

## **ENERGY SAVINGS**

### **a) BMS (Buildings Management System)**

In 2019 the EUI succeeded in performing the missing tests on Villa Salviati main building's systems, in order to properly use and manage it.

The above-mentioned tests showed that a number of components were missing and some features could not be implemented until the completion of the hardware.

The REFS even asked for an economical offer to close the loop and make the system work as foreseen in the original design: the total amount needed is € 19.000.

Given the low impact on users of the unimplemented part of the system and due to the current financial constraints, for the moment REFS does not consider this expenditure as a priority.

In 2019 the REFS managed to launch a pilot project for installing WiFi environmental conditions sensors. Currently 9 sensors are in place in the Badia meeting rooms and, without any wiring connection, they allow to monitor:

- Natural light level;
- People's presence;
- Temperature;
- Humidity RH;
- Smoke detection;

They also regulate the temperature in 9 rooms considered critical from this point of view.

We do hope that this new self-developed technology could be more widespread in the next future at the EUI.

### **b) Utilities Consumption**

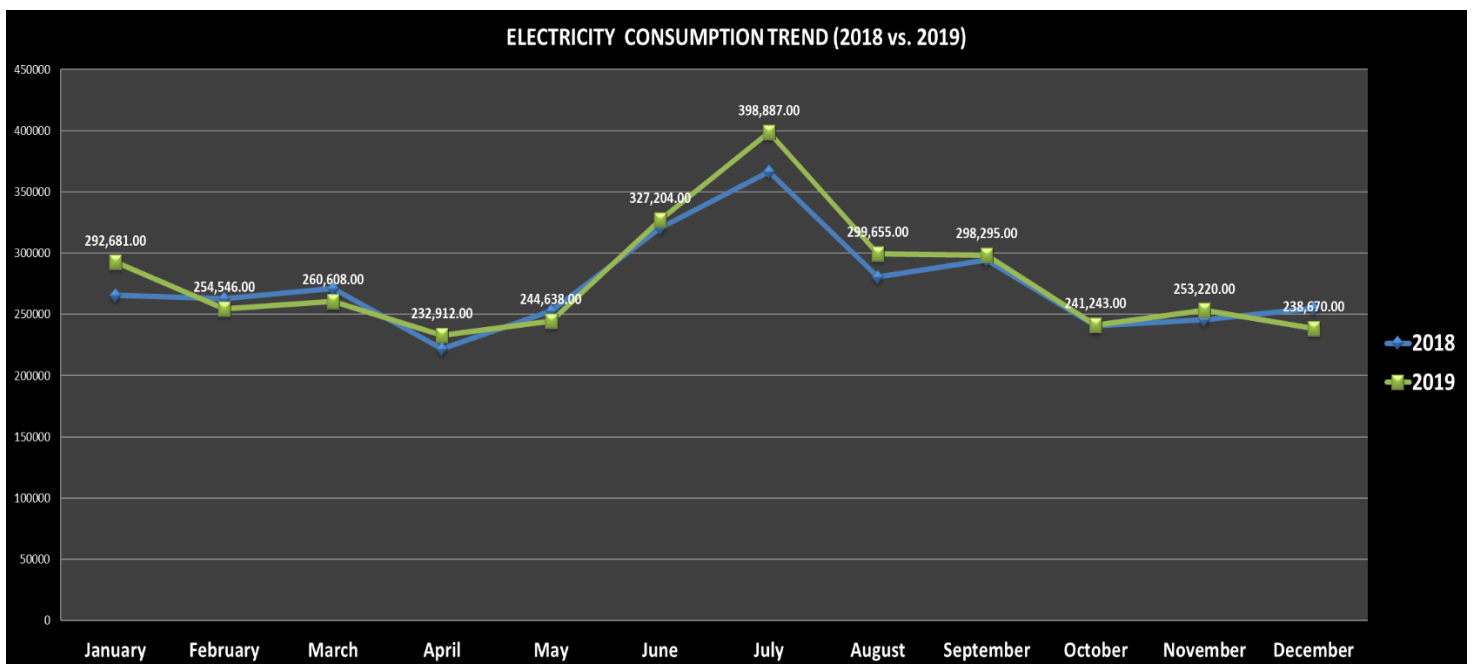
Over the course of 2019 the overall electrical consumption in the EUI premises (including EUI residences at PAB and PDM) resulted in a total of 3.342.559 Kwh\*, which, compared to the official data for 2018 (3.278.338 Kwh)\*, shows an increase of **1,96%** in absolute terms: the unsatisfactory performance and the relevant causes (the objective was to reduce consumption by 1 to 3%) have already been illustrated and assessed in the Action Plan Completion section (see p. 62), although some additional clarifications should be considered.

