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1 Definitions and abbreviations

DB	Design-build
NZEB	Net zero energy building
PPO	Primary project owner
PPP	Public/private-public partnership
RE	Renewable energy
SDG	Sustainable development goal
SPV	Special Purpose Vehicle

2 Introduction

The purpose of this task was to assess and validate the business models developed by MODER project.

The business model of an activator was assessed and validated with regard to alternative models described in MODER deliverable “Business models for district level refurbishment”¹. These are also listed in Table 1. The validation was done for activator’s business model and thus only those process models were considered where the role of an activator is important. These are step-by-step refurbishment, primary project owner, Local distributed renewable energy system procurement, and Enabling financing of large scale refurbishments by smart step-by-step approach (marked grey in Table 1).

Table 1 – Delivery / business models for district level refurbishment

Name	Description
Step-by-step refurbishment	<p>An approach to district level refurbishment where the process proceeds in steps. Every new activity step bases on the success of the previous step, i.e., the potential savings and benefits of a step are analysed for the next step. As a process, this requires more time than other straightforward approaches. The benefits of a step-by-step approach are clear budgeting, possibility better design and realistic goals.</p> <p>The first step includes an analysis of the energy performance and assessment of energy savings through simple and cost-efficient measures. The benefits of the approach become tangible through a careful monitoring of energy performance of a district or a neighbourhood for potential energy savings in the present use. The step-by step assessed savings will be invested on the next steps.</p>
Alliance refurbishment	<p>Project alliance is a project delivery method based on a multi-party contract between the key players in a project. The parties have a joint responsibility for the design and construction of the project to be implemented through a joint organization, which includes the owner or the client. The players share both positive and negative risks related to the project and follow principles of openness in pursuing close cooperation.</p> <p>The basic idea is that risk is borne jointly and reward is shared based on the success of the entire project. This makes the parties to consider each other’s views and collaborate more efficiently for the benefit of the project. The method also allows combination of a wide range of expertise needed to foster innovation and to make demanding ventures successful. However, it necessitates early selection of the players and makes offering services at a fixed price impossible. The solution to that challenge is the selection of partners based on a thorough review of team performance and capacity</p>

¹ Business models for district level refurbishment. Available on <http://www.vtt.fi/sites/moder/Pages/Reports-and-papers.aspx>

<p>Primary project owner</p>	<p>Group refurbishment is a process that can be utilised in housing cooperatives' refurbishment of facades and building services. Group refurbishment enables cost savings compared to individual refurbishment projects through lower design and contracting costs, and volume discounts for materials and equipment. At the same time, contractor risks are lower and smaller housing corporations can get better services.</p> <p>The primary project consists of one strong project party, the Primary Project Owner PPO, inviting other stakeholders to take part. The PPO can be, e.g., an owner of an office building or housing cooperation housing, a shopping centre or a hotel. The business model describes how PPO develops the project.</p> <p>The primary project owner can hire a coordinator for the project. PPO or coordinator initiates and manages the project and represents all the other building owners in communication towards authorities in early project phase. The project can start by strategy development before sending the invitations to other building for fast proceeding of the project. This in turn requires fast decision-making from the invited stakeholders.</p>
<p>Distributed Design-Build Coordinator</p>	<p>Distributed Design-Build (DB) procurement is coordinated by a steering committee. The steering committee selects a coordinator for daily operations. The business model describes how the coordinator manages the process for the steering committee consisting of owners, designer (district level) and cost expert with the decision-making power and supervision capacity. Individual DB projects have their own design teams. There are two cost expert positions: Coordinator's cost expert and individual DB project cost expert.</p> <p>The aim is to form a common ground for the decision making for different DB projects. Distributed DB model suits best in cases where the market is expected to be able to offer innovative solutions.</p>
<p>Public/Private-Private Partnership (PPP) Coordinator</p>	<p>PPP model consists of several interest groups with or without a public partner that establishes a company taking the responsibility over the project, Special Purpose Vehicle (SPV). SPV oversees fundraising and finances, technical design and construction time supervision and can act as the energy producing company after the project. In that case, the stakeholders become the SPV company's owners.</p>
<p>Local distributed renewable energy system procurement</p>	<p>Group distributed renewable energy system procurement describes a joint acquisition for a renewable energy system. Activator's role is important to initiate the process. The objective is to exploit economic benefits from mass procurement.</p>
<p>Renewable energy production, resource sharing and operation</p>	<p>The business model describes an approach for common energy production at block or building level. The number of buildings is limited to avoid energy distribution to, e.g., across a street. The distribution grid or network can thus be independent and owned by the stakeholders, e.g. through a commonly owned company.</p> <p>The operator of the system can be a local energy co-operative or local energy company. The approach allows energy production for common equipment used for electrical appliances, heating and cooling. The investors benefit on the low energy costs as well as attractiveness and property value.</p>
<p>Enabling financing of large scale refurbishments by smart step-by-step approach</p>	<p>A step-by-step approach is a long-term development for improving the energy efficiency of buildings and utilisation of low-carbon or carbon free technologies for energy production for district level refurbishment. The approach includes actions for energy efficiency improvements of individual buildings such as energy audits and energy analysis and further district-level energy analysis to harvest the best possible options for sustainable refurbishment. The business model is for an activator or a developer that is the key player in this approach.</p>
<p>The energy management of buildings</p>	<p>Cost efficient energy management of building contributes both for reduced energy costs and improved indoor climate. These again have an impact on property values and inhabitant or user satisfaction.</p>

The business models of the four approaches are presented in Figures 1 - 4.

