FINAL PUBLISHABLE EXECUTIVE SUMMARY

CONCERTO INITIATIVE

RENAISSANCE

Renewable **EN**ergy **A**cting **I**n **S**u**S**tainable **A**nd **N**ovel **C**ommunity **E**nterprises

Instrument (e.g. Integrated Project)
Thematic Priority

Period covered

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CONCERTO is co-funded by the European Commission and aims to create a more sustainable future for Europe's energy needs.

1 RENAISSANCE OBJECTIVES AND CHARACTERISTICS

RENAISSANCE project has demonstrated that ambitious urban regeneration programmes in two large communities of contrasting character, **Grand Lyon** (France) and **Zaragoza** (Spain), can benefit from an integrated energy approach.
The Region of Lombardy (Italy) took part as an observer partner and carried out several research activities on technical, legal and social issues related to fuel wood supply.
The ambitious energy efficiency goals applied to the project, coupled with a high contribution of renewable energy, demonstrated that drastic reductions in conventional energy consumption (up to 70%) are achievable at reasonable costs and acceptable financial risks on energy saving investments.
As showcases, RENAISSANCE included a comprehensive programme of Research and Technical Development (RTD) as well as active and widespread dissemination activities. **RTD activities addressed all phases of the construction process from planning, building design, construction, building operation and maintenance to building usage.**

They can be classified in five main categories:

- **Innovative eco-building solutions,** built on with thermal simulations
- **Renewable energy sources** (mainly wood fuel and photovoltaics)
- **Commercial and fiscal solutions** such as ESCo
- **Socio-economic activities** mainly focusing on inhabitants behaviour
- **Comprehensive monitoring** to assess actual energy performance of buildings and to improve knowledge regarding energy efficiency.

In addition, several activities have been carried out to encourage local and national energy policies and regulations to leap-frog in terms of energy efficiency and renewable energy targets, by exploiting the unique opportunities for innovation offered by demonstration projects of this size.
Last but not least, the project focused on strengthening the capacity of project stakeholders involved at each stage of the building process (from de- sign to commissioning), through training and expert technical support.

RENAISSANCE at a Glance

7,700 m2 of refurbishment (residential & school)

143,300 m2 of new buildings (residential, offices, exhibition centre)

350 kWp of photovoltaic systems

2,200 kW of biomass wood boilers

1,220 m2 of solar thermal panels

225 kW of gas and geothermal heat pump

In total the project achieved **a reduction of 67 %** of conventional final energy consumption.

3 WORK PERFORMED & RESULTS ACHIEVED

3.1 Demonstration activities progress

3.1.1 Grand Lyon (France)

Grand Lyon Community is an urban community which includes Lyon, the second largest city in France, and 57 peripheral towns.
The Confluence area is a 150-hectare site located at the southern tip of Lyon's peninsula, on land which was originally reclaimed from the surrounding waters in the late 18th century. Cut off from the rest of the city by the railway tracks and highway, the site is currently home to a lively, working- class neighbourhood, originally established in the 19th century, as well as a vast expanse of industrial wasteland (70 hectares).
The Lyon Confluence project is one of the most ambitious city-centre urban regeneration projects in Europe. It will extend the centre of Lyon to the very tip of the peninsula by means of high-quality development projects that meet stringent quality criteria in terms of urban planning, architecture, environmental impact and landscaping. The aim of the project is to create a vibrant, bustling neighbourhood that is both economically and socially diverse.

Three construction zones (named blocks A, B and C) within the Lyon Confluence urban development project were chosen as the demonstration site for Grand Lyon's European CONCERTO project, RENAISSANCE. Real estate developers were selected early in 2005, a little before the CONCERTO- RENAISSANCE programme was signed, and construction took place between 2007 and 2010. All these construction projects had to respect the specific criteria laid down for energy efficiency and the use of renewable energy sources, derived from CONCERTO specifications. They also had to comply with High Environmental Quality ("HQE®") criteria amongst which were specifications of reinforced insulation, careful selection of materials, rainwater management and natural ventilation.

ENERGY EFFICIENCY AND RENEWABLE ENERGY OBJECTIVES

All constructions are now finished: in total, 670 new apartments and 15,400 m2 of office space complying with the RENAISSANCE objectives were built. RENAISSANCE ob- jectives for the Confluence project were very ambitious compared to the thermal regulation (RT2000) in place at the time of design as the following table shows. The very high coverage of energy demand by renewable energy sources at such an urban scale remains very innovative today.

