ENGINEERING
TOMORROW

Danfoss

Danfoss – your energy efficiency partner of choice for the hospitality industry

Energy saving in hotels: a treasure hidden among the installations

Short Version

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Reconsidering efficiency in hotels

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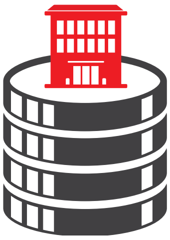
Reconsidering energy efficiency in hotels and the hospitality industry

In a highly competitive market like the hospitality industry, cost control is a vital factor for successful businesses. Margins and profits have a decisive impact on the management of activities, including the quality of services for guests. With energy costs typically representing up to 10% of operating costs (the second largest item after personnel costs), it's no wonder hospitality companies are on the lookout for savings opportunities



Energy costs may represent up to **10%** of operating costs

the **2nd** item after personnel costs

About **60%** of energy costs are attributable to heating, cooling and hot water production

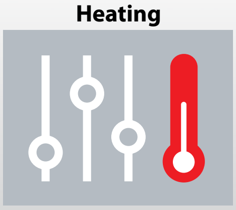
Energy plays a key role in ensuring adequate levels of comfort and service for guests. Furthermore, there is a clear trend in this sector that aims to reduce both energy consumption and water usage. Together with growing demand for certified environmental sustainability, this requires increasingly efficient components, systems and installations – and more effective building management too.

Technical building systems (**TBS**) are a fundamental element of the energy efficiency of hotels. These systems are linked, for instance, to the operation of heating, air-conditioning, ventilation, hot water and lighting installations. Danfoss has the right technologies and proven experience to make your buildings more efficient.

Almost 60% of energy costs result from heating, cooling and hot water production, providing plenty of scope for potential improvements in energy efficiency in these areas. Combining the latest HVAC (heating, ventilation and air conditioning) technologies (including automatic hydronic and thermal balancing, variable speed compressors and speed-controlled pumps) with advanced TBS building automation enables more granular control of areas and rooms within the hotel – delivering both greater comfort and efficiency.

Technical systems: possible improvements

Heating

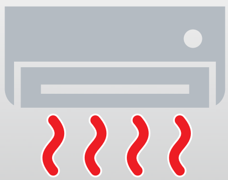


Individual checks per room; automatic hydronic balancing; speed-controlled pumps

Domestic hot water

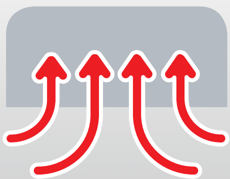
Automatic thermal balancing

Air-conditioning



Checks for each single room; variable speed compressors

Ventilation



Speed control of the fan motors

Table of contents

Reduction of energy consumption and management costs with variable flow Danfoss solutions in installations with boiler and refrigerating unit

The aim of this chapter is to show the effect on the annual energy consumption, and on energy cost reduction, when Danfoss solutions are used as an alternative to other solutions, both in the renovation of existing buildings and in the construction of new buildings.

The analysis illustrated in the following paragraphs refers to buildings for hotel use with north-south orientation, where only the areas intended for the rooms and common areas have been taken into consideration. Areas intended for restaurants, meeting rooms and spas have not been taken into consideration in this first analysis.

The results related to the case of a building with east-west orientation have not been reported, as it was verified that they are very similar to the case of the building with a north-south orientation.

The following cases were each examined separately:

- Retrofit of building with year 2005 thermal insulation type
- Retrofit of building with year 2010 thermal insulation type
- Design of building with year 2021 thermal insulation type

For each of these cases, different technical implementation solutions were considered

Retrofit of building with year 2005 thermal insulation type

In this case, as it is a relatively outdated building, it is assumed that in the basic starting solution, low energy efficiency refrigerating machines could still be present, such as for example Class D Eurovent refrigerating units, and AHU at high pressure drops, with regenerator efficiency $\varepsilon = 50\%$ and fan efficiency $\eta = 50\%$. The following solutions were therefore considered to increase the plant performance:

Two solutions with measures to improve the efficiency of the equipment installed

- Class A Eurovent refrigerating unit installation
- Installation of AHU with energy efficiency ErP 2018