Key partners Energy auditors, facility managers (service companies) Architects Municipality	Key activities 1. Potential energy savings in present use 2. Needs analysis: Renewal and targets 3. Building based energy analysis 4. District level energy goals 5. Strategy for refurbishment Key resources Energy expert Designer Planner Developer	Value propositions Environment: Energy savings in present use Renewable energy Improved efficiency Economy Cost savings Value increase Social Better indoor climate Positive stimulation Customer satisfaction	Customer relationships Close to end customers and financiers: Continuous discussion Channels Open collaborative platform Face-to-face with stakeholders: stakeholder parliament Social media	Customer segments Private and institutional building owners Developers Energy system producers Energy companies
Cost structure Energy analysis Strategy work Planning		Revenue streams Building owners: Goals and strategy Value promise based pricing, bonuses and sanctions		

Market understanding & unique insight: Activator understands the needs for condition assessment and energy surveys. Unique insight is to develop scenarios for potentials of the district level refurbishment.

Selected target segment / customers: Private and institutional building owners, developers, energy system producers, energy companies.

Understanding of the competitive landscape: Activator understands the competing companies' strategies, their market approach and pricing mechanisms.

Product & services defined: Early phase development of solutions for district level refurbishment, and a concept for implementation.

Value proposition defined: District development through environmental efficiency, economic savings, value increase and social improvements.

Customer relationship & channels defined: Activator's position in the value chain is being close to end customers which enables continuous discussion with possible financiers. Activator can establish a collaborative platform for information sharing with customers and use social media for interactive communication.

Way of working & organisation defined: Activator works closely with known energy experts, designers, planners and developers. Extended organisation includes energy auditors, facility managers (service companies), architects and municipality.

Identified synergy with other businesses: Project management and procurement, construction companies specialised in refurbishment, district development including services providers (retail, cafeterias, restaurants, gyms, etc.).

Sustainable competitive edge: Early phase total service for project development to capture the value.

Confirmed business case (profitability): Management of a company's cost structure, e.g., applying takt-time methodology. Value promise based pricing, bonuses and sanctions for project development.

High commitment decisions made & conviction to act: Balance between commitment and flexibility.

Action plan and resources in place: Needed resources are in place with sufficient mandate.

Figure 1. Activator's business model in step-by-step approach

Key partners Project coordinator Financer Anchor users	Key activities 1. Strategy development 2. Group refurbishment development 3. Design development 4. Implementation 5. Use and operation	Value propositions Renewable energy easily and cost efficiently: <ul style="list-style-type: none"> Nearly zero energy district Return on invest End user advantages 	Customer relationships Primary project owner communicates actively with all building owners	Customer segments Building owners Energy companies Municipality
	Key resources Designers Contractors Renewable energy system expert		Channels Tendering according to competitive dialogue	
Cost structure Design cost Refurbishment cost Renewable energy system cost		Revenue streams Reduced operation costs Increased property value		

Market understanding & unique insight: PPO understands the RES market and benefits for the stakeholders on the long run, and manages the client network and follows new technology and business opportunities.

Selected target segment / customers: Recognised customer segments are building owners, energy companies and municipalities, e.g. an owner of an office building, shopping centre or hotel.

Understanding of the competitive landscape: Activator must understand the competition at the marketplace.

Product & services defined: Activator's new consulting services expand the business possibilities. Design and installation of services can be outsourced. These services can be supplied through partnership network.

Value proposition: Renewable energy easily and cost efficiently. Value based procurement.

Customer relationship

Information sharing: Interactive digital platform and Big room. Face-to-face and provide services with key stakeholders: Creating and maintaining trust.

Channels: Awareness raising, information sharing and participatory events. Social media, website, newsletters.

Way of working & organization defined: PPO/coordinator manages together with key partners the procurement: competition, price, brand, performance, services and tendering. Anchor user (e.g. key tenant) can be PPO's key partner at the development phase

Identified synergy with other businesses: new services are built based on existing businesses.

Sustainable competitive edge: cost efficient procurement.

Confirmed business case (profitability): Optimized operating costs and incentives from the customer benefit.

High commitment decisions made & conviction to act: Strategic commitment will be achieved through service design for the business aiming at flexible refurbishment for defined customer segments.

Action plan and resources in place: Needed resources are selected and responsibilities defined. PPO's network provides extended services if needed.

