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**

**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**

<table>
<thead>
<tr>
<th>Year</th>
<th>MW of network</th>
<th>Connected buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>4.4 km</td>
<td>10</td>
</tr>
<tr>
<td>2008</td>
<td>10.8 km</td>
<td>37</td>
</tr>
<tr>
<td>2010</td>
<td>13.1 km</td>
<td>59</td>
</tr>
</tbody>
</table>
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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

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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Heat production 2010

Cold production 2010

Annual reduction compared to conventional decentralized thermal energy production:
- Fossil fuel consumption: 53%
- Emissions: 10,100 t CO₂
- EER Cooling: 5.2
- COP Heating: 11.7

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

3 energy production plants
Integrated to the urban landscape, linked by a pipes network, in an area foreseen to up to 12,600,000 m² 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 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) and 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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- Cooling recovery plant in Barcelona and L’Hospitalet de Llobregat

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

Annual reduction compared to conventional decentralized thermal energy production:

Emissions: 13,400 t CO₂

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
Heating demand: 9.8 kWh/m²·a
Cooling demand: 4.7 kWh/m²·a

Inaugurated in Spring 2012

Connection to the DHC network in the building’s basement
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Climate*: HDD
Barcelona: 1200
København: 3360

Climate*: CDD
Barcelona: 132
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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Residential block, Madrid, EPBD “A” certification:

- Heating: 15.8 kWh/m²·y
- Cooling: 4.9 kWh/m²·y
- 5.1 kgCO₂/m²·y
- 1.2 kgCO₂/m²·y

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

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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

Poor building envelope – little comfort

- High thermal transmittance U = 1.54 W/m²·K
- lead to high energy demand:
  - Heating: 56 kWh/m²·a
  - Cooling: 15 kWh/m²·a

Measured demand, assuming a boiler efficiency of 75%:
- Heating: 40 kWh/m²·a
- No cooling devices
- Heating discomfort: 28%

Habits:

- Few experience in building centralised heating and cooling systems

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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

ÀMBIT D’ACTUACIÓ

Nucli Urbà d’El Vendrell on l’impacte de millora tindrà una repercussió més important, en contraposició a altres.

ESTRATÈGIES DE MILLORA

3 tipus d’acciós a dur a terme:

- Canvis Normatius (A)
  Canvis en la normativa urbanística vigent, per mantenir espais com el SNU i per millorar la eficiència energètica i reduir la demanda.

- Millora d’eficiència energètica. (B)
  Valoració i proposta de 4 xarxes dins el municipi. Separades per les característiques físiques del municipi (rieres, Via del tren).

- Millores Mètodes Oligàtics (C)
  Alternatives al vehicle privat.
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.

<table>
<thead>
<tr>
<th>Nº</th>
<th>people to be trained</th>
<th>duration</th>
<th>cost of training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public bodies</td>
<td>1000</td>
<td>short</td>
<td>low</td>
</tr>
<tr>
<td>Private planners</td>
<td>500</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>Private experts</td>
<td>50</td>
<td>long</td>
<td>high</td>
</tr>
</tbody>
</table>

Hungary: accredited postgraduation programme 60 ECTS
Spain, Finland, Germany: long term professional training
UK: short courses tours to cities all over the country for professional training

Thank you for your attention!

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