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Smart Retrofitting of Urban Housing

AMS project report

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Content

Smart Retrofitting of Urban Housing

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1. Management summary

With the aim to identify the social and institutional conditions under which retrofitting of urban housing in Amsterdam and China may lead to energy efficiency, this project set out to investigate:

- The chances and opportunities for 'smart' retrofitting of urban housing projects in Amsterdam and the Chinese city of Mianyang;
- What 'smart' retrofitting does to existing relations between local authorities, housing agents, and consumers and between consumers;
- Which changes in lifestyles and consumption practices are required and realized in urban retrofitting projects;
- The potentials for replication of the smart retrofitting projects into the housing and energy regime of Amsterdam and Mianyang.

Smart retrofitting is defined as the restructuring of existing housing stock to increase buildings' resource efficiency and resource generation capacity involving structural change in energy and informational flows, actor relations, governance arrangements and consumer practices.

The NWO-JTSP funded 4 years project entails a comparative case study of retrofitting projects in Amsterdam, the Netherlands and Mianyang, China, executed by a consortium of Wageningen University and the Chinese Academy of Social Sciences (CASS) in Beijing, with partnerering AMS-institute, Waag Society and housing associations in Amsterdam. In 2016 an in-depth case study was done in the preparation phase of a specific retrofitting project of Ymere in Amsterdam: Dapperstraat/ Wagenaarstraat. A co-creation strategy was employed with about 20 residents in two series of sessions, one to take stock of current housing conditions, housing use, complaints and preferences, one with explanations of retrofit options and implications for residents.

The impact of this co-creation intervention in the retrofit process is yet to be assessed, as the decision making on the retrofit implementation has not been completed. However,

the sessions with residents did open a black box of current housing practices and preferences of residents that were hitherto not taken on board in retrofit programs.

Zooming out to other cases of retrofit we observed that both in Mianyang and in Amsterdam many new city policies for housing retrofitting have emerged that have speed up the programs and projects for urban housing retrofitting. Secondly our findings show that while technical measures like insulation, new waste, lightning, ventilation and heating systems are being applied, its proper uptake by consumers is still uncertain. Residents see retrofitting as a necessary means for home improvement for comfort and convenience rather than for energy efficiency. Although in potential quick returns can be made on investments in energy efficiency measures, consumers are hesitant to accept the inconvenience of the construction, uncertainty and higher rents that are based on these investments. Thirdly, we found that insulation and new ventilation- and heating systems may enable other user practices which in the end lead to higher energy consumption.

Retrofit projects enhance the interactions between residents in various ways. Both in China and Amsterdam residents committees are formed to represent the stakes of residents during the retrofit stages, and to seek the approval of 66-70% of residents before the retrofit plan can take off. Our findings show that most of the conversations both in formal and informal settings regard the level of home improvements and the relation with the housing providers, the finances, construction, retrofit improvements rather than energy efficiency.

Conventionally householder consumption practices and lifestyles are framed from a techno-economic dominated policy-field. The researched retrofit projects in Amsterdam and Mianyang show that changing domestic practices to save energy and improve wellbeing cannot be stimulated by introducing technology alone. Household retrofit technologies only obtain meaning in operation by households and use in domestic practices. Especially comfort related practices, like ventilating, heating and lighting, should be understood as being socially and historically situated, shaped by collective conventions, personal levels of control, which co-evolve with technical systems. The main policy challenge for improving effectiveness in urban retrofitting is to redefine the goals and means of retrofitting. Technical energy and housing efficiency should be balanced with private and community interests concerning comfort, convenience, social security and community building. Participation, deliberation and co-creation of those actors which have a stake in the retrofitting tend to increase the legitimacy of decision-making. Experiences in Amsterdam show this could slow-down the decision process tremendously. But bottom-up strategies, like co-creation and community participation, have become a crucial and necessary means of urban retrofitting in both Amsterdam and Mianyang.

The impact of this project on the housing sector of Amsterdam is building up with continuing participative research in collaboration with housing associations in Amsterdam (Ymere, Eigen Haard, De Key and De Alliantie) and the Amsterdam Municipality. Continuing field research on diverse retrofitting projects aiming at residents, their practices and preferences, and retrofit procedures are delivering necessary insights for improving residents' uptake and appreciation of retrofit, and smoother transitions from an outdated to an energy efficient housing stock.

2. Extended abstract

Keywords

Housing retrofitting, urban governance, provider-household interactions, resident participation, energy efficiency, Amsterdam, China

2.1 Introduction

One of the key challenges of urban sustainable development is the effective governing of retrofitting urban neighbourhoods (Bulkeley, et al 2011). It has been estimated that existing urban neighbourhoods and their buildings account for 32% of global carbon emissions (IPCC, 2014). To curtail urban carbon emissions, improving buildings by means of urban retrofitting is seen as the most cost efficient way to reduce global building carbon emission by at least 25-30% at the end of the 2020's (IPCC, 2014). Furthermore, energetic improvements of apartment buildings come with substantial improvement of householder's life quality and well-being (Thuvander, 2012).

For these reasons urban retrofitting has become a priority in urban governance of cities around the globe. Although the need for housing retrofitting is not new, and various retrofitting procedures have already been developed and implemented over time, there are a number of challenges that deserve research attention. First, the ambitions to cut down carbon emissions with 25-30% require novel approaches to retrofitting. This means Taylor-made rigorous insulation of apartments, replacing entire systems for heating and ventilation, lightning and waste treatment. The retrofitting goals for China and the Netherlands aim for making fifty to sixty percent of the existing housing stock energy efficient (Yang, et al., 2013, Ministry of Internal Affairs and Kingdom Relations, 2014).

Secondly, conventional procedures of housing retrofitting need to be renewed as they are not equipped to make energy measures acceptable or successful in everyday use after retrofit. The realization of energy savings is 40 - 50% lower than theoretical expectations due to householder' practices (Galvin & Sunnika-Blank, 2017).

This report presents the findings of a study of a retrofit project in Amsterdam as part of a wider NWO-JTSP funded research project (May 2015-May 2019) on smart housing retrofit in China and Amsterdam. Before we zoom in to introduce the retrofit case in Amsterdam we firstly present the objectives of the wider project, how we conceptualise smart urban retrofit and the policy contexts of housing retrofitting in Amsterdam and China.

