ENERGY SAVINGS

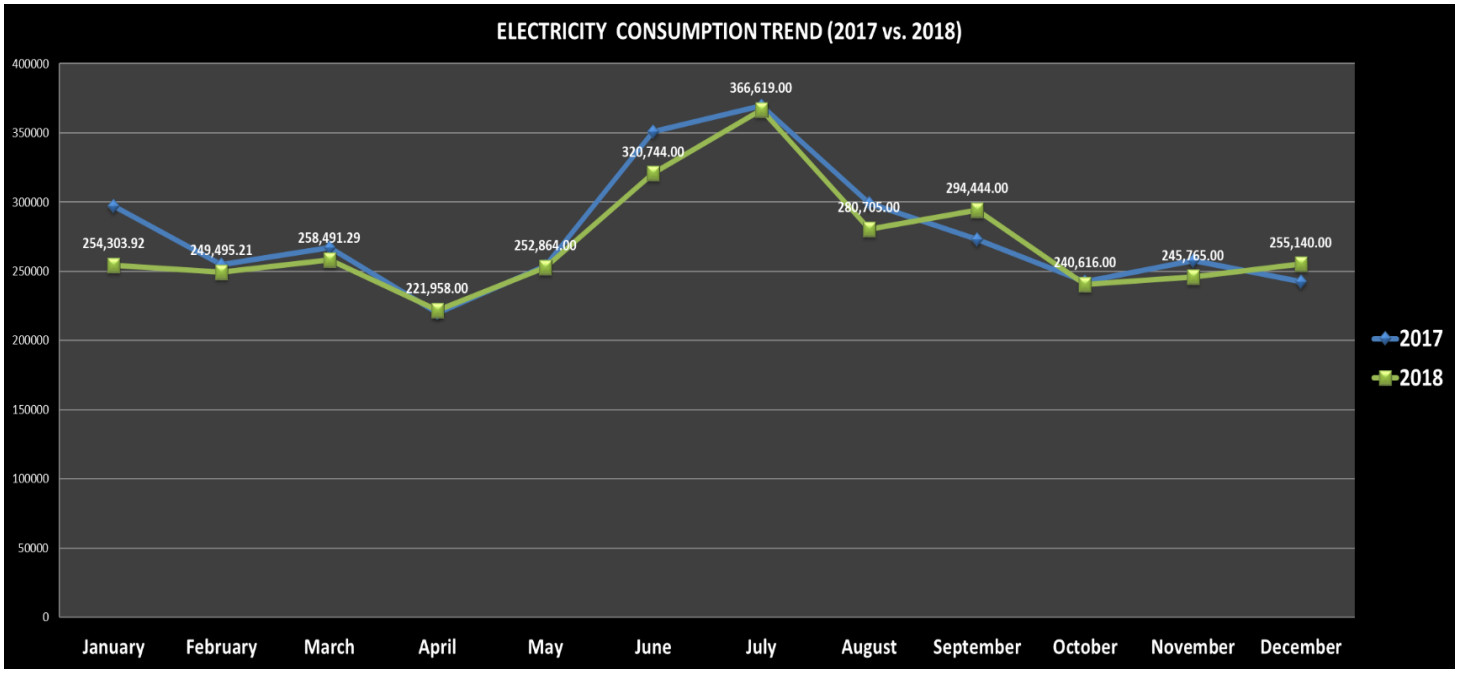
1. BMS (Buildings Management System)

Unfortunately, even in 2018 the Italian Government did not manage to complete the final tests on Villa Salviati main building's systems, due to the bankrupt of the company that had been awarded the tender for these works.
This prevented the EUI from starting the BMS integration project as foreseen.
However, owing to a malfunctioning of the on-site temperature sensors and given the unreliability of the construction company, at the end of 2018 the EUI decided to directly intervene purchasing and installing new sensors in order to replace the proper functionality of the system and the arising comfort conditions for the users' community.

