Scientific Committee

“ This committee aims to anchor Energisme in disruptive innovation and to forge links with research laboratories. ”

Thierry CHAMBON, CEO of Energisme

**Marc BUI**

EPHE

Head of Human and Artificial Cognition Laboratory

**Andrea MASINI**

HEC Paris

Managing director of MBA – Energy Speciality

**David MENGA**

EDF Lab

Research Engineer

**François STEPHAN**

IRT SystemX

Deputy General-Director for International Development

**Etienne GAUDIN**

Bouygues

Head of Innovation

**Thierry BRAINE-BONNAIRE**

MECD (Venture of four institutes dedicated to building issues)

President



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