Objectives

The aim of the research is to identify the social and institutional conditions under which smart retrofitting of urban housing in Amsterdam and China may lead to decoupling of domestic energy demand and greenhouse gas emissions.

The overall project seeks to answer the following research questions:

1. What are the chances and opportunities for smart retrofitting of urban housing projects in Amsterdam and China to substantially increase energy efficiency and generation on a building level?
2. What does smart retrofitting do to existing relations between local authorities, housing agents, energy providers and consumers and between consumers?
3. Which changes in lifestyles and consumption practices are required and realized by domestic consumers in urban retrofitting projects?
4. Given the above analysis, what are the potentials for replication and socio-technical and institutional embedding of the smart retrofitting projects into the housing and energy regime of Amsterdam and the Chinese city of Mianyang? What are the (socio-technical, institutional) conditions under which such replication can succeed?

Our answers will inform local authorities, housing corporations, building companies and householders on smart(er) ways to plan and organise future retrofitting projects in China and Amsterdam.

Conceptualising Smart Urban Retrofit

Urban retrofitting refers to the reshaping of the built environment, and the networks and flows that run through them. In most of the literature and in practice, urban retrofitting has been the domain of engineers, using material flows analysis as a common ground to grasp the complex empirical dynamics of resource flows through cities (Hodson, Marvin, Robinson, & Swilling, 2012). Material flow analyses identify direct and indirect flows conducted through cities and supported by urban infrastructures, ending up as stocks or moving through production-consumption cycles and transforming them into waste, goods and services. Retrofitting in these terms, is then to redesign urban infrastructures and buildings to increase resource efficiency or productivity, with an emphasis on "converter",

“demand” or “re-converter” technologies (Hodson, et al., 2012, p. 792). A socio-technical approach to urban retrofitting includes in the analysis the governance of flows and infrastructures, and the actors and institutions involved in the processing of flows and their passage through the city. This is an emerging field of study in Science and Technology Studies, Transition studies and in urban studies (Nevens et al 2013; Loorbach et al 2008; Brand, 2013; Bulkeley, Castán Broto, & Maassen, 2013; Monstadt, 2009; Ozaki & Shaw, 2013; Verbong & Geels, 2010). More specifically, the various infrastructures of consumption such as energy, water, waste water and solid waste systems have been studied in relation to liberalisation of utility markets, environmental innovations and its implications for the shifting responsibilities between providers and domestic consumers (Spaargaren & Van Vliet, 2000; van Vliet, Chappells, & Shove, 2005; Hegger, 2007; Van Vliet, 2012).

Energy consumption in an urban context is closely linked to sustainable building and urban retrofitting. While in the 1990s policies for sustainable building in the Netherlands were mainly focussed on new-built residential areas, today the retrofitting of existing housing stock is of major concern. Housing associations together with the financial sector and with support of local authorities and grid operators are rolling out retrofitting programs focussing especially on the 1,5 million rental housing estates built before the 1970s. Apart from applying insulation measures, houses needed to be applied with mechanical ventilation and renewed heating systems. In occasional cases new energy generation technologies like PV, solar heaters, combined heat power units, or geothermal heat systems need to be implemented. The present generation of energy-technologies applied in retrofitting residential urban areas differs from the (passive, insulation-) technologies and infrastructures of the 1970s and 1980s in the sense that they allow for a more citizen-consumer-inclusive, localized system of domestic energy consumption.

Apart from these institutional conditions, social conditions are of equal importance. Research has shown that a transition to energy efficiency or renewable energy production will often not always lead to net carbon emission reductions at household level (see Gosens et al. 2012). A reduction in carbon emissions also requires adaptations in consumers’ lifestyles and domestic practices (Spaargaren 2011; Van Vliet 2012). This is why research has to inquire which roles consumers and producers take within a given (renewable) energy system, and to what extent it implies a change in consumer practices (see e.g. Bluemling et al. 2013), and may eventually lead to carbon emission reductions.

Smart retrofitting

The concepts of smart cities, smart urban retrofitting and smart grids have gained footing in many cities around the globe. They add notions of automation, data generation and informational governance around modern urban energy flows. Smart systems are based on the application of modern information and communication technologies, and increasingly depends on two-way (digital) information exchange between providers and consumers - primarily through the use of smart meters. We posit however that it requires knowledgeable users and providers, adjusted and new social practices and relationships between consumers and providers before a technical system can become “smart” (Naus et

al 2014). New energy related information flows within and between householders and between householders and providers require interpretation and a re-embedding in energy related social practices. The smartness of infrastructures should therefore be assessed in social scientific research focussed on particular practices 'scripted' by the infrastructures, informational flows and associated actor networks.

In our research project that includes the study of urban retrofitting projects in Amsterdam and China we define smart urban retrofitting as *the restructuring of existing housing stock to increase buildings' resource efficiency and resource generation capacity involving structural change in energy and informational flows, actor relations, governance arrangements and consumer practices*.

Policy Context of Retrofitting in China and Amsterdam

Since 1992, a series of covenants between Ministries and the housing and building sector has been concluded on energy efficiency in housing in the Netherlands (RVO, 2017). The latest energy covenant (2012) co-signed by associations of housing corporations (Aedes) rental housing consumers representation (Woonbond) and builders (Vastgoed Belang) intends to bring all 2.4 million rental social housing in up to the average level of energy label B in 2021 (a theoretical energy index of 1.25). This equals a saving of 33% of theoretical energy use in buildings in 2021 as compared to 2008 (Aedes, 2017). The challenge is huge, especially in cities with a relatively large and also aging social rental housing sector with mostly apartments like Amsterdam.

In China, more than half of the total 42 billion building floor surface is outdated requiring a retrofit upgrade (Yang, 2013). The first state level guideline for conservation design standard for building energy-efficiency was introduced in 1986. Over the years a series of national codes and standards have been issued to further cover these targets in various climate zones of China supplemented with subsidy regulations for property owners. Every year more stringent state level retrofitting guidance on energy saving and emission reduction for existing buildings are issued. In the 12th Five-Year Plan China is conducting residential retrofit of 400 million square meters in the northern heating zone and 50 million square meters in the hot-summer and cold-winter zone. By government agreements these national targets are divided in targets for provincial and local governments. The national aim is to reduce energy consumption by 16 percent from a 2010 baseline and by 32 percent from a 2005 baseline (Davoudi, 2014).