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Opposite to what happened last year (reduction of aggregate consumption vs. increase in expenditure) the budgetary balance highlighted a decrease of approx. 1.12%: as already explained in the 2018 AAR the existing contract does not provide for a fixed price but for a fixed spread on the monthly price for energy established by the Authority (PUN), which in 2019 registered an average of -14.66%\*\* on annual basis (52.32 €/Mwh vs 61.31 €/Mwh).

(\*data source: EDISON monthly invoices Jan-Dec 2018-2019, available for consultation at S:\Filing Plan\LO.01 Infrastructure and maintenance\01 Maintenance\Utilities\ENERGIA ELETTRICA)

(\*\*data source: <http://www.mercatoelettrico.org/It/Statistiche/ME/DatiSintesi.aspx>)



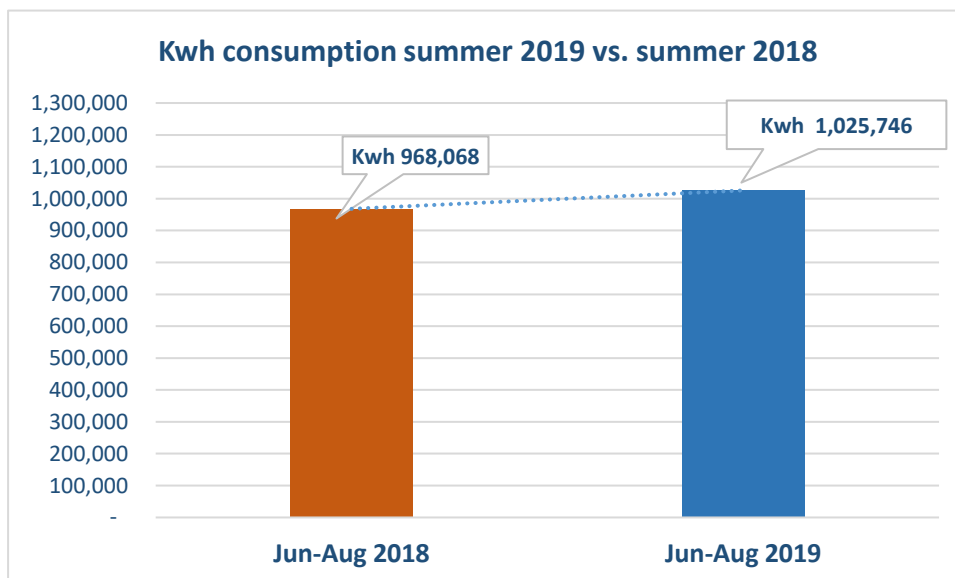
The chart above puts in evidence, as already explained at pp. 62-64, that the aggregate electricity consumption in 2019 (green line) decreased or almost matched the previous years' result in every month compared to 2018 (blue line) with the outstanding exception of the months of January (+10.24%) and the summer trimester June-July-August (+ 5.85%).

Contributing factors to the consumption increase need to be also identified in:

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- 1) the extensive use of electric heaters at the HAEU in January to cope with a major breakdown of the central heating system which lasted for weeks (and in fact the January performance is mainly attributable to the HAEU power supply, almost doubled compared with 2018: 13172.80 Kwh vs 6977.7, + 88.78% !)
- 2) The new lighting system in Villa Salviati after the completion of the new car park (VSA overall consumption amounts to 821768 Kwh in 2019 compared to 785821.20 in 2018, +4.57%).

The summer trimester (JUN-AUG), as already mentioned above, shows an increased consumption of +5.85% (see chart below):



According to climate statistics for the geographical area of Florence and its surroundings<sup>2</sup>, during the summer period (Jun-Aug 2019) average temperatures were approx. 3.72% above the average temperatures registered during the same period in 2018 (25,96°C vs. 25,03°C – almost 1° higher), which would have determined the need for a decidedly increased energy consumption.

