



## New built and refurbishment with DHC in the Mediterranean context

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## New built and refurbishment with District Heating & Cooling in the Mediterranean context

### Objectives

**Urban level:** High quality multifunctional urban spaces (through urban revitalisation of post-industrial areas)

**Building level:** High thermal comfort with minimum ecological footprint, security in supply, easy maintenance at competitive prices



- Demand reduction: Energy efficient building design
- Low carbon resources: RE and waste energy
- Optimum supply: DHC

Examples from Barcelona



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## New built and refurbishment with District Heating & Cooling in the Mediterranean context

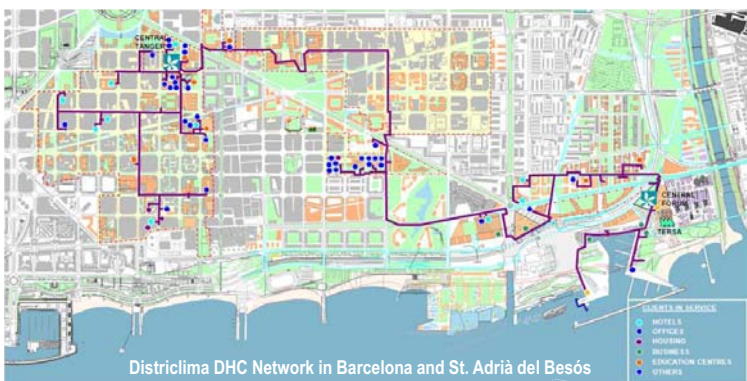
### Case 1: Innovation District 22@

Transformation of the "Manchester of Catalonia" industrial area into the Innovation District 22@

- Recovery of waste heat from an urban waste-to-energy plant for heating
- Sea water cooled machines for cold production
- Absorption machines to produce cooling from steam

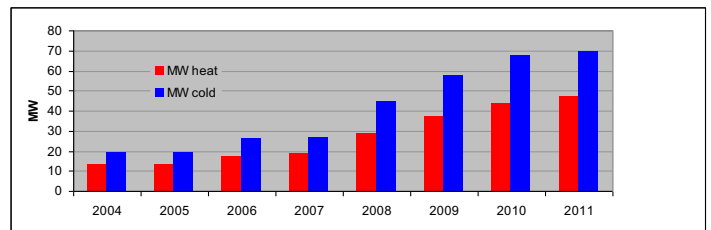


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2004 - 4.4 km of network and 10 connected buildings  
 2008 - 10.8 km of network and 37 connected buildings  
 2010 - 13.1 km of network and 59 connected buildings



District energy network Barcelona, evolution of installed power 2004 - 2011



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- Steam / water exchangers (4 x 5,000 kW)
  - Gas boiler back-up (20,000 kW)
  - Absorption machines (Broad) (2 x 4,500 kW)
  - Compression chillers (McQuay) (2 x 4,000 kW)
  - Compression chillers (Johnson Control) (2 x 7,000 kW)
  - Sea water / cooling water exchangers (3 x 12,500 kW)
  - Cold water storage tank (5,000 m³)
- 2012 inaugurated second production plant:
- Natural gas boilers (2 x 13,400 kW)
  - Compression chiller (6,700 kW)
  - Ice storage (2 x 40,000 kWh)

Installed equipment in the Districlima DHC Network in Barcelona and St. Adrià del Besòs

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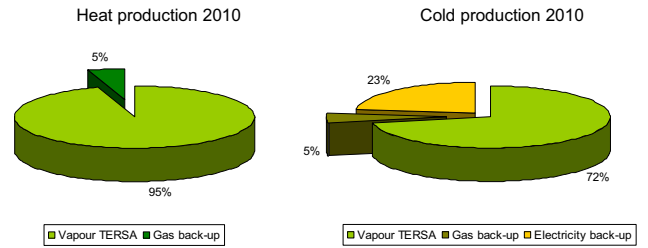
Exterior view of the Districlima central production in the Forum area

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Absorption chiller in the Districlima central production in the Forum area

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Annual reduction compared to conventional decentralized thermal energy production:  
 Fossil fuel consumption: 53%  
 Emissions: 10,100 t CO<sub>2</sub>  
 EER Cooling: 5.2  
 COP Heating: 11.7

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## Case 2: Innovation District Zona Franca

Transformation of an industrial area into a Tertiary Sector and Residential area Zona Franca

Valorization of waste cold from depressurizing liquid gas

Biomass from maintenance of city parks for heat production

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3 energy production plants integrated to the urban landscape, linked by a pipes network, in an area foreseen to up to 12,600,000 m<sup>2</sup> ground floor area.