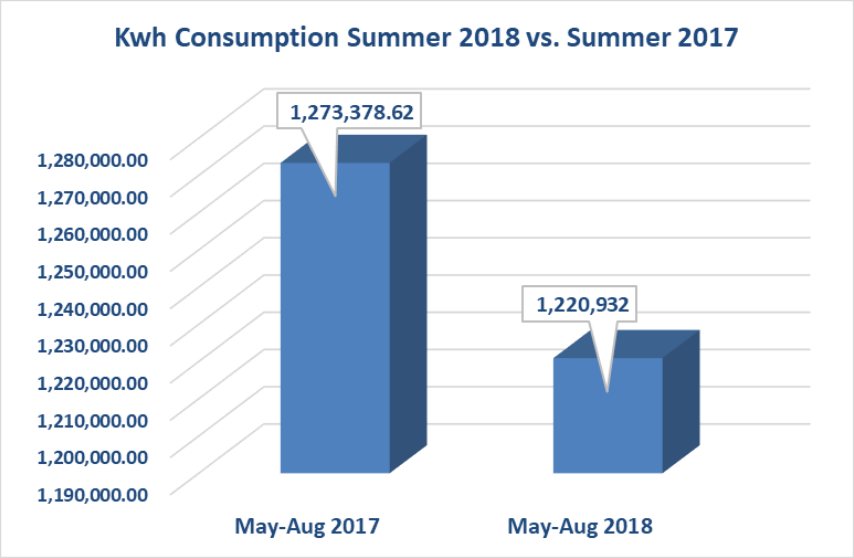
2. Utilities Consumption

Over the course of 2018 the overall electrical consumption in the EUI premises (including EUI residences at PAB and PDM) resulted in a total of 3.241.146 Kwh*, which, compared to the official data for 2017 (3.328.492 Kwh)*, shows a reduction of **2,62%** in absolute terms, with a budgetary increment of approx. **6.85%*:** this latter increase was largely expected, considering that 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 2018 registered an average growth of 13.62%** on annual basis (61.28 €/Mwh vs 53.94 €/Mwh).

(*data source: ENERGETIC monthly invoices Jan-Dec 2017/Jan-Mar 2018 and EDISON monthly invoices Apr-Dec 2018, 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 shows that the aggregate electricity consumption in 2018 (green line) has decreased almost every month compared to 2017 (blue line), with the sole exception of the months of September and December (+ 7.78% and + 5.21% respectively). The detailed monthly analysis reveals that during the summer months (May, June, July and August), which traditionally register the most intensive consumption of electricity due to the switch on of air conditioning system across the EUI Campus (28 May for 2018), the reduction was even heavier than on annual basis: -4.11%, corresponding to 1.220.932 Kwh vs. 1.273.378, 62 in 2017 (- 52446.62 Kwh, see chart below).

