

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

# Energy saving in hotels:

a treasure hidden among the installations

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## Short Version

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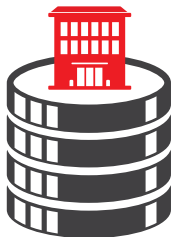
A white line-art silhouette of a city skyline is positioned at the bottom of the page. It features various building shapes, including a prominent skyscraper with a pointed top on the right side. The background behind the skyline is a large, faint, semi-transparent graphic of a Danfoss logo.

**Reconsidering efficiency** in hotels

# 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.

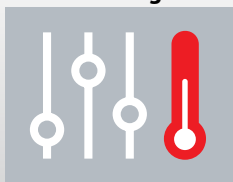
the right technologies and proven experience to make your buildings more efficient.

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

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



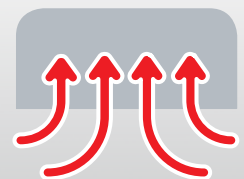
Automatic thermal balancing

### Air-conditioning



Checks for each single room; variable speed compressors

### Ventilation



Speed control of the fan motors



# Table of contents

<b>Executive summary</b>	5
<b>Chapter 1 - Introduction</b>	6
Available spaces: the most precious resource in the nZEB era	6
A new energy parameter: the equivalent photovoltaic surface	7
<b>Chapter 2 - Energy simulation of a building for hotel use</b>	8
<b>Chapter 3 - Influence of endogenous loads</b>	10
Requirements without endogenous loads	10
Requirements with endogenous loads	11
Conclusions	12
<b>Chapter 4 - Influence of orientation</b>	13
Conclusions	14
<b>Chapter 5 - Influence of thermal insulation on energy requirements</b>	15
Conclusions	17
<b>Chapter 6 - Influence of intake of external air</b>	18
Influence of the regenerator's efficiency on consumption	18
Influence of the injected air temperature on the power required to the terminals	19
Total power required to the regenerators	19
Energy requested by the AHU (Air Handling Units) fans	20
Conclusions	20
<b>Chapter 7 - Influence of thermal insulation on the air temperature in the rooms</b>	21
Air temperature in the occupied rooms	21
Consequences on the plant management	22
Conclusions	23
<b>Chapter 8 - Comparison between maximum design powers and maximum powers in the standard average year</b>	24
Load on the batteries of the air handling unit	24
Fan Coil in heating and cooling	24
Total annual load on hot and cold circuits	25
Consequences on the flow in the terminals	26
Conclusions	28
<b>Chapter 9 - Theoretical advantages of variable water flow circuits</b>	29
Power required to move a water flow	29
When the power varies with the cube of the pump rpm	29
Limits of traditional two-way valves	32
The risk of hunting	38
The risk of starving	40
Conclusions	41
<b>Chapter 10 - Advantages of pressure-independent valves Danfoss AB-QM</b>	42
How the pressure-independent valve Danfoss AB-QM works	42
Resolution of the overpressure issue on the control valves thanks to the use of Danfoss AB-QM valves	43
Resolution of the risk of hunting issue thanks to the use of Danfoss AB-QM valves	46
Resolution of the starving issue thanks to the use of Danfoss AB-QM valves	48
Simplification of the installation and reduction of installation and commissioning times	50
Conclusions	52
<b>Chapter 11 - Advantages of variable air flow in hotel rooms</b>	53
Variation of air flow during the day	53
Effects of the air flow on the energy required to the generators	54
Energy Consumed by AHU fans	55
Conclusions	57

