Trigeneration District Heating & Cooling Central in ExpoZaragoza Business

European Green Capital Award 2016

11. Energy performance

EUROPEAN GREEN CAPITAL

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Zaragoza AYUNTAMIENTO

Spain

11. ENERGY PERFORMANCE

11A. Present Situation

Describe the present situation and development in relation to housing over the last five to ten years, using quantitative data. List any disadvantages resulting from historical, geographical and/or socio-economic factors which may have influenced this indicator area.

Make reference to:

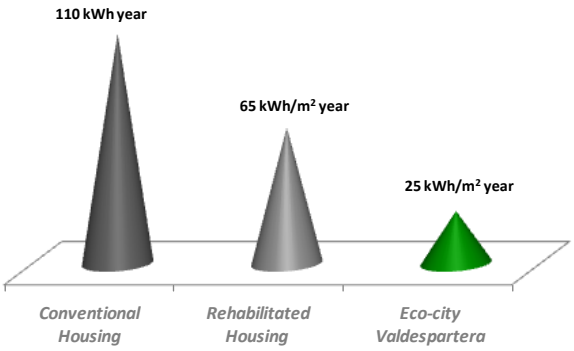
1. *Energy consumption & performance of municipal buildings (in KWh/m2) according to your current Development or Action Plan;*
2. *The development so far and the current strategy of the renewable vs non-renewable mix of energy sources during the past 10 years (for both heat and electricity; expressed in KWh, MWh or GWh);*
3. *The current plan for integration and performance of renewable energy technology in municipal buildings and homes compared to the total energy use, (in KWh/m2);*
4. *The current plan of compatible and integrated district heating energy and of combined heat and power energy consumption compared to the total energy use, (expressed in KWh, MWh or GWh);*
5. *The current plan for increasing energy efficiency and decreasing the use of energy in municipal buildings and homes, expressed as energy saved (in KWh/m2);*
6. *The current plan for increasing the use of LED lamps in public lighting.*

Zaragoza has a continental-Mediterranean climate with cold winters, hot summers and frequent NW winds, which has an influence on energy consumption at home.

The energy policy of the Municipality of Zaragoza takes on the objective 2010-2020 of reaching a 24% reduction in consumption and an increase of a 35% in the installation of renewables in order to reach a fall of 24% in CO_2.

The *Municipal Bylaw on Saving, Efficiency and Use of Renewable Energies in Buildings* (2009) fosters the improvement of the energy system of the city by planning, saving, efficiency and using renewable energies.

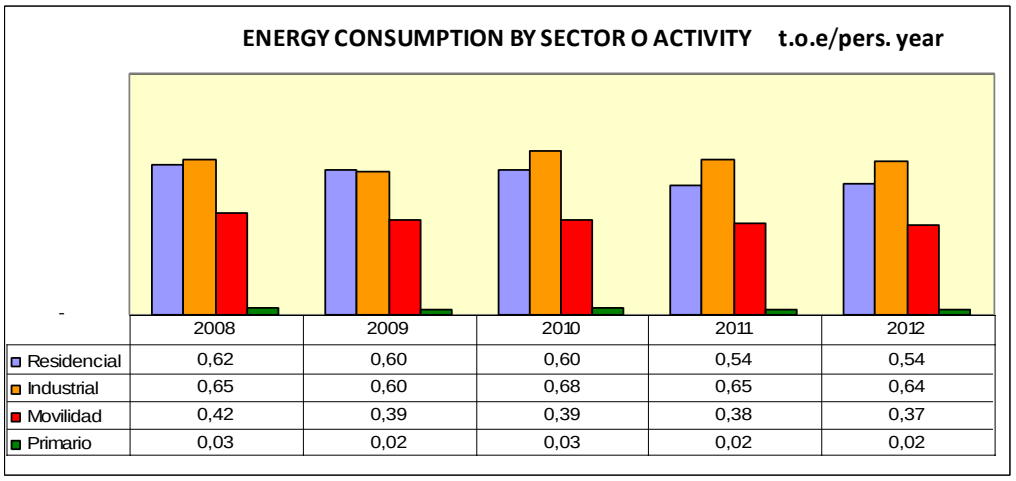
In 2001, before thermal insulation was regulated, the city had 179,226 homes built between 1940 and 1980 (63.18% of the total. From 2000, Zaragoza has been introducing criteria of environmental sustainability and rehabilitation, and construction of council housing.



