E2ReBuild

Industrial Energy Efficient Retrofitting of Resident Buildings in Cold Climates

D2.7
Demonstrator London

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Executive Summary

Thamesmead was originally conceived as a utopian “town of the 21st century” by the Greater London Council in the mid-1960s. The initial plans for the only New Town in the capital envisaged the creation of a community of 60,000 people over a 10 to 15 year period. Set in the context of London’s post-war housing shortage Thamesmead’s creation required a significant physical transformation of the Plumstead and Erith Marshes with the reclamation, remediation and preparation of a 1,300 acre site.

However, the original aspiration to create an ideal community was diluted over time. Wider housing allocations policy, a lack of investment, poor transport connections, institutional weaknesses, resources, design problems and social deprivation led to a spiral of decline.

For many years consigned to the ‘too hard to do’ category of regeneration, Thamesmead remains one of the last great regeneration challenges for the capital. Within Thamesmead two focal so called ‘hubs’ were identified. Parkview Hub, which became the E2ReBuild demonstration object, is one of those.

In the period from 2007 – 2011 Gallions did chair the SEECO network, a gathering of five social housing organisations in South East London collaborating with the objective to define ambitious and energy efficient solutions for affordable social housing projects. The network was coordinated by Ken Walker of Ken Walker and partners and Chiel Boonstra, Trecodome. Each member selected a pilot demonstration project. Gallions selected a block in Thamesmead along Maran Way. When the opportunity arose, Gallions joined E2ReBuild with this project. Finally Parkview Hub, the first block of the series along Maran Way became the E2ReBuild demonstration project, which has now been completed as the first steps in the regeneration of Thamesmead.

The key strategies of the regeneration are reflected in the design. The ground floor level is changed into a community centre and small business and shops, whereas the apartments get a new façade around the building, covering the whole block in a new coat. The new appearance focuses on vertical elements and colours, thus emphasising the individual apartments as town houses. The new pitch roof is designed to refer to other building types than the current flat roofs throughout Thamesmead.

The demonstration project exceeds current practice by far, in achieving energy conservation through the technical solution that is used. The demonstrator shows that U values in the range of 0,15 – 0,10 for W/m^2K, combined with airtight construction, triple glazing and mechanical heat recovery is able to achieve 80% reduction in space heat demand. The applied prefabricated solution points to the lesson that good quality and shorter renovation processes can easier be achieved in this way compared with traditional on site renovation work. The building is much more attractive, socially more secure, while the environmental impact of the renovation is small because of the chosen renovation method with renewable and recycled materials.

Parkview Hub offers a good opportunity for replication, both in Thamesmead as in similar locations in the UK and other European member states. There is a huge building stock that is in need of deep renovation, and Parkview Hub provides good insight in the potential achievements. Millions of homes in the UK are in need of deep renovation, since either the energy costs are hard to afford, in many cases tenants suffer from unhealthy living conditions because of fuel poverty. The potential to upgrade buildings paves to way to extend the exploitation period of buildings, increase the property value, reduce heating costs and thus generating a sound business case. This is the innovation road that the E2ReBuild demonstration project Parkview Hub is pointing to. Upgrading the existing stock at the demonstrated quality results in more affordable housing than new construction as a replacement can do.

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1 Introduction

1.1 E2ReBuild Demonstrations

The demonstration projects in E2ReBuild are the core of the project. E2ReBuild is driven by the demonstration projects, whereas research activities feed into the demonstrations, and results of the demos feed into the evaluation and lessons learned in other work packages. The results and conclusions from the demonstrations will be gathered to produce an industrial platform for energy efficient retrofitting (work package 6).

The objective of the work package 2 projects is to demonstrate seven high energy efficient innovative retrofitting technologies and measures for low energy performing buildings with typologies representative for a large geographical area in Europe.

Each project establishes and demonstrates sustainable renovation solutions that will reduce the energy use to fulfil at least the national limit values for new buildings according to the applicable legislation based on the Energy Performance of Buildings Directives (for 2010) and to reduce the space heat use by about 75%.

Monitoring and follow-up: Based on recommendations given by work package 5, monitoring takes place during at least one year within this project, in some cases for a longer period (also continuing after the completion of this project).

One of the main issues in initial refurbishment discussions concerns costs. This has been treated in depth in deliverable D3.4 *Holistic Strategies for Retrofit* where costs from all demonstration projects are reported, analysed and discussed[1].

The demonstrators are supported by work carried out in work packages 1, 3, 4 and 5.

This deliverable is defined as a “demonstrator”. This document is the written record of the achievement.

1.2 Demonstrator London

Thamesmead was originally conceived as a utopian “town of the 21st century” by the Greater London Council in the mid-1960s. The initial plans for the only New Town in the capital envisaged the creation of a community of 60,000 people over a 10 to 15 year period. Set in the context of London’s post-war housing shortage Thamesmead’s creation required a significant physical transformation of the Plumstead and Erith Marshes with the reclamation, remediation and preparation of a 1,300 acre site.

However, the original aspiration to create an ideal community was diluted over time. Wider housing allocations policy, a lack of investment, poor transport connections, institutional weaknesses, resources, design problems and social deprivation led to a spiral of decline.

For many years consigned to the ‘too hard to do’ category of regeneration, Thamesmead remains one of the last great regeneration challenges for the capital.

We believe that Thamesmead, originally created as a solution to London’s housing problems of the mid-20th Century, has the potential to once again provide a unique solution to the problems facing the capital today.

Change is already underway at Thamesmead, with large-scale regeneration projects to improve existing estates and neighbourhoods in place. A number of agencies are working together to effect positive change. As a result there have been improvements to educational attainment, community safety and a far more stable (and diverse) community than in the past. Major physical regeneration projects are starting to have an impact, particularly at South Thamesmead.