<b>Chapter 12 - Reduction of energy consumption and management costs with variable flow</b>	
<b>Danfoss solutions in installations with boiler and refrigerating unit</b>	58
Retrofit of building with year 2005 thermal insulation type	58
Efficiency improvement of installed equipment	59
Improvement of thermal insulation	60
Use of Danfoss solutions for variable flow installations	60
Economic benefits retrofit of building with year 2005 thermal insulation type	63
Retrofit of building with year 2010 thermal insulation type	64
Efficiency improvement of installed equipment	64
Improvement of thermal insulation	65
Use of Danfoss solutions for variable flow installations	65
Building design with year 2021 thermal insulation type	66
Use of Danfoss solutions for variable flow installations	66
Economic grounds	67
REconomic savings on retrofit of building with year 2005 insulation type	67
Economic savings on retrofit of building with year 2010 insulation type	68
Economic savings on retrofit of building with year 2021 insulation type	68
Conclusions	69
<b>Chapter 13 - Advantages of Danfoss solutions in other hotel areas</b>	70
Restaurant and Spa premises	70
Dining area and Breakfast Room	70
Spa premises	72
Conference Room	73
Savings obtainable by taking into account bedrooms, common areas and additional rooms	74
<b>Chapter 14 - Danfoss MTCV multifunctional thermostatic circulation valves</b>	75
The recirculation ring	75
Difference between static balancing valves and thermostatic valves	76
The versions of the Danfoss MTCV valves	76
Calculation of the water flows for the balancing valves MTCV	82
Estimates of obtainable saving	82
Conclusions	83
<b>Chapter 15 - Use of new Danfoss compressors</b>	84
Volumetric compressors and centrifugal compressors	84
Limits of traditional scroll compressors	84
Scroll compressor IDV with Intrinsic Variable Volume	86
Centrifugal turbochargers	89
Adjustment of power at constant rpm	90
Centrifugal turbochargers: performance when revolutions vary	91
Optimum operation of a centrifugal turbocharger with inverter	93
Savings obtainable by using the inverter	94
ITurbocor® compressor	94
Conclusions	97
<b>Chapter 16 - Efficiency improvement of cold food management installations</b>	98
<b>Chapter 17 - Conclusions</b>	99
Index of Figures	101

# 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  $\epsilon = 50\%$  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

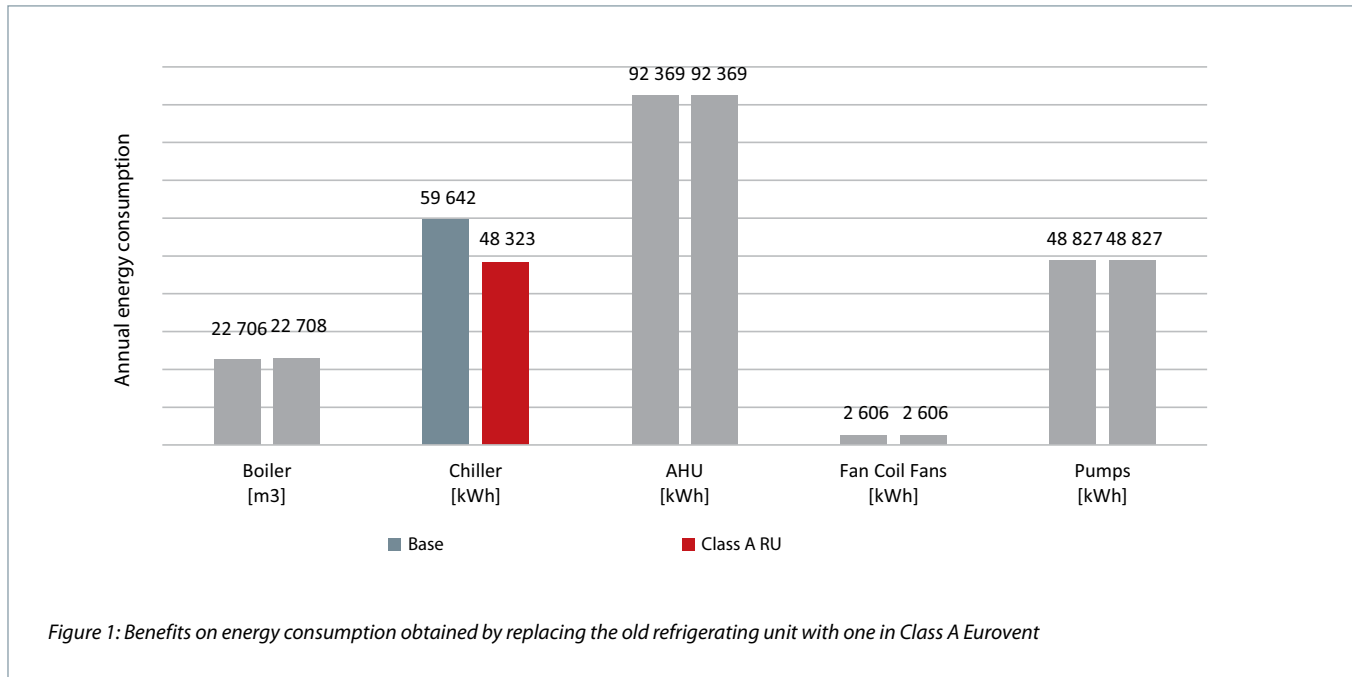
### Three Danfoss solutions for variable water and air flow systems