We need to take into consideration that a reduction of 1°C for temperatures in offices/buildings implies a corresponding increase in energy consumption of about 10%: in fact, in order to keep interior temperatures compliant with the standard set in the EUI heating and cooling policy, with external temperatures ( $t^{\circ}\text{ext}$ ) higher than 35°C air conditioning units must improve their efficiency according to the following formula:

$$t^{\circ}\text{int} \leq \frac{1}{2} t^{\circ}\text{ext} + 11.5^{\circ}\text{C}$$

Which means that they need a higher amount of energy supply to refrigerate the environment (as already indicated, + 10% for 1°C).

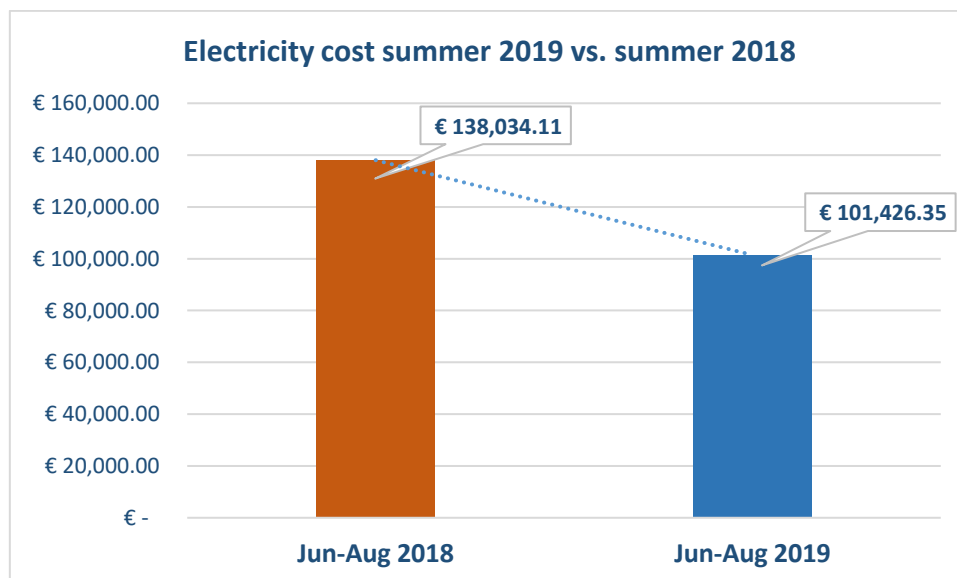
The increase of 5,85% is therefore to be considered a satisfactory result, as, according to what explained above, we could have expected an indicator well beyond that value: the need for higher electricity consumption was in fact balanced by the following factors:

1. Correct functionality of the automated control system (BMS, see page 84), ensuring that cooling was provided to the standard required (as indicated in the EUI heating and cooling policy) but only at the times required and only in the areas of the building where it was actually necessary;
2. Attentive regulation of heating units' clocks within the Campus;
3. Increased awareness of our community users on energy saving practices.

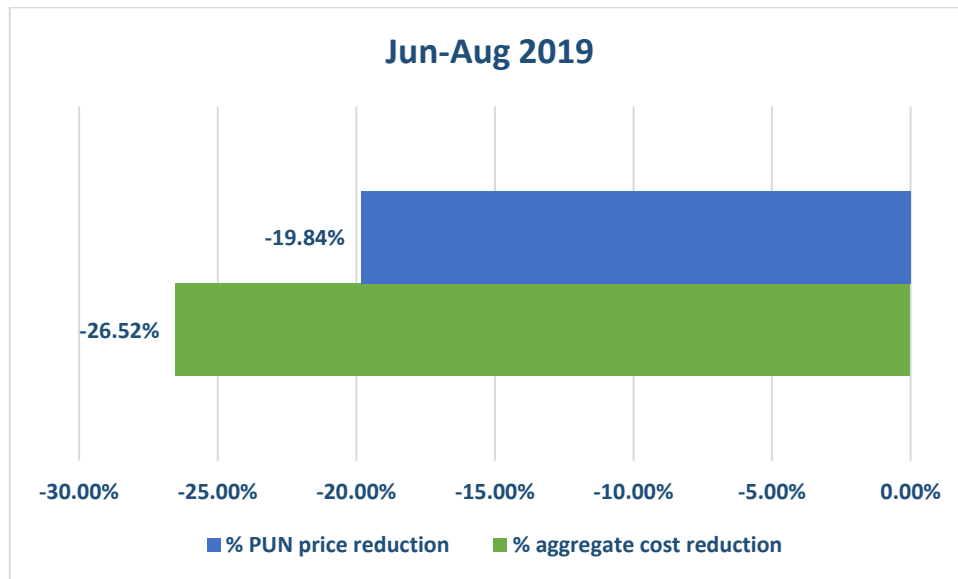
<sup>2</sup>data source: [www.ilmeteo.it](http://www.ilmeteo.it) (<https://www.ilmeteo.it/portale/archivio-meteo/Firenze/2019/>)