(kWh/m²/year)		Housing	Office
Heating	RENAISSANCE targets	< 60	< 40
	RT 2000	110	-
Domestic Hot Water (DHW)	RENAISSANCE targets	< 25	< 5
	RT 2000	40	-
Electricity	RENAISSANCE targets	< 25	< 35
	RT 2000	50	-
Air Conditioning	RENAISSANCE targets	0	< 10
	RT 2000	-	-
Renewable energy share	Heating consumption + Hot water	80 %	
	Electricity concumption of commons property	50 %	
Summer comfort		0 Inside temperature must be equal or inferior to 28 degrees C except 40 h per year	

Strategies used to meet a high level of energy efficiency for heating, cooling and electricity demand

- **Passive solar design** Passive gains, natural lighting and sun protections u **Envelop insulation** High performance windows and several types of insulation: exterior, single-wall insulating brick or interior with thermal bridge breakers
- **Strict specifications on airtightness** u **Insulation of hot water distribution networks** u **Ventilation** with heat recovery or with humidity sensors on the inlet and outlet u **Cross-ventilation for natural cooling** Flats with double orientation
- **Demand side energy efficiency and conservation** Standby power interruption switch, low electricity consumption light bulbs, occupancy sensors
- in commons, flow restrictor to limit DHW demand and water consumption, etc.

3.1.2 Zaragoza (Spain)

Zaragoza is the fifth largest city of Spain, situated in the northern part of the country. The RENAISSANCE project has been carried out in two districts with two different but complementary approaches.
"Valdespartera" district is an ancient military precinct in the Zaragoza outskirts that has been transformed into a bioclimatic neighbourhood with 9,650 social housings. The RENAISSANCE project is involved with the construction of social housing and an interpretation centre.
The "Picarral" neighbourhood was planned in the 1940's during the rural-urban migration with very poor quality construction. The neighbourhood, ageing and occupied by the working class, has been the second area of intervention of the project, involving refurbishment works for residential buildings and a public school.
In addition, considerable work on energy performance monitoring, socio-economical studies and software design has been carried out in parallel, making RENAISSANCE not only a building construction project but also providing a holistic approach to integrate rational use of energy at a neighbourhood scale.

VALDESPARTERA

The RENAISSANCE project includes specific actions on 616 apartments, with 64 027 built square meters. An interpretation centre on urban sustainability (CUS) has been designed, constructed and set up.
The neighbourhood was designed from the beginning with a sustainable urban design plan, which improves the efficiency of the bioclimatic buildings. The participation of public institutions has been very important. Ayuntamiento de Zaragoza (Municipality), which has a strong commitment to sustainable development, promoted the idea of the eco-neighbourhood, creating Eco- ciudad Valdespartera Zaragoza. This institute managed the design and construction of the neighbourhood and the interpretation centre. The initial bioclimatic buildings (4 blocks) were developed by Sociedad Municipal Zaragoza Vivienda. The Universidad de Zaragoza assisted their design phase, set up the monitoring campaign and developed the social work with the neighbourhood residents. New technologies have been integrated in the neighbourhood. In the interpretation centre a tele-controlled net is monitoring water supply, irrigation, sewage, lighting... allowing control and measurement.
Renewable energies have been integrated in the project, with a selection of the most appropriate for each building. In Valdespartera **654m2 of solar thermal panels** for DHW have been integrated on the project buildings (reaching a total amount of 9,000 m2 in the neighbourhood). In the interpretation centre, **a 37 kW biomass boiler, and a 45kW geothermal and reversible water-water heat pump** has been installed as well as **37kWp of photovoltaic systems.**
One of the most innovative solutions is the one designed by URBIC, which consists of a collective energy efficient gas heat pump for cooling and heating integrated in an ESCo model.



PICARRAL

Picarral was involved in the project through the **refurbishment of 196 apartments** (14,422 m2). Being a pilot experience not only for Zaragoza but for Spain, the project attracted the interest of many municipalities. **A public school** (Cándido Domingo), built in 1971, **has been refurbished, with a total area of 1,914 m2,** work led by Ayuntamiento de Zaragoza. All the refurbishment plans have been evaluated by CENER, a national public institution specialized in renewable energy.
In Picarral, **renewable energies also play an important role.** In the public school Cándido Domingo an **18 kWp photovoltaic system** has been installed on the roof of the building. Also, **photovoltaic panels** have been integrated in refurbished buildings with an innovative economical solution designed by Sociedad Municipal Zaragoza Vivienda: the economical benefits of the energy sale will be invested in the building refurbishment. Also **240 m2 solar thermal panels** have been integrated in the Picarral buildings.