The new council homes built in Valdespartera Ecocity present an energy consumption of 20-25 kWh/m^2 and those rehabilitated between 50-60 kWh/m^2 (compared to consumption in a standard home of 80-110 kWh/m^2) *(Graphic 1)*

Fig 1. Energy consumption in residential buildings Contrast

From 2008 on, electric consumption per person has been reduced in all the sectors. In the residential and mobility sector, precisely the two most related to the municipal policies on saving energy the reduction has been over 12% *(Graphic 2)*



-	2008	2009	2010	2011	2012
Residencial	0,62	0,60	0,60	0,54	0,54
Industrial	0,65	0,60	0,68	0,65	0,64
Movilidad	0,42	0,39	0,39	0,38	0,37
Primario	0,03	0,02	0,03	0,02	0,02

Graphic 2. Energy Consumption by Sector of

(1) Consumption in municipal buildings is **57 kWh/m^2**. Several buildings have its own installations that use renewables.

(2) Zaragoza Strategy for the Mitigation of Climate Change and the Improvement of the Quality of Air (2009) include actions in dwellings, mobility, public services and renewable energies. It has been reached the goal of reducing a 10% in CO_2 emissions.

The industrial sector also participates by voluntary agreements with the City Council, with an investment over 6 million euro.

Zaragoza and its surrounding area has 534.64 MW produced by renewable energy: wind (194.03 MW), cogeneration with biomass (5.4 MW) and photovoltaic (53.95 MW), without taking into account the primary and industrial sectors.

(3) A Strategy on Full Maintenance and Energy Efficiency in the Municipal Facilities is being prepared right now.

Nevertheless, Zaragoza has 8.92 MW of installed power (84,720,48 MWh/year) in municipal buildings, some of them with full self-supplying.

Other actions implemented are these *(graphic 3)*:

- ✓ photovoltaic system for pumping water for irrigation taken from Puerto Venecia artificial canal
- ✓ all the parking metres are photovoltaic
- ✓ combination wind-photovoltaic energy at Parque de las Garzas
- ✓ photovoltaic street-lamps in periurban areas

Graphic 3. Renewable energy Public Performances: Centre for Sustainable Urbanism, lampposts and parking meters photovoltaic

(4) Because of Zaragoza´s climate, the district network system DHC (District Heating and Cooling) has not been a profitable option.

An exception is the DHC placed at ZentroExpo that has obtained a reduction of a 50% in emissions. Currently there are 17 buildings connected with a demanded power between 115 kW and 2.8 MW. The network is currently at the 30-35% of its capacity.

(5) Audits on energy use in the municipal buildings for the actions to be implemented from 2014 on are right now being implemented.

Zaragoza is participating in the European project **E3SOHO** *Efficient Energy in Social Housing in Europe*. It is a research on energy consumption habits in social housing aiming to find solutions on energy saving to its residents.

(6) The use of led light is right now in its test stage. Its durability, lighting and other relevant characteristic is being tested right now, even though the current public lighting is efficient.

Zaragoza is mainly using street lights with a high light efficiency, lights with a good light performance, light-up equipments with astronomical clock in every control centre, regulation equipments and an optimum maintenance of the facilities.

11B. Past Performance

Describe the measures implemented over the last five to ten years concerning energy, as a qualitative narrative. Comment on which measures have been most effective.

Make reference to:

1. *Attempts to improve the energy performance of municipal buildings above national requirements;*
2. *Maximizing and prioritizing the use of renewable energy technology in municipal buildings and homes;*
3. *Measures to improve the City's overall energy demand performance preferably including both local government institutions, local market actors and citizens;*
4. *Measures to facilitate integrated district systems and a more sophisticated city-wide control.*

(1) In 1998 the City of Zaragoza went ahead the compulsory actions of the Technical Construction Code, requiring all the Municipal buildings to adapt its facilities to the use of solar thermal energy in the DHW.

Just before the Strategy for Climate Change Mitigation and the Improvement of the Quality of Air of Zaragoza was passed, the City of Zaragoza has already been implementing actions for the installation of renewable energies in the municipal buildings.

These are some examples:

RENAISSANCE PROJECT
Rehabilitation of a public school and installation of a photo-voltaic cover

VALDESPARTERA ECOCITY
10,000 households with bioclimatic characteristics.

ZERO EMISSIONS BUILDING
It has the maximum energy qualification and counts with bioclimatic architecture, air-ground conditioning by a geothermal system. led lighting, a photovoltaic system in façades and cover, and a mini-eolic system.