On the financial side, in front of a reduction of the unit price by 19.84% for the examined period<sup>1</sup>, the REFS budget registered savings amounting to 26.52%, corresponding to -€ 36,607.76 (see charts below).

<b>Average PUN price Jun-August 2019</b>	<b>50,14 €/Mwh</b>
<b>Average PUN price June-August 2018</b>	<b>62,55 €/Mwh</b>

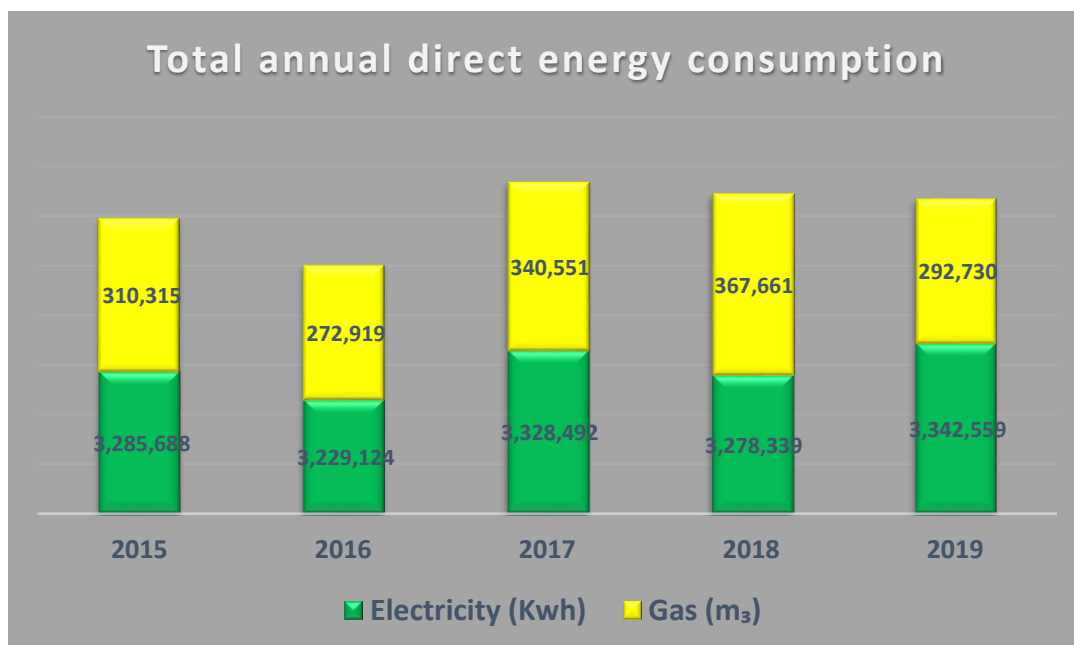


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(\*data source: <http://www.mercatoelettrico.org/It/Statistiche/ME/DatiSintesi.aspx>)