Figure 2. Primary project owner's business model



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Key partners Public/private client System suppliers Designers	Key activities 0. Pre-feasibility study 1. Collecting group of interested stakeholders 2. Design 3. Preparing procurement documents 4. Group procurement 5. Hearing process	Value propositions Renewable energy easily and cost efficiently Value based procurement	Customer relationships Awareness raising, Information sharing and participatory events	Customer segments Project area stakeholders e.g. owners, planners Neighbourhood associations
	Key resources Procurement specialist		Channels Information sharing: Interactive digital platform and Big room Face-to-face and provide services with key stakeholders: Creating and maintaining trust Social media, website, newsletters	
Cost structure Operating costs: Personnel costs, subcontracting etc. Marketing, promotion materials Procurement and delivery costs		Revenue streams Scalable models Service fees % share compensation of cost reduction compared to market level price Life cycle revenues (green fund), subsidies		

Market understanding & unique insight: Activator understands the RE system market and benefits for the stakeholders on the long run. Activator manages the procurement: competition, price, brand, performance, services and tendering.

Selected target segment / customers: Project area stakeholders e.g. owners, planners and neighbourhood associations.

Understanding of the competitive landscape: Activator must understand the competition at the marketplace.

Product & services defined: Activator's new consulting services - renewable energy easily and cost efficiently - expand the business possibilities. Design and installation of services are outsourced. These services are supplied through partnership network.

Value proposition: Renewable energy easily and cost efficiently. Value based procurement.

Customer relationship and channels: Information sharing: Interactive digital platform and Big room. Face-to-face and provide services with key stakeholders: Creating and maintaining trust. Awareness raising through information sharing and participatory events, social media, website and newsletters.

Way of working & organization defined: Activator manages the client and partner network and follows new technology and business opportunities.

Identified synergy with other businesses: new services are built based on existing businesses.

Sustainable competitive edge: cost efficient procurement.

Confirmed business case (profitability): optimized operating costs and incentives from the customer benefit.

High commitment decisions made & conviction to act: Strategic commitment will be achieved through service design for the business aiming at scalable refurbishment for defined customer segments.

Action plan and resources in place: Awareness raising through project area stakeholders e.g. owners, planners and neighbourhood associations. Activators' network provides extended services if needed.

Figure 3. Activator led group renewable energy system procurement canvas (Local distributed renewable energy system procurement)



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Key partners Financing organisation, e.g.: Green fund Global footprint network Bank Public fund Philanthropists	Key activities 1. Analysis of energy saving potentials 2. Target setting 3. Analysis of refurbishment costs 4. Potential value increase assessment 5. Payback planning 6. Securing funding 7. Implementation monitoring Key resources Energy expert Finance expert	Value propositions Profitable investment at low risk level	Customer relationships Awareness raising Developing dialogue Channels Digital marketing channels, e.g.: Social media Interactive website Webinars References	Customer segments Private building owners
Cost structure Preparatory costs		Revenue streams Provision based fee		

Market understanding & unique insight: Understand the financing mechanisms for and whole life costing of nearly zero energy refurbishment.

Selected target segment / customers: Private building and apartment owners.

Understanding of the competitive landscape: The business model bases on the low risk level of investment. We know the offering of different financing organisations such as green funds. We understand the cost / benefit ratio.

Product & services defined: Full service package for green energy including the technology and funding.

Value proposition defined: Profitable investment at low risk level

Customer relationship & channels defined: Developing dialogue between the activator / developer and private building owners using appropriate means such as open collaborative platform.

Way of working & organisation defined: Communication of technological and financial possibilities and benefits.

Identified synergy with other businesses: Renewable energy system providers, special designers and contractors.

Sustainable competitive edge: The anchor point is a lucrative offer for the customers including also financial and technical expertise.

Confirmed business case (profitability): Provision based fee.

High commitment decisions made & conviction to act: The project meets the green funds' priorities supporting the customers' decision-making and national sustainability development goals (SDG7 Ensure access to affordable, reliable, sustainable and modern energy for all and SDG11 Make cities and human settlements inclusive, safe, resilient and sustainable).

Action plan and resources in place: Defining the solutions and benefits with key resources energy and finance experts.

Figure 4. Enabling financing of large scale refurbishments canvas

MODER has described three different models for the activator of district-scale refurbishment projects depending on the extensiveness of the activities during the overall process as follows (Table 2 and Figure 5):

Table 2 Different models of activator

Project consultant	Assesses the potentials for neighbourhood level refurbishment Motivates building owners Collects a group of building owners to start neighbourhood scale refurbishment
Project developer	Assesses the potentials for neighbourhood level refurbishment Motivates building owners Collects a group of building owners to start neighbourhood scale refurbishment Provides services such as project management, or design and/or construction
Project integrator	Assesses the potentials for neighbourhood level refurbishment Motivates building owners Collects a group of building owners to start neighbourhood scale refurbishment Provides services such as project management, or design and/or construction Networks with the municipality and energy company and other service providers, organises collaborative delivery of neighbourhood scale refurbishment