The building consumes half the energy of similar construction and is self-sufficient by its use of renewable energies in general services, air conditioning and lighting, with 26.475 kWh not consumed.

CENTRE OF URBAN WASTE TREATMENT
Its goal is making good use of waste and counts with a power of 5,4 MW that produces 15.730,5 Mwh.

SEMINARY BUILDING *(graphic 4)*
The Old Seminary has been turned into an administrative building with bioclimatic architecture and a platform of photovoltaic panels with 45 kW of power (39,575 kWh).

Fig 4. Rehabilitación bioclimática del edificio del antiguo Seminario Metropolitano

WATER INFRASTRUCTURES
Casablanca waste management plant, with its 2 MW of power, produces a 35.1% of the energy that it needs. The purifying plants produce the 12.78% and the 73% of the energy by processes of mud incineration and biogas recovery.

ENERGY EFFICIENCY IN MUNICIPAL BUILDINGS
The audits before starting the works for the construction of the main administration buildings are been implemented now.

MUNICIPAL LIGHTING
Among the actions implemented, improvement of the efficiency of the facilities, reduction of consumption by using regulation equipments, reduction of light-on times, selective light-off in not-crowded areas and installation of highly efficient street lights with a saving of 9,447,5 MWh every year.

Public Building	Type of renewable	Installed Power kW	Energy produced/year MWh
Former Seminar Building	Photovoltaic	45	39,58
Water Teatement Plant Casablanca	Photovoltaic	2.000	3.412,90
EDAR La Cartuja	Sludge Incineration	630	3.588,30
EDAR Almozara	Biogaz	240	1.713,40
Public School	Photovoltaic	18	19,76
CMTRUZ	Biogaz	5.400	15.730,41
ZeroCO_2 Building	Photovoltaic	80	9,55
ZeroCO_2 Building	Eolic	12	74,45
Interpretation Centre Galacho de Juslibol	Photovoltaic	2	Sufficiency
Europa Building (Centro ambiental del Ebro)	Photovoltaic	10	Nigth lighting
Expo Zaragoza Business	Photovoltaic	500	856,92

Graphic 5. Renewal in Zaragoza's Public Building

(3) As it has been shown in the above mentioned examples, Zaragoza has committed itself to the use of renewable energy in the whole of the city and to improve its general energy efficiency.

The **MEETING CLUB WITH AGENDA 21 LOCAL** is an original initiative of the Agency of Environment and Sustainability born from the collaboration between the City of Zaragoza and business organizations for working together to reach sustainable development in the city. It is a key element for social participation in the city.

The Club is developing actions on energy saving and efficiency addressed to non-industrial sectors of a second rank energy expending but that together represent an important reduction of CO_2 emissions and a valuable example.

ENERGY EFFICIENCY IN SHOPS. Students of Zaragoza University have made energy audits that form part of the participation process of Zaragoza Agenda 21.

Pharmacies have reached an average reduction of CO_2 emissions of about 840 kg in every commerce, representing an average saving of about 530 €/year. This program is being extended now to smaller shops.

The Municipality, through the Agency of Environment and Sustainability, organises educational and participatory activities for fostering energy saving and an efficient use:

STOP TO CO_2 program. Education practices on the rehabilitation of buildings and the installation of renewable energies.

GREEN HOUSEHOLDS. It is a booster for a responsible consumption of energy and water at home, trips for respecting nature and a responsible way of shopping.

A saving in electricity home consumption (8.51%) and gas (3.65%) was obtained between 2008 and 2010.

GOYA PARK, PINTA VERDE. Pilot program of environmental education based on social participation. A saving of an 8.54 % of power electricity consumption has been obtained in six months.

e2 DEMOCRACY is a project of the European Science Foundation for conducting an international evaluation on the role of social participation in energy saving and the reduction of CO_2 (an average of 3`745 % in the two years of application has been reached).

COURSES ADDRESSED TO MUNICIPAL WORKERS. The goal is to make municipal workers aware of the necessity to reduce energy consumption and avoid CO_2 emissions.

(4) As it has been explained before, the introduction of integrated district systems is not being a valid practice for the whole of the city, mainly due to the changeable climate conditions of Zaragoza.

Nevertheless, tests continue to be made. Zaragoza Vivienda is studying the establishment of a district system in a residential group of El Picarral neighborhood. The first rehabilitation projects of Renaissance program were made in this neighborhood but its residents, owners and users must agree on it.