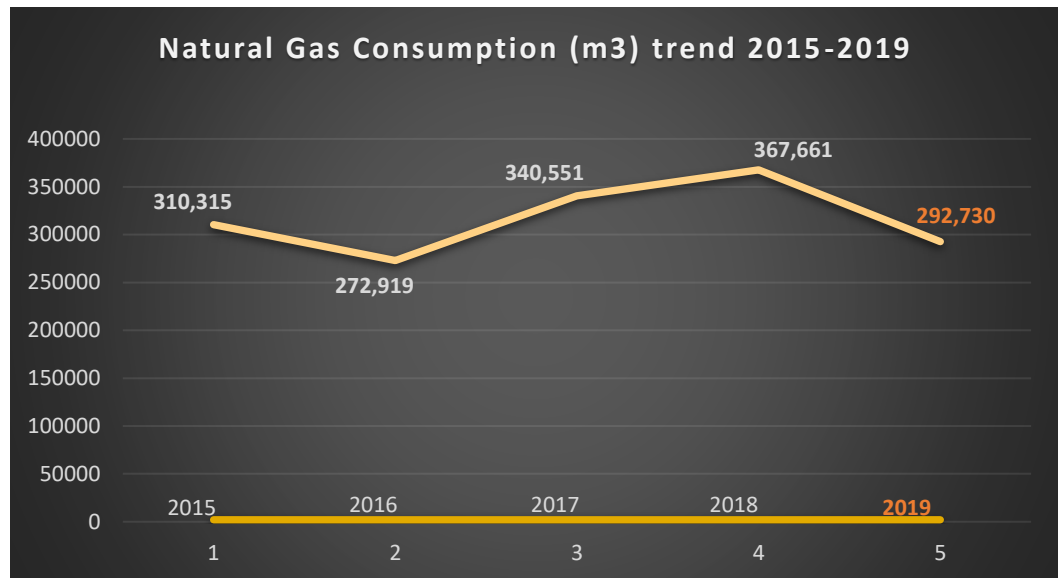
Looking at the comparative analysis of aggregate direct energy consumption (natural gas + electricity) over the period 2015-2019:



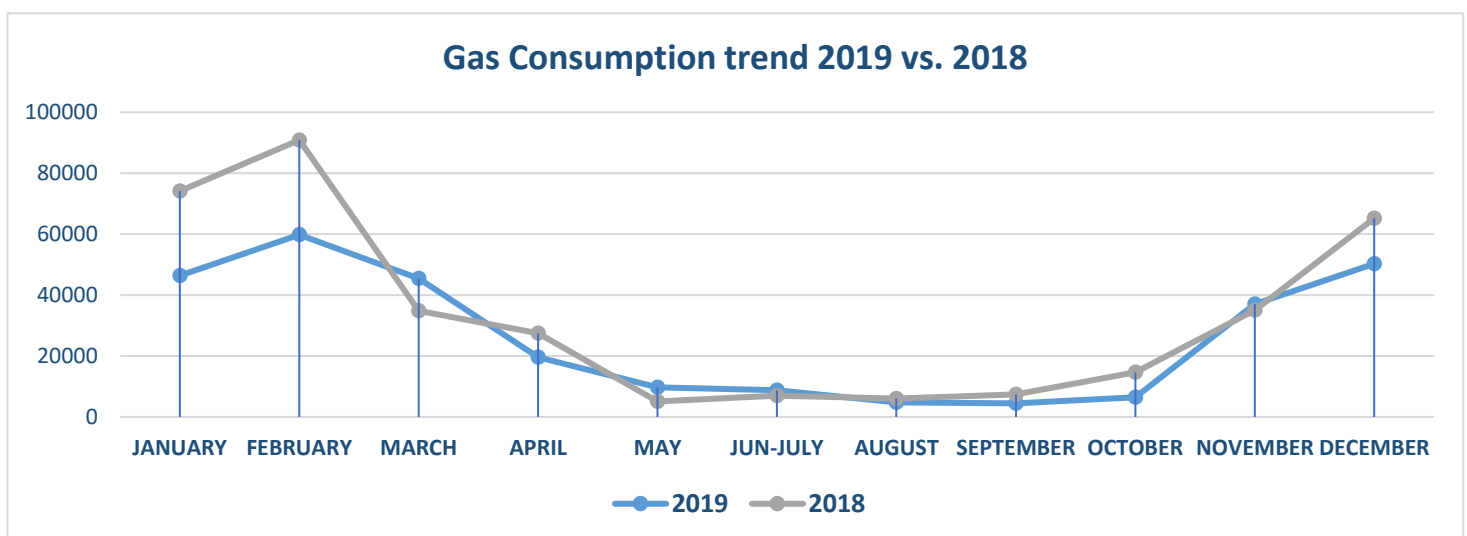
We observe that, regardless of actual values (it is worth recalling also that the EUI Campus has grown considerably from 2015 to 2019, passing from an aggregate surface of 31444 sqm to the current 39092 sqm), the incidence of Kwh and m<sub>3</sub> is equally balanced in 2015, 2016 and 2017, whereas in 2018 the gas component is definitely dominant and in 2019 the electricity component prevails.