PUBLIC-PRIVATE PARTNERSHIP

The participation of private companies in the project enables the development of commercially innovative solutions. The engineering company URBIC has set-up the previously mentioned ESCo and has played an important role in the design phase of the building's systems. ENDESA, an international company, has contributed with its experience on gas and electricity consumption and management at the district scale.

The monitoring campaign, with **more than 750 probes installed and 220 apartments monitored,** when combined with the feed- back of the social work with the neighbours, has proved to be very important in improving building efficiency. The project enabled a combined study of the analysis of energy system performance plus the **identification of construction problems with improper user behaviour** resulting in extra consumption of energy. Thus, a characterization of user types and events which result in extra consumption has led to the creation of a **web based system to provide users with specific recommendations** in order to avoid these energy-consuming behaviours.

Strategies used to meet a high level of energy efficiency for heating, cooling and electricity demand

- **Urban planning** to ensure solar gains and cross ventilation, and to create a temperate microclimate u **High performance windows:** double-glazing and frames without thermal bridge and double windows on North and West sides façades
- **High insulation** of the buildings coupled with massive walls to ensure inertia u **Insulation of thermal distribution networks**
- Strict specifications on **air tightness**
- Night **cross-ventilation** coupled with **thermal inertia** to get a reduction in diurnal temperature

3.1.3 Lombardy region (Italy)

The Region of Lombardy, whose capital is Milan, is situated in the northern part of Italy. The Region expressed its strong interest in participating in the RENAISSANCE project as observer Community at the beginning of 2006.

No urban demonstration project was financed in Lombardy. Rather, the Region of Lombardy actively took part to the research and development activities of the project. With the support of the Regional Agency for Development of Agriculture and Forestry (ERSAF), they were responsible for the research activities related to the wood fuel supply chains in urban district.

The Region of Lombardy carried out several studies on valorising zones on the periphery of big infrastructures in order to produce wood fuel using short and medium rotation forestry techniques. The feasibility of ambitious projects has been assessed, namely the creation of green belts along BREBEMI highway and Malpensa airport.
In addition, Lombardy carried out studies regarding the socio-economic impacts of such projects and on the feasibility of a rural-urban ESCo to promote agro- forestry solid biomass through combined heat and power installations (CHP).

3.2 RTD/innovation, dissemination and training results

At each step of the project, different technical support and building competency to meet the challenges of the expected final energy performance of building.

URBAN DESIGN

Zaragoza

- The urban plan was designed according to the Zaragoza climate. **A "right to the sun" has been granted** through fixing a maximum height to buildings and optimizing distances between buildings. All the buildings are rectangular and face south for more efficiency and to optimize solar gains and cross ventilation.
- Streets are designed **to allow inner cross ventilation in buildings and to stop the cold and dry wind called "cierzo".** Gardens and roads have been designed to promote quiet streets.
- **Vegetation** regulates the local microclimate. Deciduous trees allow the sun to heat streets and façades in winter, while in summer they stop solar radiation. Vegetation has been **selected according to the climate** and to minimise irrigation needs.

BUILDING/REFURBISHMENT DESIGN PHASE

Grand Lyon

- **Technical support** was put in place in the form of monthly meetings to provide assistance **on the design of low energy consumption buildings, sizing and positioning of renewable energy systems and defining technical solutions to meet the High Environmental Quality criteria.** RENAISSANCE experts provided technical support to promoters and their energy- engineering consultants.
- **Dynamic thermal simulations** were made to estimate energy consumption of one dwelling per building in order to evaluate the technical design choices made by architects and engineers, and adapt the design if necessary.
- **A study on short rotation coppice** was realized to assess the feasibility of an energy crop supply chain from short rotation coppice in the surroundings of Lyon that would serve to fuel the whole Confluence district.
- **A study tour** was organised in the Netherlands in order to show building designers and promoters large-scale innovative photovoltaic building integration techniques.