- 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

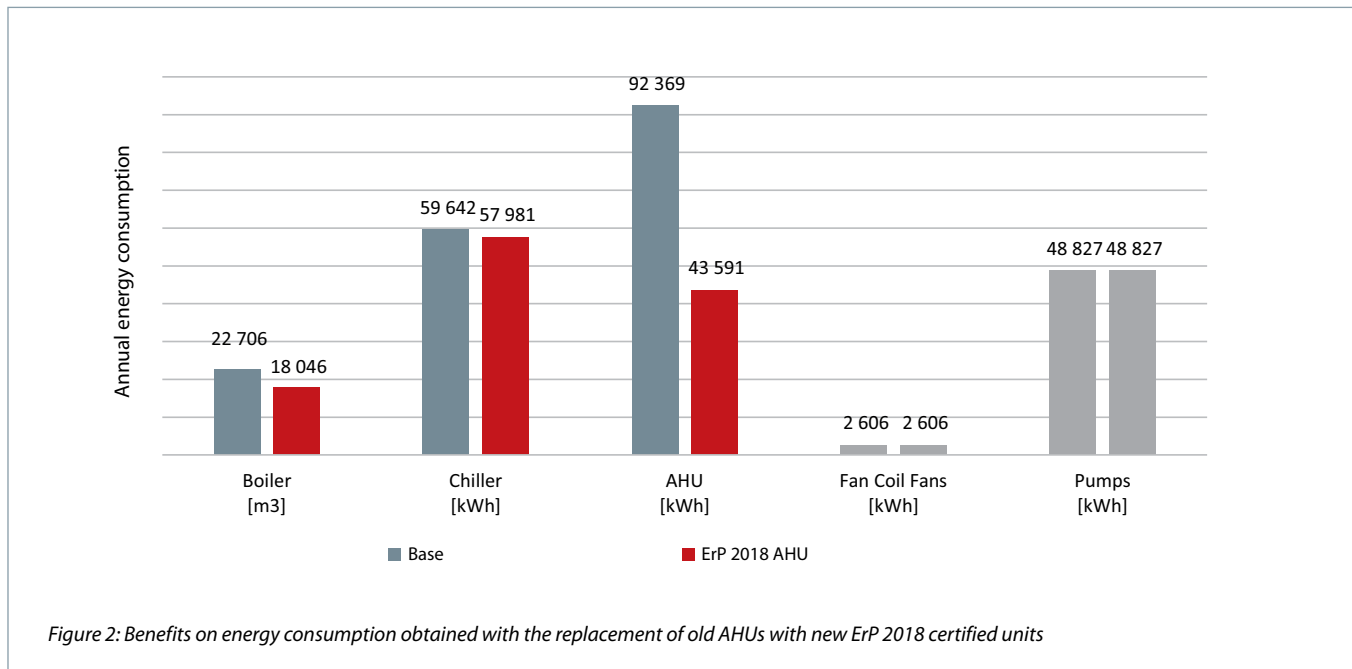
By performing only the replacement of the refrigerating unit with one of higher energy class, without intervening on balancing and efficiency improvement of the plant, an improvement limited to the

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.



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.