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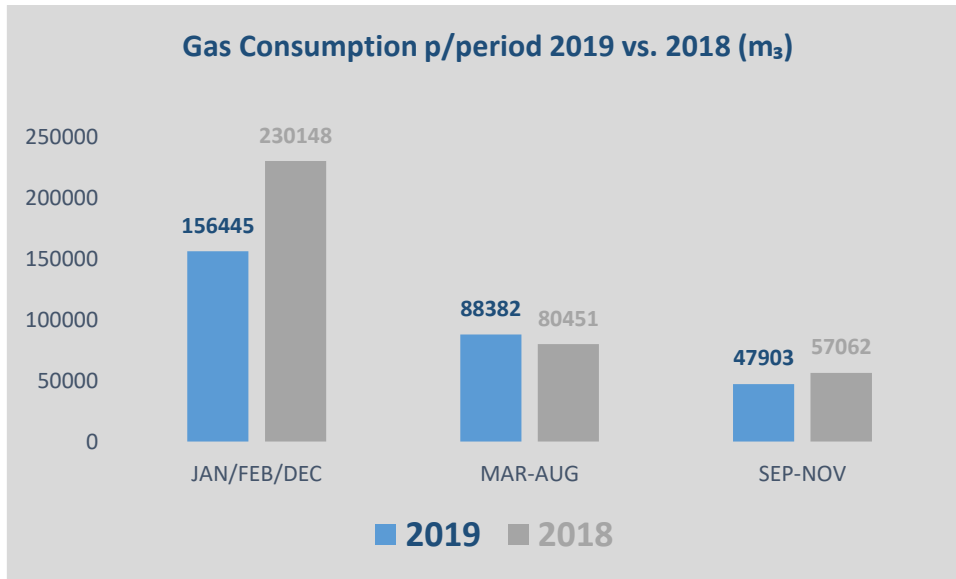
In 2019 the EUI registered the lowest result in terms of gas consumption over the past 3 years (292,730 m<sup>3</sup>)<sup>3</sup>, thus stopping the ever increasing trend:



Going into details, the difference with 2018 amounts to -20.37% (-74.931 m<sup>3</sup>) and mainly concentrated (as usual) over the coldest months of the year (namely January, February and December, -32.02%), see graphs below:

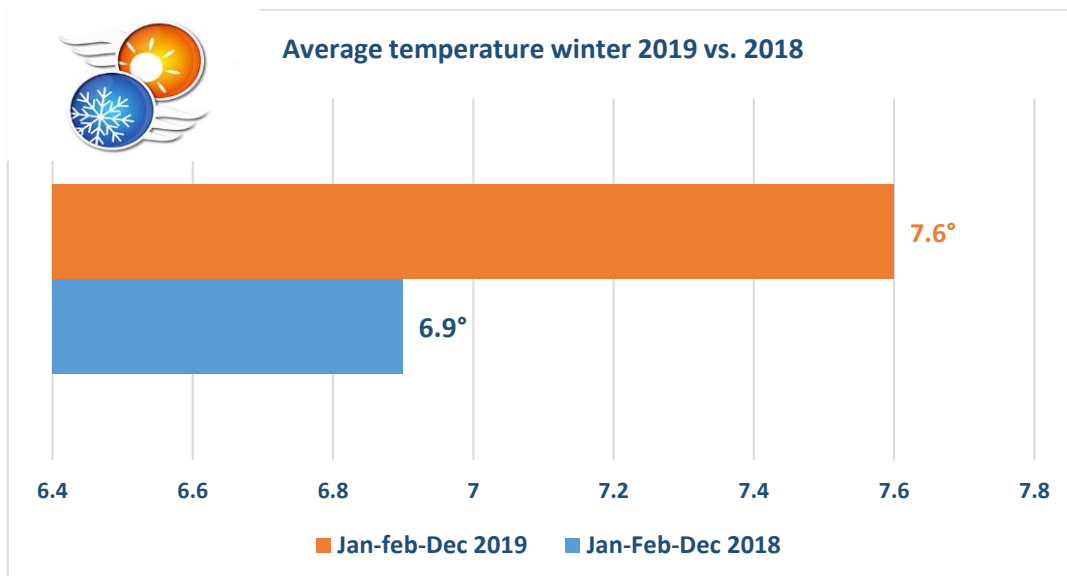


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(<sup>3</sup>data source: monthly reading of gas meters recorded in excel files and matched with monthly invoices by gas suppliers (S:\Filing Plan\LO.01 Infrastructure and maintenance\01 Maintenance\Utilities\GAS))