Two solutions with thermal insulation improvement measures, with equal system

- Intervention to bring the building to the year 2010 thermal insulation type
- Intervention to bring the building to the year 2021 thermal insulation type

Three Danfoss solutions for variable water and air flow systems

- Variable water flow only, by using the Danfoss inverter VLT® FC102 and pressure-independent valves Danfoss AB-QB
- Variable air flow only, by using the Danfoss inverter VLT® FC102 and shutters per room
- Solution with variable flow rate of both water and air, by combining the two solutions mentioned above

Efficiency improvement of installed equipment

By performing only the replacement of the refrigerating unit with one of higher energy class, without intervening on balancing and efficiency improvement of the plant, an improvement limited to the consumption of the refrigerating unit only is obtained, due to its greater efficiency. The boiler increases consumption in an absolutely marginal way, while all other consumption remains unaffected.

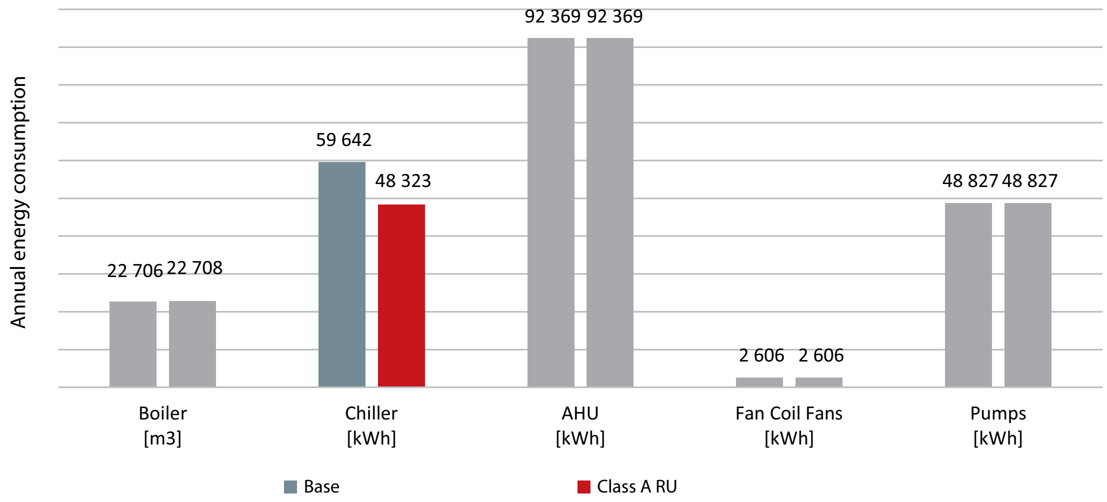


Figure 1: Benefits on energy consumption obtained by replacing the old refrigerating unit with one in Class A Eurovent

Assuming instead that only the air handling units are replaced (by keeping the refrigerating unit and the rest of the system unchanged), the item that changes the most is the consumption of the AHU fans, due to lower pressure drops and fan efficiency improvement.

The regenerator's efficiency improvement also lowers methane consumption and, marginally, the refrigerating unit's consumption.