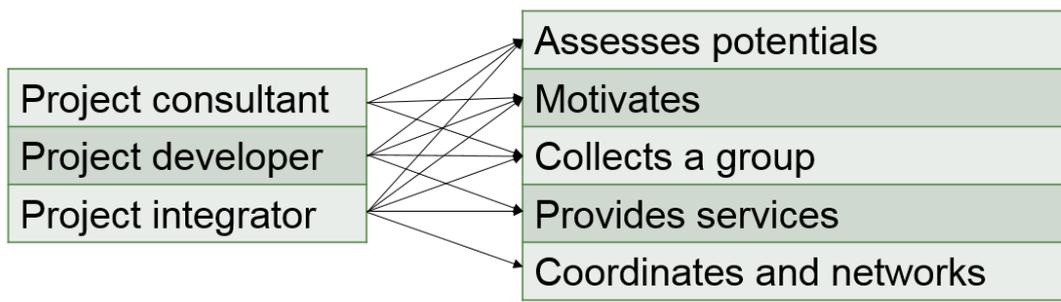


Figure 5. Activator models.

3 Methods

The main questions concerning the usability of different models include who is the customer, what are the needs of the customer, what are prerequisites that need to be fulfilled for successful agreement. The validation of delivery and business models aims at clarifying the assumptions in different options concerning the models.

The validation of delivery and business models was carried out with the help of the following steps:

- 1st STEP
All described delivery / business process models were assessed in terms of 12 essential aspects as follows:
 1. Market understanding and unique insight,
 2. Selected target segments / customers,
 3. Understanding of the competitive landscape,
 4. Product and service defined,
 5. Value proposition defined,
 6. Customer relationship and channels defined,
 7. Way of working and organisation defined,
 8. Identified synergy with other businesses,
 9. Sustainable competitive edge,
 10. Confirmed business case (profitability),
 11. High commitment decisions made and conviction to act,
 12. Action plan and resources in place.

This assessment was done in connection of MODER Task 5.3 and the results are presented in MODER Deliverable 5.3².

- 2nd STEP
The suitability, strengths and weaknesses of the models where the activator has an essential role were assessed with reference to the characteristic aspects of districts. The essential characteristic aspects of districts are presented in Table 3. The assessment was done with the help of a series of internal workshops organised at VTT. An expert group consisting of the following experts made the validation:

- Tarja Mäkeläinen,
- Tarja Häkkinen
- Jari Shemeikka
- Jaakko Ketomäki
- Mia Ala-Juusela

The results of the stakeholder interviews were used as background knowledge. The interviews were done by Tarja Häkkinen, Tarja Mäkeläinen and Mia Ala-Juusela in 2018 as described in the presentation “Roles and business models for district level refurbishment”³. The interviews covered five stakeholder groups:

- municipalities,
- energy companies,
- contractors,
- engineering companies and
- project managers.

² Business models for district level refurbishment. Available on <http://www.vtt.fi/sites/moder/Pages/Reports-and-papers.aspx>

³ Roles and business models for district level refurbishment. Authors Tarja Häkkinen, Tarja Mäkeläinen, Mia Ala-Juusela. MODER Workshop in Technology Innovation Conference / Energy and Buildings. Wels 2.3.2018.



The number of interviewees was 25. The interviews focused on the potentials and value propositions of different business models of activators that initiate district level refurbishment.

The results of the workshops are reported in Section 4.

- 3rd STEP

The suitability, strengths and weaknesses of selected business-process models were also assessed with reference to two real cases: Case Riihimäki in Finland and Case Kranj in Slovenia. The both cases were assessed in external workshops together with invited stakeholders of the cases. The cases are described and the workshops and results are presented in Section 5.

4 Assessment with reference to characteristics aspects of districts

4.1 Definition of characteristics

This section assesses the models described in Table 1 with reference to the characteristics of districts. The districts are here characterised with the help of the following parameters (Table 3). The term ‘district’ represents here the region to be refurbished with the help of ‘district-level energy-efficient refurbishment’. District-level energy-efficient refurbishment means here concurrent refurbishment of several buildings located in a same district, with the view to achieve common benefits such as cost savings in procurement, more effective use of renewable energy sources, more cost-effective financial solutions or support for NZEB operation. Thus, a district may be for instance a suburb or one part of an urban or suburban area.

Table 3. Characteristic aspects of the district and options to be considered.

Characteristics	Possible options			
Building stock (types of buildings, property value)	Mainly multi-storey residential buildings	Multi-storey residential buildings and retail/office buildings	Multi-storey residential buildings and small houses	
Age structure of buildings	Mainly 19070s and 1980s	Mainly 1950s and 1960s	Mainly 19050s and older	
Property value	Low	Moderate	High	
Building protection issues	No specific	Significant part of buildings are protected		
Ownership structure of buildings	Mainly privately owned housing companies	Mainly privately owned housing companies and privately owned retail/office buildings	Mixed structure with privately owned housing companies and rental apartment buildings owned by the municipality or private companies	Mainly municipality owned residential buildings (rented)
Ownership structure of plots	Mainly rental plots owned by the municipality	Mainly private owned plots		
Location type (urban/suburban) and transport connections	Suburban with good public transport connections	Suburban with moderate public transport connections	Urban with good public transport connections	
City development strategy	The district / neighbourhood belongs to an active urban development program	No active development plans / actions		
Local RES potential	High local RES potential	No specific RES potential		
Potentials for infill building	The municipality supports infill building and aims	The municipality supports some infill building (new	Low potentials for infill building	

	at offering equal possibilities for housing companies	apartments into attics / extra storeys)		
Local housing management	Active local housing management office	No locally active housing management office		
Local associations representing local citizens	Active local association(s)	No / no active local associations		

