IEE ECOLISH
Energy Exploitation and Performance Contracting for Low Income and Social Housing

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The problem - general

- Energy use in residential buildings in EU is 9500 PJ (= 23% of total use) > largest proportion
- Measures on existing residential buildings will make major contribution in energy and CO₂ reduction

But large number of barriers:
- Technologies are available (however, often particularly developed for new buildings, not for retrofitting)
- Financial constraints
- Social constraints
- Organisation
The problem - specific

- Social housing and (extreme) low incomes
  - Often high energy consumption (poor thermal and building physical quality, building services)
  - In combination with poor IAQ and Thermal Comfort
  - Increasing energy prices (>> inflation rates), leading to fuel poverty

- Spread ownership
  - how to organise
  - who is interested/responsible

- (Allocation of) revenues of investments
  - Investors do often not have repays of investments
  - How to allocate the repays
Objectives of ECOLISH

“The objective of this project is to investigate and to demonstrate the feasibility and the potential of Energy Exploitation and Performance Contracting for people with low income and social housing By organising private owned and managed Energy Exploitation companies, involving occupants and other concerned parties”
... organised on 4 pilot locations

- Heerlen - the Netherlands
- Ogre - Latvia
- Pieria – Greece
- Pécsvárad – Hungary

Representing 4 different regions and climate zones (moderate, cold, mild, continental)
Pilot location Heerlen - Vrieheide
Characteristics

- High energy use due to poor energy efficiency of heating installations and poor thermal insulation
- Poor thermal comfort and indoor air quality
- Lack of charisma
- Major barrier is the lack of financial means as well as with the owners as housing corporations
- Energy savings from 40 to 80 % is feasible
- There is an occupant organisation in Vrieheide already active [www.vrieheide.nl](http://www.vrieheide.nl)
Photo-inventory of all dwellings

• All app. 800 dwellings are photographed from the outside to get an idea of:
  ✓ Enlargements and improvements
  ✓ Window frames and glazing
  ✓ Reachableness in case of upgrading
  ✓ State of maintenance
Detailed inventory by local inhabitants

• Six inhabitants visited and investigated 71 dwellings in detail
• Registration form by CHRI, translated and spread to other Ecolish partners
• Analysis of forms gives detailed information on the current situation
Topics of the detailed inventory

• Ownership and number of occupants
• Building marks (glazing, insulation)
• Installations for space heating and DHW
• Ventilation and air-tightness
• Cooking
• Option: air-conditioning and solar energy
• Occupants: set point, presence, airing
• Energy use (natural gas and electricity)
• Improvements and complaints
Final results fieldwork

• Domestic Hot Water:
  – Unvented appliances in kitchen: 65 %
  – Combined appliance: 31 %

• Space heating:
  – Mainly central heating with radiators
  – Sometimes local heating

• Ventilation:
  – 93 % natural
  – 7 % mechanical exhaust
Final results fieldwork

- Average temperature setting: 20°C
- Bed rooms:
  - 28 % heated
  - 72 % unheated
- Cooking:
  - 86 % natural gas
  - 11 % electric
- Some airconditioning
- No solar systems
Notes by occupants

- Rainwater and bad sewing
- Draft and rainwater leakage through windows
- Condensed water on single glazing
- Lack of storage room
- Bad sound insulation
- Repairs of concrete construction
- Disorder and garbage in neighbourhood
- Desired option: double glazing
Gas consumption by type

<table>
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<th></th>
<th>Terraced house</th>
<th>End-of terraced house</th>
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<tbody>
<tr>
<td></td>
<td>Measured gas consumption [m³ / period]</td>
<td>Corrected gas consumption [m³/year]</td>
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<tr>
<td>Average</td>
<td>1.717</td>
<td>1.481</td>
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<td>Standard deviation from average</td>
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<td>657</td>
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<td>Minimum</td>
<td>581</td>
<td>375</td>
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<td>Maximum</td>
<td>2.859</td>
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Long term average gas consumption: 2.100 m³/year
(based on the reading of 10 to 20 year old gasmeters)
Building analysis

• Moisture and leakage
• Driving rain
• Biological degradation
• Freeze-thaw damage
• Thermal cracks
• Detached weather strip
• Detachment of plaster
• Decay of concrete
Conclusions Vrieheide Heerlen

• Wide variety of adjustments on individual houses (enlargements, heating system state of maintenance)
• Gas consumption (far) lower than assumed from earlier studies, therefore:
  – Less financial space for improvements
  – Difficulties in fitting the actual and calculated energy consumption
• Occupants are organised, and can be a party (legal entity) for investors to negotiate with
  – Per block/6 dwellings or as total
  – For partner ESSENT (ESCO) reason to develop improvement, investments and financing plans
  – Extra potential to use ‘collective’ elements like large flat roofs for solar thermal or PV
Strategy energy savings

• Individual measures
  – Upgrading building envelope
  – Upgrading building services

• Measures on block level
  – Upgrading building envelope
  – Collective heating system

• Measures on district level
  – Upgrading building envelope
  – District heating (cogen, minewater)

• Partner ESSENT (ESCO) develops proposals for improvement, investments and financing plans
Energy analysis EPBD

- Original 1960’s
  - 5075 m³ nat. gas
  - EI = 4.05 (G-label)

- Renovation 1980’s
  - 2605 m³ nat. gas
  - EI = 2.68 (F-label)
Actual situation

- Fitted gas consumption: 2190 m³
- Energy-index = 2.18 (E-label)
- Some packages:

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Pilot location Ogre - Latvia
Situation - housing