[1] As report D3.4 is restricted, public information can be found in GEIER, SONJA; EHRBAR, DORIS; SCHWEHR, PETER (2014); Holistic Strategies for the Retrofit to Achieve Energy-efficient Residential Buildings. In: Proceedings 9th International Masonry Conference 2014. Guimarães (P)

Current circumstances have unlocked a much wider opportunity, to not only provide a significant number of new homes and jobs, but to create a high quality location on the eastern edge of London that provides a great place to visit as well as a thriving and sustainable community for local people to settle in.

The challenges of Thamesmead are well known and documented. Gallions and its partners have commissioned a number of visions and master plans, all of which set out sensible proposals to improve the district's sense of place. These include:

- Enhancing the unique network of existing parks and green and blue spaces
- Capitalising on the 1.5km of undeveloped riverfront at Thamesmead
- Diversify the community and housing in areas of concentrated social housing
- Improve the local and regional transport connections such as promotion of the Thames Gateway Crossing and creating better public transport and walking/cycling connections in/within Thamesmead
- Transform and diversify the existing town centre
- Use a mixture of redevelopment and retrofitting to improve existing estates
- Create community champions to better involve local people.

Unfortunately many of these proposals have not been implemented. As with many other commissioned plans, the capacity, resources and relationships of the local and regional institutions were probably insufficient to make this happen.

Thamesmead is designated by the London Plan as one of the capital's Opportunity Areas. Recent changes to the London Plan recognise that the growth of the city requires revised approaches to planning policy and the consultant's work under this commission will help to inform Peabody's input to the development of planning policy by relevant planning authorities.

We believe that four critical factors could be game-changers:

1. Peabody Group has recently incorporated Gallions and is in the process of incorporating Trust Thamesmead and therefore also Tilfen Land, thereby owning much of the land in Thamesmead. This will bring together housing, community and commerce into a well-resourced organisation that instinctively takes a long-term and holistic approach in the interests of the poor of London.
2. Peabody has already committed £225m of additional funds for regeneration – predominantly in South Thamesmead. Together with ongoing Gallions, GLA and other funding this has pushed this neighbourhood into the top 50 regeneration projects in the UK.
3. London is undergoing significant growth in population and jobs. Limited numbers of new homes and a benign economic environment has led to a major challenge in housing affordability and considerable additional costs to Londoners and the wider economy. There is now an urgent need to deliver on major opportunities for more homes and jobs in an affordable way. Thamesmead is able to make a major contribution towards solving this problem
4. Crossrail will serve Abbey Wood from December 2018, roughly halving journey times across the Capital and linking Thamesmead to a Development Axis of major change between the eastern edge of the city, including: intensification of Surrey Quays/Rotherhithe, expansion of Canary Wharf, development of derelict land at Royal Docks/Custom House and the building of thousands of new homes at Woolwich. This will provide jobs and economic opportunities within a few minutes for residents and businesses of Thamesmead.

Figure 1: Aerial view Thamesmead (picture from regeneration plan, source unknown)

Background of demonstration building block

Thamesmead used an urban planning model that separated cars from pedestrians deploying an urban design at two levels. In addition the flood plain regulation supported the rule that in Thamesmead the ground floor cannot be used for apartments, because it must be possible to escape to the next floor level within the same apartment. Therefore the ground floor levels of the multi storey blocks have been designed as semi open car parks or storage spaces without any lively use of this level which in today's views is needed to ensure a safety perception through street live.

The building structure themselves are in good shape; however there are thermal bridges in the envelope. The concrete façade elements do contain some 5 cm of insulation, but not around the edges of each element. Also the shape of the buildings resulted in many poorly or non-insulated surfaces such as the entrance walkways, balconies and floors above the garages and storage level.

Figure 2: Building blocks in Thamesmead are interconnected by bridges and walkways. (Picture Chiel Boonstra, Trecodome)

Thamesmead buildings are interconnected by bridges, walkways and staircases. From a social point of view in recent years a strategy has been applied to disconnect the buildings by adding controlled entrances without public access, only for tenants in their own building and their visitors.

From the early days there has been a district heating system in the whole Thamesmead area. The system operated in the way that each apartment had its own air to water heat exchanger. The district heating itself operated at high temperatures and with great system losses on its way. Inside each apartment there was internal heat distribution through air heating.

Figure 3: air heating system as part of district heating from 1970 – 2000. (Picture Chiel Boonstra, Trecodome)

Early 2000 the district heating has been replaced by the installation of individual condensing gas boilers both providing space heating to a newly installed radiator system and hot water via an indirectly heated storage tank.

Figure 4: storage tank connected to condensing gas boiler from 2000 – 2014. (Picture Chiel Boonstra, Trecodome)

Thamesmead has become an area for the less deprived, because of the way that accommodation is being offered at the London housing market. All of the above issues have resulted in a regeneration strategy for Thamesmead which aims at a fundamental re-arrangement in the urban fabric.

Figure 5: Regeneration plan for Thamesmead with central hubs (Picture from regeneration plan, source unknown)

Introducing street live by abandoning the strict separation between the car level and pedestrian level is part of the regeneration. Within Thamesmead two focal so called ‘hubs’ were identified. Parkview Hub, which became the E2ReBuild demonstration object, is one of those.

In the period from 2007 – 2011 Gallions did chair the SEECO network, a gathering of five social housing organisations in South East London collaborating with the objective to define ambitious and energy efficient

solutions for affordable social housing projects. The network was coordinated by Ken Walker of Ken Walker and partners and Chiel Boonstra, Trecodome. Each member selected a pilot demonstration project. Gallions selected a block in Thamesmead along Maran Way. When the opportunity arose, Gallions joined E2ReBuild with this project. Finally Parkview Hub, the first block of the series along Maran Way became the E2ReBuild demonstration project, which has now been completed as the first steps in the regeneration of Thamesmead.