4.2 Assessment of models

The assessment results are presented in Table 4. The results are presented with the help of five columns showing the assessment results for business opportunities with regard to

- the district-scale refurbishment in general
- activator in step-by-step process
- PPO or coordinator in primary project owner process
- activator in local distributed energy system procurement model
- activator in large scale refurbishment by smart step-by-step approach.

Table 4. Assessment results for the models Step-by-step refurbishment, Primary project owner, Local distributed renewable energy system and local scale refurbishment by smart step-by-step approach.

	BASIC BUSINESS OPPORTUNITIES FOR DISTRICT-SCALE REFURBISHMENT	STEP-BY-STEP REFURBISHMENT	PRIMARY PROJECT OWNER	LOCAL DISTRIBUTED RENEWABLE ENERGY SYSTEM	LARGE SCALE REFURBISHMENTS BY SMART STEP-BY-STEP APPROACH
		<p><u>The role of activator:</u> The role of activator is especially important in the beginning of the process to initiate the process, search for commitments of owners, doing analyses and concepts for implementation.</p>	<p><u>The role of activator:</u> The primary project consists of one strong project party, the Primary Project Owner PPO, inviting other stakeholders to take part. The PPO can be, e.g., an owner of an office building or rental housing company, a shopping centre or a hotel. The business model describes how PPO develops the project. The primary project owner can hire a coordinator for the project. PPO or coordinator initiates and manages the project and represents all the other building owners in communication towards authorities in early project phase.</p>	<p><u>The role of activator:</u> This model is a joint acquisition of a renewable energy system. Activator's role is to initiate the process. The objective is to exploit economic benefits from mass procurement. The activator is often the system provider operating on the basis of a Turn-Key model with performance guarantee instead of providing components.</p>	<p><u>The role of activator:</u> The activator is a key player in the process that aims at a long-term development of the energy efficiency of buildings and utilisation of low-carbon or carbon free technologies. The approach includes actions for energy efficiency improvements of individual buildings such as energy audits and energy analysis and further district-level energy analysis to harvest the best possible options for sustainable refurbishment.</p>
Building stock (types of buildings, age structure,	From the viewpoint of activator's potential for business, the most suitable districts are sub-urban and urban districts, where the building types are similar built during a rather	The similarity of buildings is important for step-by-step process because it makes the analysis	This model is only possible when an actor suitable for PPO is present. It is easier for the PPO or his	This model is best suitable for residential buildings, as other types of buildings often have a professional	The model is not suitable for a district with mainly small houses. The economy based on large scale is

<p>property value and building protection issues)</p>	<p>short period, and there is a big need for refurbishment. It is also good if the attitudes for infill building are rather permissive and if the value of flats is relatively high or at least not low compared to the foreseen cost of refurbishment. This kind of building stock is typical in suburban districts built in 1970s.</p> <p>Local building protection requirements limit the variety of technical solutions for energy refurbishment. However, the architectural and cultural value of the local building stock may also form a good basis district-scale refurbishment, if it reinforces common appreciation and willingness to maintain the local cultural values of the building stock.</p>	<p>phase easier. Similarity brings significant benefits also because of learning based on the possibility to repeat processes. The activator benefits from all kinds of issues that help collaboration and participation of occupants.</p>	<p>coordinator to invite others, when the building types and refurbishment needs are similar. The possibility for cost beneficial joint ventures in procurement are also thus better.</p>	<p>owner, and the role of the activator is more limited. Otherwise, the suitability of the model is less affected by the age and type of the buildings (e.g. PV panels or heat pumps). The mass acquisition will most probably reduce the price of the system compared to individual purchase.</p>	<p>lost when there are many small units. However, the model does not require that the built environment consists of similar buildings.</p>
<p>Ownership structure of buildings</p>	<p>The final customers may be housing companies and/or institutional owners of rental residential or other buildings. The institutional owners can be private owners or municipal owners.</p> <p>Institutional owners should act as forerunners for the process.</p> <p>If the owners are owner-occupants of housing companies, incentives are needed to finance the initial phases or the activator should be hired by the municipality.</p>	<p>The role of activator is much easier if there are big private or municipal owners having several buildings in the district and interested in acting as forerunners for district-scale refurbishment.</p> <p>The activator needs support from the municipality if there are no institutional owners who support district-scale refurbishment.</p> <p>If there is mixed ownership, the</p>	<p>This model is only possible when an actor suitable for PPO is present. This means that among owners there need to be a strong actor having a significant property in the district. It is also easier for the PPO or his / hers coordinator, when they can negotiate rather few owners to get adequate volume for group procurement. However, PPOs as forerunners would be</p>	<p>This model is suitable in situations where the building owner and user is the same entity (B2C). Also, institutional owner is well suited (B2B).</p>	<p>Heterogeneous ownership makes decision-making more difficult. It will help if the housing company has a strategic decision to be e.g. zero energy or green housing company in for example five years.</p>

