Photovoltaic roofs, Tudela

Project information

Address 1:	Rafael Delgado Garcés 8, Tudela
End construction year:	2012
Installed photovoltaic field capacity:	24 kWp
Address 2:	Jesus Clemos Burgaleta 2, Tudela
End construction year:	2012
Installed photovoltaic field capacity:	12 kWp
Address 3:	Paseo de los Poetas, Tudela
End construction year:	2012
Installed photovoltaic field capacity:	12kWp
Total cost*:	249.503€

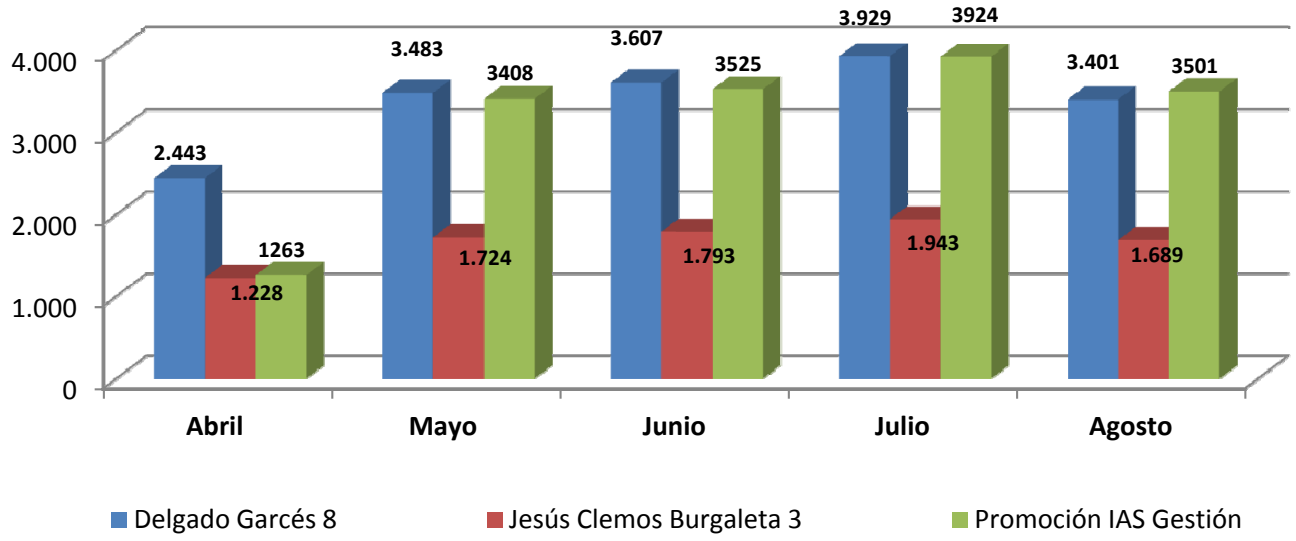
*** Not included industrial benefits, overheads and taxes**

Special ECO-technologies applied:

- Smart inverter management system installed, which optimizes energy generation.
- Connected to the electrical network instead of being used for self-consuming energy.

Energy consumption

Energy production of the photovoltaic fields (kWh)



ECO-City project partners

BEST 1: Residential new buildings

IAS Gestión, Tudela

Project information

Project type:	New eco-dwellings
Address:	Paseo de los Poetas 12,14 Tudela
End construction year:	2011
Building type:	Multi level block of apartments
Dwellings:	36
Storeys:	5
Gross area BTA:	6173 m²
Net area:	3835 m²
Heated area:	4115 m²
Additional costs* for eco-applications:	653.261 €
Total building costs*:	2.710.056 €

*** Not included industrial benefits, overheads and taxes**

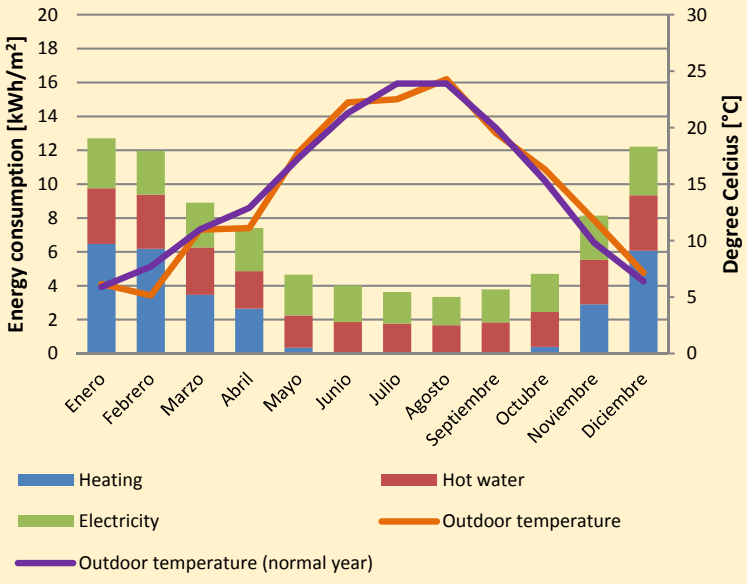
Special ECO-technologies applied:

- Optimization of window type
- Passive solar
- Avoidance of thermal bridges
- Increased insulation in roof, floor and facade
- Photovoltaic Field
- Intelligent control system (TIC) for DHW+Heating
- Individual measurement system
- Improved air tightness of building envelope
- ECO-materials (mineral wool insulation and wood frames for the windows)
- Biomass powered DHW+Heating

Energy consumption

*** National Regulations (2006)**

Energy consumption (simulated)



Heat trans.	Unit	National reg.*	Concerto spec.	Actual
Outerwall	W/m²K	0.66	0.3	0.29
Roof	W/m²K	0.49	0.2	0.19
Floor	W/m²K	0.49	0.25	0.25
Windows North	W/m²K	3	_	_
Windows South	W/m²K	3.5	_	_
Glazing	W/m²K	_	1.6	1.6
Vent. rate	h^{-1}	1	0.5	0.5

Energy consumption	Unit	National reg.*	Concerto spec.	Actual 2012
Heat	kWh/m²	53.6	29.7	_
Hot water	kWh/m²	18	14.5	_
Electricity	kWh/m²	23	15.5	_
Total	**kWh/m²**	**94.6**	**59.7**	**_**
PV	MWh	-	-	18.5

ECO-City project partners

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BEST 1: Residential new buildings

IAS Gestión , Tudela

Lessons learned:

- Designer subject to urban regulations, buildings cannot be optimally oriented. As a result, savings could be higher.
- Since these were private property developments, public administrations have been unable to have an influence on the design. As a consequence of the little know-how in bioclimatic architecture of private architects, design geometry is not optimal although concerto specifications have been successfully achieved.
- Extra costs due to energy efficiency improvement measures have been lower than expected.
- Due to the photovoltaic field, one of these buildings almost meets zero emission building specifications.

Key figures

Heat trans.	Unit	Normal practice	Concerto spec.	Actual
Outerwall	W/m²K	0.66	0.3	0.29
Roof	W/m²K	0.49	0.2	0.19
Floor	W/m²K	0.49	0.25	0.25
Windows (North)	W/m²K	3	–	–
Windows (south)	W/m²K	3.5	–	–
Glazing	W/m²K	-	1.6	1.6
Vent. rate	h^{-1}	1	0.5	0.5

Energy consumption	Unit	Normal practice	Concerto spec.	Actual 2012
Heat	kWh/m²	53.6	29.7	-
Pipe losses	kWh/m²	Inc	Inc	-
Ventilation	kWh/m²	Inc	Inc	-
Hot water	kWh/m²	18	14.5	-
Total heat	**kWh/m²**	**71.6**	**44.2**	-
Lighting	kWh/m²	Inc	Inc	-
Other	kWh/m²	Inc	Inc	-
Total elec.	**kWh/m²**	**23**	**15.5**	-
Total	**kWh/m²**	**94.6**	**59.7**	-
PV	MWh	-	-	18.5

ECO-City project partners

BEST 2: Refurbishment

The 100 dwellings , Tudela

Project information

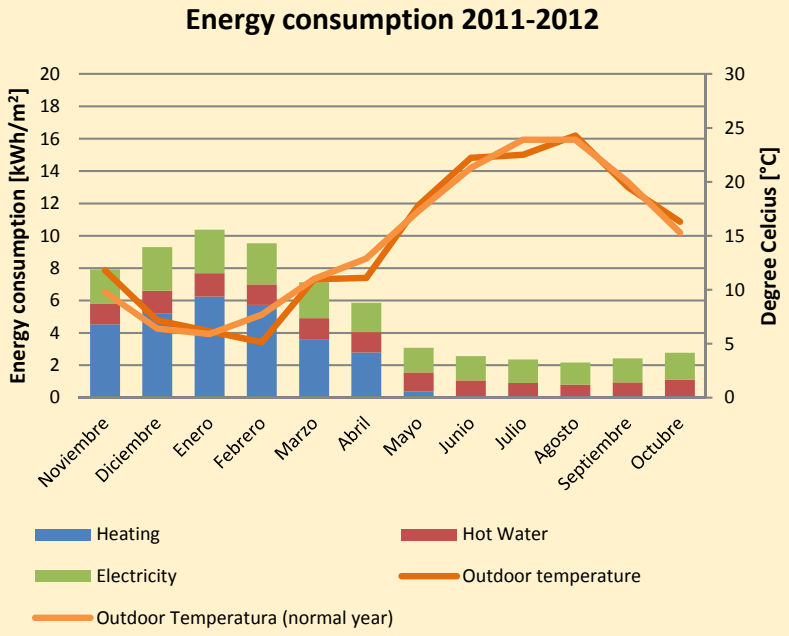
Project type:	Eco-Refurbishment
Address:	Rafael Delgado Garcés 4,6,8,10,12
End rehabilitation year:	2011
Building type:	Blocks of dwellings
Dwellings:	90
Storeys:	5
Gross area BTA:	9431 m²
Net area:	7730 m²
Heated area:	7034 m²
Additional costs* for eco-applications:	483.674 €
Total building costs*:	1.366.065 €