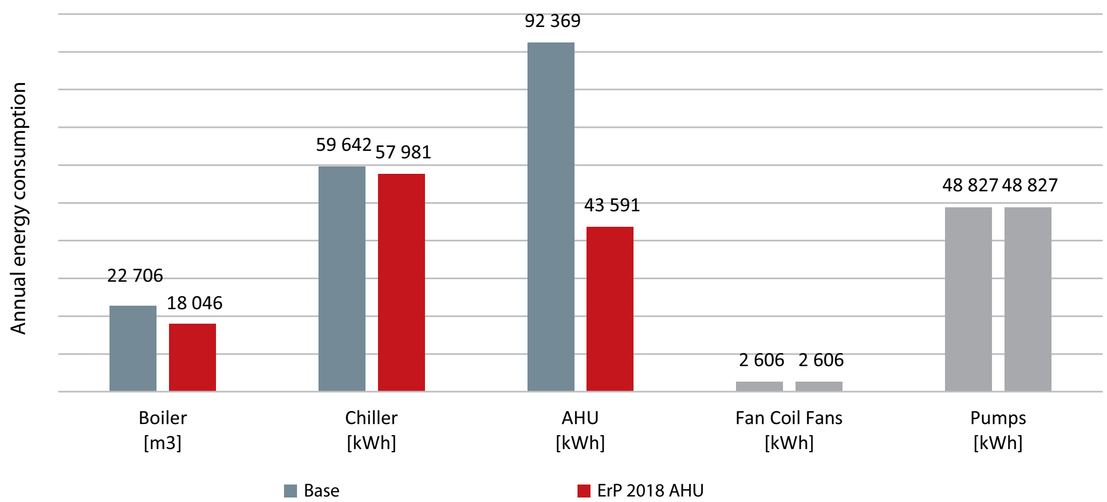


Figure 2: Benefits on energy consumption obtained with the replacement of old AHUs with new ErP 2018 certified units

Improvement of thermal insulation

By intervening on thermal insulation, improving it up to the construction typology typical of the year 2010, and leaving instead the plant unaltered, quite poor results are obtained, as only the methane consumption of the boiler decreases and, in marginal way, that of the electric energy absorbed by the refrigerating unit.

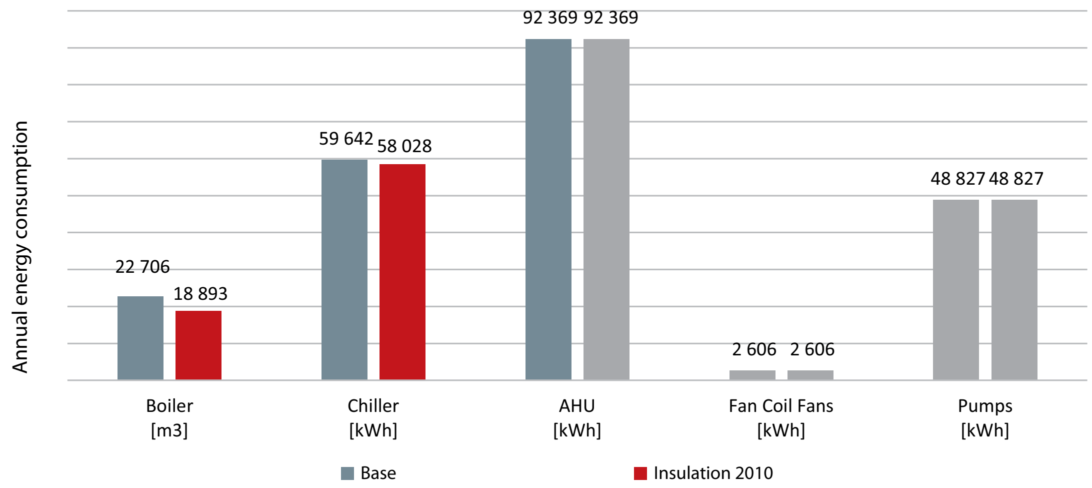


Figure 3: Benefits on energy consumption obtained with the improvement of thermal insulation (from year 2005 to 2010)

By improving the thermal insulation up to the construction typology typical of the year 2021, leaving instead the plant unaltered, quite poor results are also obtained. The methane consumption of the boiler decreases even more and, in an always marginal way, that of the electric energy absorbed by the refrigerating unit, but overall, the economic impact continues to be modest.