		required competences of the activator are higher.	very valuable also in districts with many owner-occupant housing companies, as a strong PPO might be able to attract also (otherwise passive) housing companies.		
Ownership structure of plots	<p>The ownership of plots affect the possibilities for infill building and the possibilities for using infill building as source of funding.</p> <p>The optimal solutions of planning may be more probable when the municipality owns the plots. however, the meaning of infill building as a funding instrument is less significant the building owners rent the plot because the selling price would be lower,</p>	The supporting role of the municipality may be stronger in districts where the municipality owns many of the plots. This may be a benefit for the activator.	The ownership of the plot / plots gives better possibilities for the PPO to aim at financial solutions with the help of infill building. Thus it may support the activities of the PPO as a whole.	Especially in the case of geo-energy systems (heating/cooling) the plot ownership may have an important effect. If the building is on rented plot, the permission from the plot owner may be necessary.	The green strategies of the plot owner and user must be ambitious enough, and in line with each other in order to have a real business potential.
Location type (urban/ suburban) and transport connections	<p>Existing experiences on district-scale refurbishment are mostly related to sub-urban districts. There are often better possibilities for district-scale refurbishment in suburban districts, because the building stock is more often similar and dates back to a certain short time period. In addition, the potential for infill building is often better. The biggest potential for infill building is limited to growing suburban/urban areas.</p> <p>District-scale maintenance service companies and housing managers are more in suburban districts than urban</p>	<p>Both urban and suburban districts are possible but suburban is better because of possible advantages related to infill building and repeatability.</p> <p>Refurbishment may become possible with the help of step-by-step processes also when the property values are relatively low.</p>	Both alternatives are suitable. The types of buildings and possibilities for similar solutions are more important for group procurement. When this is more typical in suburban districts than urban districts, the first mentioned is better.	The both types are possible.	The both types are possible.

	<p>districts. These might act as activators or valuable partners for an activator.</p>				
<p>City development strategy and active role of the municipality</p>	<p>The active role of the municipality is important for the activator in district-scale refurbishment because of several reasons.</p> <p>The municipality can bring neutrality with the help of objective information about benefits and potentials and support with the help of proactive, far seeing and flexible town planning.</p> <p>If the property value is low, district-scale refurbishment may still be possible with the help of significant investments by the municipality for example for a new school/campus area, essentially better traffic connections and significant infill building, which remarkably improves the image of the district.</p> <p>The municipality could also provide a facilitator that acts locally in collaboration with owners, owner-occupants, contractors and others and support working together - and thus actually take the role of an activator in the early phase of the process.</p> <p>The municipality could also support platform-based approach, and through that encourage participation of all and provide open data and thus help the activator in the analysis of refurbishment potentials.</p> <p>The municipality could provide a small incentive for forerunner housing companies to attract energy</p>	<p>The active role of the municipality is essential for the activator in step-by-step process especially when the clients are housing companies mainly occupied by owner-occupants. The support by the municipality is especially important because of neutrality, support in participation processes, and the activator may also need financial support from the municipality.</p> <p>When the clients are institutional owners, this model is possible also if the support by the municipality is lower.</p> <p>When the sustainability strategy and infill building strategies of the municipality are very ambiguous, step-by-step process is not the best alternative.</p>	<p>Positive support by the municipality is beneficial but not as essential as in the case of an activator working in step-by-step process.</p>	<p>The city can take an active role, by facilitating the permission procedures, or even giving incentives for the renewable energy systems. The city can e.g. give examples of installations that easily get a permission, while other types of installations need a more detailed permission procedure. The municipality's positive attitude and support are essential when considering less distributed RES types, like central solar district heating. The availability of space for this kind of applications is often limited in urban environment.</p>	<p>The city can support the long term planning of the development and operation of a district that is committed in step-by-step refurbishment. When the city starts to host a platform for sharing the experiences of good examples, this could offer a good dissemination channel.</p>