Zaragoza

Valdespartera new buildings

- Municipal regulations specifically defined for Valdespartera establish **specific envelope parameters** (U values, % of glazing, dimension of the overhangs, etc.).
- Prior to the construction phase, the Universidad de Zaragoza conducted a thorough review of the project to **verify compliance with the defined bioclimatic rules.**

PicarraL refurbished buildings

- It was necessary **to convince inhabitants to engage refurbishments** as they are often reluctant. Improvements in energy consumption and economical savings have to be explained, bank loans must be managed and all of this requires significant fieldwork

CONSTRUCTION PHASE

Grand Lyon

- **Construction site visits** by energy efficiency experts to closely follow the implementation of insulation and airtightness techniques and the installation of energy efficient and renewable energy systems in order to ensure that technical specifications agreed on during the design phase were respected. These visits were pursued even after the delivery of dwellings to verify that detected defects had been corrected.
- **Training for craftsmen of different professions** were provided on the subject of airtightness. This educational program was later extended to training of trainers.
- **Analysis of the impact of improved energy performance of buildings on the level of rents and charges in social housing.**

Zaragoza

- **Construction site visits** were carried out by RENAISSANCE experts to check for potential air leaks or poor insulation. Infrared images and blower door tests revealed some defects that were corrected.
- **A control of renewable energy systems** to identify defaults in installation and maintenance was carried out. training technicians and monitoring facilities is necessary to ensure optimal efficiency.
- Inefficient design and improper maintenance combined with excessive use of heating leads to excessive losses (46,3%). The analysis carried out shows that heating needs correspond to 42.6 % and DHW to 11.1 %
- Better control during the construction process and after occupation is required. New laws could make this possible and inexpensive in the overall process.

BUILDING USAGE, OPERATION AND MAINTENANCE

Grand Lyon

- **Residents were involved in the project once flats were put up for sale.** RENAISSANCE experts, promoters and developers joined to organise **information sessions to promote and explain building particularities and residents contributions to energy savings.**
- **A very detailed monitoring campaign on energy demand and wood fuel delivery and consumption** was planned with the installation of hundreds of sensors. After one full year of measurements, it will be possible to draw some conclusions on the actual energy performance of buildings and on building operation.
- **A study of operation and maintenance (O&M) contracts** has initiated a reflection on main elements and special clauses to integrate in O&M contracts to guarantee targeted energy performance.
- With the same objective, **training on the operation and maintenance** of energy efficient buildings, ventilation and renewable energy systems were organised **for O&M companies.**

Zaragoza

- **A widespread monitoring campaign** coordinated with **public awareness** and **training activities** has been one of the most important tasks: without adequate information and training of inhabitants, energy consumption of bioclimatic buildings can be higher than consumption in standard buildings.
- Users heating demand is in general lower or equal to simulated value (53 % of the 1,600 houses analyzed), this is positive. However, despite the intense campaign developed with monthly articles, meetings, posters, etc., there are still 31.5 % of dwellings that consume up to three times the targeted performance
- First data shows that for most of dwellings the summer air conditioning is not required with proper use of bioclimatic design (heat island effect mitigation, night cross ventilation and thermal mass reducing temperature peaks). More precise data will be available after the summer 2012 and compared to the low cooling loads obtain from simulation (11 kWh/m2/yr)

4 RENAISSANCE END RESULTS

The principal end result of RENAISSANCE has been to demonstration that **high level of energy performance in new and refurbished buildings** can be achieved at reasonable costs, with existing technological solutions if applied appropriately.

Secondly, RENAISSNACE **accelerated replication of this know-how**, by continuously influencing both **policy makers** (in their Energy & urban planning policy approaches at local, regional, national & European levels) and the **building sector** (including low-energy refurbishment, social housings and tertiary branches).

The thirdly, RENIASSANCE highlight **the importance of the appropriation process** of numerous changes resulting from ambitious energy performance for all stakeholders, including developers, architects, engineers, constructors, building operators and end users, and as a consequence the need of developing **appropriate information, training and technical supports**.

To widely disseminate the projects results and to foster the mainstreaming of **innovative buildings for low-energy cities**, a **sound experience capitalization** work was carried out to assess all lessons learnt from the project regarding each stage of the appropriation process. The results of these analysis lie in several handbooks that have been made available on the website and widely disseminate in hardcopies through conferences, workshops and trainings.

More details can be found on the project website: http://www.renaissance-project.eu