

M3 Energy Demand Reduction Strategies: Urban Planning



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1. Introduction

1.1. EE and RES Integrated City Planning

- Integration of EE and RES to urban planning will reduce primary energy consumption and green house gas emissions, but sometimes also costs of utility infrastructure construction and operation.
- The local municipality would benefit financially from the reduced utility investment and operation costs
- Reduced energy need and lower emissions together with eventually lower utility costs would improve the attractiveness of the municipality

How is this possible?

Let us demonstrate the benefits of the new EE and RES integrated urban planning approach through two examples from Freiburg, Germany and Porvoo, Finland.

3. Case Porvoo - Integral Energy and Urban Planning

3.1. Location of Porvoo and the Planned Skaftkärr Expansion



Porvoo Skaftkärr Case in Finland

- Land area 400 ha
- Population target: > 6000
- Mainly small houses
- About 1000 lots
- Distance from the city center 2,5-5 km

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.2. EE and RES Integrated to City Planning

Objectives

1. A city area that can be used both as **national and international pilot** of energy efficiency integrated city planning;
2. **Instructions** to energy efficiency integrated city planning;
3. **"The Living Lab"** area, where the constantly improving energy efficiency will be targeted; and,
4. **Business models** to the local energy utility (Porvoo Energy) that respond to the challenges of the low-energy buildings to come.

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.3. Energy Supplier – Porvoo Energy Ltd



Heat production:

- 92% from CHP that is 70% based on bio fuel (wood chips)

Other fuels:

- 28% natural gas
- 1% landfill bio gas
- 1% oil

The plan is to add solar collectors to the heating mix.

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.4. Reference Case 0+ - Business as Usual

Reference Case:

OLD CITY PLAN FROM YEAR 2007

BUT WITH PASSIVE-ENERGY BUILDINGS

Energy in reference case:

A mix of DH, electric and heat pump heating as typical in Finland in loosely built one-family house districts



Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.5. Reference Case 0+: Energy Consumption and Carbon Balance of Porvoo City

Based on research carried out:

- Private cars: 30% of energy but 50% of emissions
- Heating: 27% of energy but 19% of emissions
- Domestic hot water: 12% of energy but 9% of emissions
- Electricity: 30% of energy but 21% of emissions



Focus on three components:

- private cars,
- heating
- electricity.

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

3. Case Porvoo - Integral Energy and Urban Planning

3.6. Planning Option M1



Features:

A dense new area that is supported by the existing city structure.

The passive energy buildings are connected to the DH.

Effective public and light transport routes are created to the city center.



Compared to Reference case:

- Primary energy consumption 40% lower
- CO2 emissions 34% lower

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.7. Planning Option M2



Features:

Effective small-house characterized Option, where 50% of heat is based on DH and the balance of other 50% on ground water heat pumps.

Effective public and light transport routes are created to the city center.



Compared to Reference case:

- Primary energy consumption 36% lower
- CO2 emissions 31% lower

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.8. Planning Option M3



Features:

A loose land use Option, where heat and power are produced inside the buildings 100% based on RES.

Passive energy houses.

Traffic like in Reference Case based on private cars and a little public transport.



Compared to Reference case:

- Primary energy consumption 67% lower
- CO2 emissions 48% lower

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.9. Planning Option M4



Features:

Community type land use Option, in which the focus was on reducing the need of transport and by locating working places and services in the area.

Effective public and light transport routes are created to the city center.

Passive energy houses served 100% by solar heating. The area will supply solar heating to all citizens of Porvoo.



Compared to Reference case:

- Primary energy consumption 45% lower
- CO2 emissions 62% lower

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.10. Carbon Balance of the Options

All four Options cause lower emissions than the Reference case.

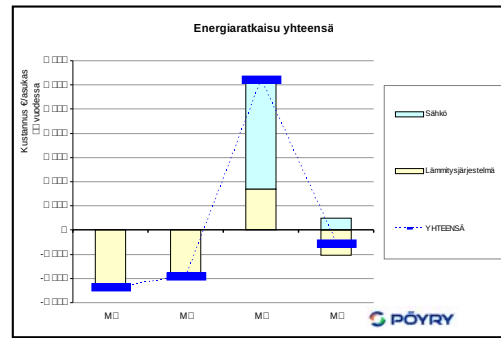
- Infra tech
- Public transport
- Private cars, other
- Private cars, work related
- Electric applications
- Electricity of common building parts
- Tap water heating
- Room space heating
- Total



Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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3.11. The Costs of the Options in € per Resident during 30 years



Cost savings obtained in Options 1, 2 and 4 but substantial excess costs in Option 3.

Electricity

Heating

In total

In Table the additional costs compared to the 0+ reference option are presented.

Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

3. Case Porvoo - Integral Energy and Urban Planning

3.12. Conclusions

- Low Energy Efficiency has its price;
- Carbon Footprint costs as well;
- Down-sizing the Footprint may reduce the costs of living;
- EE integrated city planning costs more (consulting, meetings) but may reduce the costs of implementation (shorter utility pipelines, benefits of scale, etc.);
- The city plan options have to be communicated to the decision makers in quantitative terms, not only investment cost but energy consumption and emissions of each option matter much as well.



Source: 11.2.2011, Mr. Eero Löytönen, City Architect of Porvoo, Finland at the UP-RES Training Course

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