Figure 6: Parkview Hub before renovation [picture Chiel Boonstra, Trecodome)

In the period 2012 – 2014 organizational changes took place in Gallions; the Chief Executive left the organization as part of the inclusion of Gallions under the umbrella of Peabody Group, the oldest social housing organization in the UK.

Peabody introduced new visions on the regeneration of Thamesmead in general and Parkview Hub in particular. The concept of the ground floor with local shops and a community centre was enhanced, whilst additional interior changes to the apartments were introduced. This is a change compared to the original plan to only externally renovate the apartments, and leave the tenants in their apartments.

2 Energy Efficient Retrofitting

The key strategies of the regeneration are reflected in the design. The ground floor level is changed into a community centre and small business and shops, whereas the apartments get a new façade around the building, covering the whole block in a new coat. The new appearance focuses on vertical elements and colours, thus emphasising the individual apartments as town houses. The new pitch roof is designed to refer to other building types than the current flat roofs throughout Thamesmead.

The expected achievements of the project are

- revitalized urban district which can be exploited a further 50 years
- (international) good practice example of advanced renovation using prefabricated solutions
- energy efficient homes, with an energy demand at passive house level.
- significantly reduced energy bills
- comfortable and healthy homes
- affordable costs of living
- insight in real performance and conditions

The E2ReBuild project has made it possible to share the renovation approach with international partners. E2ReBuild also financially contributes to the project.

Figure 7: Redesign of Parkview Hub as town houses

The existing construction, based on prefabricated concrete elements and timber infill (later on replaced by the PVC sub-structures in figure 10) presents a challenge to the retrofit of the envelope. An add-on insulation system would have had to deal with an irregular shape and the PVC panels would have had to be replaced by

new better performing ones, creating difficult connections between envelope systems, and a complex fixing to the structure behind the pre-cast panels.

The prefabricated approach creates a new envelope which wraps around the existing construction with one uniform timber envelope, which solves cold bridges, air tightness and insulation independently from the existing structure. This new envelope is supported entirely on the internal load bearing walls, and on an extension of the foundation, in order to build it independent from the complex existing non load-bearing pre-cast façade panels.

As a result of this strategy, and to avoid reproducing the complexity of the existing envelope, external terrace space was incorporated inside the new envelope, creating extensions for the lower maisonettes.