	<p>refurbishment at district scale and thus support the work of the activator.</p> <p>The rental housing companies owned by the municipality could show leadership, demonstrate and invite others to participate.</p>				
Local RES potential	<p>Specific potential for the use local renewable energy sources may support district-scale refurbishment. For example the intention of the energy company to start to offer RES based heat on the border of the district may formulate a basis for district-scale refurbishment of that area.</p>	<p>The local RES potential improves the business potential of an activator in step-by-step process only when the local RES potential offers significant possibilities to reduce the need for delivered energy and save energy cost. This could help the activator to wake interest among owners and thus help the work of the activator.</p> <p>Step-by-step process might lead to a situation where a RES-option beneficial in short term eventually blocks out options that would be the most beneficial in long run.</p>	<p>Significant local RES potential may promote PPO's aim at cost-efficient refurbishment and thus, also easier the invitation of others to the group procurement process.</p>	<p>The local RES potential and a good knowledge of that is crucial for this model.</p>	<p>Large scale gives better possibilities for efficient utilization of the local RES potential, when the generation units can be placed and oriented optimally, and the demand response and balancing of demand and supply have better opportunities at district scale.</p>
Potentials for infill building	<p>The possibility for infill can be an important financial enabler for district-scale refurbishment. However, the potential should be extensive compared to the area of refurbishment to support financially. Otherwise, for</p>	<p>Significant potential for infill building is necessary, when the activator is a contractor whose foreseen business is strongly</p>	<p>Significant potential for infill building may promote PPO's aim at cost-efficient financing of refurbishment.</p>	<p>In some special cases the optimal orientation of e.g. solar panels can be found with the help of infill building.</p>	<p>Infill building is one of the potential measures among others. It can be used as a financing opportunity.</p>

	<p>example the needed parking arrangements may eventually radically weaken the potentials for funding the refurbishment measures.</p>	<p>related to the possibilities for infill (new) building in the connection of refurbishment.</p> <p>Step-by-step process as a whole is less suitable, when the municipality aims at extensive infill building. In this case it is better that the municipality has a strong and proactive role and the activator/facilitator - when needed - works for the municipality.</p>			
<p>Local housing management and/or local maintenance service company</p>	<p>Local housing management companies and local maintenance service companies can have a very good picture of the characteristics, needs and attitudes of local owners and occupants. Their expertise may be valuable when initiating district-scale refurbishment and when doing analyses.</p>	<p>Local housing managers/service companies might act as activators or be partners of activators in step-by-step processes.</p>	<p>Not very relevant for the PPO process. If the PPO or the coordinator tries to invite private (owner-occupant) housing companies for group procurement, the local expertise of local service company can be helpful.</p>	<p>A local management or maintenance company can act as a promotor for local RES solutions. If e.g. the local maintenance company is able and willing to operate and maintain the installations, that would increase the potential for this business model.</p>	<p>Local housing manager is a key partner for the activator, taking out the message about the achievable benefits and acting in central role in the planning phase.</p>
<p>Local associations representing local citizens</p>	<p>Local associations representing local citizens can support district-scale refurbishment, when those reinforce sense of solidarity, participation and formulation of a common vision for the district.</p>	<p>An activator in step-by-step process can benefit significantly, if a local association supports common vision building and the</p>	<p>Not very relevant for the PPO process. If the PPO or the coordinator tries to invite private (owner-occupant) housing companies for group procurement, the</p>	<p>Local associations can act as a good channel for dissemination and promotion of the RES systems, by sharing information of the successful examples.</p>	<p>Local associations can act as a good channel for dissemination and promotion of the step-by-step refurbishment, by sharing information</p>

		idea of district-scale refurbishment.	existence of a local association, which supports district scale refurbishment, can be helpful.		of the successful examples.
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5 Assessment with the help of case studies

The suitability, strengths and weaknesses of selected business-process models were also assessed with reference to two real cases: Case Riihimäki in Finland and Case Kranj in Slovenia. The both cases were assessed in external workshops together with invited stakeholders of the cases.

5.1 Case Kranj

The assessment workshop was organised in Kranj on May 16th 2018. Attendees in the workshop were as follows:

- Jure Erzen LEAG
- Anton Pocagnic LEAG
- Marjana Šijanec-Zavrl ZRMK
- Henrik Gjerkeš ZRMK
- NN Municipality of Kranj
- NN Municipality of Kranj (not present but the results sent for comments)
- Jyri Nieminen Sweco
- Tarja Häkkinen VTT

The main features of the Kranj Case are as follows:

- Case study district is a part of local community called Zlato Polje. There are approximately 1130 people living in the district with area about 0.27 km². Average year of construction of buildings in the district is 1964.
- The district area has mainly residential buildings (72 out of 88), most of them are multifamily houses and have individual boiler rooms (mostly gas boilers). There are 14 public buildings in the studied district. Some are under national, and some under municipality jurisdiction. Main energy source for heating is gas that is distributed to individual buildings, mostly by pipelines. Small district heating system is in use for educational facilities under national jurisdiction. District heating boiler power is 1,5 MW, and needs to be renovated.
- Key strategies and visions are stated in sustainable urban strategy of municipality Kranj 2030, Local energy concept of Municipality Kranj, Sustainable energy action plan for the municipality. First document outlines goals for the region – development of transportation – new central bus station and appointed infrastructure, energy refurbishment of buildings, monitoring of KPIs and improved accessibility of health care infrastructure. Second and third strategy documents binds the municipality to increase usage of RES, lower energy consumption and also to monitor KPIs and report about the achieved goals. In coordination with local energy concept for lowering of CO₂ emissions, and increase of use of RES, discussed region has several RES potentials: Biomass, Solar, Heat pumps, Geothermal (heat pumps water/water).
- Primary goal of the investments in refurbishment and development of a district is reduction of greenhouse gas emissions, energy and cost savings, increase in use of RES and improvement of living conditions for the residents. In theory, selected district has a great potential for energy savings, because buildings are rather old and not refurbished. Also, buildings are mainly connected to existing gas pipeline, and use individual inefficient gas boilers
- Local energy agency of Gorenjska is a partner of municipality Kranj, on various projects, including energy management for public buildings, advisory for refurbishment projects, preparation of various energy management reports and preparation of mandatory documents such as Local energy concept.
- Municipality is interested in refurbishment and development of whole discussed district, but due to the short time for obtaining subventions for refurbishment of DH system, decided for this stage to focus mainly on public buildings. In addition, at the time there is lack of activators and initiative in this region that would represent and unite residential sector. Municipality plans to renovate both public buildings in the district that are under their jurisdiction (both primary schools). In the same time, public buildings (under national jurisdiction) are also planned to be renovated. These buildings are connected to inefficient local natural district heating system. We have proposed extension of the district heating system and replacing existing boilers with biomass cogeneration system.