The main stakeholders at the provisioning side of retrofitting are national- and local governments, building companies, housing associations and developers. These stakeholders are responsible for the financing, production and distribution of retrofitting. In both the Netherlands and China, retrofit providers recognise that urban retrofitting is of strategic importance for improving well-being and vulnerable aspects of environment and society. Unfortunately, series of governmental failures in China and market shortfalls in Netherlands stand in the way of exploiting the full potential of housing retrofit (Van der Heijden, 2015). Retrofit providers in both countries have to face limited financial capacities, problematizing the scope of retrofitting to deal with stringent energy saving targets and

competing householders' demand for life quality (Hoppe, 2013; Liu, 2014). The financial structures of retrofitting, and possibilities to share the financial burden between multiple actors, lead to tensions in decision-making and complicates the way of democratising and broad community participation in retrofitting processes. The receiving side of retrofitting: residents and their representative bodies, like community representative organisations, boards of tenants or employees, is considered increasingly relevant in housing retrofit projects, both in the Netherlands and China.This leads to certain degrees of responsibility for retrofit improvements constructed by retrofit providers and paves the way for household-consumers to take their responsibility. However, in current policy making retrofit providers in China and the Netherlands largely ignore that the way of organising decision-making and responsibilities for retrofit improvements is influencing the everyday activities of householders. Little is known how in the way of executing domestic routines of heating, ventilating and waste treatment is interfered (Mlecnic, 2012, Xu, 2013). Ultimately these domestic practices determine whether the home is environmentally sound and is saving energy or not (Gram-Hanssen, 2010). This problem divide between retrofit provision and the seeming separate sphere consumption necessitates on reorientation of varying roles of government, market and consumers (Hodson & Marvin, 2016; Van Beckhoven, 2006; Li & Griebhaber, 2013). The recognition that the financial burden-sharing, distribution of responsibilities, decision-making power and everyday domestic practices vary substantially between China and the Netherlands makes them relevant to examine.

Building upon these conceptual and policy considerations, we take as a starting point that the effectiveness of urban housing retrofitting arises from the way interaction is organised between retrofit providers and household-consumers. The wider NWO-JTSP funded research project is based on a comparative case study research into a number of retrofitting projects in Amsterdam and China of various scales. In this report we present the preliminary findings of comparative case study research between Amsterdam and China, but we focus on one specific case study that was executed in Amsterdam (Wagenaarstraat/Dapperstraat) in which an innovation in the process of involving and recruiting tenants in the retrofit process was investigated. The case and the methodologies of case selection, the intervention and research are detailed below.

2.2 Methods

The wider study on housing retrofitting in Amsterdam and Mianyang examines neighbourhoods that have been retrofitted to meet higher energy- and life quality standards, as starting point for exploring the effectiveness of retrofitting governance. The case-studies in more public-led and private-led contexts are helpful to develop further in-depth information on governance for sustainable development in the retrofitting housing estates. A case study approach allows investigation of contemporary phenomena within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1994: 13–14).

Table 1: cases of housing retrofitting in Amsterdam and Mianyang

Case	Households	Building year	Building specificalities
Lishan (Mianyang)	105	1993	2 apartment building block of 8 floors
Muzong (Mianyang)	56	1997	1 apartment building block of 7 floors
Gongan (Mianyang)	48	1988	1 apartment building block of 7 floors
Olympia (Amsterdam)	535	1926	5 multi-layered building block of 3-4 floors
Anton Waldorp & Charles Leikert (Amsterdam)	279	1958	6 apartment building block of 6–7 floors
Dapper Wagenaar (Amsterdam)	21	1880	1 multi-layered building block of 4 floors

A selection of case studies distributed over Amsterdam and Mianyang is presented in table 1. The cases have in common that they target large-scale residential apartment blocks built before the era in which stringent energy saving became a common prerequisite in Dutch and Chinese urban planning and building regulation. The case studies did not only focus on the retrofitting of the buildings, also the direct surroundings are part of the inquiry. In addition, a criterion for selecting the cases was that the retrofitting is governed by institutional actors (local government, housing association, building companies), rather than by individual householders. We have made this decision for reasons of comparability taken into account the standard Chinese way of living in apartments.

In this study qualitative methods were employed for data gathering. The main body of data was gathered by semi-structured interviews. Using this semi-structured interview technique, data was gathered from local government officials, housing association officials, building companies, private developers and householders. In total, 45 individuals have been interviewed across the six cases. These interviews of around 60 minutes directed on the one hand to describe and understand the projects and on the other hand to describe broader trends in urban retrofitting in the two cities. The interview checklist included four parts: 1) general questions about the institutional structure, financial burden sharing and specific regulations, etc.; 2) questions targeting the planning- and decision-making process, such as who initiates the project, who are majorly involved into the decision-making, what kind of decisions are made and how the end-users are involved etc.; 3) questions aiming at design and construction, such as what kinds of objective and scale of the retrofitting housing project, and which distribution of responsibility for retrofit improvements is in place, etc.; 4) questions aiming at the use of the retrofitted house, including who is in charge of the house management and maintenance, how the occupants find the new housing style and what they expect for any changes in terms of energy use, etc.; The interview findings have been triangulated with site observations on the related retrofit projects and a literature review to strengthen the validity of the generated data.

Methods case study Wagenaarstraat/Dapperstraat

To apply and investigate innovative forms of recruitment of tenants in a retrofitting project, an inventory of existing and starting retrofit projects in Amsterdam was made based on meetings and materials from housing associations in Amsterdam. The resulting inventory of +20 retrofit projects or projects about to start was discussed with Waag Society and Ymere upon which it was decided to select the retrofit project of

Wagenaarstraat/Dapperstraat. Meanwhile Waag Society made a plan of action for involving users-as-designers at retrofitting projects aiming for energy saving. The first meeting to explore the possibilities of project was about to start in Spring 2016, and suitable to intervene in as the first information sessions with tenants about the retrofit were yet to planned. The project encompasses 21 apartments and 5 businesses in a multi-layered building block consisting of 6 apartment houses, built around 1880. The buildings are owned and managed by housing association Ymere who rents the apartments to low income residents and small retail businesses.