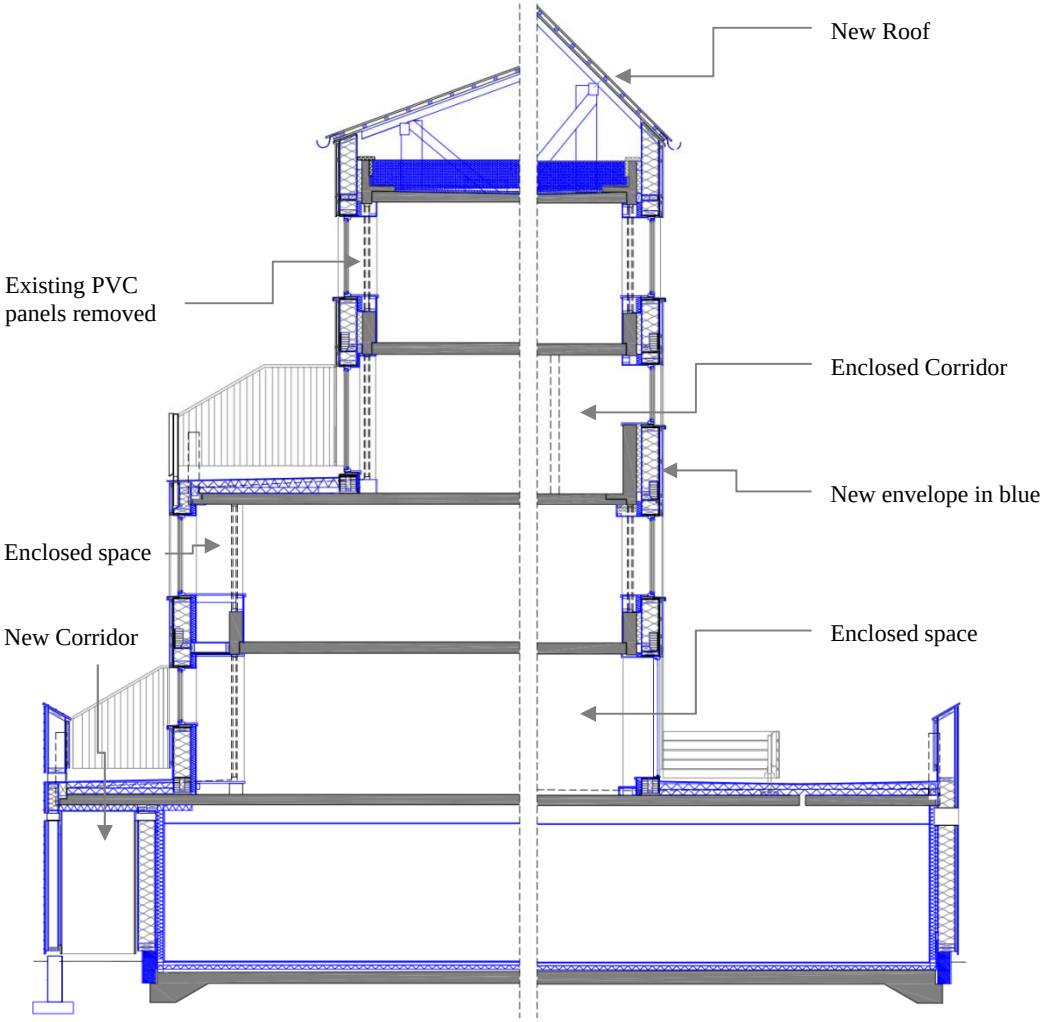

Figure 8: Cross section of Parkview Hub

The energy design of the project can best be introduced using the cross section of the building. The façade line has multiple steps. The façade along Yarnton Road steps forward at the level of the garages. This creates a huge deck level for the entrances of the lower dual storey apartments. The entrance itself is even deeper since a sort of front space is created below the bedroom level of these apartments. Façade steps back again on the level of the walkway entrance to the top dual storey apartment. Thus the facades steps back and forth at every level, thus generating a huge external heat loss surface area.

Also the rear façade with the balconies makes steps. The garage line is not the same as the rear façade of the lower apartments. The balcony of the upper apartments steps forward, and the façade steps backwards.

The renovation design of the block focused on reducing the surface area by placing the new façades in such a way that the front elevation only has two levels: the shop-fronts and the apartment front elevation. The 'front' area of the lower apartment is added to the interior space by creating a new entrance, a study and room for the mechanical heat recovery ventilation equipment. The walkway for the upper apartments is included in the interior.

The lower apartments have increased in size by lining behind the upper balcony, which creates a larger living room and kitchen on one level, and some additional volume to the bedrooms at the other level. The size of the upper apartments has not changed.

The function of the ground level changed into a community space, small local shops and a supermarket. The front elevation was opened with shop windows facing Yarnton Way and create street live at this level.

Finally a new pitch roof has been introduced as an architectural landmark to create a different look compared to the flat roofs of all other buildings in its direct surroundings, but without creating new useable space.

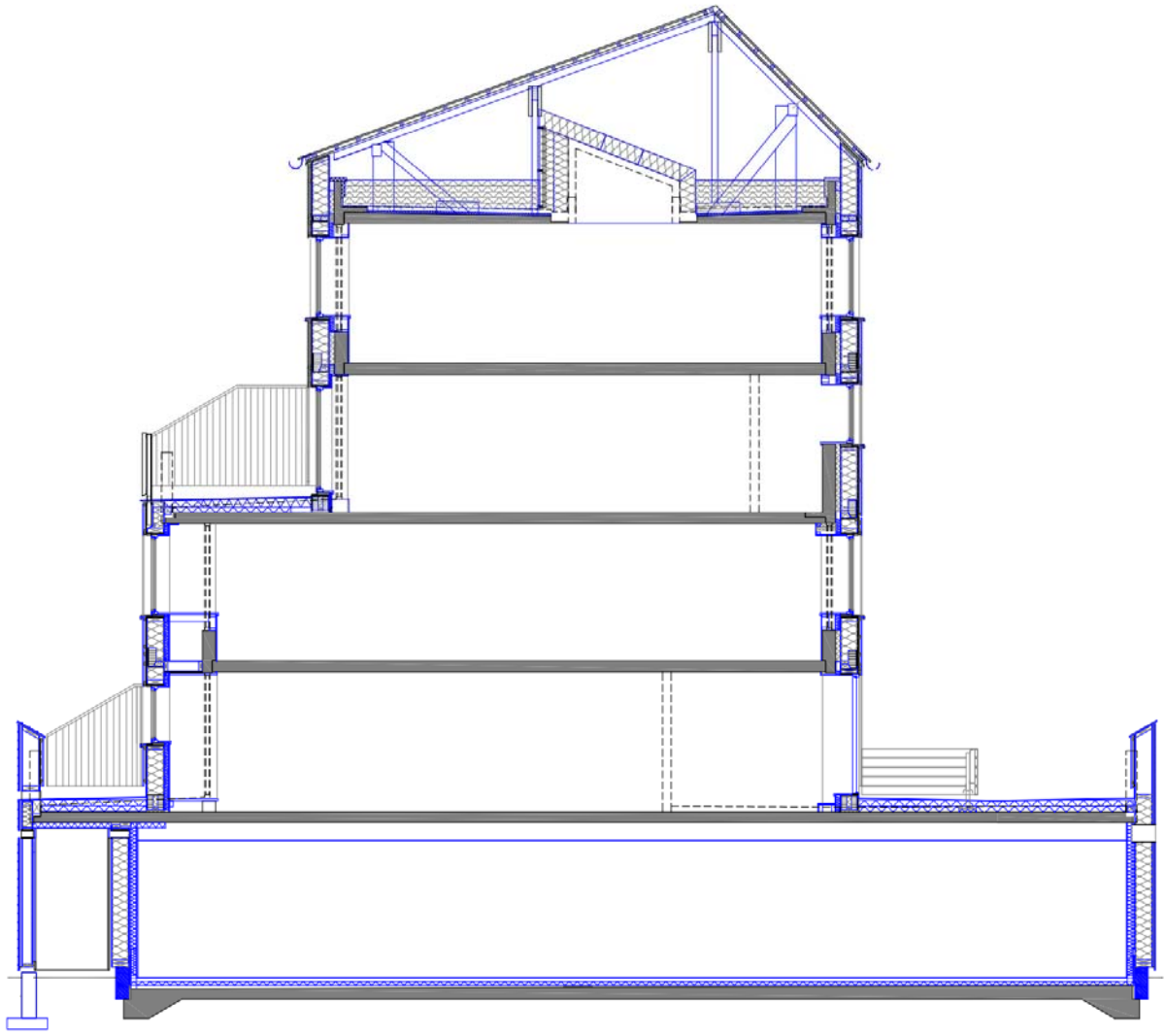

Figure 9: Cross section with new elements in blue and existing structure in grey.