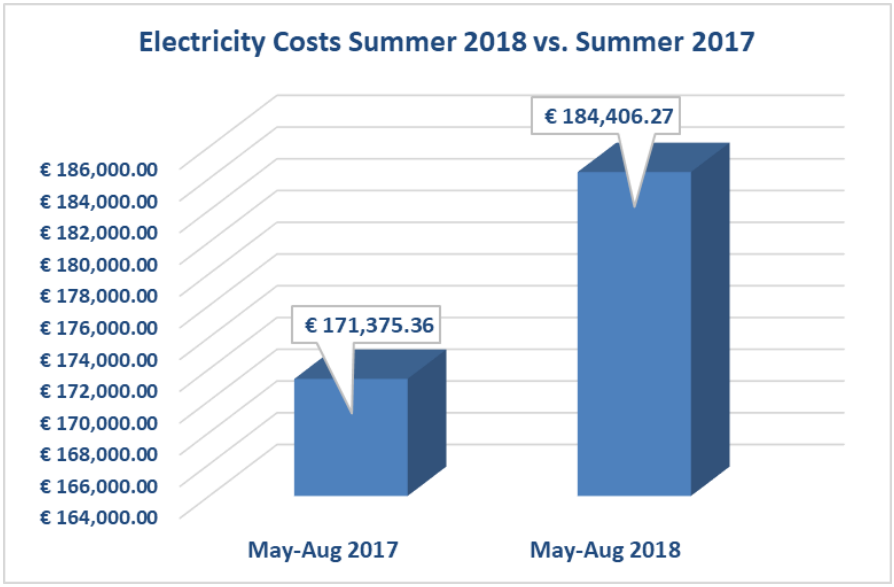


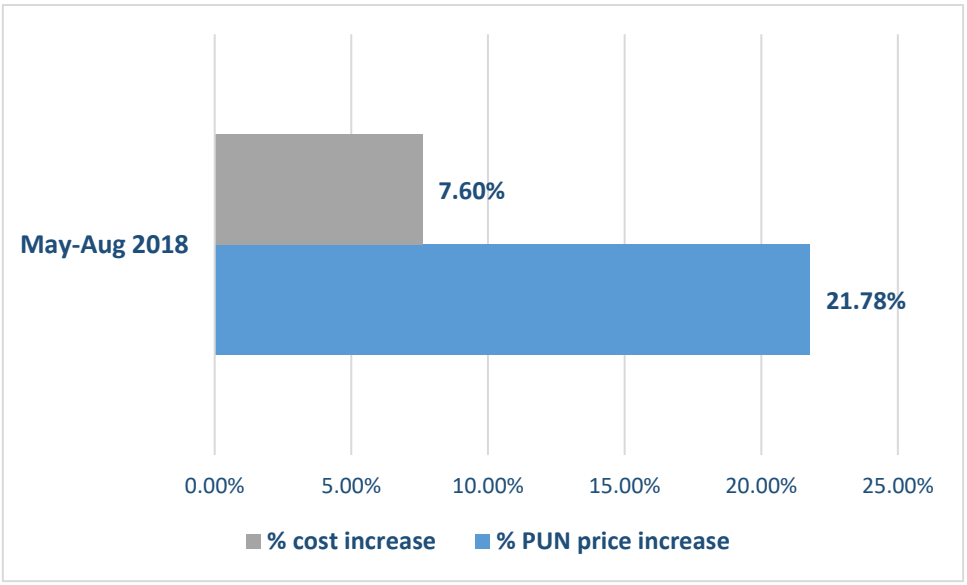
This result is mainly due to the correct functionality of the BMS (see page 61), although not yet integrated on a single platform (ensuring that cooling is provided to the standard required but only at the times required and only in the areas of the building where it is actually necessary), and to an attentive regulation of heating units' clocks within the Campus, as well as to an increased awareness of our community users on energy saving practices.

The remarkable drop in consumption is not matched by a cost reduction, due to the growth of the PUN price registered in 2018 (see above): however, despite an increase of the unit price amounting to 21.78% for the examined period[1], the financial impact on the REFS budget weighed only for 7.6% (see charts below)