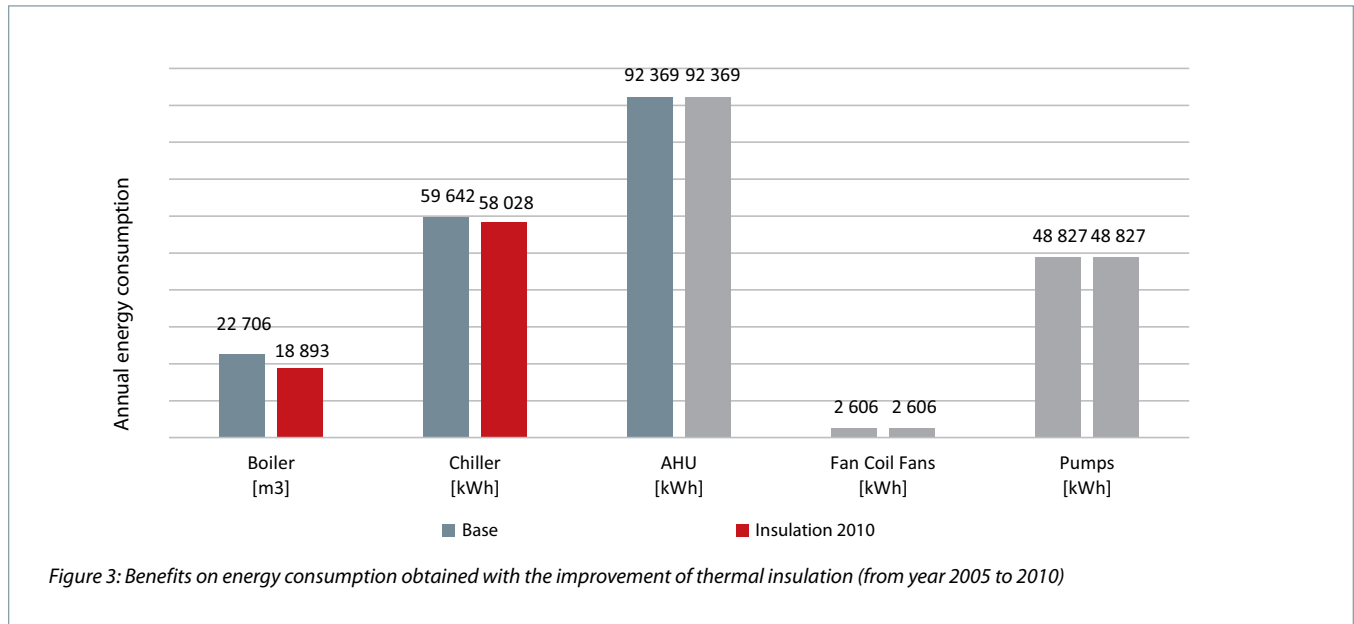
The regenerator's efficiency improvement also lowers methane consumption and, marginally, the refrigerating unit's consumption.