The envelope approach is grounded in architecture, and in the energy concept. The surface area of the block is significantly smaller; the new envelope encloses all thermal bridges and is well insulated and airtight. U values have been determined using PHPP calculations and matching the results with available timber trush thicknesses. New window frames with triple glazed windows have been built into the façade elements in the

factory before on site mounting. In this project it was possible to mount the new facades completely around the existing facades and windows and demolish the old windows until after the new facades have been placed. The timber cassettes have been insulated with cellulose fibre which was blown into the elements in the factory in Germany.

The roof has also been insulated with cellulose fibre, but as on site loft insulation. The roof itself is a ventilated structure that is constructed on top of the existing building. The function of this roof space is limited to an architectural image. In future projects such additional space could be made economically valuable by adding useable space to a building. Since there were no space considerations underneath the added value of prefabrication was not valid, thus is was chosen to use prefabricated timber components instead of prefabricated elements.

The ground floor of the shops and community centre is insulated at the upside, since there is no space available underneath. It is assumed that the indoor temperatures at the ground level will not be very different from the apartments. Therefore the floor between the shops and the apartments is not thermally insulated.

Extensive PHPP calculations have been made to design the project. Also comparisons with a standard renovation have been made, based on assumptions on typical measures. See table 1 with results of the energy studies. Based on scattered information on the existing energy consumption it was recalculated that the current comfort conditions are such that the average indoor temperature over a 24 hours cycle in the heating season is no more than 16 Celsius. The renovated situation has been designed to achieve an average temperature of 20 Celsius, thus improving comfort and achieving large energy savings in practice. For comparison also a standard renovation with a typical 18 Celsius has been calculated. A standard renovation is what is done to other buildings in the same area based on current renovation practice approaches. The right column based on passive house renovation and the application of PV panels has been applied to the London demonstration project.

Figure 10: thermal bridges and steps in the façade (Picture Chiel Boonstra, Trecodome)

PHPP analysis - Parkview Hub					
London Climate file		existing	existing		
	2493	Existing - PHPP	Existing - PHPP	Standard renovation	passive + PV panels
Average indoor temperature	C	18	16	18	20
Conditions					
U roof	[W/m2K]	3,53	3,53	0,30	0,10
U façade	[W/m2K]	1,67	1,67	1,67	0,12
U end façade	[W/m2K]	1,67	1,67	1,67	0,12
U floor	[W/m2K]	4,80	4,80	4,80	0,30
U glazing	[W/m2K]	3,00	3,00	1,50	0,50
U frame	[W/m2K]	2,00	2,00	2,00	1,20
g-value	value	0,75	0,75	0,60	0,50
n50 value	-	5,0	5,0	4,0	1,0
MVHR efficiency	%	0	0	0	85
Result					
Net heat demand	kWh	462624	380661	236366	41337
Net heat demand per m2	kWh/m2	186	153	95	17
Total primary energy	kWh/m2				
Energy demand					
Space heating demand	kWh	462624	380661	236366	41337
Hot water demand	kWh	45000	45000	45000	45000
Fans+pumps	kWh	3000	3000	9000	9000
Lighting	kWh	13500	13500	13500	13500
Household electricity	kWh	not included	not included	not included	not included
Solar energy					
Solar thermal					
Solar PV					10000
Final energy use					
Gas - space heating	kWh	514027	422957	262629	45930
Gas - hot water	kWh	64286	64286	64286	64286
Electricity	kWh	16500	16500	22500	12500

Table 1: Energy comparisons with standard renovation

Before and during the building design process there have been discussions about fundamentally different approaches towards the heating and ventilation of Parkview Hub.

1. Block heating + communal solar thermal + individual heat exchangers + mechanical heat recovery ventilation
2. Individual condensing gas boiler + PV to replace the foreseen solar thermal performance + mechanical heat recovery ventilation.

Gallions' preference to not having to maintain a communal heating plant, and managing heating bills invoicing resulted into the choice for individual systems.

Parkview Hub	Heating + DHW						
	Existing	All individual		Semi communal		Communal	
Trecodome, 28 February 2013							
Chiel Boonstra							
Building distribution							
distribution	gas ducts through the building and units	gas ducts through the building and units	9 gas meters either side of the building needed	gas duct into central plant	easy to design gas system: one central meter	gas duct into central plant	easy to design gas system: one central meter
			routing through building to be designed by Gas company and could have negative effects to overall design	heat distribution through building	central vertical shaft can be used for heat network, heat exchanger at the location of current hot water storage	heat distribution through building	central vertical shaft can be used for heat network, heat exchanger at the location of current hot water storage through central shaft
						DHW distribution through building	
Space heating							
Supply	condensing gas boiler	condensing gas boiler	easy to understand for tenants	heat exchanger per unit	easy to understand for tenants	heat exchanger per unit	easy to understand for tenants
distribution	pipes + radiators	existing pipes + radiators		existing pipes + radiators		existing pipes + radiators	
control in unit		living room thermostat		living room thermostat		living room thermostat	
billing	gas bill	gas bill	no involvement of landlord in energy billing	heat bill	landlord need to take care or outsource the heating bill	heat bill	landlord need to take care or outsource the heating bill
Hot water							
supply	condensing gas boiler+storage	condensing gas boiler+solar storage	individual solar systems require proper installation and yearly checkup on pressure and performance	individual solar storage + post heating by heat network	individual solar systems require proper installation and yearly checkup on pressure and performance	heat exchange per unit	very little maintenance inside the units
distribution	circulation in unit	on demand		on demand		DHW distribution through building	well insulated circulation network needed
billing		gas bill	together with space heating gas bill	heat bill	together with space heating bill	heat bill	together with space heating bill
Solar thermal							
solar collectors		18 * 4 m2 individual collectors on the roof	connections from collector to every appartment through central shaft	18 * 4 m2 individual collectors on the roof	connections from collector to every appartment through central shaft	60 m2 solar collector	less collector area, because of common use
storage		individual storage	storage at location of current hot water storage	individual storage	storage at location of current hot water storage, together with heat exchanger	communal solar storage	professional maintenance possible
post heating		from condensing gas boiler	post heating in same way as current situation	post heating from heat network	specific design + controls needed	post heating centrally	one point of maintenance
Cooking							
	gas and/or electrical	gas and/or electrical		electrical cooking	cooking supply needed	electrical cooking	cooking supply needed