Average PUN price May-August 2018 **60,28 €/Mwh**

Average PUN price May-August 2017 **49,50 €/Mwh**



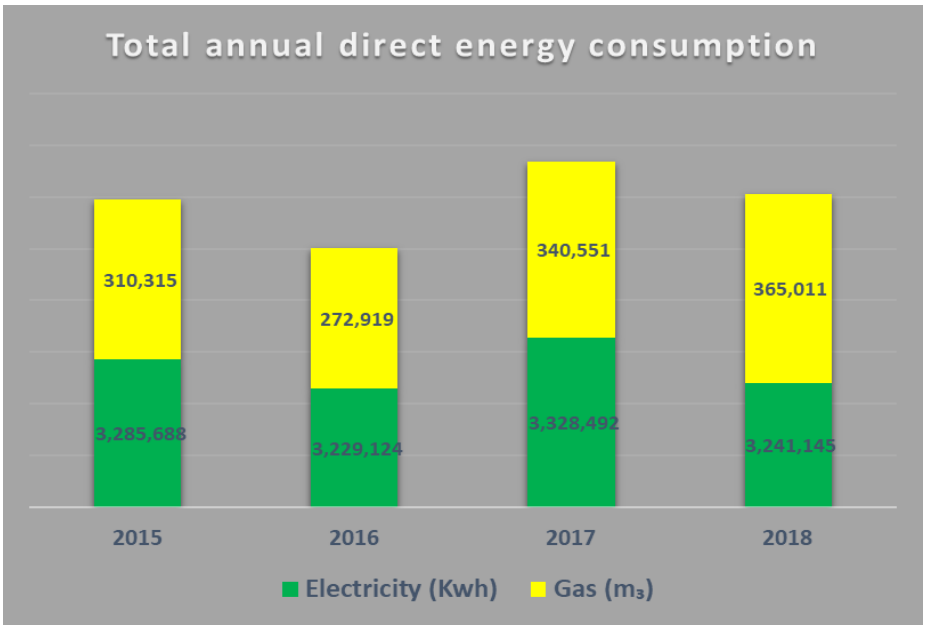


([1]data source: http://www.mercatoelettrico.org/It/Statistiche/ME/DatiSintesi.aspx)

According to climate statistics for the geographical area of Florence and its surroundings[2], during the above mentioned period (May-Aug 2018) average temperatures were approx. 2.46% below the average temperatures registered during the same period in 2017 (23,575°C vs. 24,17°C – 0,59° lower). The good performance of energy savings measures is once again witnessed by the fact that the reduction in actual consumption was well beyond that value (-4.11% vs. – 2.46%).

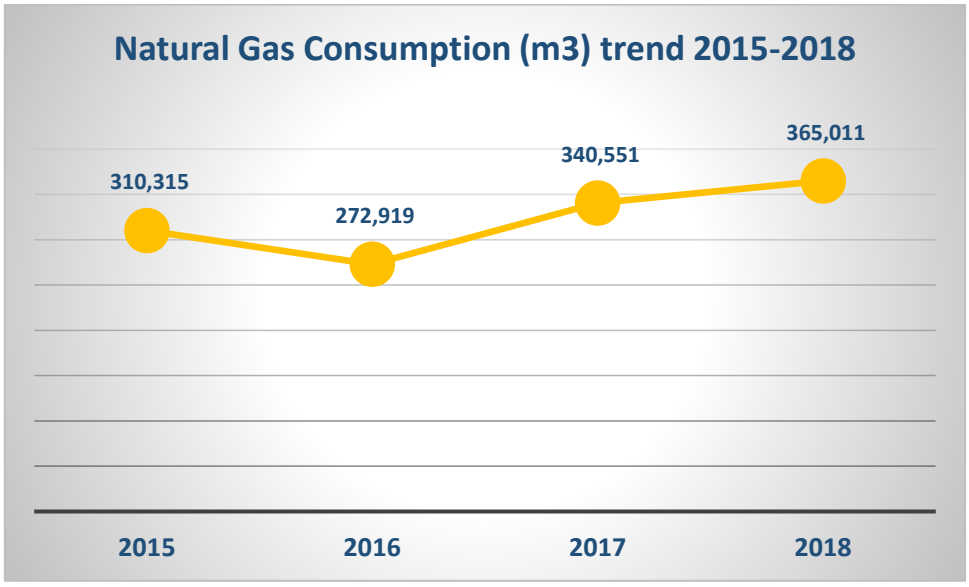
[2]data source: www.ilmeteo.it (https://www.ilmeteo.it/portale/archivio-meteo/Firenze/2018/)

An extremely interesting data is provided by the comparative analysis of aggregate direct energy consumption (natural gas + electricity) over the period 2015-2018:



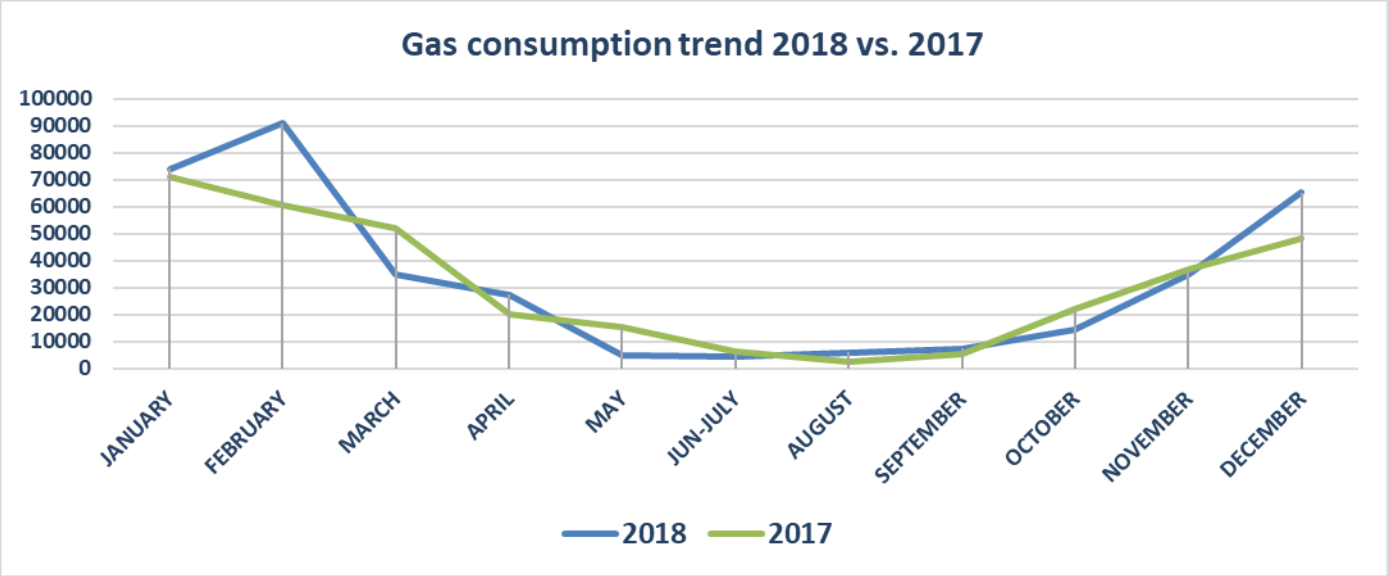
The chart above shows that, regardless of actual values (it is worth recalling also that the EUI Campus has grown considerably from 2015 to 2018, passing from an aggregate surface of 31444 sqm to the current 35673 sqm), the incidence of Kwh and m_3 is equally balanced in 2015, 2016 and 2017, while in 2018 the gas component is definitely dominant.