*** Not included industrial benefits, overheads and taxes**

Special ECO-technologies applied:

- Complete refurbishment, including the installation of elevators
- EIFS (Exterior Insulation and Finishing System) applied to the external façade (Avoidance of thermal bridges and increased insulation)
- Individual electric and thermal meters
- Optimization of window type (duplication of the frames)
- Photovoltaic Field

Energy consumption



Heat trans.	Unit	National reg.(2006)	Concerto spec.	Actual
Outerwall	W/m²K	0.66	0.66	0.36
Roof	W/m²K	0.49	0.38	0.38
Floor	W/m²K	0.49	0.5	0.62
Windows (north)	W/m²K	3	_	_
Windows (south)	W/m²K	3.5	_	_
Glazing	W/m²K	_	1.7	1.7
Vent. rate	h^{-1}	1	0.5	0.5

Energy consumption	Unit	60's National reg.	Concerto spec.	Actual 2011-2012
Heat	kWh/m²	110	58	28.5
Hot water	kWh/m²	20	-	14
Electricity,	kWh/m²	25	-	23.1
Total	**kWh/m²**	**155**	**58**	65.6
PV field	**MWh**	-	-	**19.5**

ECO-City project partners

BEST 2: Refurbishment

The 100 dwellings , Tudela

Lessons learned:

- Several difficulties have been found since an agreement between the 100% of the users was necessary. In Spain every flat has a private owner so it is necessary to achieve a high percentage of agreement to modify structural components of a building.
- To grant the success of Eco-rehab in areas where inhabitants have low incomes, it is crucial to gain the access to soft loans. The application of these loans must be done in the basis of the Community and not as a personal loan, due to the risks analysis that financial entities develop.
- The EIFS system is optimal for refurbishing since it fixes thermal bridges and does not require the users being vacated.
- Thermal comfort improvement confirmed by the users.
- Call effect (once that other users have seen the results, they want to refurbish their own buildings)
- Consumptions lower than expected, probably due to the economical context.
- Special difficulties were found to install the photovoltaic field because of the user's distrust (even though the cost for them was 0).

Key figures

Heat trans.	Unit	Normal practice	Concerto spec.	Actual
Outerwall	**W/m²K**	0.66	0.66	0.12
Roof	**W/m²K**	0.49	0.38	0.07
Floor	**W/m²K**	0.49	0.5	0.09
Windows (north)	**W/m²K**	3	_	0.9
Windows (south)	**W/m²K**	3.5	_	-
Glazing	**W/m²K**	_	1.7	0.6
Vent. rate	**h-1**	1	0.5	0.7

Energy consumption	Unit	Normal practice	Concerto spec.	Actual 2011-2012
Heat	kWh/m²	110	58	28.5
Pipe losses	kWh/m²	Inc	Inc	Inc
Ventilation	kWh/m²	Inc	Inc	Inc
Hot water	kWh/m²	20	Inc	14
Total heat	**kWh/m²**	**130**	**58**	**42.5**
Lighting	kWh/m²	Inc	-	Inc
Other	kWh/m²	Inc	-	Inc
Total elec.	**kWh/m²**	**25**	**-**	**23.1**
Total	**kWh/m²**	**155**	**58**	**65.6**
PV	MWh	-	-	19.5

ECO-City project partners

zabala CENER cenifer Ayuntamiento de Tudela Gobierno de Navarra Nasuvinsa Navarra de Suelo y Vivienda, S.A. Mancomunidad de la Ribera