Table 2: HVAC system alternatives

A number of design alternatives have been investigated, including the concept of have multiple façade connected MVHR units, and more common concepts based on one unit per apartment with a subsequent ductwork through the apartment to supply and extract air. The latter one has been selected. Option V4 is closest to the finally implemented design.

Heat recovery ventilation options for Parkview Hub
Trecodome, 16 June 2013

Ventilation

Top appartment	**Option V1**	**Option V2**	**Option V3**	**Option V4**
MVHR unit	FIWI ventilation	FIWI ventilation	Paul / Zehnder	Paul Zehnder
Unit location	former water storage cupboard, floor level 5	top of stairwell, floor level 5	water storage cupboard, floor level 5	top of stairwell, floor level 5
Outdoor to MVHR unit / MVHR to outdoor	via roof (fresh air from North side)	via front elevation and bedroom	via roof (fresh air from North side)	via front elevation and bedroom
internal supply	via stairwell and overflow provisions above doors	via stairwell and overflow provisions above doors	via supply ducts to habitable rooms	via supply ducts to habitable rooms
internal exhaust	via stairwell, plus temporary direct exhaust WC	via ducts from WC, bathroom and kitchen	via ducts from WC, bathroom and kitchen	via ducts from WC, bathroom and kitchen

Table 3: MVHR alternatives

At the time of the E2ReBuild energy assessments among all projects, the decision about PV had not yet been taken. Therefore the PV generation is not reflected in the D3.4 analysis, but is included in the Annex of this report about energy demand and primary energy figures. On the south facing roof of Parkview Hub an array of 80 m^2 PV will be installed, which replaces as much primary energy as 30 m2 solar thermal collectors for domestic hot water would have generated.

3 Retrofitting Process

The design of Parkview Hub was proposed based on the experience in Roosendaal, The Netherlands and for instance Augsburg, Germany in using prefabricated TES elements as the basis for a renovation. The benefits of such approach are the potential speed of renovation, the exclusion of all thermal bridges by including all elements within a new well insulated external building shell, and achieving an energy performance at passive house level. The new shell results in a fully new architectural appearance. The approach is innovative, in particular for the UK market. There are no UK companies with experience in this technology. Therefore a specific procurement strategy has been followed to be able to implement the project idea of using prefabricated facades. Gallions agreed a design and build contract with Gumpp and Maier, who did set up as main contractor in the UK market, to be able to fully service projects like Parkview Hub, instead of being subcontractor of a traditional UK contractor who is not familiar with the concept.

The architects firm Sustainable by design became architects; Alan Clarke designed the HVAC systems. Martin Arnolds acted as project manager for Gallions.

Trecodome assisted Gallions from their perspective and guided the E2ReBuild energy concept by actively participating in design choices, preparing PHPP energy calculations to safeguard the ambitious energy goals for the project, and supervising the energy aspects in all stages, and help preparing the monitoring strategy.

Gallions Housing association acted as client for Parkview Hub, and as E2ReBuild partner.

	From	To
Brief	January 2010	December 2011
Design	January 2012	June 2013
Construction	July 2013	June 2014
Monitoring	September 2014	August 2016

Table 4 Time frame for demonstrator

The key players that were involved in the retrofitting project can be found in the table below.

Role	Name	Brief	Design	Construction	Monitoring
Building owner	Gallions Housing Association	X	X	X	X
Architect	Sustainable by design		X	X	
Contractor	Gumpp Maier UK Ltd			X	X
TES facades/ structural engineer	Gumpp Maier GmBH		X	X	
HVAC engineer	Alan Clarke		X	X	
Energy specialist	Trecodome	X	X	X	X
University	Coventry University				X
Client representative	Martin Arnolds		X	X	

Table 5 Key players involved in the retrofitting demonstrator

The stages of the renovation are illustrated below. Even though the mounting of the façade elements itself has been a process of only a week per façade, the full process took longer since the entrance walkway system has

been modified at the same time. Since the houses were in use during the renovation, the completion of the final end façade had to wait until the staircase at the other side had been renewed.

Since the project because of these reasons took much longer than necessary for a TES renovation with prefabricated elements, the strategy of keeping the tenants in the houses failed. Also the client changed the plans for the apartments during the renovation. Instead of very minimal interventions inside it was chosen to completely redesign a number of units to allow for a new and more luxury tenure. The involved drilling and demolition works were beyond acceptance levels for most tenants.

By the end of the renovation works only 2 out of 18 tenants still live in the houses.

Figure 11: Destructive investigation in preparation for the renovation works. (Picture Chiel Boonstra, Trecodome)

Figure 12: Arrival of the prefabricated TES façade elements from Germany at Parkview Hub. (Picture Martin Montgomery, Gumpp & Maier UK Ltd.)

Figure 13: Mounting of the façade elements at the North facing façade. (Picture Martin Montgomery, Gumpp & Maier UK Ltd.)