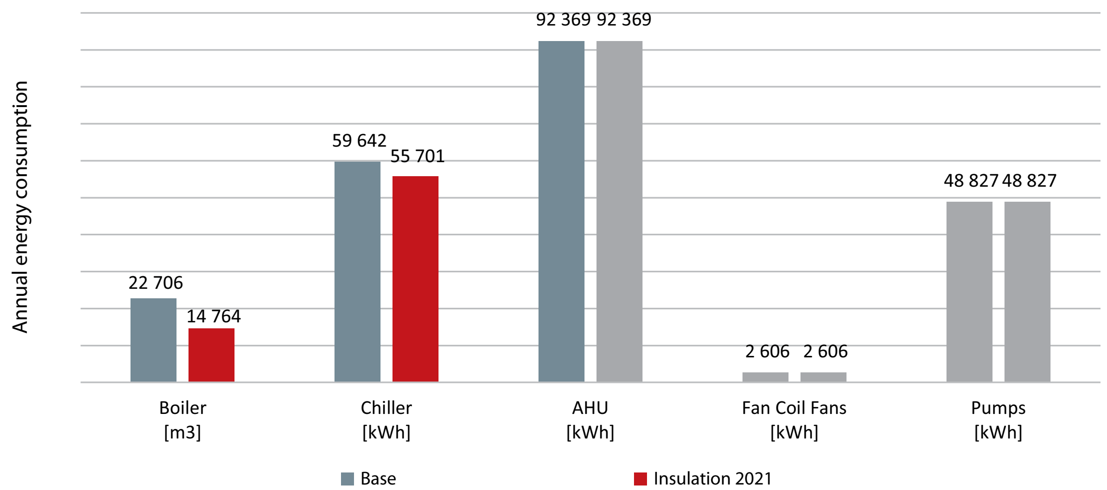


Figure 4: Benefits on energy consumption obtained with the improvement of thermal insulation (from year 2005 to 2021)

Use of Danfoss solutions for variable flow installations

Starting from the implementation of the variable flow of water only, a very stable and well-balanced plant is obtained, as already shown in Chapter 10, and it is immediately clear that the impact on consumption is definitely significant. The consumption of the pumps comes down from almost 49,000 kWh at just over 11,300 kWh, over 76% savings.

The considerable reduction in pump absorption impacts positively on the total electric consumption of about 18%. The savings obtained with this solution are over three times higher than that obtainable by replacing only the refrigerating unit from class D to Class A Eurovent.

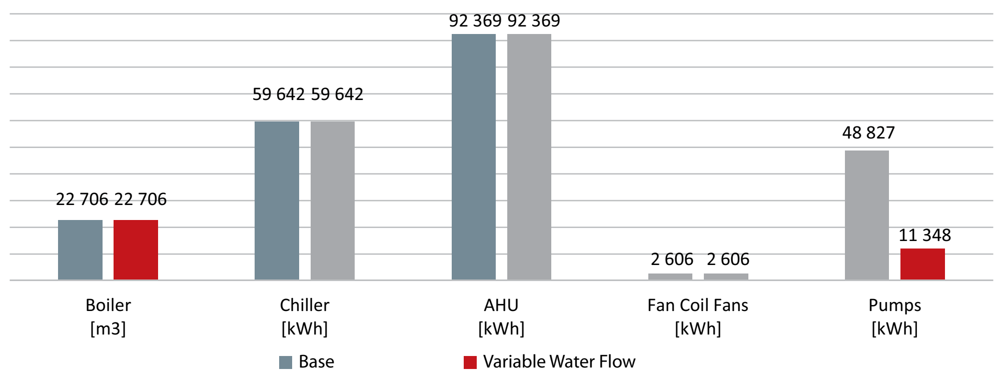


Figure 5: Benefits on energy consumption obtained with Danfoss variable water flow solutions (building 2005)

By intervening instead on the variable air flow only, the air flow reduction obtained with the use of Danfoss inverters brings down both the electric consumption of AHU fans and methane consumption and the electric consumption of the refrigerating unit. All of this is obtained with the sole addition of an inverter on the AHU fan and of shutters in the rooms.

The results are remarkable, as they reduce gas consumption by about 28%, and the total electricity consumption of the refrigerating unit and AHU by 30%.