BEST: 2 Refurbished

50's dwellings, Tudela

Project information

Project type:	Eco-rehabilitation
Address:	Clemos Burgaleta 1,3
End refurbishment year:	2011
Building type:	Blocks of dwellings
Dwellings:	12
Storeys:	3
Gross area BTA:	1150 m²
Net area:	877 m²
Heated area:	978 m²
Additional costs* for eco applications:	66.548 €
Total building costs*:	211.533€

*** Not included industrial benefits, overheads and taxes**

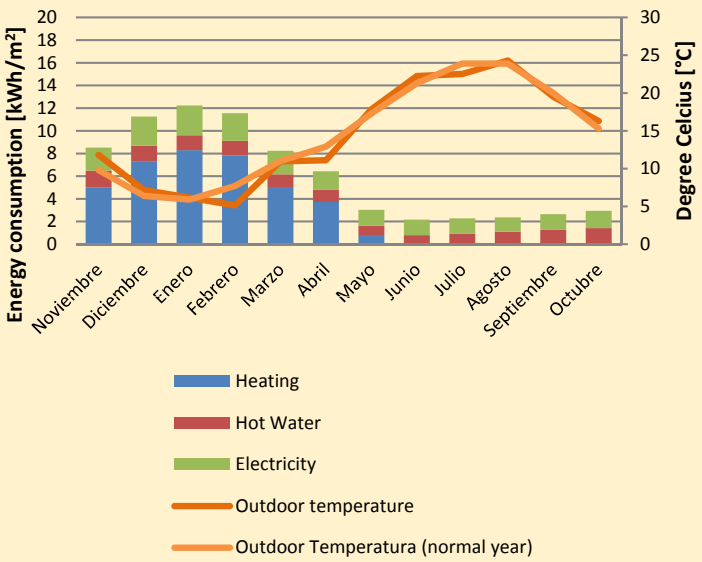
Special ECO-technologies applied:

- Complete refurbishment, including the installation of elevators
- EIFS (Exterior Insulation and Finishing System) applied to the external façade (Avoidance of thermal bridges and increased insulation)
- Individual electric and thermal meters
- Optimization of window type (duplication of the frames)
- Photovoltaic Field

Energy consumption

*** National Regulations (2006)**

Energy consumption 2011-2012



Heat trans.	Unit	National reg.*	Concerto spec.	Actual
Outerwall	W/m²K	0.66	0.66	0.442
Roof	W/m²K	0.49	0.38	0.265
Floor	W/m²K	0.49	0.5	0.25
Windows (north)	W/m²K	3	–	–
Windows (south)	W/m²K	3.5	–	–
Glazing	W/m²K	–	1.7	1.67
Vent. rate	h^{-1}	1	0.5	0.5

Energy consumption	Unit	National reg.*	Concerto spec.	Actual 2011-2012
Heat	kWh/m²	125	58	37.9
Hot water	kWh/m²	20	-	14.2
Electricity	kWh/m²	25	-	21.6
Total	kWh/m²	170	58	73.7
PV field	MWh	-	-	9.67

ECO-City project partners

BEST: 2 Refurbished

50's dwellings, Tudela

Lessons learned:

- Several difficulties have been found since an agreement between the 100% of the users was necessary. In Spain every flat has a private owner so it is necessary to achieve a high percentage of agreement to modify structural components of a building.
- To grant the success of Eco-rehab in areas where inhabitants have low incomes, it is crucial to gain the access to soft loans. The application of these loans must be done in the basis of the Community and not as a personal loan, due to the risks analysis that financial entities develop.
- The EIFS system is optimal for refurbishing since it fixes thermal bridges and does not require the users being vacated.
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Key figures

Heat trans.	Unit	Normal practice	Concerto spec.	Actual
Outerwall	W/m²K	0.66	0.66	0.442
Roof	W/m²K	0.49	0.38	0.265
Floor	W/m²K	0.49	0.5	0.25
Windows (north)	W/m²K	3	–	–
Windows (south)	W/m²K	3.5	–	–
Glazing	W/m²K	–	1.7	1.67
Vent. rate	h-1	1	0.5	0.5

Energy consumption	Unit	Normal practice	Concerto spec.	Actual 2011-2012
Heat	kWh/m²	125	58	37.9
Pipe losses	kWh/m²	Inc	Inc	Inc
Ventilation	kWh/m²	Inc	Inc	Inc
Hot water	kWh/m²	20	Inc	14.2
Total heat	**kWh/m²**	**145**	**58**	**52.1**
Lighting	kWh/m²	Inc	-	Inc
Other	kWh/m²	Inc	-	Inc
Total elec.	**kWh/m²**	**25**	**-**	**21.6**
Total	**kWh/m²**	**170**	**-**	**73.7**
PV	MWh	-	-	9.67

ECO-City project partners