Energy Efficiency and Renewable Energies in Local Renovation Projects;

Experiences from The Netherlands

Forum on: CITY, RENEWABLE ENERGIES AND ENERGY EFFICIENCY

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Presentation outline

- Introduction
- The problem of applying RE and EE systems in existing residential areas
- Case studies
- Results
- Implication of results
- Discussion

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The Dutch housing stock: brief characteristics (1)

Year of construction category[1]	Absolute (x1000)	Relative (percentage)
before 1945	1422	20.9
1945 - 1969	1797	26.4
1970 - 1974	720	10.6
1975 - 1979	538	7.9
1980 -1984	611	9.0
1985 - 1989	573	8.4
1990 - 1994	436	6.4
1995 – 1999	438	6.4
2000 and later	280	4.1
Building type[2]		
One family	4793	70.3
More families	2022	29.7
Ownership[3]		
Owner-osccupied	3623	54.0
Social rent sector (public housing)	2348	35.0
Private rent sector	738	11.0

Source: Ministry of Housing (2002); CBS (2004).

The Dutch housing stock: brief characteristics (2)

•Yearly turnover rate of houses is less than 1% of the total stock.

• Largest energy potential for energy conservation to be found in the existing stock.

• Reduction potentials up to 90% of original energy use are technically feasible.

• Market demand for energy efficiency improvements in houses is lacking due to a number of barriers preventing large-scale adoption.

• Energy performance standards are present for the construction of new houses.

• However, they don't exist for activities concerning existing houses (maintenance, renovation, change of ownership).

Barriers perceived by house-owners to further improve energy efficiency of their houses (1)

Three types of barriers that block investment of house owners and tenants from furthering the energy performance of their houses:

- cognitive barriers;
- economic barriers;
- technological barriers.

Cognitive barriers:

- share of energy costs in living costs is perceived as too low;
- lack of knowledge on how to improve energy efficiency;
- other values and aspects of houses are perceived as more important;
- fear that energy efficiency measures may negatively affect health and comfort issues of the house;
- convenience matters are perceived more urgent; neglect of energy efficiency;
- lack of urgency of with regard to the problem of climate change.

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Barriers perceived by house-owners to further improve energy efficiency of their houses (2)

Economic barriers:

- large investment budget required;
- return on investments perceived as too low or payback period as too long;
- investments only made at natural moments (maintenance, renovation or sudden change of ownership);
- overestimation of short term costs to long term benefits;
- ownership distribution; split incentives;
- lack of supply in specific goods and services;
- deterring economic conditions; clearly affecting the construction sector;
- low income families not likely to have access to loans;

Technical barriers:

- new techniques don't fit conventional energy infrastructure;
- old houses are not suitable for installation of state of the art EE and RE systems;
- orientation of the house doesn't always facilitate application of solar energy systems (either thernal or electrical).

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Key interests and resources of main actors in urban residential areas

- *Housing association*: interests: provision of quality housing to low income tenants; operate as a cost effective firm; project development activities to compensate for little cost-effective investments; resources: housing property, firm budget, organizational capacity.

- *Local government*: interests: deliverance of quality housing and spatial neighborhood development, project development (selling ground property), achievement of local policy goals such as a local CO_2 emission cap; resources: spatial and housing (legal) permits, organizational capacity, sometimes subsidy schemes.

- *Tenants*: interests: high quality housing, little or no increase in living costs (with the emphasis on monthly rent); resources: legal 70% approval norm, legal appeal procedures.

- *Owner-occupiers*: interests: housing quality, long term value of their house; resources: house/ground property, mortgage, savings/budget to invest.