### Improvement of thermal insulation

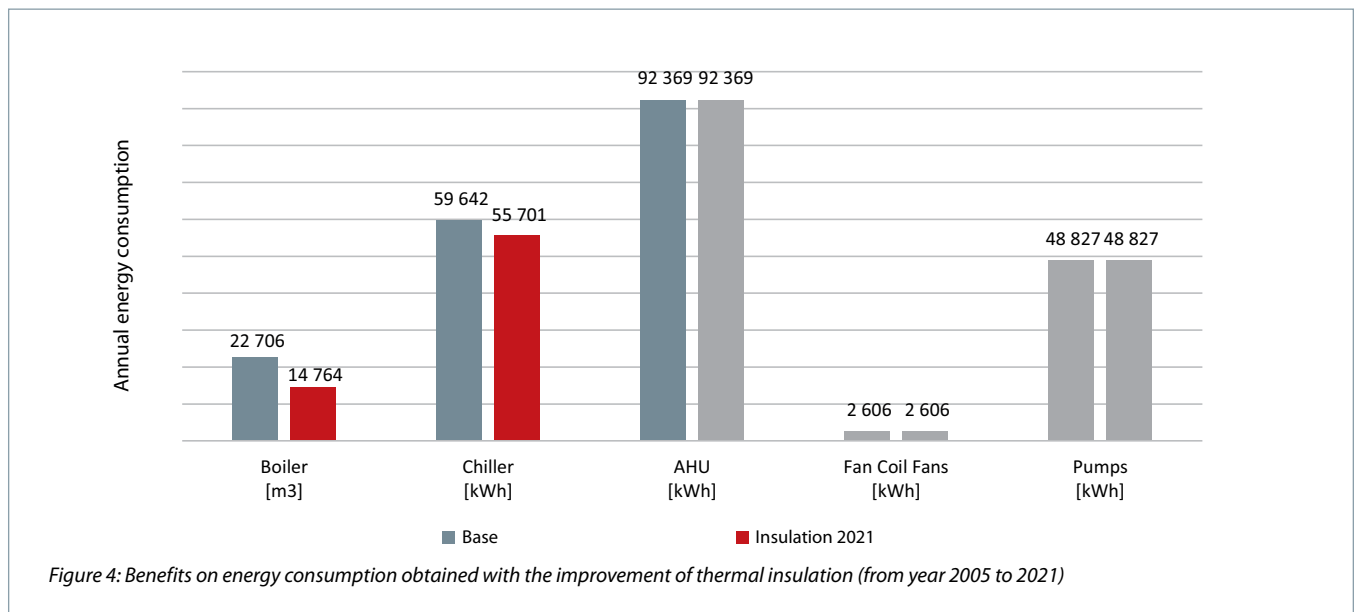
By intervening on thermal insulation, improving it up to the construction typology typical of the year 2010, and leaving instead the plant unaltered, quite poor results are obtained, as only the

methane consumption of the boiler decreases and, in marginal way, that of the electric energy absorbed by the refrigerating unit.



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.



### 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.

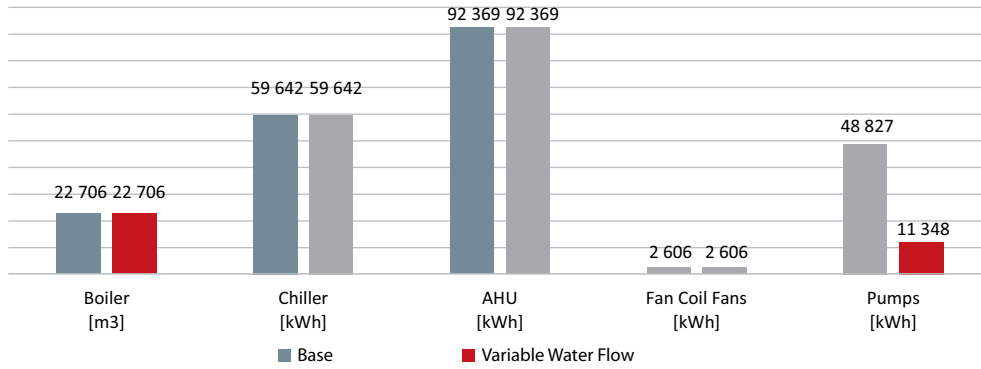


Figure 5: Benefits on energy consumption obtained with Danfoss variable water flow solutions (building 2005)

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%.

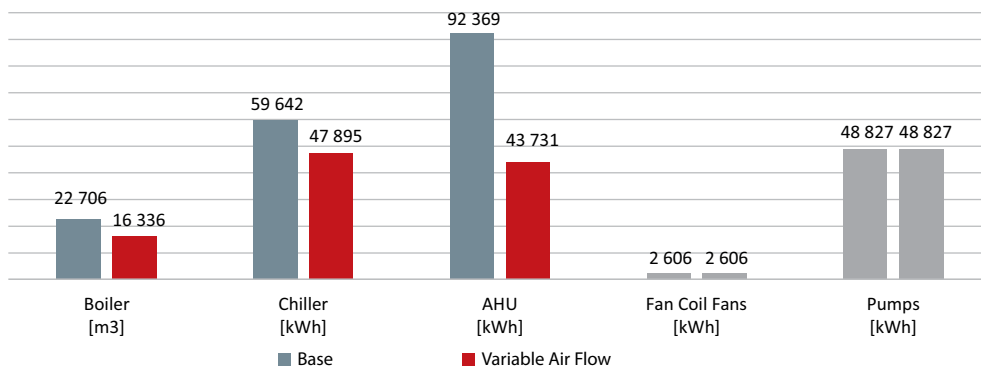


Figure 6: Benefits on energy consumption obtained with Danfoss variable air flow solutions

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/m<sup>3</sup> and of electricity of €0.20/kWh, the reduction of consumption enables money savings on the bill for over 40%.