• Typical soviet time town with block houses.
• Largest part of privatized houses maintenance is performed by Ogre municipal agency ‘Mālkalne’ maintaining 211 blocks.
• Budget and repair works are planned depending on collected sums of money for houses maintenance.
• There are planned repairs of roofs, staircases, entrance doors (with code locks)
• District heating is modernised
Typical kind of buildings

Concrete panel houses
Types of buildings

- 103 series – 40 buildings ("mixed type" panels + bricks, mainly 3 and 5 storied)
Types of buildings

318 series – 42 buildings
- typical “hrushovkas” white brick buildings, built mainly in 1960, 3 and 5 stories
- 1 room flat 29 m², 2 room flat 41 m²
Types of buildings

- 602 series – 27 buildings (typical 9 storied concrete block buildings)
- Mainly built at the end of 70 ies and 80 ies
- Started to be thermal insulated
Types of buildings

- 467 series – 12 buildings, concrete panel buildings, 5 storied, mainly built in 70’s
Typical social problems

- problems connected to social and political change and transition taking place in Latvia;
- **lack of income**;
- Individual problems economic and social, lack of self-esteem and self-reliance, young people prefer to move to Riga and work abroad. Lack of interest in municipal politics and public issues is also a problem at the individual level;
- Lack of extension and knowledge in home economics and especially in house management;
- Lack of free time
- **FUEL POVERTY!**
Ogre: problem of fuel poverty

How much percent of your net income do you spend on energy costs (heating and electricity)?

- 0 - 10%: 2
- 10 - 20%: 5
- 20 - 30%: 6
- 30 - 40%: 7
- 40 - 50%: 7
- 50% or more: 6

Evaluation of the house (score from 1 to 10):
- 1: 2
- 2: 1
- 3: 4
- 4: 3
- 5: 10
- 6: 12
- 7: 14
- 8: 9
- 9: 1
- 10: 1

Evaluation of the living environment (score from 1 to 10):
- 1: 1
- 2: 2
- 3: 1
- 4: 1
- 5: 4
- 6: 8
- 7: 12
- 8: 17
- 9: 5
- 10: 9

But still also satisfied on the house and living environment.
Common technical problems

- Specific heating consumption of the buildings exceeds 2-4 times EC standards;
- The buildings need capital repair works; the main problems are inside of buildings:
  - inside water and heating net;
  - electric power supply net;
  - ventilation systems;
  - rain water sewerage systems
  - balconies, pilasters, walls;
- Poor infrastructure:
  - bad driveways and sidewalks,
  - lack of parking places,
  - poor children playing areas,
  - poor street lighting
Further developments

- Full energy audit of analyzed buildings
- Calculating of average cost for heat insulation of existing buildings;
- Second IR analyses in winter 2007/2008
Pilot location Pecsvanad - Hungary
Houses

- 121 flats in 10 buildings
- Min. floor area 65 m²
- Max. floor area 105 m²
Data of structures – after renovation

- **External wall**
  
  38 cm brick wall with cavernulous + 6 cm insulation  
  \[ U = 0.45 \text{ W/m}^2\text{K} \]

- **Window**

  \[ U = 1.6 \text{ W/m}^2\text{K} \]

- **Roof**

  roof with ceramics inset + 11 cm insulation  
  \[ U = 0.29 \text{ W/m}^2\text{K} \]

- **Basement roof**

  roof with ceramics inset + 4 cm insulation  
  \[ U = 0.49 \text{ W/m}^2\text{K} \]
Heating and DHW systems – after renovation

- Condensating boiler for each flat, two-pipe system with TRV, DHW with indirect storing from the heating system
- Common condensating boiler in the staircase, two-pipe system with TRV, heat meter, DHW with common indirect storing, heat meter for DHW
Certification of the buildings

Before - Category: F

After - Category: B
Pilot location Pieriki - Greece
Typical characteristics

• Katerini has 4 organised settlements of low income social housing by the Workers’ Housing Organisation. Two of these settlements were built before 1980 (no insulation regulations).

• Some residents took actions for energy efficiency as fenestration alterations, cooling units and solar collectors, sun protection small scale installs.

• No central energy management system for apartments, residents are responsible for covering their energy demands.
Building types & technical problems

- 16 apartment blocks are of three floors (ground floor, 1st floor and 2nd floor). The main characteristics of the apartments are:
  - No insulation.
  - Wooden fenestration.
  - Different central heating system for each block, with no management systems or selection devices.
  - No roofing.
Future actions

• Start the technical screening according to actual situation (comparison with designs).
• Social analysis.
• Legal and financial analysis.
• Dissemination of the project at local level.
Conclusions (1)

- Fuel poverty is becoming a serious problem for (social) housing
- In social housing energy costs are high in combination with poor thermal comfort and indoor air quality
- Saving potential and benefits are high
- Benefits can be allocated to investments
Conclusions (2)

• Specific problem is spread ownership: to be solved by organising occupants and forming (legal) entities; very important to achieve any results and commitment.

• To negotiate with possible investors, ESCO’s etc.

• Important to provide a balanced set of energy saving measures, measures to improve IAQ and thermal comfort, in combination with ways how to finance this for these groups of housings that normally don’t have possibilities for this. However, comfort standards and expectations differ from country to country.

• Technical solutions are not so much the problem but rather the relation between the quality and expected lifetime of buildings, and the lack of vision of strategic housing and strategic maintenance and financing.

• Many buildings are at the end of their technical and economical lifetime.

• Risk allocation in energy exploitation is still a big problem.