Dutch policy on energy efficiency and the use of sustainable energy in the housing sector

- *Experience* with energy conservation and energy efficiency programs in the housing sector since 1975. Experience with renewables since the 1980's.
- According to the main Bill on Housing 2 out of 3 Mton/yr. reduction of GHG emissions is to be yielded in the existing building stock (VROM, 2000).
- However, *emphasis on new construction* of houses.
- In 2002-2006 little policy attention to energy efficiency in housing due to right wing government coalition and implementation of emission trading system.
- *Wide range of instruments*: mainly economic and communicative.
- A number of subsidies had a *temporal, discontinuous character* and were abolished halfway through the administrative term of government.
- EOS subsidy scheme to stimulate application of innovative energy systems;
- Attempts to norm buildings has been avoided by ntnl. government for a long time; nevertheless EC demanded the certification of energy performance by buildings (e.g. 'label'); implementation in 2008.
- Since 2007 ambitious policy goals to achieve 30% energy conservation (46-50% for the public housing sector) and 20% renewable energy share by 2020.
- New set of subsidy schemes, covenants, and communicative instruments to reach 2020 goals. More budget and higher ambitions than previous government coalition policies on the subject.
- Local policy emphasis on to hook on with large-scale, ongoing construction and renovation projects.

Central problem definition in case study research

"Which factors explain the appliance of innovative energy systems in renovation projects on existing housing sites (e.g. EE and RE)? "

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Relevant theoretical insights

- Theories explaining outcomes of environmental policy implementation processes; mainly the Contextual Interaction Theory (Bressers, 2004, 2009).
- Three core variables per *actor*: motivation, cognition, power/resources.
- Influence of *policy instruments*.
- Influence by *contextual factors*.
- However, other theoretical insights useful as well, mainly *network theories* (inter-organizational collaboration affects outcome/performance), and *diffusion of innovations theories* (social network factors influence the speed in which innovations are adopted by social communities).

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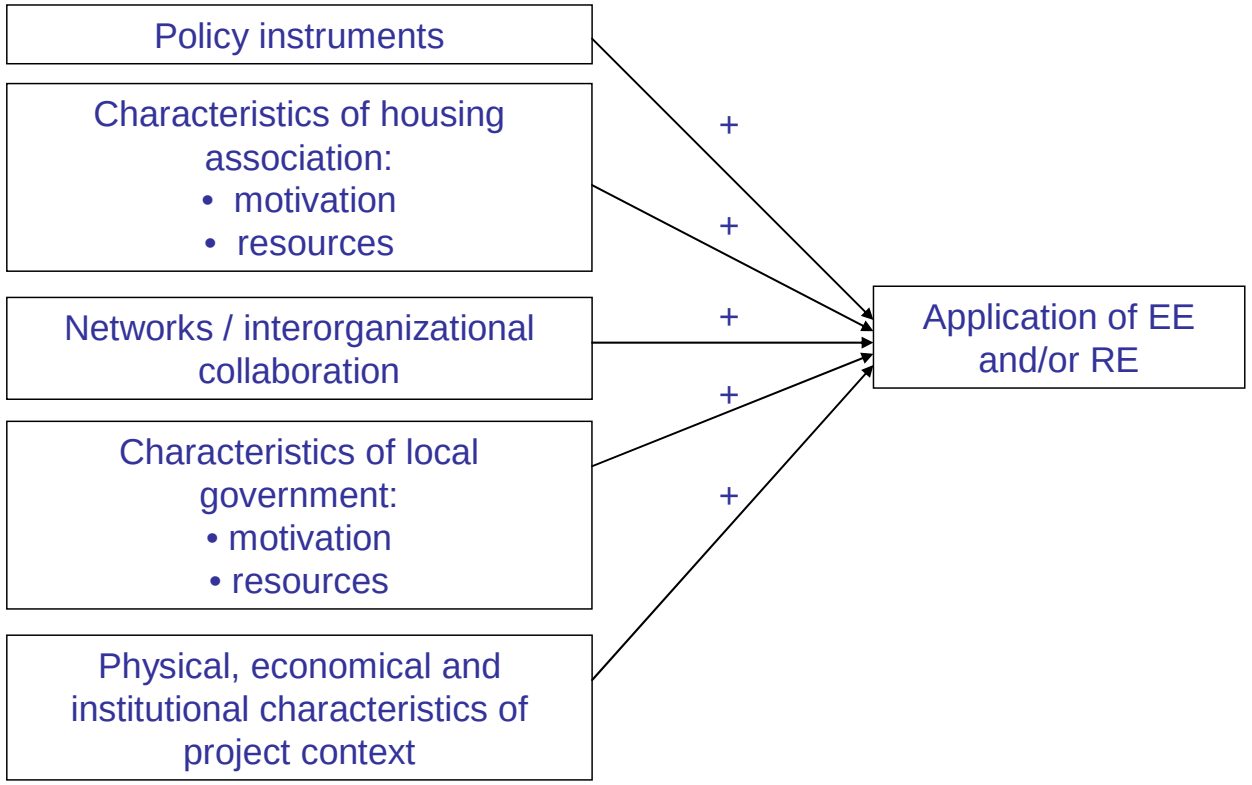
Analytical framework