Figure 1: Impression apartments Ymere in Dapperstraat/ Wagenaarstraat

The intervention is an innovative co-creation trajectory that ‘adds on’ the interactions with residents that are normally planned in a standard procedures within housing retrofitting by Ymere. The co-creation strategy as designed by Waag Society consisted of two interactive sessions with each of the three groups of residents from different apartment blocks. These sessions are originate from the understanding that users - as experts of living in the apartments - are the best producer of the retrofit plan. User experiences of householders in broader context of everyday life constitute specific “needs” and “wants” to be considered when preparing large-scale renovation projects. Retrofitting housing is a physical reconstruction, a tangible object, while domestic practices signify also an emotional relationship (Dovey 1985; van Vliet 1998; Cristoforetti et al. 2011) embracing dimensions

such as security, comfort, identity, privacy, and control (Kearns et al. 2000; Ellsworth-Krebs et al. 2015). Social innovation is meant to bridge the top-down technology implementation into social collaboration with the society.

The first session is to become acquainted with the residents, their ideas about comfort, usage and their aspirations concerning the apartments with a focus on energy related practices and facilities. The second series of sessions addressed the possible retrofit measures and aims to gather residents' ideas and opinions about the financial and constructional consequences of different retrofit scenarios. Details about the procedure are presented in Annex 1 (report Waag Society in Dutch). In the following sections, we first zoom in and report on the findings of the co-creation project for the retrofit in Dapperstraat/Wagenaarstraat. This is followed by a zooming out on preliminary findings of the wider project in which we reflect on a range of case studies in Amsterdam and China.

2.3 Zooming in: Dapperstraat – Wagenaarstraat project

Residents and Condition of the Buildings

The project Dapperstraat/Wagenaarstraat is a special, yet very small project of Ymere that is in need of a tailor-made retrofit because of its specific characteristics: its location in the heart of Amsterdam East; its mixture of residents and the very poor state of the buildings. The area is popular for residential and commercial functions and continuously rising housing prices. It means that social housing, with its legally determined maximum allowed rents, is under pressure. Housing associations are tempted to selling property in such areas rather than retrofitting it and being restricted to offering apartments against maximised rental prices. Residents in this project have diverse cultural and migration backgrounds; their ages range from 20 to 80, and they have been living here from 1 to 27 years.

The poor technical status of the buildings be retrieved from the technological audit that was made in 2013 by WVAU Architecten, commissioned by Ymere. Since the last retrofit in 1989 no substantial maintenance has been done. Especially the state of roofs, window frames, masonry and stairwells is poor and urgently needs retrofit. The energy performance of the buildings is assessed with energy label E.

Co-creation trajectory and results

The first set of three co-creation sessions started off with small groups of two to four residents. They were asked to bring photos of pleasant/positive aspects of their apartment as well as those of poor/unpleasant parts. The session aimed to gather individual and group values concerning housing and living in the complex. After this inventory their wishes were addressed in terms of comfort, social functions, common spaces and finances. Lastly the current uses of the houses and energy consumption practices were discussed, using a map of each house on which participants for instance could indicate

where energy is used or lost and which parts of the apartment they use most intensively. The outcomes of these sessions were mixed. Participants have been not in all cases familiar with the concept of co-creation. The generous interests from our side in the way they use their home, and their specific interests was surprising for them. The trust relation with housing association is damaged for some participants. These participants expected that these meetings would (finally) inform them about specific retrofit plans and were disappointed when they found out that this expectation could not be met directly. The sessions did however fulfil its purpose of gathering more precise information about current uses, values, wishes and complaints about living in these apartments.

The second set of co-creation sessions was devoted to discuss the upcoming renovation plans and measures and possible consequences for residents. Contrary to the first sessions, also a representative of Ymere was present to explain the planned measures based on the technical state of the apartments as well as the wish-lists obtained from the first sessions. Issues to be discussed were costs and benefits, implications of measures for future rents and energy bills, whether or not temporary moving house is deemed necessary during the renovation and the interrelatedness of different measures. The participants were asked to sign a document to approve an anonymised transcript of the conversation with their own quotes highlighted. The documents will be used for decision making in the follow up steps by Ymere and the residents committee on the implementation of the retrofit.

A detailed report about the co-creation (in Dutch) is presented in Annex 1. The sessions mainly revealed to residents the implications of measures of insulation, mechanical ventilation, double glazing and other improvements. It was explained to participants that these measures would lead to a rent increase of 116 euro per month (on top of a rent of about 200-250 Euro per month). Except one, all participants were opposing this, as they cannot compensate this rent increase with a lower energy bill. They are used to their low rent-levels and not willing to pay more rent for an improved apartment. They consider the retrofit as delayed maintenances to apartments they rent.

Reflection on the co-creation

The co-creation trajectory deviated from the standard procedures in housing retrofit especially with respect to the face-to-face group inventory of resident's views on their homes and practices and wish-lists for improvements. Normally the wish-lists are collected through paper survey questions that residents should fill in and return to the housing association. The first round of sessions were therefore new to residents. They had never before discussed their housing conditions amongst themselves before. The sessions enabled them to express their views and complaints about their housing situation, the maintenance and relations with the housing corporation. The sessions succeeded in an elaborate collection of data on current practices, satisfactions, pros and cons of living conditions and wish lists, but not as much as was aspired in the design of these meetings. Energy practices and energy measures could not be discussed in detail as much time was needed to express current views and complaints and because residents prioritized discussing general home improvements and financial costs. The fact that the first sessions were intentionally not attended by a representative of the housing association enabled

residents to speak out freely about their living conditions and relations with Ymere. Residents' involvement in the retrofitting project has been enhanced through the facilitated interactions amongst themselves and later on in the second round of sessions with Ymere. The mostly qualitative findings of the co-creation trajectory are now taken on board in the further decision making of Ymere and the residents committee on the retrofit plan and further steps. It is advised to follow up and reflect on the process with residents after the retrofitting project has been executed at the end of 2018.

2.4 Zooming out: retrofit in Amsterdam and China

Results for Mianyang Retrofit

Public-led retrofitting of housing estates for the urban poor is in an early state in the urbanising and industrialising city of Mianyang. For a long time, economic interests of developers and the local government lead to demolishing and constructing new buildings, rather than retrofitting existing buildings. In 2015, the local government launched the first four-year retrofit program of 'retrofit and governance of old communities' to retrofit existing residential communities built before 2000. This retrofit program structures the retrofitting of residential communities originated from former working-unit companies of approximately 50 – 300 households. Most of these companies are now closed.