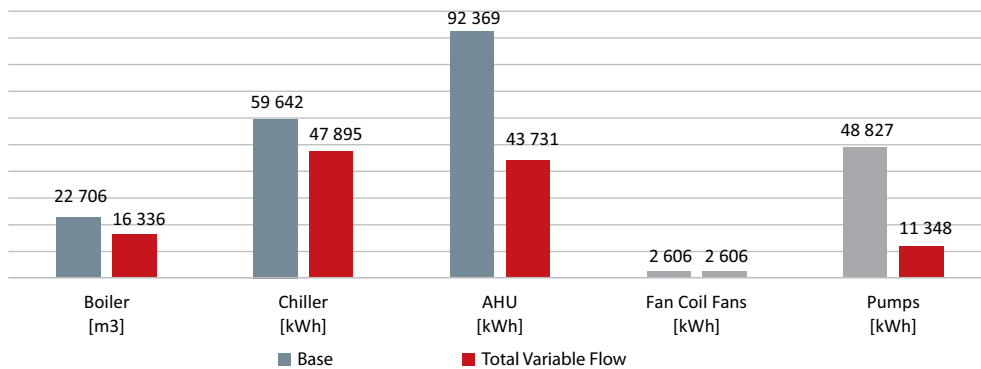


Figure 7: Benefits on energy consumption obtained with Danfoss variable water and air flow solutions



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.

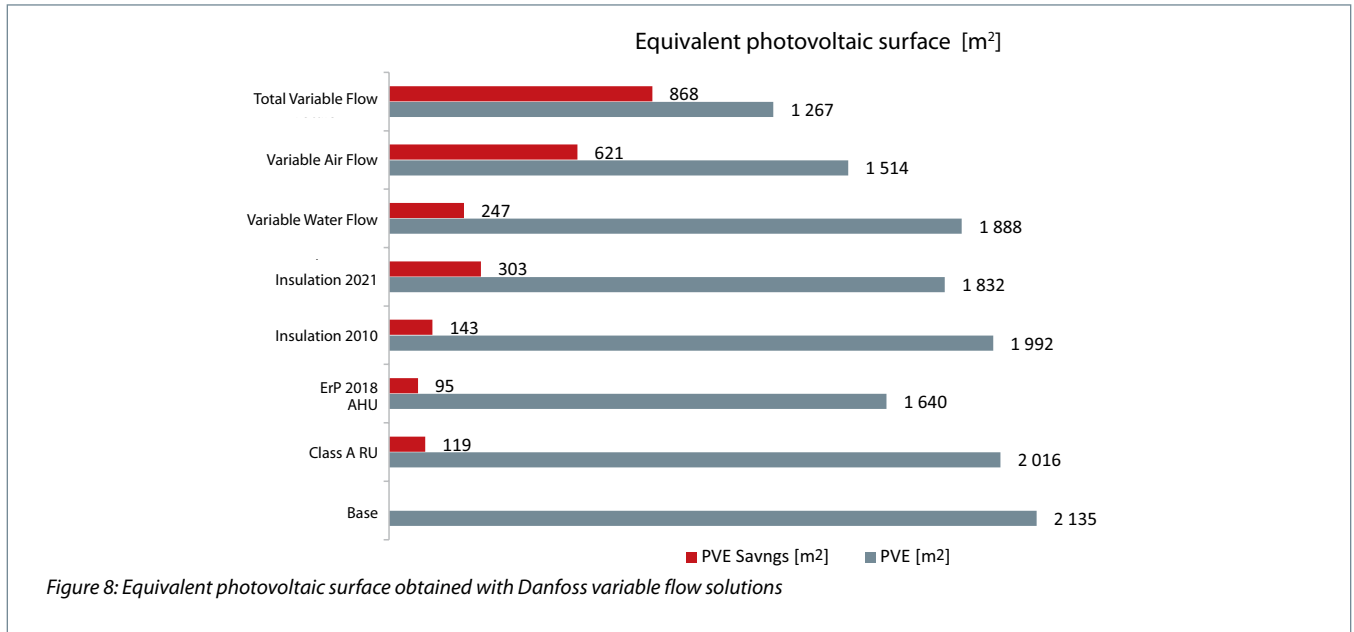
In fact, think about the energy efficiency objectives in force starting from 2021 relating to the buildings' energy requirements, and the use of renewable energy sources to cover part of the request.

