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Aalto University
School of Science
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Urban Planners with Renewable Energy Skills (UP-RES)

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UP-RES Consortium

- **Spain : Sabaté associats Arquitectura i Sostenibilitat**
  www.saas.cat
- **United Kingdom: BRE Building Research Establishment Ltd.**
  www.bre.co.uk
- **Germany :**
  AGWF - German Association for Heating, Cooling, CHP
  www.agfw.de
- **Universität Augsburg** www.uni-augsburg.de/en
  Technische Universität München http://portal.mytum.de
- **Hungary : University Debrecen**
  www.unideb.hu/portal/en
- **Finland : Aalto University School of science and technology**
  www.aalto.fi/en/school/technology/

WHY SHOULD URBAN PLANNING INVOLVE ENERGY PLANNING?

Challenges to Urban Planning

- Need to reduce heat consumption in buildings;
- Need to reduce fuel consumption in transportation;
- Need to reduce electricity consumption in lighting, cooling, heating;
- Need to turn from fossil to renewable energy;
- Need to reduce overall emissions to atmosphere; and,
- Need to circulate material flows of waste and energy supplies (use of ash, waste to energy,..).

Urban Planners are not familiar with ….

….RES, EE, CHP, DHC

Only four (!) universities were identified in Northern America and EU in total that have integrated energy and emissions with their urban planning syllabus!

➡ Energy and emission issues are not taught to urban planners, neither in planning schools nor in continued education programs.

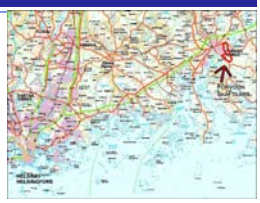
Energy Efficiency Starts from Urban Planning

Urban planning shall include quantitative energy and emission planning, because:

the decision makers shall have quantitative facts on emissions, energy consumption and costs when taking long-term decisions.

Example: Porvoo, Finland (1)

Steps



1. Local urban and energy planners were put together to co-work in order to develop a new sustainable city expansion area (Skaftkärr);
2. As reference case the city plan of year 2007 was used but with passive energy housing for the city expansion area;
3. Four alternative energy efficient green field plans were created to the city expansion area;
4. An external consultant (Pöyry Ltd) was hired to analyse the reference plan and the four new plans, and to calculate the energy consumptions, emissions and costs.

Example: Porvoo, Finland (2)

Results **New planning process was created!!!**

1. All four alternatives provided 20-40% lower energy consumptions and emissions than the reference case;
2. Life-cycle costs of three of four alternatives were lower than the one of the reference case;
3. Therefore, co-working of urban and energy planners provided a win-win benefit to the Porvoo city.
4. The best energy option was district heating (DH) together with combined heat and power (CHP) based on biomass. Solar heating is expected to come as well.

WHAT IS CHP AND TRI-GENERATION TO CONTRIBUTE TO URBAN SUSTAINABILITY?

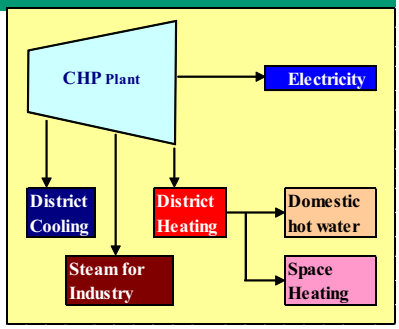
CHP and Trigeneration (1)

Definition of CHP:

CHP – Combined heat and power when heat and electric power are produced together in the technical process of the plant

Trigeneration is called when both heat, cold and electric power are produced together in the technical process of the plant.

District cooling with CHP requires an absorption chiller, which produces cold water to customers while using the heat energy as the driving force.



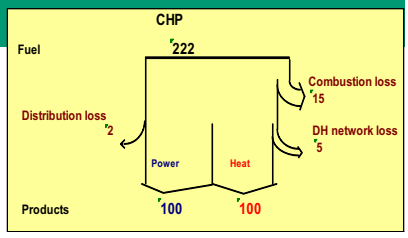
CHP is the only way to produce electricty from any fuel at such high efficiency of 90% and above.

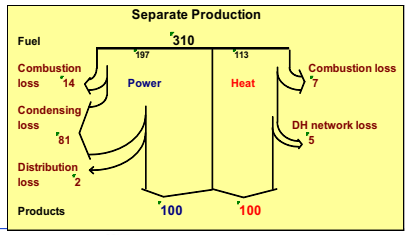
CHP and Trigeneration (2)

- The same amount of sold energy to customers as in the previous slide (100 and 100)
- Fuel consumption (222) 30% less than without CHP (310)
- The quantitative fuel savings vary but 30% is independent on the type of fuel or the plant

"Fuel" is the largest cost component in energy production based on fossil and renewable fuels.