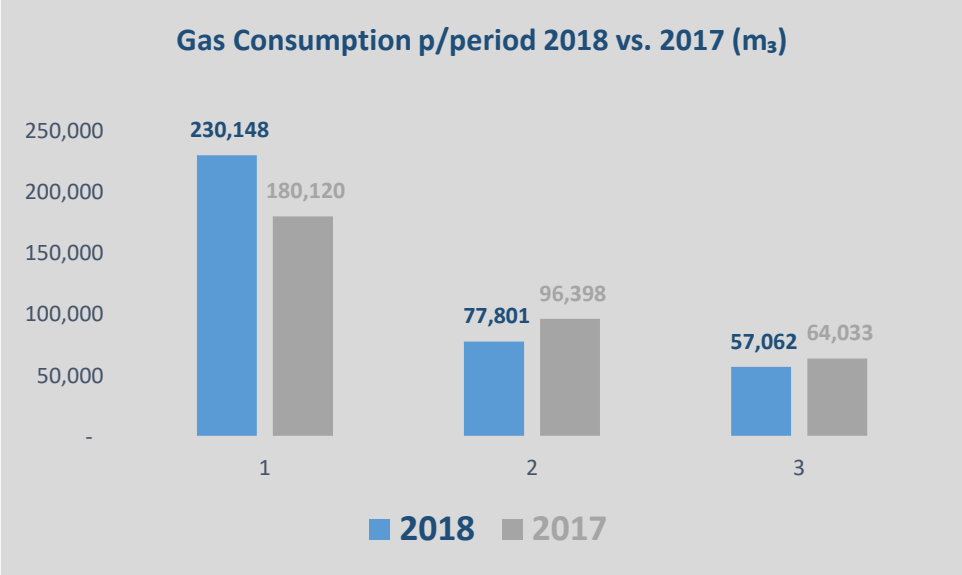
In 2018 the EUI registered the highest result in terms of gas consumption over the past 4 years, confirming the ever increasing trend:



Going into details, the difference with 2017 amounts to + 7.18% (+24.660 m_3), which is is far below the increase registered in 2017 (+ 24.78%) and mainly concentrated (as usual) over the coldest months of the year (namely January, February and December, + 27.78%),

while the overall performance during the rest of the year can be considered more than satisfactory (-19.29% in 2nd period and -10.89% in 3rd period, see below)*:





(*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))

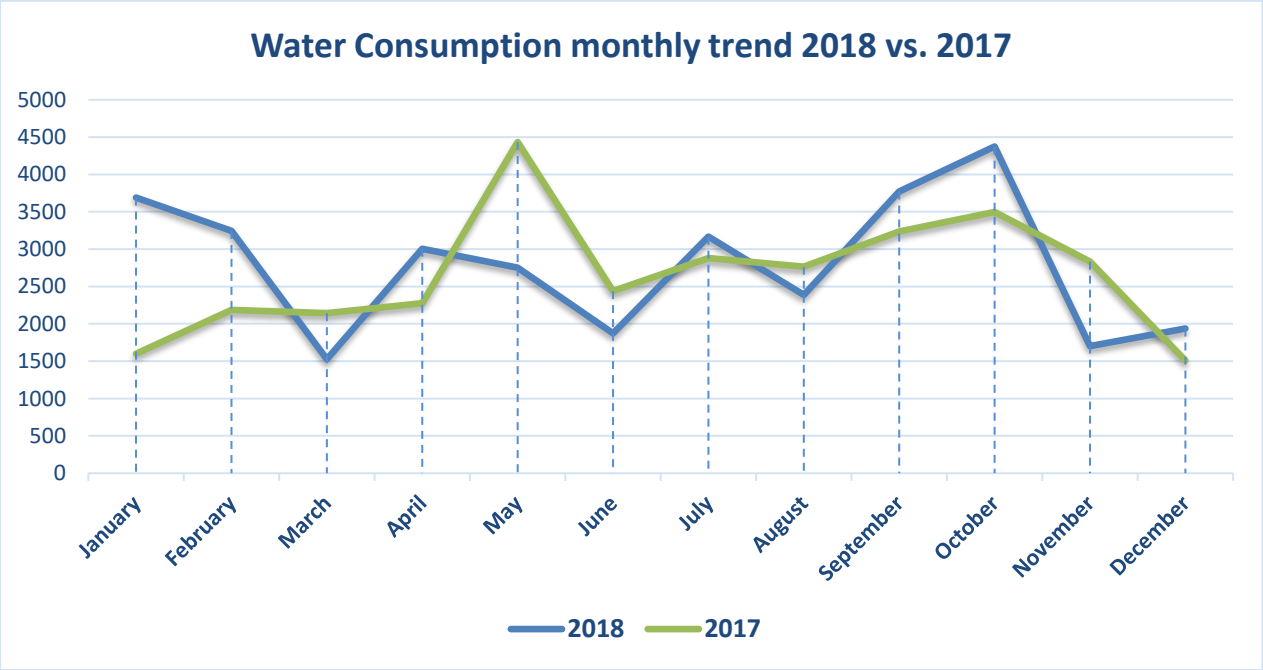
The determining factor could be represented by the specificity of the EUI Campus

