



Improving the energy performance of existing buildings in retrofit interventions

A subsidy scheme included in the Financial Law 2007 has introduced remarkable incentives for energy-saving retrofit interventions on existing buildings. The subsidies are awarded in the form of tax reductions, up to the amount of 55% of capital investments for interventions that have increased the energy efficiency of the buildings, and in particular:

- reduction of overall energy consumption of the buildings;
- improvement of the buildings envelope performance

(enhanced thermal insulation, low-transmission glasses...);

- replacement of old heating appliances by condensing boilers.

Robur solutions are of primary interest to meet the criteria for the general improvement of the buildings efficiency (point 1 above), allowing to obtain an "energy performance index for winter heating" at least 20% lower than the values required by the Decree of the Ministry of Economy and Finance of February 19, 2007, thus implying a fiscal benefit of up to

100,000.00 Euro.

As a matter of fact, the Decree does not describe what are the specific interventions or the type of installations which must be implemented to improve the energy performance of the buildings.

As a consequence, even if the replacement of heating appliances is just considered in the case of condensing boilers (point 3 above), any other type of heat generator, as by example absorption heat pumps, can be subsidized when the overall performance of the

building is increased. In this respect, a lot of retrofit projects have been successfully realized choosing Robur's technology and products for their extremely high thermal efficiency, as in the couple of examples reported hereafter.

Energy performance retrofit of a commercial building

A first interesting example of energy performance retrofit that has profited by the subsidies of 55% included in the Financial Law 2007 is the intervention carried out by the Engineering Office "Poli Enzo", in Prato (near Florence), on an existing commercial building, situated in Prato too, erected in the early 90's, with walls insulated according to the codes and laws in force at that time. The intervention consisted in the simple replacement of one of the existing heat generators, serving a part of the building (which is subdivided in several properties), with a reversible gas-fired absorption heat pump Robur GAHP-AR; the intervention is particularly interesting because it was the opportunity to check if the

utilization of a highly performant heat generation technology was able by itself to allow meeting the requirements of the beforementioned Financial Law and obtain subsidies without any other intervention on the building structure, envelope or facilities. The check gave positive results, as it proved that just by replacing the existing boiler with the high efficiency absorption heat pump GAHP-AR, with a nominal G.U.E. (Gas Utilization Efficiency) of 140%, the "energy performance index for winter heating" reached a value more than 20% lower than the limit given by the Ministerial Decree of February 19, 2007. Therefore, the intervention obtained the 55% subsidy. Here are the details of the verification according to the Law of Finance 2007, paragraph 344:

- limit value for the energy performance index for winter heating (MD 02/19, 2007) = 23,41 kWh/m³ per year;
 - value of the energy performance index for winter heating reached by the building after the replacement of the heat generator = 12,90 kWh/ m³ per year;
 - minimum improvement = limit value - 20% = 23,41 - 20% = 18,73;
 - verification criterion : 12,90 < 18,73 (the result is positive).
- In the specific case, the capital cost of the intervention (the professional expenses not included) was 14,155.00 Euro and the subsidy awarded was 7,785.00 Euro; the net cost for the building's owner was then reduced to 6,370.00 Euro. It is worth mentioning that the previous heat generator (replaced not because obsolete

or out of order) was a Robur unit, started up in 1993, model AYC 60-165, which is a combination of an absorption chiller and a standard boiler, used both for winter heating and for summer cooling. With the new reversible unit GAHP-AR, beyond the capital incentives, it is also interesting to analyse the reduction in running costs due to the change in technology and increase in efficiency, and estimate the pay-back time of the intervention. In this case, the outcome is that the new GAHP-AR unit is able to improve both winter and summer efficiencies, resulting in a reduction of gas consumption of 1,500.00 Euro per year, giving an overall pay-back time of about 4 years.



Software for energy diagnostics

Building data

Dati di input riferiti a: Edificio Zone

| n° | Descrizione | Generatore |
|----|-------------|------------|
| 1 | Ufficio 4A | Tabellato |
| 2 | Ufficio 4B | Tabellato |

Fattore di intermittenza

Modalità di funzionamento: C h.spd(ore) = 0
 T. min: 16 gac(giorni) = 2 h.spn(ore) = 0

Rendimento di emissione: Term. di erogazione = 2 Tipologia di install.: 0
 Temp. di mandata (°C) = 50

Rendimento di distribuzione: Tipo Zona = C Altezza Zona = 2.5 m
 Volume Zona = 337.6 m³

Temp. di ritorno = 12
 Eta E = 98 % Eta D = 96 %

Rendimento di Regolazione: Tipo = 07 Climatica+Ambiente modulante banda p 1°C
 Eta C = 98 %

Energie Riscaldamento (UNI EN 832) e Op.var. Energie per Acque sanitarie

Careatteristiche generali del generatore

Generatore per riscaldamento:

con produzione di acqua calda
 con produzione per altri usi (Op.var)
 con produzione da fonte rinnovabile (Op.risc)

Rend. sist. elettrico nazionale EtaSen = 36 %

Generatore scelto: Tabellato

Elenco Generatori:

- Caldaia
- Gen. aria calda
- Pompa di calore
- Tabellato
- Caldaia a condensazione