A common timeline for retrofitting processes (fig. 2) in Mianyang is six months for establishing a resident committee and getting householder' agreement and three months for executing the construction of retrofitting.

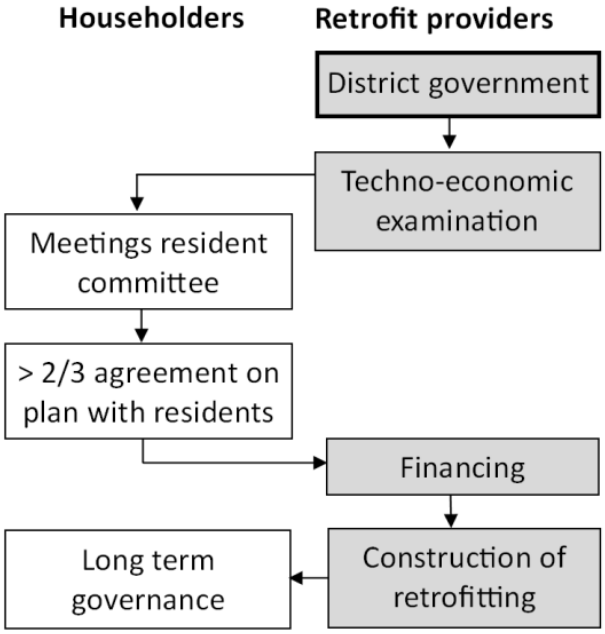

Figure 2: Retrofit decision making Mianyang

The first step to be taken by the householders is to represent themselves in a resident committee of 5, 7 or 9 residents. A resident committee and sub-district government informs householders via introductory meetings and leaflets about the retrofit. All householders are

asked to fill in a questionnaire to give their recommendations and suggestions for the retrofit project to initiate an application to the district government. Compulsory for application of the retrofit project is approval by at least 2/3 of the householders. The district government decides thereafter on building and financial feasibility. The retrofit construction has to be carried out by a qualified construction company selected via an open tender. During the retrofit design and executing of construction, retrofit standards and rules had to be followed. In particular, retrofit construction works needs to be verified, approved by a supervision company and monitored by the resident committee. When the retrofit construction is finished the district government evaluates the used budgets. The district government uses the resident committee as a 'representative bridge' towards the householders. Sometimes the sub-district government organises meeting about energy saving and water saving. The last step in the procedure is to encourage the resident committee to set up their own funding as a limited form of 'self-governance'.

The government takes responsibility for long-term integrated sustainable urban retrofitting. Priorities in this integrated approach are to improve the basic quality of life and repairing earthquake damage. This is combined with improving the environment and securing cultural heritage, so-called "red values". The latter is important in the Mianyang style of urban retrofitting. The beautification of outdoor spaces and communal facilities has always been neglected because of the indeterminate responsibilities and lack of investments in the past. Nowadays, the district government takes into account maintenance and repair for collective urgent needs of householders. Due to their own lack of financial investment power householders are welcoming the retrofit to solve their needs. The urgent needs of householders mentioned in the questionnaires are their sewage systems and roof leakage. Although householders in Mianyang meter and pay their own use of gas, electricity and water, urges like a high energy bill are not mentioned. In many cases the retrofitting project in this city with hot-summer-cold-winter climate focuses on "superficial" environmental measures of adding garbage cans and solemnly improvement of wall insulation, LED-lightning or sockets for e-bikes. In the eyes of the government, especially resident committees are invited to take care of environmental improvements related to energy saving and "organising" the individual householders. The role of urban residents' committees is to take responsibility to mobilise residents' self-governance activities and drawing synergy and cooperation among government departments and the residential community. In one project the volunteers of the resident committee organised a collective buy-in of solar protecting sheds in a unified style. From the district government point of view the 'inside' of their individual apartments is considered householders' responsibility. This made energy saving measures, like efficient solutions for heating and ventilation, largely depending on the dedication of householders.

The district government "outsourced" the formation of sustainable domestic practices to resident committees and does not focus consciously on steering everyday practices of householders in the retrofitting of their housing. The district governments occasionally facilitated sustainable practices by providing material improvements like sockets for the charging of E-bikes in one case. In this project they also gave householders a smart gas meter with a card system for easy charging. The district government chose to retrofit the windows in another case. These new windows are easier in use compared to the old

windows, which have been re-curved after the tragic earthquake of 2008. Regarding socio-cultural organisation of decision-making the government occasionally organised meetings to educate of households for waste treatment and water saving. Example houses to visualise the retrofit improvements are not common because the retrofit is mostly focused on the public space. District governments invited the resident committees to cultivate volunteerism in the community and organise and encourage people to behave more environmentally friendly. The resident committees prioritised low-cost measures to promote green lifestyles, like shading and waste treatment. Different garbage cans are made available to invite residents to separate their waste after the retrofitting. For householders waste separation is the most mentioned change in their daily activities. The resident committee monitors whether wastes are put in the correct garbage bins. As for energy practices, householders are used to low indoor temperatures and wear coats inside during the Winter as central heating systems are not available. Low-tech ventilation and heating improvements are important because the rapidly rising use of electric heating.

Results for Amsterdam Retrofit

Housing associations in Amsterdam have been involved in the improvement of energy efficiency in housing estates using national government-tied target-setting and regulation since the 1970s. Nowadays the national government made agreements with housing associations of Amsterdam to raise the minimum energy standard of all their 190.000 existing properties before 2020. The local government made a compulsory agreement with the housing associations of Amsterdam for large scale improvement of 18.000 houses with bad energy performance between 2015 - 2018. Often housing associations retrofit serially dwellings with 50 – 300 inhabitants, like gallery flats and apartment blocks from the 1970s. Both the democratization of project organization and the broad community participation in retrofitting typically leads to lengthy amount of time spend for reaching consensus with and between the residents.