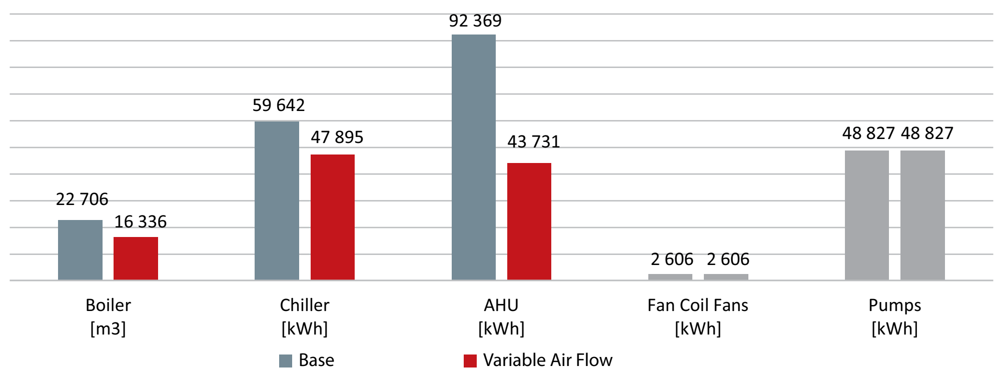


Figure 6: Benefits on energy consumption obtained with Danfoss variable air flow solutions

By combining the two types of intervention, and by implementing a plant solution with variable flow rate of both air and water, the best possible solution is obtained, as all the plant's consumption is reduced with very high percentages of reduction.

The total flow rate almost halves total energy expenditure, reducing the consumption of gas by 28% and the electric consumption by 48%. Assuming an average cost of gas of €0.60/m³ and of electricity of €0.20/kWh, the reduction of consumption enables money savings on the bill for over 40%.

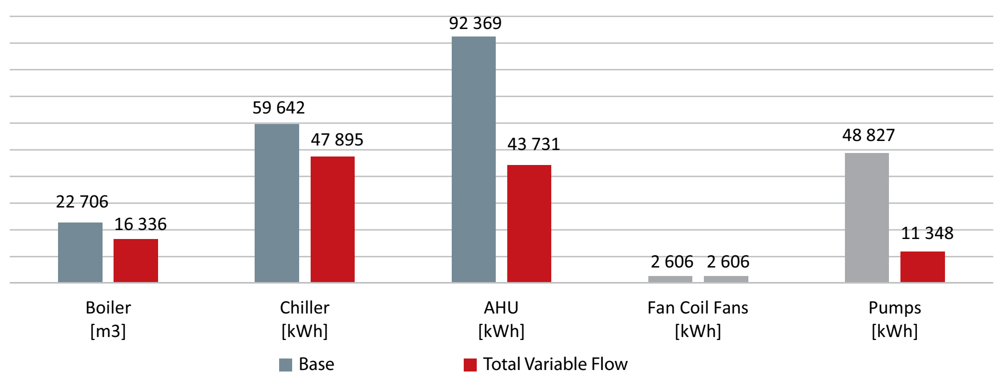


Figure 7: Benefits on energy consumption obtained with Danfoss variable water and air flow solutions

However, it is of the utmost importance to choose an appropriate design to obtain a reduction in energy consumption that is not limited only to reducing operating costs, but extends to the optimisation of the whole building's design.

In fact, think about the energy efficiency objectives in force starting from 2021 relating to the buildings' energy requirements, and the use of renewable energy sources to cover part of the request.

A building that consumes less energy is easier to design and build. If we consider, for example, solar energy as a renewable source (because it is the only renewable energy source available everywhere), we must find a suitable surface for the installation of solar panels (that can become quite large, and that it is not always available), especially in urban centres with purely vertical constructions.

So let us analyse, in the case of the retrofit just considered, what are the savings on the surface of photovoltaic panels necessary to obtain an annual energy balance of zero: i.e. a building which is able to produce independently all the energy that it consumes.

The following graphs show, respectively, the surface of equivalent photovoltaics necessary to bring the annual balances of the plant to zero and the savings obtainable with the individual solutions.