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Research design case studies

Comparative case design

- 11 case studies;
- cases: renovation projects on existing housing sites (with overrepresentation of public housing);
- research domain: The Netherlands;
- unit of analysis: application of innovative energy systems (EE and RE);
- use of both qualitative and quantitative methods of social-scientific research;
- period of data collection: November 2007 – April 2008 (prior to effects of energy certificate implementation);
- period of analysis and reporting: May 2008 – October 2008.

Geographic locations of sites in the Netherlands

Key information per case study (site)

#	Name of site	Name of town	Number of dwellings	Dwelling type	Ambition	Realisation	Degree of achieved energy conservation
1	Groot Kroeven	Roosendaal	246	Family house 1960s	Bio-fuelled district heating	Passive renovation	69,8%
2	Eygelshoven	Kerkrade	300	Family house 1950s	-	-	51,1%
3	Europarei	Uithoorn	635	Flat appartment 1960s	Solar thermal	Solar thermal energy and solar P.V.	50,2%
4	Prinsenhof	Leidschendam-Voorburg	1628	Flat appartment 1960s	Solar thermal	-	43,8%
5	Hogewey	Weesp	258	Flat appartment 1960s	Heat pumps with geothermal energy	HRe-condensation boiler; small-scale cogeneration	35,0%
6	Espels	Leeuwarden	117	Family house pre-War	-	-	34,1%
7	Binnenstad-Oost	Helmond	121	Family house pre-War	Heat pumps with geothermal energy	-	32,9%
8	Tannhäuser	Apeldoorn	100	Flat appartment 1960s	Bio-fuelled district heating	-	32,9%
9	Bijvank het Lang	Enschede	854	Family house 1970s	Solar thermal	-	30,5%
10	Nieuwstad	Culemborg	200	Family house 1970s	Solar thermal	-	30,1%
11	Atol- en Zuiderzeewijk	Lelystad	380	Family house 1960s	-	-	26,5%

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Barriers to the application of RE and EE-systems