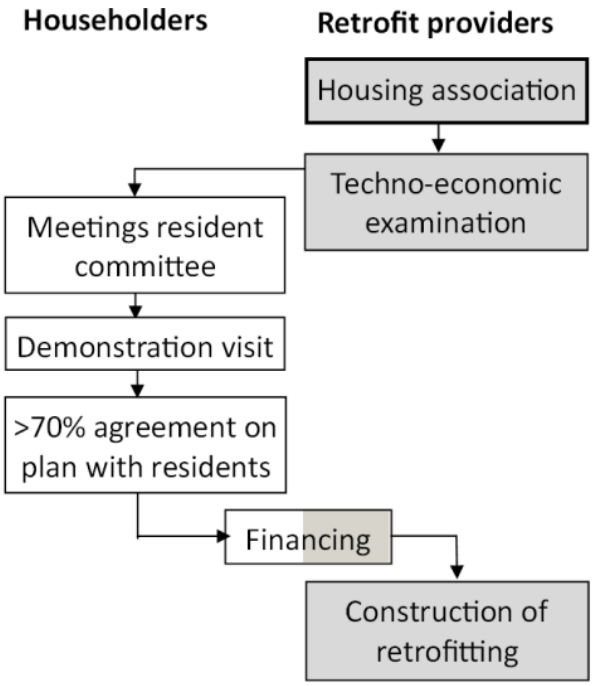

Figure 3: Retrofit Decision Making Social Housing Amsterdam

The duration of retrofit processes (see fig. 3) in Amsterdam can range from one and a half year to 5 years in difficult projects. The processes of retrofitting start with the responsible housing association deciding on the scheduling of the extensive maintenance and appointing a project team. The housing association creates a provisional program of requirements and takes care for techno-economic examination of the housing qualities. A legal commitment is that a resident's committee must be formed as representation of the householders. The resident committee is the discussion partner of the housing association with the help of non-profit tenant right organisations as qualified bridging partner. In the context of communication about retrofitting small meetings are organised for the householders. Householders are informed via leaflets, notifications, invited to a showcase-house and asked to fill in a questionnaires with their suggestions. A legal approval rate of at least 70% of the tenants in every building block is needed to approve the proposed retrofit. Housing associations decide on the basis of suggestions from householders and the techno-economic examination to a qualified advice on the preferred scenario of the retrofit plan. The agreement is personalised to an individual retrofitting proposal for every householder. Sometimes householders can choose between basic packages and more ambitious retrofitting measures with different financial consequences in rent increase. After this, the housing associations start a tender selection process for choosing the construction company. In case of conflict about the implementation of the agreements the housing corporation and the residents committee have the option to go to the conciliation committee.

The housing associations take responsibility to improve the energy performance of their real estate properties. Their retrofit plans to improve their apartments focus on technical energy performance and sometimes side-goals of improving comfort and liveability. Due to agreements on national level the aim of housing associations is to upgrade all their dwellings to an average energy performance label B or improve at least by 2 energy performance label classes. This improvement is roughly half of the theoretical energy-use. The improvement of life quality for householders is not the highest priority for housing associations. The priorities between householders and the housing association are often conflicting. Representatives of housing association need to ensure the long-term energetic sustainability of the real estate properties in the negotiations while residents are often quite focused on their own comfort and beautification of indoor improvements, like a new kitchen or bathroom. Housing associations tend to retrofit many apartments with the same improvements to save costs and consider the wishes of householders to have the best possible apartments as their responsibility. The different interests create imbalances in urban retrofitting projects due to the ensuing social differentiation, uncertainty and polarization. From the perspective of householders the major improvements in retrofitting can be framed as overdue maintenance. The apartments have been in a very bad shape prior to the retrofitting with inadequate insulation and condensation problems according to several householders. They have been living in their apartments for a long period of time and therefore feel knowledgeable about their own house.

Although public tours, open homes, demonstration days, information sessions are used to visualize the urban retrofit plans, and bring them closer to the residents' perspective

housing associations do not focus consciously on everyday domestic (energy) practices. Evaluation by the housing association after one year on the use of the retrofitted house is not common. The improvements of the retrofit projects are framed from a theoretical energy use perspective based on energy label steps. This made the improvements occasionally consciously targeted interference with householder everyday practices. Householders are not consulted about the ways they wanted to be supported with low carbon alternatives. For householders the higher rents caused by the retrofit can be earned back over time in the form of lower energy costs compared to the starting situation. The length of the payback period varies depending on householders' domestic practices. One householder explained his bills for heating were lowered with 100 euro per month after the retrofit. Other householders pay higher energy bills after the retrofit because they happen to heat more rooms than before or misunderstand the new ventilation or heating installation. Illustrating the fluid boundary between material techniques and competences is shown in how the use of ventilation systems controls can have a big impact on energy consumption. Housing associations partly "outsourced" the steering of energy to voluntary energy coaches to motivate and instruct tenants in energy efficient behaviour, for example, lowering the in-house temperature, shortening shower times and turning off lights when leaving home. For householders in social housing energy use and energy saving remain an abstract phenomenon and they are more likely to take into account costs in the short term than long-term benefits. Rising energy prices present a potential hazard both for the tenants themselves and for the housing association due to the possible risk of delayed or non-payments of rents.

Comparing Amsterdam and Mianyang

The previous sections highlighted the governance arrangements of the two cities of Amsterdam and Mianyang in terms of retrofitting housing estates (table 2). In Mianyang we have seen a historical-developed and socially specific dominance of public-led arrangements. Urban retrofitting for low-income householders is depending on public funding to structure urban renewal. Working unit companies, house owners, as well as heating companies rarely paid their shares. Amsterdam retrofitting in social housing can be characterized by a private-led set-up with substantial private funding and financial burden-sharing with householders. An undoubtedly important driver for differentiation has been the privatization of housing associations in the Netherlands and liberalization of the housing market in China. Given the importance of these institutional differences, we will now address the question of which aspects are most effective in governing urban retrofitting. Thereby we conceptualize effectivity to levels of democratization, responsibility distribution between stakeholders and focus on formation of everyday (energy) practices. The available data on decision-making models, physical manifestations of retrofitting and everyday domestic consumption give some indication of effectivity levels for urban retrofitting and could serve as a proxy for advancement in urban retrofitting implementation.