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

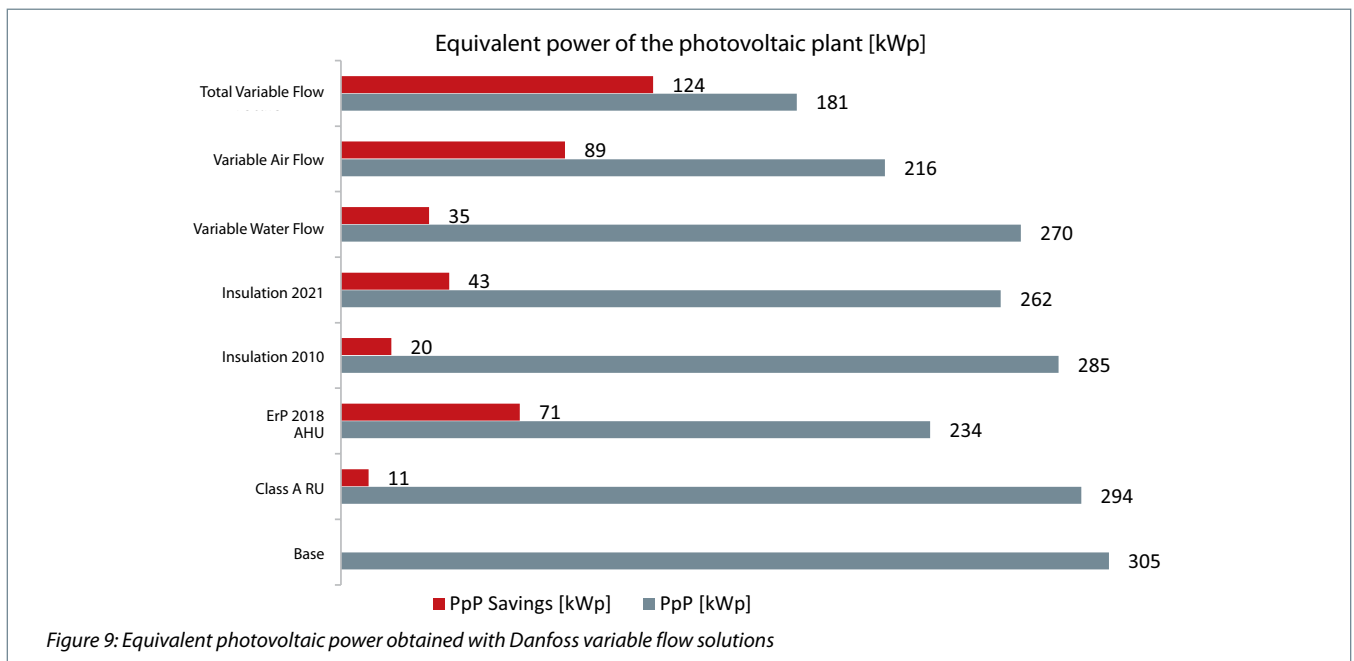
must find a suitable surface for the installation of solar panels (that can become quite large, and that it is not always available), especially in urban centres with purely vertical constructions.

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.



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



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<sub>2</sub> 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.

# 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**



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