Reason for non-application of EE or RE-systems	Frequency (name of case)
The environmental permit for the start up of a bio-fuelled district heating facility was not granted. This lead to the full cancellation of the bio-fuelled district heating facility, and therefore also the connection to a residential project site.	1 (Tannhäuser)
A lack of trust between the local government and the housing association lead to discontinuation of the project. This included the termination of agreements about application of RE-systems.	1 (Nieuwstad)
The tenants were against renewed use of collective heating systems (which allowed the connection to RE-appliances). They favored individual gas-fuelled heating systems. They were afraid that the distribution of energy costs would be disappropriate if the use of the collective heating system was to be continued.	2 (Prinsenhof, Hogewey)
Advices that derived from energy audits and consultancy reports were never seriously considered as an alternative to conventional heating systems. They only had a symbolic function.	2 (Eygelshoven, Binnenstad-Oost)
Tenants were not willing to accept increases in their monthly rents. This meant that investments in RE-systems could not be compensated for the housing associations. Because investments were not considerd cost-efficient without the compensation the investment in RE-systems was cancelled.	1 (Bijvank het Lang)
The use of geothermal energy makes it necessary to use ground water. This is only allowed if a permit from the province is granted. However, this requires a long procedure. In one case the project needed to be hurried and for time reasons the procedure for the permit was stopped. This meant that the use of geothermal energy was no option any more. The tenants wanted their newly renovated appartments quickly and did not allow any delaying in the process.	1 (Hogewey)
In two cases RE or EE-systems were never considered alternatives to conventional gas fuelled heating systems. The housing association also didn't posess the financial means to bare the risk of investing in innovative but expensive energy systems.	2 (Atol- en Zuiderzeewijk, Espels)
Bad experiences with the application of innovative EE-systems in a former project led to downscaling of EE- and RE-ambitions in the current project. Because the experience featured a very expensive balanced heat recapture system the financial feasibility of EE-systems in the current project was considered a risk to be avoided.	1 (Prinsenhof)
The placement of a biofuelled heating facility in a residential environment was considered a potential safety and environmental risk, and therefore not considered a feasible option.	2 (Hogewey, Groot Kroeven)

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Results of the case study analysis

- Innovative RE- or EE-systems only applied in 3 out of 11 cases, although planning featured application in 8 cases.
- High ambitions were downscaled during the process.
- Strikingly, high ambitions were only realized in small-sized municipalities in which local governments implemented little ambitious policies.
- Achievement of high ambitions depended on initiatives and commitment by local actors, especially housing associations.
- The influence of urban renewal activities and -policies can be considered as negative.
- Local climate policies overemphasize the application of RE and EE in new construction sites as compared to renovation projects in existing housing sites.
- Many necessary but not sufficient conditions, including: the use of subsidies, high ambitions in the planning stage of a project, a sufficient degree of interorganizational collaboration, and a motivated and financially well-equiped housing association.
- Tenant participation did not influence outcomes (rather limited outcomes).

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Implications of results (1)

- Need for policies that facilitate knowledge exchange and collaboration efforts between local actors (e.g., process management, covenants, information campaigns).
- Large and “rich” housing associations eager to invest and increase energy performance of housing stock, but how to reach the “poor” ones?
- Planning (ambition-setting) did not predict outcomes; the commitment of local actors needs to be improved.
- Local government capacity did affect ambition-setting, but did not affect project outcomes; better policy equipment necessary for local governments?
- Local actors primarily concerned with social issues; environmental/energy issues considered with less priority.
- The results of the case study analysis are useful to inform both national government and local level policy makers/implementing agencies.
- Insights could be useful to moderate the results of ‘top down’-designed quantitative models about GHG emissions and the scenarios they predict.

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Implications of results (2)

- Tenants were little concerned with the subject and in some cases actively preferred conventional suboptimal energy systems over innovative ones that performed better both energy-efficiency-wise and financially. Even when offered sufficient information tenants favored conventional systems.
- It is difficult to persuade low income house-owners, even when substantial policy support is offered (loans, subsidies, mortgages, green funds, campaigns, personal assistance).
- The ‘top down’ designed policy plans 2009-2020 by Dutch national government are far too optimistic and need to be revised; a ‘bottom up’-approach (such as this study) could help national government to validate future policy-making (‘backward mapping). Especially, the coupling of the policy budget to the 2020-goals falls short. Also the goal set, is too ambitious (comparison by means of energy conservation: mean results study 40%; mean policy goal 48%).
- Housing associations are not able to quickly find the budget necessary to meet the agreements necessities, laid down in the national energy efficiency covenant. They need financial assistance.
- Need for more systematic policy evaluation / structural monitoring;
- Need for systematic international comparative studies.

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Discussion

Thanks for your attention.

If you have any comments or suggestions, please contact: t.hoppe@utwente.nl

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