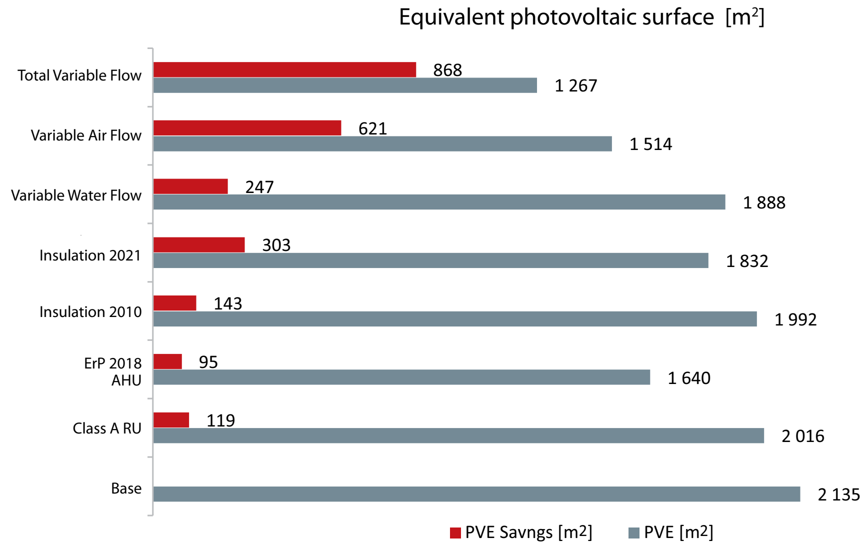


Figure 8: Equivalent photovoltaic surface obtained with Danfoss variable flow solutions

Similarly, the result can be reported in terms of the power of the equivalent photovoltaic plant.

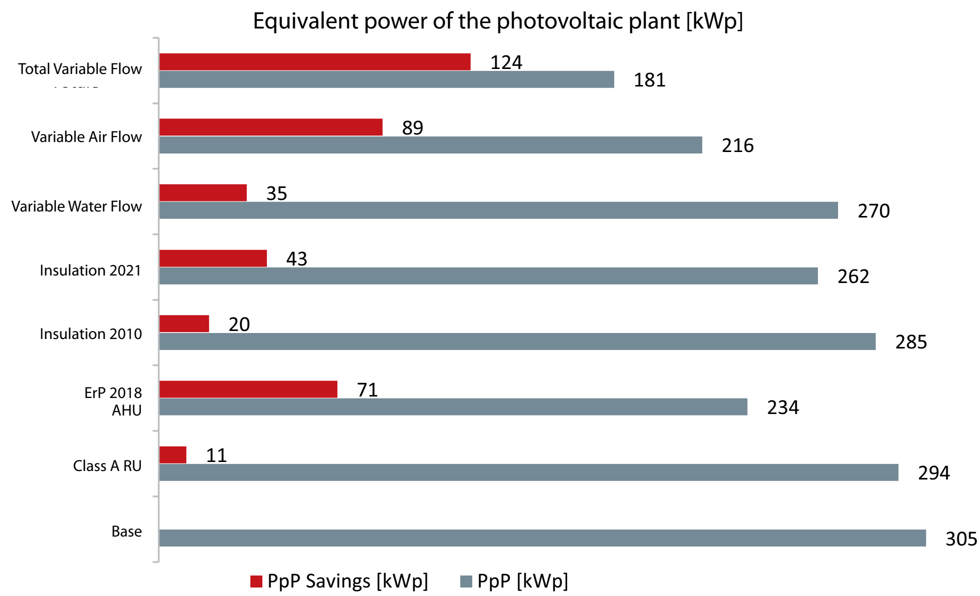


Figure 9: Equivalent photovoltaic power obtained with Danfoss variable flow solutions

Also, from an eco-sustainability point of view (a topic that many big hotel chains are focused on), the benefits of variable flow lead to important results, and with Danfoss solutions, tens of tons of CO_2 per year can be saved.

For reference, 1,000 kg of emissions are equivalent to those of a medium-powered car that travels 6,000 km.

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Danfoss
Your Hotel Sector Partner

We deliver our hotel expertise through the most advanced and efficient technologies to support smarter use of electricity and water, reduce running costs, improve environmental impact and deliver superior guest comfort.

- **HVAC**
- **Domestic hot sanitary water**
- **Refrigeration systems**
- **Fire fighting systems**
- **Elevators and lifting**
- **Fresh water**

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