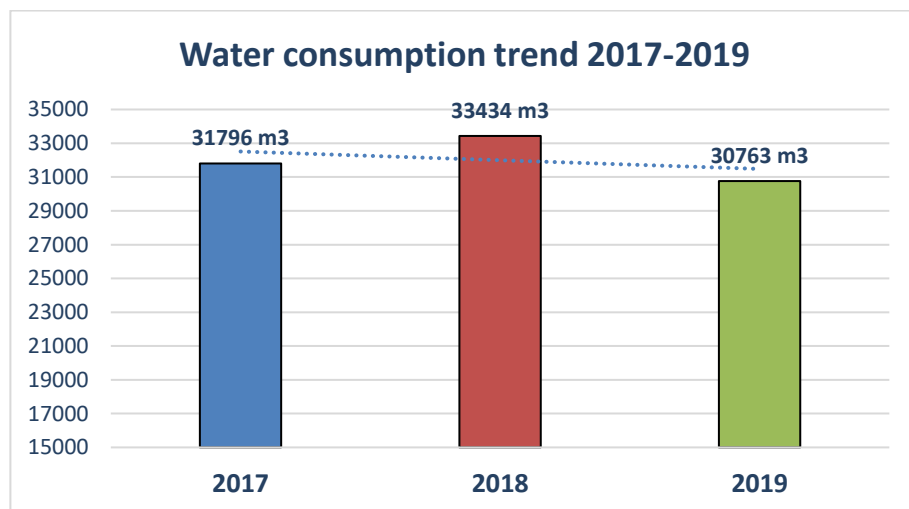
The determining factor could be represented again by the analysis of meteorological conditions, which over the winter months in 2019 were particularly favourable (+0.7° on aggregate value = +10.14%):



The consumption reduction is however more significant than the climatic circumstance, demonstrating once again the effectiveness of energy saving measures currently in place at the EUI (BMS and remote control).

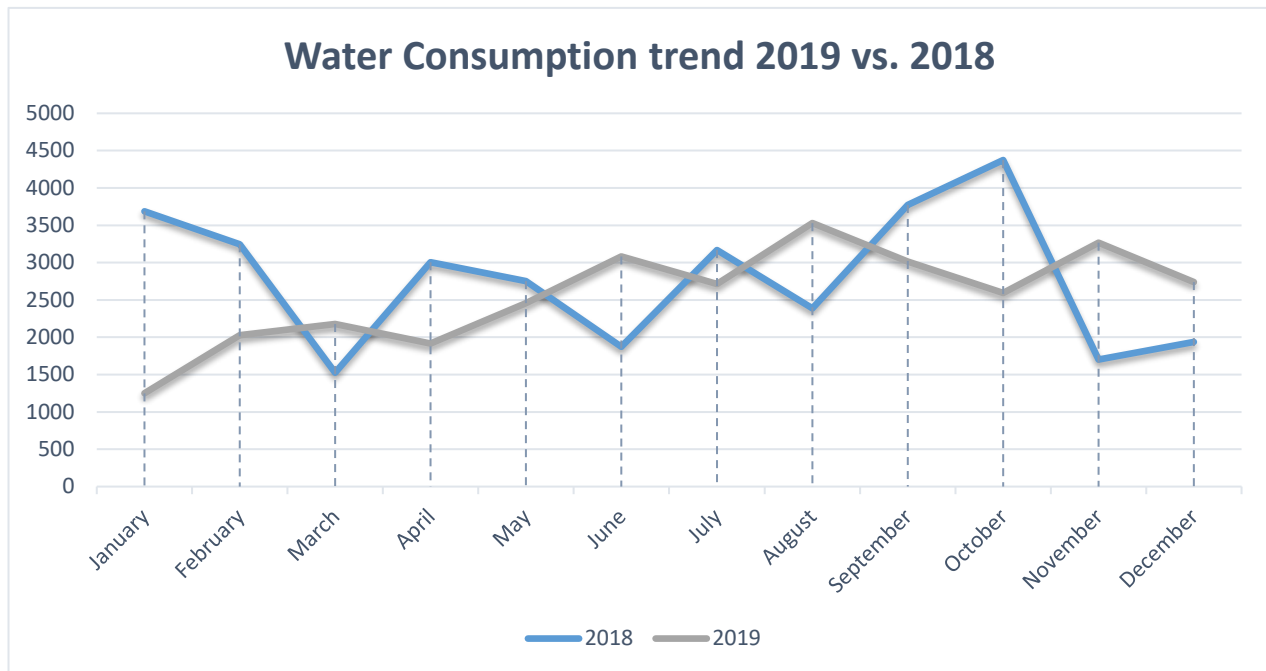
As water consumption represents one of the biggest issues for the REFS, in terms of utilities management, in 2019 we finally implemented the installation of automated water meters across the EUI campus, in order to gather real-time information on water consumption and eventually detect leakages and other disruptions: the water meters will be operational as of January 2020, so that no specific improvements are related to 2019.