Figure 14: The elements are craned to other side of the building. (Picture Martin Montgomery, Gumpp & Maier UK Ltd.)

Figure 15: The new north façade with different colours of Parkview Hub. (Picture Martin Montgomery, Gumpp & Maier UK Ltd.)

Figure 16: The new pitch roof construction on top of the existing flat roof. (Picture Chiel Boonstra, Trecodome)

Figure 17: Foundation detail for the end façade with cellular concrete on a steel profile with the prefab element on top. (Picture Chiel Boonstra, Trecodome)

Figure 18: The final end façade can be installed once the staircase at the other side is completed. (Picture Chiel Boonstra, Trecodome)

Figure 19: Parkview Hub regeneration announcement along Yarnton Way, Thamesmead, London UK.
(Picture Chiel Boonstra, Trecodome)

Figure 20: The south elevation before completion of the ground floor shops and community centre.
(Picture Sebastian Hernandez, Gumpp & Maier GmBH)

Figure 21: Overview of Parkview Hub, adjacent to a similar non-renovated building. (Picture Chiel Boonstra, Trecodome)

4 Results

4.1 Conclusions and Experiences

In recent years the decision has been taken to implement Crossrail2, a new and fast underground line between West and East London, via Central London and the Docklands. The east end station will be Abbey Wood, centrally located in Thamesmead. As a consequence Thamesmead will in future be within 20 minutes range of the Docklands and Central London. This has potentially a significant impact on the market position of housing stock in Thamesmead. Around Abbey Wood station major redevelopment plans are being planned.

It is foreseen that Thamesmead will develop into a more mixed area with a wider range of income levels, and with the addition of new office spaces and shops. In this context Parkview Hub is part of the first series of interventions to regenerate Thamesmead.

The London demonstration project exceeds current practice by far, in achieving energy conservation through the architectural and technical solution that is used. By achieving a better surface-volume ratio, it is a combination of spatial and technical decisions. The demonstrator shows that U values in the range of 0,15 – 0,10 for W/m^2K, combined with airtight construction, triple glazing and mechanical heat recovery is able to achieve 80% reduction in space heat demand. See the BEST sheet in the Appendix and table 1. The applied prefabricated solution points to the lesson that good quality and shorter renovation processes can easier be achieved in this way compared with traditional on site renovation work.

			Before	E2ReBuild
Facade/wall	U	W/m^2K	1,67	0,12
Roof	U	W/m^2K	0,30	0,10
Ground floor	U	W/m^2K	2	0,3
Windows	U	W/m^2K	2.4	1,0
Glazing	U	W/m^2K	4	0,6
Average	U	W/m^2K	2	0,29
Ventilation rate		air changes/h	1	0,93

Table 6: U values before and after renovation

The innovation in the E2ReBuild project is the use of prefabricated timber frame elements for the façade. The elements have been industrially manufactured. The on-site works consist of demolition of old components such as window frames, glazing, doors, and foundation preparation works. In a few weeks the full envelope can be renovated. This process saves much time in the physical renovation work and a constant quality is better ensured.

The demonstrator shows that the renovation method is not only suitable for rectangular shaped buildings, but offers a great opportunity for complex structures which have been built in the seventies of the last century.

The fact that a new staircase and elevator had to be installed caused a problem in the speed of execution of a prefabricated renovation approach. Part of the elevation had to wait until the staircase at the other side had been replaced.

During the design and development process the client organisation did change, and with the new opportunities that arise in Thamesmead also the project brief changed. After all it can be said that the project was executed as a key project in the regeneration, which can function as a beacon for further potential developments in Thamesmead. In the current social housing environment, investments cannot be recouped by rent increases, but when part of the Thamesmead stock is converted into more expensive apartment types, the business case for prefabricated renovation becomes rather positive. The cost analysis made in work package 3 indicates that the

cost for this type of renovation is well below the investment level for new construction, while the energy performance will be better than required for new construction.

Monitoring works will follow in the two years after completion. The E2ReBuild partners Gumpp & Maier, Gallions and Trecodome will follow the results.

4.2 Replication Potential

Parkview Hub offers a good opportunity for replication, both in Thamesmead as in similar locations in the UK and other European member states. There is a huge building stock that is in need of deep renovation, and Parkview Hub provides good insight in the potential achievements. Millions of homes in the UK are in need of deep renovation, since either the energy costs are hard to afford, in many cases tenants suffer from unhealthy living conditions because of fuel poverty. The potential to upgrade buildings paves to way to extend the exploitation period of buildings, increase the property value, reduce heating costs and thus generating a sound business case. This is the innovation road that the E2ReBuild demonstration project Parkview Hub is pointing to.

Thamesmead was conceived as utopian "town of the 21st century". Considering the holistic approach it might become a "leading example for holistic industrial retrofit" which is urgently needed all over Europe.

As personal remarks, the project has been a challenge because of the changing ownership and changing regeneration strategies for the area and the project. The building itself is a connected and interlinked knot with bridges and access ways, which requires a long logistical process to renovate such buildings with the tenants in place. It might be better for such complicated environments to vacate tenants and have a more efficient renovation process, where in more simple environments there are no access limitations that prolongue the process beyond what is needed for prefabricated renovation.

The advantages of prefabrication are the precision, the constant and high quality of the works, and the high savings that can achieved. In particular the London demo shows that complicated buildings can get a high quality second life and offer good comfort standards and affordable energy costs.

It is expected that the energy savings will be exemplar and well beyond standard renovation practice in the UK and many other places in Europe.