11C. Future Plans

Describe the future short and long term objectives for energy plans and the proposed approach for their achievement. Include measures adopted, but not yet implemented, and details for future measures already adopted. Emphasize to what extent plans are consolidated by commitments, budget allocations, and monitoring and performance evaluation schemes.

Make reference to:

1. *The city's strategy to achieve goals by 2030 and 2050 (% of renewable energy share of the total energy supply);*
2. *The city's strategy regarding renewable vs non-renewable energy mix, as well as of the renewable energy mix per se (the percentage of different renewable energy sources). Describe the dynamics of energy mixes for at least the coming two decades, preferably add diagrams to describe this dynamic development;*
3. *Other measures affecting the total energy use in the city, e.g. changes in transport and communication systems, industrial practices, food and commodities production and consumption, urban morphology and import and export chains.*

1. Zaragoza strategy to reach the goals for 2030 and 2050

It is foreseen that, for the year 2020, the renewable energy installed in Zaragoza will be ready to produce the 109,98% of the electricity consumption of the city.

The goals for 2030 and 2050 will focus on the continuity and strengthening of the current policies:

- go on with the plans of sustainable mobility, boosting the use of the bike, electric high-capacity means of transport (tram, commuting train, hybrid-electric bus) as well as electric private vehicles for reaching an important reduction in the consumption of oil products
- maintain the idea of a compact and multifunctional city with strong recycling policies (rehabilitation of urban areas, neighborhoods and households), avoiding sprawling and reducing mobility necessities

- keep on making a good use of weather conditions -wind and sun- even integrating this kind of energy in the urban planning and layout in order to obtain a substantial increase in the use of renewable energies.

Even though the present economic crisis will have an influence on the results, thanks to the continuation of these policies and its boosting, Zaragoza will be able to face the challenges for 2030-2050.

2. Strategy of Zaragoza on the struggle between using renewable energies versus using non-renewable types

From the data available on the installation of renewable energy in Zaragoza and its surrounding area, the Strategy for a Sustainable Management of Energy 2010-2020 established the following forecast:

	Electricity consumption MWh	Renawable Power Installed MW	Renewable Production MWh	Suficiency
2010	2.307.175	653,81	1.618.149	70,14%
2020	1.730.381	791,81	1.903.008	109,98%

It has not been established a working diagram since the current period of crisis and the uncertainty of the sector of renewable energies in Spain has produced a slowing down of the processes for the establishment of renewable energies and other actions.

3. Other measures affecting the total consumption of energy in the city

The Plan of Sustainable Mobility articulates three main axes:

- ✓ cycling mobility and the spreading of the bike system;
- ✓ tram line No 2 North-South which is currently in its final draft stage, with an estimated cost of 200 million euros;
- ✓ renovation of public buses for reaching an 80% of hybrid and electric vehicles in 2020.

In the long run, it is being studied the possibility of building a commuting train service that will link the villages placed at the South of the city to the Logistic Platform and the city centre.

The proposal for the Zaragoza of the future is a strategic plan that articulates the city and its surrounding area in an urban, compact, global and polycentric model able to keep and strengthen its connections with the nearest urban areas and other places.

The City has chosen a model of sustainable growth based on successful experiences such as Ecociudad Valdespartera, which combines bioclimatic criteria in its architectural layout (distances and orientation of the buildings) and the use of plants and renewable energies to create microclimate conditions adapted to the severe weather conditions of Zaragoza. It has also been obtained an important improvement of energy efficiency and quality of life as its is stipulated by the Municipal Bylaw on energy ecoefficiency and the use of renewable energies in builidngs and its facilities.

Zaragoza has also adopted a model for the recovery of the consolidated city by passing policies for the rehabilitation of buildings and for establishing new urban developments through the occupation of empty urban zones to complete the current city. Its natural limits are the fourth ring road, serving as a transition zone between the metropolitan corridors.

LIFE km0 Orchards is a project for the environmental recovery of periurban areas of Zaragoza, for the production of agroecological products and its distribution to nearby areas (LIFE12ENV/ES000919).

The industrial sector of the city also collaborates with the Municipality by voluntary agreements in order to participate in projects on environmental improvements, saving measures, energy efficiency and the installation of renewable energies.

The City has high expectations for participation in the Program Horizon and the actions that may be made thereunder. Several multidisciplinary teams are in design project process.

11D. References

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