Scegli Modifica

Energy system data

Generatore scelto: TABELLATO

Ufficio 4B Funzionamento: CONTINUATO

Intermittenza = 1.00 TMN 16 °C Ore interm. Diurna = 0 Ore interm. Notturna = 0
 Oh,s = 19890 MJ Terminele Venticconvetori Regol.: Climatica+Ambiente modulante banda p
 Ohv,s = 19890 MJ
 Op,s = 21355 MJ
 Qs = 15676 MJ
 Opo = 0 MJ

Rendimenti

| | EtaC | EtaP |
|------|-------|--------|
| Gen | 99.00 | 130.90 |
| Feb | 99.00 | 133.50 |
| Mar | 99.00 | 140.00 |
| Apr | 99.00 | 147.50 |
| Mai | 0.00 | 0.00 |
| Giun | 0.00 | 0.00 |
| Lug | 0.00 | 0.00 |
| Ag | 0.00 | 0.00 |
| Set | 0.00 | 0.00 |
| Ott | 0.00 | 0.00 |
| Nov | 99.00 | 140.20 |
| Dic | 99.00 | 140.20 |

EtaC = 99.0 Medio
 EtaE = 98.0
 EtaD = 96.0
 EtaP,s = 136.2
 EtaG,s = 126.9

Combustibile scelto: Metano

| | Sen. | Veri. | Risc. | Totale |
|--------------------------|------|-------|-------|-----------------|
| Consumo Acque sanitarie | 0.0 | | | 0.0 MJ/m² anno |
| Consumo Op.var | 0.0 | | | 0.0 MJ/m² anno |
| Consumo Riscaldamento | | | 46.4 | 46.4 MJ/m² anno |
| Consumo Totale | | | 46.4 | 46.4 MJ/m² anno |
| Consumo di combustibile | | | 461.1 | 461.1 Nm³/anno |
| Consumo di en. elettrica | | | 0.0 | 0.0 kWh/anno |

Scala: 0 a 500 MJ/m² anno. Legend: Inaccettabile, Molto Elevato, Elevato, Normale, Basso.

Energy outcome of the intervention

Ufficio 4B Generatore: TABELLATO

Tipo di intervento: Sostituzione del generatore di calore

Verifiche previste dal DLgs 311/06, Allegato I, comma 3
 Verifiche alternative previste dal DLgs 311/06, Allegato I, comma 4
 Verifiche alternative previste dal DLgs 311/06, Allegato I, comma 5

| | Verifica | Ammissibili | Calcolati |
|---|----------|-------------|-------------------|
| Prestazione energetica per la climatizzazione invernale | | 23.41 | 12.9 kWh/(m²anno) |
| Rendimento globale medio stagionale EtaG | Positiva | 79.2 | 126.9 % |
| Rendimento utile - 30 % Pn EtaU | | | |
| Rendimento utile - 100 % Pn EtaU | | | |
| Rendimento di combustione 100 % Pn EtaC | | | |
| Trasmittanza media chiusure trasparenti | | | |
| Trasmittanza medie strutture opache | | | |

Energy performance retrofit of a laboratory

A second example of energy performance retrofit with fiscal benefit is another intervention realized by the same Engineering Office Poli Enzo in Prato on a building in Bagno a Ripoli (Florence), located at the first floor of a complex erected in the early 80's. The installation is equipped with fan coils supplied by the hot/cold water produced by 4 Robur units type AYC 60-140, started up in the early 90's, and replaced in 2007 with a new multiple unit RTAR

240-480, composed by 4 reversible absorption heat pumps. The replacement of the 4 units equipped with a standard boiler by units equipped with high efficiency absorption heat pumps resulted again in a reduction of the energy performance index for winter heating allowing to profit of the fiscal benefit:

- limit value for the energy performance index for winter heating (MD 02/19, 2007) = 22,33 kWh/m³ per year;
- value of the energy performance index for winter heating reached by the building after the replacement of the heat generator = 14,81 kWh/m³ per year;
- minimum improvement = limit value - 20% = 22,33 - 20% = 17,86 kWh/m³ per year - verification criterion : 14,81 < 17,86 (the result is positive).

In this instance, the overall capital cost (professional expenses not included) was 57,000.00 Euro, the fiscal benefit was 31,350.00 Euro, and then the net cost for the final client 25,650.00 Euro. The higher efficiency (both in the heating

and in the cooling season) gave a reduction in gas consumption and then in running costs of around 5,700.00 Euro per year, with a pay-back time of around 4,5 years.

Software for energy diagnostics

Building data

Energy system data

| Mese | EtaC | EtaP |
|-----------|-------|--------|
| Gennaio | 96.00 | 130.90 |
| Febbraio | 96.00 | 133.50 |
| Marzo | 96.00 | 140.00 |
| Aprile | 96.00 | 147.60 |
| Maggio | 0.00 | 0.00 |
| Giugno | 0.00 | 0.00 |
| Luglio | 0.00 | 0.00 |
| Agosto | 0.00 | 0.00 |
| Settembre | 0.00 | 0.00 |
| Ottobre | 0.00 | 0.00 |
| Novembre | 96.00 | 140.20 |
| Dicembre | 96.00 | 140.20 |

Energy outcome of the intervention

| Verifica | Ammissibili | Calcolati |
|----------|-------------|-----------|
| 22,33 | > | 14,81 |
| 81,01 | < | 123,3 |