Appendix A Original BEST Sheet

Building Energy Specification Table (BEST) | Community / site: Thamesmead | Maran Way | BEST no. 7

1,1	Building Category	residential retrofitted		total area / category / BEST sheet [2]	2774 m²		
		[1] multi-storey, build 1974					
1,2	Local Climate			January average outside temperature	°C		2,8
				August average outside temperature	°C		17,2
	Climatic Zone	North-West European Sea Climate		Average global horizontal radiation	kWh/m² yr		1000
	(national definition)	London, UK		Annual heating degree days [3]	°Cd/yr		3075

1,3 Maximum requirements of building fabric			Existing building [5]	National regulation for new built [6]	suggested specification [7]	Energy savings [%] [8]
Façade/wall	U	W / m2K	0,8	0,3	0,1	67
Roof	U	W / m2K	2	0,3	0,1	67
Ground floor	U	W / m2K	2	0,3	0,1	67
Glazing	U_g	W / m2K	4	4,2	0,6	86
Average U-value	U_{av}	W / m2K	2	1	0,2	80
Glazing	g	total solar energy transmittance of glazing	0,7	0,7	0,6	14
Shading	Fs	Shading correction factor		-		
Ventilation rate [4]		air changes/hr	1	0,5	0,5	0

2 Building Energy Performance

2,1 Energy demand per m2 of total used conditioned floor area (kWh / m2yr) incl. system losses

energy carrier existing	suggested energy carrier		specify energy efficiency measures [13]	Existing building [5]	regulation / normal practice for new built	suggested specification [7]	% Energy savings [8]
Heating + ventilation							
Radiators	Radiators	kWh/m²yr	Passive insulation, heat recovery	200	150	25	83
Cooling + ventilation							
		kWh/m²yr					
Ventilation (if separate from heating/cooling)							
	Heat recovery	kWh/m²yr					
Lighting							
	electricity	kWh/m²yr	Energy efficient lighting	7	7	5	29
Domestic Hot Water (DHW)							
	District heat.	kWh/m²yr	Compact vent + solar + backup system	30	30	30	0
Other energy demand							
		kWh/m²yr					
		kWh/m²yr	Subtotal sum of energy demand	237	187	60	68
Appliances (please indicate, but costs are not eligible)							
	electricity	kWh/m²yr		13,6	20	13,6	32

2,2 RES contribution per m2 of total used conditioned area (kWh / m2 yr)

total production kWh/yr	m² installed	kW installed	specify RES measures	Existing building [5]	National regulation / normal practice	suggested specification [7]	RES contribution [%][8]
			Solar thermal system + 200 litre storage	0	0	15	
		kWh/m²yr	Subtotal sum of RES contribution	0	0	15	

3 Building Energy Use

per m² of total used/heated floor area (kWh/m2 yr)

kWh/m²yr	Subtotal sum of energy demand	237	187	60	68
kWh/m²yr	Subtotal sum of RES contribution	0	0	15	
kWh/m²yr	Total Building Energy Use	237	187	45	76

4 Other national overall energy performance targets or criteria (additional information, mandatory if existing)

	Units [9]	explain content and scale [10]	Existing building	National regulation for new built (2006)*	suggested specification
	Label	Energy certificate	F	A	A++
	kwh/m2	PassiveHaus - existing buildings	150	60	25

Appendix B Energy Data

London Before

Calibrated calculation in PHPP

	Energy Demand Before [kWh/m2 NFA]	Source	PE conv. fact. fp [kWh PE / kWh S] national /local	PE national [kWh/m2 NFA]	PE conv. fact. fp [kWh PE / kWh S] acc. EN 15603	PE based on EN 15603 fp [kWh/m2 NFA]
Heating Source 1	153	Gas	1,026	157	1,36	208
Heating Source 2				0		0
DHW Source 1	26	Gas	1,026	27	1,36	35
DHW Source 2				0		0
Auxiliary	1	Electricity	2,56	3	3,31	3
Losses Source 1	15,3	Gas	1,026	16	1,36	21
Losses Source 2	7,8	Gas	1,026	8	1,36	11
Total	**203,1**			**210**		**278**
Delivered to the grid			0	0		0

London Afterwards

Calculation in PHPP

	Energy Demand Afterwards [kWh/m2 NFA]	Source	PE conv. fact. fp [kWh PE / kWh S] national /local	PE national [kWh/m2 NFA]	PE conv. fact. fp [kWh PE / kWh S] acc. EN 15603	PE based on 15603 fp [kWh/m2 NFA]
Heating Source 1	17	Gas	1,026	17	1,36	23
Heating Source 2				0		0
DHW Source 1	26	Gas	1,026	27	1,36	35
DHW Source 2				0		0
Auxiliary	6	Electricity	2,56	15	3,31	20
Losses Source 1	1,7	Gas	1,026	2	1,36	2
Losses Source 2	7,8	Gas	1,026	8	1,36	11
Total	**58,5**			**69**		**91**
Delivered to the grid			0	0		0

Conversion factors fp (total) acc. EN 15603:2008* Table E1 - Annex E		
Electricity (UCTE Mix)	3,31	[kWh PE / kWh S]
Natural gas	1,36	[kWh PE / kWh S]

National PE conversion factors	**SAP2012 figures**
Gas	1,026
Electricity	2,56

Appendix C Plans

Drawings of the London demo can be found on the E2ReBuild web site:

Ground, first and second floor:
http://www.e2rebuild.eu/en/demos/thamesmead/Documents/Ground,%20first%20and%20second%20floor.pdf

Third, fourth floor and North-South section:
http://www.e2rebuild.eu/en/demos/thamesmead/Documents/Third%20and%20fourth%20floor%20and%20NorthSouth%20section.pdf

South-North and East-West elevation:
http://www.e2rebuild.eu/en/demos/thamesmead/Documents/SouthNorth%20and%20EastWest%20Elevation.pdf