Ecoenergies DHC Network in Barcelona and L'Hospitalet de Llobregat

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- Biomass - heat (10,000 kW)
- Gas boiler (120,000 kW)
- Cold recovered from Enagas plant (30,000 kW)
- Compression chillers (68,500 kW)
- Industrial cooling (12,000 kW)
- Cold water storage tank (5,000 m<sup>3</sup>)
- Biomass - electricity (2,000 kW<sub>e</sub>)

Installed equipment in the Ecoenergies DHC Network in Barcelona and L'Hospitalet de Llobregat

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Biomass originated from maintenance of the city's parks and gardens of Barcelona (approximately 8,000 tons per year) maintenance of forests of Catalonia (total of 28,000 tons per year).

Ecoenergies biomass plant in Barcelona and L'Hospitalet de Llobregat

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Annual reduction compared to conventional decentralized thermal energy production:  
Emissions: 13,400 t CO<sub>2</sub>



Recovery of the residual cooling originated from the industrial depressurisation process of the Enagas plant (30MW) originated from the liquid gas maritime transportation

Cooling recovery plant in Barcelona and L'Hospitalet de Llobregat

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Demand side reduction

95 Social housing apartment block  
First EPBD "A" Classification  
in Barcelona: 3.8 kgCO<sub>2</sub>/m<sup>2</sup>-a

Low U-values  
Ventilated façade  
Movable wooden blinds  
Natural cross ventilation

Connected to DHC 22@  
Invoicing by building administrator

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Demand side reduction  
95 Social housing apartment block

Heating demand: 9.8 kWh/m<sup>2</sup>-a  
Cooling demand: 4.7 kWh/m<sup>2</sup>-a



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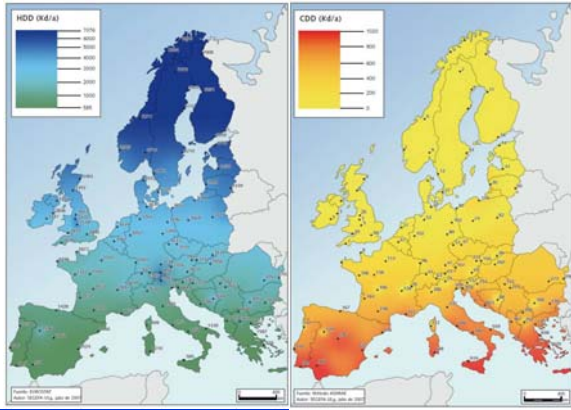
95 Social housing apartment block

Inaugurated in Spring 2012



Connection to the DHC network in the building's basement

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Climate\*: HDD  
 Barcelona: **1250**  
 København: **3360**

Climate\*: CDD  
 Barcelona: **352**  
 København: **25**

Electricity\*\*:  
 Spain: 21.5 c€  
 Denmark: 30.8 c€

Natural gas\*:  
 Spain: 5.9 c€  
 Denmark: 11.7 c€

\*www.degreedays.net  
 HDD 18/18 - CDD 21/21  
 \*\* Europe's Energy Portal (11/11)

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18.6.2010 Official Journal of the European Union L 153/13

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the energy performance of buildings (recast)

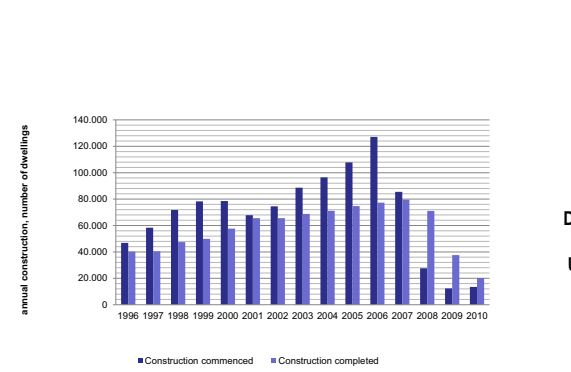
Residential block, Madrid, EPBD "A" certification:

Heating: 15,8 kWh/m<sup>2</sup>·y  
 5,1 kgCO<sub>2</sub>/m<sup>2</sup>·y

Cooling: 4,9 kWh/m<sup>2</sup>·y  
 1,2 kgCO<sub>2</sub>/m<sup>2</sup>·y

Source: Departament Domèstic i Edificis. IDAE, Passivhaus Conference, Donostia, 2010

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Annual construction of residential new dwellings in Catalonia. Source: Secretaria d'Habitatge

Economics:

Average salary\*:  
 Spain: 30,600 USD  
 Denmark: 40,200 USD

Unemployment rate\*:  
 Spain: 20.8%  
 Denmark: 6.2%

\*Figures for 2011 by: 2012 CIA WORLD FACTBOOK www.theodora.com

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Poor building envelope – little comfort

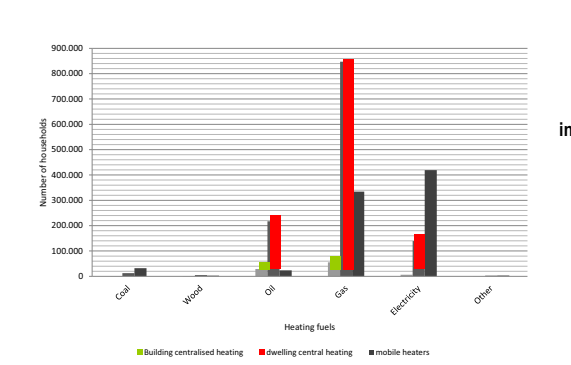
High thermal transmittance  
 $U = 1.54 \text{ W/m}^2\cdot\text{K}$   
 lead to high energy demand:  
 Heating: 56 kWh/m<sup>2</sup>·a  
 Cooling: 15 kWh/m<sup>2</sup>·a

Measured demand, assuming a boiler efficiency of 75%:  
 Heating: 40 kWh/m<sup>2</sup>·a  
 No cooling devices

Heating **descomfort: 28%**

Can Jofresa, Terrassa – Catalonia. Source: Josep Linares, Director UORMH of the Catalan Housing Agency, "1 Jornada Tècnica. Rehabilitació energètica en habitatges de protecció oficial", Barcelona, 17<sup>th</sup> March 2011

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Domestic heating systems and their fuel sources, Catalonia 2001. Source: Idescat, population census INE2001

Habits:

Few experience in building centralised heating and cooling systems

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Postgraduate professional training: Energy and Urbanism

INTELLIGENT ENERGY EUROPE

Col·legi d'Arquitectes de Catalunya Demarcació de Barcelona

Escola Sort

SaAS

UP-RES

Urban Planners with Renewable Energy Skills

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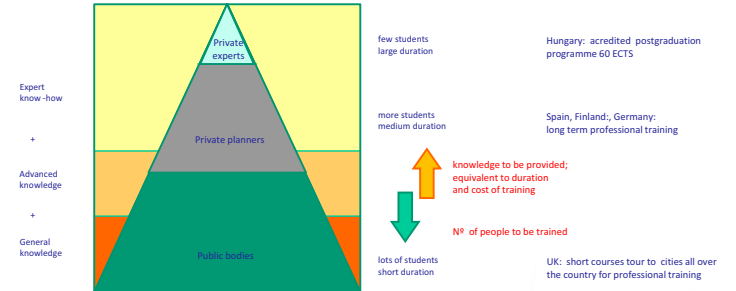
10 Modules with a total of 150 hours face to face – october 2011- july 2012

- M1 An integrated vision. Sustainability in regional and urban planning
- M2 Energy. The existing energy model and market outlook
- M3 Buildings. Energy demand reduction strategies in new buildings and refurbishment
- M4 Mobility. Energy consumption reduction strategies in urban and interurban mobility
- M5 Urban planning. Energy demand reduction strategies in the urban metabolism
- M6 Energy resources. Renewable energy technologies in the urban scale
- M7 Energy distribution: District heating and cooling
- M8 New management concepts in the energy market
- M9 Energy management. New models in contracting and management
- M10 Workshop. the right scale for every energy concept

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Different training levels:

Lots – especially from public bodies (prescribers) – to get general knowledge, some private urban planners to attend public tenders prescribed by public bodies, a few private urban specialists to give support to urban generalists



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Thank you for your attention !

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