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

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**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**

**Case 1: Districlima**
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

**Case 2: Ecoenergies**

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

- 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
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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 Besós

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)

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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

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 m³)
- Biomass - electricity (2,000 kW)

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

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

Annual reduction compared to conventional decentralized thermal energy production:
Emissions: 13,400 t CO₂

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

Demand side reduction
95 Social housing apartment block
First EPBD “A” Classification in Barcelona: 3.8 kgCO₂/m²-a
Low U-values
Ventilated façade
Movable wooden blinds
Natural cross ventilation

Connected to DHC 22@
Invoicing by building administrator

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
- **CDD**
  - **Barcelona:** 352
  - **København:** 25

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

**Natural gas**:
- **Spain:** 6.9 c€
- **Denmark:** 11.7 c€

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

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**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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**Residential block, Madrid, EPBD “A” certification:**
- **Heating:** 15,8 kWh/m²·y
- **Cooling:** 4,9 kWh/m²·y
- **CO₂ emissions:**
  - **Heating:** 5,1 kgCO₂/m²·y
  - **Cooling:** 1,2 kgCO₂/m²·y

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

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**Poor building envelope – little comfort**
- **High thermal transmittance (U):**
  - **1.54 W/m²·K**
- **Measured demand, assuming a boiler efficiency of 75%:**
  - **Heating:** 40 kWh/m²·a
  - **No cooling devices**
- **Heating discomfort:** 28%

Source: Josep Linares, Director UORMH of the Catalan Housing Agency, “1 Jornada Tècnica: Rehabilitació energètica en habitatges de protecció oficial”, Barcelona, 17th March 2011

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**Habits**
- **Few experience in building centralised heating and cooling systems**

Source: Idescat, population census INE2001

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**Postgraduate professional training: Energy and Urbanism**
10 Modules with a total of 150 hours face to face – October 2011- June 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

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

Here students need basic knowledge

More students: medium duration

Knowledge to be provided: equivalent to duration and cost of training

More students: long term training

Hungary: accredited postgraduation programme 60 ECTS

Spain, Finland, Germany: long term professional training

UK: short courses tour to cities all over the country for professional training

In summary, the number of people to be trained:

General knowledge:
- Lots of students: short duration

Advanced knowledge:
- More students: medium duration

Expert knowledge:
- Few students: long duration

Thank you for your attention!

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