Table 2: Comparison of cases in Mianyang and Amsterdam

City	Mianyang	Amsterdam
Typical model	Public-social partnership	Private-social partnership
Initiator	District government	Housing association
Financing	Government	Market/householders
Resident representation	Resident committee	Resident committee
Approval	2/3 householders	70% householders
Focus	Life quality public space	Energy saving
Duration	12 months	> 36 months
Speciality of process in city	Resident's long term governance	Independent tenant organisation

Power dynamics in the decision-making process turn out to be closely linked with the socio-cultural mode of retrofit provision. The degree of actor-involvement and their impact on decision-making differs between the models of retrofit provision (Table 2). Retrofit providers obviously are major decision makers about the way of organising the process. The involvement of householders as end-users of redeveloped houses, in decision making processes for urban retrofitting appears to have some common features among Mianyang and Amsterdam. In the joint scheme model of Mianyang, all householders involved in the community play a role to initiate and approve retrofit plan with a majority agreement. The role of the resident committee and majority approval has similarities with retrofitting processes in Amsterdam. Although in Amsterdam retrofitting is initiated by the housing association. Similar to Mianyang, an independent resident representation is given an important role to contribute to the majority approval of householders.

The distribution of responsibilities for selected retrofit-related technologies is not equal in the case cities. The different models of retrofit provision show major differences in the application of material retrofit improvements. To a large extent this can be attributed to the different funding abilities, standards and norms that apply to retrofit housing in China and the Netherlands, together with geographical climate differences. The differences in investment power and different property rights are determining. The retrofitted housing in China are largely owned by the inhabitants, while in social housing in the Netherlands the inhabitants are tenants. The substantial limited investment power and house-ownership give district governments in China less opportunities to interfere with the private properties. In Mianyang there is little emphasis on energy saving measures inside the apartments as they are left to the householders. In Amsterdam the housing associations focus extensively on energy saving measures inside the apartments.

Governance of everyday practices of urban residents is hardly emphasised in retrofit provision of the two cities. Focus in low hanging fruit measures, theoretical energy use and outsourcing responsibility for environmental aspects are the reason for this situation. Retrofit providers occasionally facilitate sustainable practices by providing specific

technologies and organise demonstration and instruction. Show-case houses or walk-in houses in the project area are a common way to explain and highlight the potential of urban retrofit in Amsterdam. The retrofit providers organise, in depending regularity, meetings about energy saving and water saving themselves, by voluntary energy coaches or the resident committee. The resident committee in Mianyang is assigned to perform an important role in the long term governance of the community and regulating individuals life and pro-environment activities. In Amsterdam energy coaches make energy use and energy saving for householders a less abstract phenomenon. The retrofit providers in Mianyang and Amsterdam have some general ideas about local people's housing demand, based on questionnaires, resident meetings, previous experiences, references from other projects, local traditions and culture. But they do not consult future residents about their preferred energy saving choices and the ways in which they prefer to be supported with low carbon alternatives for their energy consumption practices.

2.5 Conclusion

This research was set up to answer the research questions as stated in the introduction. The NWO-JSTP project on smart housing retrofitting in Amsterdam and China project is almost half way and therefore its findings have a preliminary status. The focus of this report was on an in-depth case of a retrofit intervention strategy (co-creation) that was run in Amsterdam in 2016. With the preliminary findings of the wider study on retrofitting in China and Amsterdam and the case study on co-creation in Wagenaarstraat/Dapperstraat we can now formulate some answers on the following questions:

1. What are the chances and opportunities for smart retrofitting of urban housing projects in Amsterdam and China to substantially increase energy efficiency and generation on a building level?

Smart retrofitting was defined as the restructuring of existing housing stock to increase buildings' resource efficiency and resource generation capacity involving structural change in energy and informational flows, actor relations, governance arrangements and consumer practices. Firstly we observed that both in Mianyang and in Amsterdam new city policies for housing retrofitting have emerged that have speed up the programs and projects for housing retrofitting. In Amsterdam the goal is to bring its entire housing stock to an average energy label B by 2021. In Mianyang the local government launched in 2015 the first four-year retrofit program 'Retrofit and governance of old communities' to retrofit existing residential communities built before 2000. Secondly our findings show that while technical measures are being applied, its proper uptake by consumers is still uncertain. Residents see retrofitting as a necessary means for home improvement for comfort and convenience rather than for energy efficiency. Although in potential quick returns can be made on investments in energy efficiency measures, consumers are hesitant to accept higher rents that are based on these investments. In the Wagenaar/Dapperstraat case, residents did not believe that their investments in energy efficiency (through higher rents) would lead to substantially lower energy bills. Thirdly, we found that insulation and new heating systems may enable other user practices which in the end lead to higher energy consumption. Replacing single heaters for central heating, adding complex mechanical ventilation systems or old windows for double glazing may lead to usage of rooms that would otherwise be left unused.

2. What does (smart) retrofitting do to existing relations between local authorities, housing agents, energy providers and consumers and between consumers?

A retrofit project can be seen as a turning point in the relations between housing associations and residents. In the Wagenaarstraat/Dapperstraat project the first conversations with residents concerning the retrofit were dominated by complaints about a general lack of communication between housing association and residents, and issues of (lack of) maintenance efforts over the past decades. This is also common in other retrofit projects in Amsterdam. The co-creation trajectory executed in the Wagenaarstraat/Dapperstraat project included a face-to-face inventory of residents' current housing conditions and practices and wishes for future housing conditions that a

retrofit needs to provide. In all other cases of retrofitting such interactions with and between residents are rare and if housing needs are collected, then only by way of standardised paper survey forms. Retrofit projects enhance the interactions between residents in various ways. Both in China and Amsterdam residents committees are formed to represent the stakes of residents during the retrofit stages, and to seek the approval of 66-70% of residents before the retrofit can take off. The resident committee in Mianyang is assigned to perform an important role in the long term governance of the community and regulating individuals life and pro-environment activities. Apart from these formal interactions, the retrofit project is an issue at informal occasions and gatherings in the neighbourhood. Our findings show that most of the conversations both in formal and informal settings regard the level of improvements and the relation with the housing providers, construction and the finances (costs of retrofit, implications for rents), rather than energy efficiency.

3. Which changes in lifestyles and consumption practices are realized and required by domestic consumers in urban retrofitting projects?