historical buildings, that depend to a large extent on geographical exposure: the in-depth analysis of the climatic and geographical area where a building is located (microclimate), taking into consideration sun exposure, wind exposure, height, humidity, ground cover, average air temperatures etc, obliges us to adapt efficiency standards on a case-by-case basis, determined by the energy demand of the site.

As regards financial data, the overall expenditure for natural gas in 2018, despite the growth in absolute consumption amounting to 7.18%, registered a reduction of -1.37%: this result is mainly related to the award in 2018 of a new contractor for the supply of natural gas, following the relevant call for tender, which led to further savings on the unit price of the raw material.

Needless to say that water consumption represents one of the biggest issues for the REFS, in terms of utilities management: 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, will at least give a great contribution to the monitoring of the flowrate.

Despite all of the above, the aggregate volume consumed in 2018 amounts to 33.434 m_3 which is almost in line with what registered in 2017 (31.796 m_3). The monthly trend is quite similar to 2017, with a peak in January and September-October (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)

Once again, we have to report several leakages that affected some of our buildings during the above-mentioned months, in particular Villa Salviati (+ 216.66%), Villa la Fonte (+ 22.84%) and the PAB Flats (+9.62%): it is worth considering that leakages were repaired with some delay, due to the difficulties of detecting them on the vast external grounds of the sites.

In general, comparing the 2018 energy/gas/water consumption performance with the previous year's, we can highlight an extremely good result for electricity and a certain stability for gas and water, in spite of climatic and/or other unexpected variables: the overall consumption expenditures have however increased, thus the building efficiency value (BE) cannot be considered very satisfactory, although we should take into account that the 2017 value did not include many invoices of water consumption that had not been billed on time

In terms of sustainability, the EUI 2018 carbon footprint on utilities consumption and the comparative analysis with 2017 can be illustrated in the tables below[3]:

Electricity – 2.62%

Electricity 2017 (3.328.492 Kwh)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	730.9365651
Carbon dioxide (CO2)	2,529,232.24
Nitrogen oxides (Nox)	5,583.88
particulates	1162.308964
Sulphur oxides (Sox)	16,188.45

Electricity 2018 (3.328.492 Kwh)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	711.7554773
Carbon dioxide (CO2)	2,462,860.64
Nitrogen oxides (Nox)	5,437.35
particulates	1131.80789
Sulphur oxides (Sox)	15,763.63

Natural gas + 7.17%

Natural gas 2017 (340.551 m_3)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	108.98
Carbon dioxide (CO2)	660,347.97
Nitrogen oxides (Nox)	584.9
particulates	170.28
VOC emissions	116.98

Natural Gas 2018 (365.011 m_3)

Pollutant	emissions (Kg)
Carbon monoxide (CO)	116.80
Carbon dioxide (CO2)	707,777.32
Nitrogen oxides (Nox)	626.91
particulates	182.51
VOC emissions	125.38

[3]conversion factors according to ANPA, Banca dati I-LCA ver. 2.0, 2000 – Rapporto ETH-ESU, 1996

Carbon Footprint (utilities) Overall result

	2017	2018
Carbon monoxide (CO)	839.92	828.56
Carbon dioxide (CO2)	3,189,580.21	3,170,637.96
Nitrogen oxides (Nox)	6,168.78	6,064.26
particulates	1,332.59	1,314.32
VOC emissions	16,305.43	15,889.01

CO2 -0.59%