Despite all the leakages that the EUI suffered over the course of 2019, the aggregate volume consumed in 2019 amounts to 30.763 m<sub>3</sub>\* which is a very good result compared with 2017 (31.796 m<sub>3</sub>) and 2018 (33.434 m<sub>3</sub>): on annual scale the reduction corresponds to -7.99% (-2.671 m<sub>3</sub>) on the previous year.



The annual trend is definitely more stable and less schizophrenic than 2018, with a peak in August and November (see chart below):





\*data source: monthly reading of water meters recorded in excel files and matched with monthly invoices by water suppliers (S:\Filing Plan\LO.01 Infrastructure and maintenance\01 Maintenance\Utilities\ACQUA)

In general, comparing the 2019 energy/gas/water consumption with the previous year's, we can highlight an extremely good result for gas and water and a moderate under-performance for electricity, in spite of climatic and/or other unexpected variables: the overall consumption expenditure has been kept under control, hence the building efficiency value (BE) can be considered quite satisfactory.

In terms of sustainability, the EUI 2019 carbon footprint on utilities consumption and the comparative analysis with 2018 can be illustrated in the tables below<sup>3</sup>:



## Electricity +1.96%

### Electricity 2018 (3.278.338 Kwh)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	719.9230902
Carbon dioxide (CO2)	2,462,860.64
Nitrogen oxides (Nox)	5,437.35
particulates	1131.80789
Sulphur oxides (Sox)	15,763.63

### Electricity 2019 (3.342.559 Kwh)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	734.0258977
Carbon dioxide (CO2)	2,539,922.14
Nitrogen oxides (Nox)	5,607.48
particulates	1,167.22
Sulphur oxides (Sox)	16,256.87



## Natural gas - 20.37%

### Natural Gas 2018 (367.661 m<sub>3</sub>)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	117.65
Carbon dioxide (CO2)	712,915.82
Nitrogen oxides (Nox)	631.46
particulates	183.83
VOC emissions	126.29

### Natural Gas 2019 (292.730 m<sub>3</sub>)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	93.6736
Carbon dioxide (CO2)	567,620.30
Nitrogen oxides (Nox)	502.763775
particulates	146.365
VOC emissions	100.552755

<sup>3</sup>conversion factors according to ANPA, Banca dati I-LCA ver. 2.0, 2000 – Rapporto ETH-ESU, 1996



## Carbon Footprint (utilities) Overall result

	2018	2019
Carbon monoxide (CO)	829.41	827.70
<b>Carbon dioxide (CO2)</b>	<b>3,175,776.46</b>	<b>3,107,542.44</b>
Nitrogen oxides (Nox)	6,068.81	6,110.24
particulates	1,315.64	1,313.59
VOC emissions	15,889.92	16,357.42



**CO2 -2.20%**

**PI on Environmental Sustainability (utilities consumption) = CFR (% of Carbon Footprint Reduction)**

**CFR= - 2.20%**

**PI on Energy Management = BE (Buildings efficiency)\***

**BE = € 19.61/sqm**

(The BE value for 2018 was 19.91 €/sqm)

\*the value is obtained by dividing the 2019 overall utilities cost (electricity, water, natural gas, gas oil) for the total sqm surface of the EUI