Householder consumption practices and lifestyles are conventionally framed from a techno-economic dominated policy-field which guarantees the energy savings. According to this ‘experts’ (architects, developer, building engineers) view energy saving is realized by an assumed ‘correct’ use of technologies due to solemnly individuals’ calculation of financial benefits. The researched retrofit projects in Amsterdam and Mianyang show that changing domestic practices to save energy and improve wellbeing cannot be stimulated by introducing technology as an entry point alone. Because domestic practices are not consciously targeted the formation of sustainable domestic practices is limited. Required attention to domestic practices is needed. Retrofitting housing is a physical reconstruction, a tangible object, while domestic practices signify also an emotional relationship with the home. Household retrofit technologies only obtain meaning in operation by households and use in domestic practices. Especially comfort related practices, like ventilating, heating and lighting, should not only be understood in techno-economic terms but as being socially and historically and context situated, shaped by collective conventions, personal levels of control, which co-evolve with technical systems. To reduce the energy demand associated with thermal comfort, comfort practices must be framed as adaptive, rather than tightly technological specified and bounded and that acceptance of such framings requires broader changes in building management. If we take comfort practices as dynamic and contextual, or a socio-cultural construct, designs of houses should offer a wide variety of possibilities to achieve thermal comfort. This might be through personal adjustments (e.g. clothing layers, warm and cool drinks, combined with much more elastic definitions of comfort), and other choices for technologies in the retrofitted house (different heating and ventilation, mechanical ventilation control, operating lights, windows and doors).

4. Given the above analysis, what are the potentials for replication and socio-technical and institutional embedding of the smart retrofitting projects into the housing and energy regime of Amsterdam and the Chinese city of Mianyang? What are the (socio-technical, institutional) conditions under which such replication can succeed?

Regarding the potential replication and socio-technical and institutional settings for retrofitting, the main policy challenge for improving effectiveness in urban retrofitting is to redefine the goals and means of retrofitting. Technical energy and housing efficiency should be balanced with private and community interests concerning comfort, convenience, social security and community building. This is essential because in urban retrofitting the interests of a plethora of public, private and community actors comes together. Governance of retrofitting is in a multi-actor context with state and local policies and subsidies shaping the structure of provision and conditioning the local delivery of retrofitting initiatives. Bottom-up strategies, like community participation, have become a crucial institutional aspect of urban retrofitting in an increasingly differentiated and stratified urban society. Regarding socio-technical conditions, the turning point of the retrofit project needs to be used as a window of opportunity for future adaptation of low carbon alternatives in daily practices. A further benefit of community involvement is that it raises societal support for the retrofit. Participation, deliberation and co-determination of those actors which have a stake in the retrofitting tend to increase the legitimacy of decision-making. Experiences in Amsterdam show this can slow-down the decision process tremendously. But bottom-up strategies, like co-creation and community participation, have become a crucial and necessary institutional aspect of urban retrofitting in both Amsterdam and Mianyang. Reasons for this are, among others, that implemented technical options will have limited effects when designing projects in a top-down manner, and many retrofitting options require coordination among residents and their active agreement.

2.6 Impact and benefits for the Metropolitan Region Amsterdam

The co-creation trajectory as designed and executed by Waag Society with Ymere in the case of Dapperstraat-Wagenaarstraat retrofitting project has informed and tested an innovative way of decision making in the retrofit project. It enabled new relations and communication between residents and the housing corporation as well as between residents on housing conditions, preferences and implications of the retrofit. The lessons learned from this first execution of co-creation in retrofit will be taken on board in following retrofit trajectories of Ymere and other housing corporations in Amsterdam (De Key, Eigen Haard).

The inventory of retrofit projects in Mianyang and Amsterdam and continuing case study research in both cities on processes of retrofit and ways of engaging residents will not only inform stakeholders at the end of the project in 2019 but even more so during the process of participative research. More cases are now being investigated on its process, and residents are being interviewed by MSc and PhD students: Het Breed (Ymere, Eigen Haard), Olympia (Ymere), Koningsvrouwen van Amstel (Eigen Haard), Airey Woningen Slotermeer (Eigen Haard) en de Anton Waldorpstraat (De Key). The latter project in Amsterdam Nieuw West is intensively monitored in an AMS-MSc thesis research (Esmeralda Hemelaar) and will serve as a major case study for an international PhD Summerschool funded by Climate-Kic, Wimek and AMS-institute in the Summer of 2017.

The project has served as inspiration for the set-up of a proposal for a STEM (Samenwerken Topsector Energie en Maatschappij) project. Together with partners HIER, Stichting Centrum Particuliere Bouw, HOOM BV, and Buurkracht (Enexis), WU researchers have successfully applied for funding of a 2 year project which aims to: a) study social practices and rhythms in housing retrofitting by house owners-occupiers; b) connect existing initiatives of user oriented strategies for retrofitting and c) formulate recommendations for a national strategy to support local initiatives in energy retrofitting of owner-occupier housing. The project has started as of 1st of January 2016. A postdoc researcher has been recruited for the STEM project at ENP WU, offering opportunities to exchange insights from both projects on housing retrofitting in both rental/ social housing and owner-occupier sectors.

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- Project Presentations at the first visit of Chinese CASS partners to WU, AMS, Waag Society and Ymere. 18-20 May 2015.
- Presentation at meeting Waag Society Housing Associations. 14 September, 2015
- Presentation for Housing Associations, 29 September 2015
- Project Poster for Sense Graduate School (September 2015)
- Mission to Beijing and Mianyang (China) to meet project partners and visit case study sites 12 – 30 October 2015. Presentations and decision making about case study selection, research design. PPT slides, Information Flyer, Interview transcripts.
- Presentation for Ymere (3 September 2016), presentation for AFWC network energy saving
- Presentation for Municipality Amsterdam 3 October 2016 at Waag Society
- Presentation for head Communication, residents participation Eigenhaard 7 March 2017
- Presentation for project developer Van Wijnen. 22 maart 2017 Heerhugowaard.

4. List of Annexes

1. Verslag Urban Retrofitting Amsterdam, Waag Society, 5 october 2016
2. PPT slides Chinese partner visit 18-20 May
3. PPT slides NESS Conference in Trondheim June 9-11
4. Paper for the NESS Conference Trondheim
5. PPT slides for meeting with Waag Society and Housing Associations, September 14
6. PPT slides presentation for Housing Associations in Amsterdam, September 30
7. PPT slides presented in Beijing for Chinese partners October 12
8. PPT slides presented at final seminar in Beijing October 29
9. Project Flyer for stakeholders in China
10. Project Poster for SENSE Graduate School September 24th (Awarded for best poster)
11. Inventory of cases retrofitting in Amsterdam
12. Verslag Think tank Young Professionals Mei 2016

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