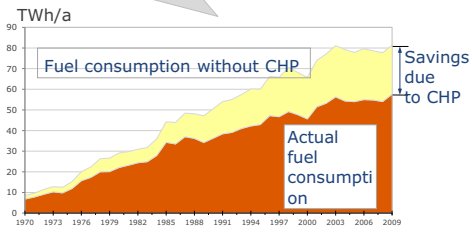
Therefore, the CHP benefits are substantial.





CHP and Trigeneration (5)

"In Finland, The fuel savings of about 25 TWh are equal to 3,3 million metric tonnes of hard coal. Such savings resulted in 700 kg of coal and 1600 kg of CO2 equivalent saved per inhabitant in 2010."



Source: Finnish Energy Industries

CHP and Trigeneration (4)

Helsingin Energia

Salmisaari CHP plant

Fuel storage in the rock cavern underground – not visible

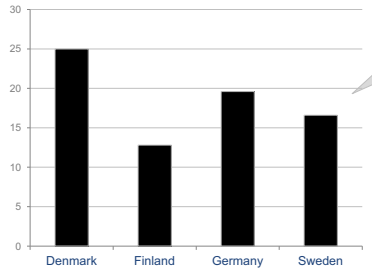
Includes a large absorption heat pump for district cooling

(photo:Juhani Eskelinen)

Source: www.helen.fi

CHP and Trigeneration (6)

" Finnish DH tariffs are the lowest in Western Europe and lowest in the world compared to the purchasing power."



DH prices EUR/GJ (2009)

Source: Euroheat&Power: Country by country/2011 Survey

Source: Finnish Energy Industries

CHP Link to Urban Planning

- District heating and/or industrial heat load is vital to CHP.
- District heating (and cooling) requires dense and compact cities, space for heat (and chilling) sources, fuel storages and underground network piping.

Co-working of urban and energy planners is a "must"

HOW WAS THE PILOT TRAINING STRUCTURED?

Structure of Pilot Training

- 9 months duration: Oct 2011 – June 2012
- Has been piloted in Spain, U.K., Hungary, and Finland and is still underway in Germany.
- Home work has been designed for students in such a way that it integrates energy issues to his/her normal work;
- 8-12 training modules (seminars of two days each) have been organised per country including local and foreign excursions.

Modules of Pilot Training

M1	SUSTAINABILITY CONCEPTS IN REGIONAL AND URBAN PLANNING: A HOLISTIC VISION
M2	ENERGY. FORMS - TRANSFORMATION - MARKET OUTLOOK
M3	ENERGY DEMAND REDUCTION STRATEGIES: POTENTIAL IN URBAN PLANNING
M4	ENERGY DEMAND REDUCTION STRATEGIES: POTENTIAL IN NEW BUILDINGS AND REFURBISHMENT
M5	ENERGY RESOURCES AND RENEWABLE ENERGY TECHNOLOGIES
M6	ENERGY DISTRIBUTION: DISTRICT HEATING AND COOLING
M7	THE RIGHT SCALE FOR EVERY ENERGY CONCEPT: HEAT AND COOL DENSITY (DEMAND SIDE), POTENTIAL ON SUPPLY SIDE
M8	NEW MANAGEMENT CONCEPTS IN THE ENERGY MARKET
M9	ENERGY PLANNING
M10	NEW TRANSPORT MODELS AND URBAN AND INTERURBAN MOBILITY

Conclusions

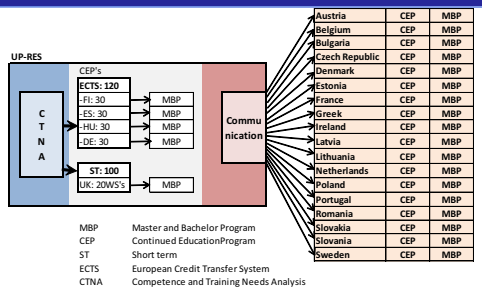
1. There is no sustainable spatial planning to address Climate Change unless RES and EE are fully integrated to planning
2. Integration of RES and EE from the beginning will reduce primary energy consumption and emissions, sometimes even life-cycle costs
3. *Co-operation* of urban and energy planners is not enough but *co-working* practices must be introduced.
4. In order to support such co-working, pilot training of urban planners in five EU countries has been carried out.
5. The lessons learned from the pilot training have been put together to a training package for other planning schools to use.

Main Deliverable of UP-RES

Training package consisting of 10 modules with introduction texts and of 300 slides;

Designed to 200 planning schools in Europe;

Translation to 10 EU languages is underway; and,



Freely downloadable in August 2012:

www.aaltopro.fi/up-res