- Primary goal of the investments in refurbishment of boiler room and expansion of district heating system is lower greenhouse gas emissions, cost savings, increase in use of RES and improvement of living conditions for the residents. Municipality and state are also planning to renovate public buildings in the selected district. Main goal of this actions are reduction of energy usage and financial expenses, improvement of conditions for building users and lowering emissions.
- In Kranj, there have been an initiative led by one local resident as the actor. The initiation covered 4200 flats. People were working together to improve the neighbourhood. The purpose and target of the initiative was to support people to involve in the development work. Kranj has a sustainable energy action plan in which the importance of the building stock is emphasized.

LEAG together with the representative of Kranj municipality has earlier assessed within MODER project that - as the buildings are mainly private residential buildings - ownership is a big problem from the viewpoint of district-scale refurbishment projects. It is difficult to get everybody to collaborate and agree. Kranj is neither increasing rapidly; thus, the expectations for value increase are not very high.

LEAG together with the representatives of Kranj municipality have earlier also assessed that the Public Private Partnership would be the best process model. PPP model consists of several interest groups with or without a public partner that establishes a company taking the responsibility over the project. PPP model is theoretical with regard to private buildings. There is no real experience yet.

During the validation workshop, the following conclusions were made:

- **PPP** as such fits well for Kranj because there are public and private buildings. However, it is difficult to define how to really run the process.
- A **Special Purpose Vehicle** established as a consortium, where everybody has to sign the contract, would be the most potential model for the Kranj Case. It would be a life-cycle consortium focusing on multi-storey residential buildings. It would be in charge for funding solutions, technical planning and supervision of construction. A company for renewable energy supply could also be established. this would stay alive after the refurbishment project.
- The municipality would be involved as a partial owner of buildings. The municipality could also participate in the renewable energy company. That could be owned or partially owned by the municipality. The municipality would probably not be the coordinator but the municipality could be among key partners if they participate in financing. One problem is that municipalities have been used to get quite remarkable funding from the EU
- In every case, an activator is needed to support the process. The activator should work between the clients and construction company.
- Housing manager would be a natural coordinator for the SPV (hired by SPV). With regard to activator models, it would be "project integrator" (Figure 1) who works through the process.
- Housing manager would be a natural choice for the coordinator as these companies have a very important role in Slovenia in energy refurbishment. On national level, trainings on energy issues have been organised for housing managers to become facilitators of holistic renovations.
- Some housing manager companies are very interested in developing good projects and ideas because they take care of several buildings and may have a significant portfolio.
- In the future, housing management companies (or property managers) will play even a more important role, and they will need to collaborate with other organisations. Their role is emphasised in national climate strategies
- An incentive paid by the municipality would enable the activator work.
- However, there is lack of persons who would be both interested and adequately experienced. Thus, the start of activities would be difficult.
- There is also lack of other companies willing to participate and work as key partners in the consortium.
- Alternatively, the coordinator could come from a builder/developer organisation.
- **Step-by-step refurbishment** is already happening on building level but not on district- scale. The first task would be to make a strategy for the whole district.
- The activator role interests LEAG, and LEAG has formulated a business model with regard to this role. The role of LEAG as the energy-agency would be doing energy audits and energy management. As an activator LEAG would support by trying to find subsidies to help the process.

- The main task would be to carry out the organisation process. LEAG has done similar work for public buildings. Social media is a good instrument if you work with private owners. Local associations are very important in the process also.
- In Kranj the process should be divided to parts to separately dealt with public buildings, private residential multi-storey buildings etc. This is because for example subsidies are different.
- A coordinator is very much needed when there are small houses in the district. Small house owners would possibly not be willing to pay to a coordinator / activator. A local association could also be a coordinator or at least make a board for coordinating. Also privately owned blocks of flats could be represented.
- Energy provider might be possible for the activator/coordinator role, but for Kranj Case it is difficult because gas is still so much dominating as energy source because of low prices.
- Better subsidies for RES would be an incentive.
- The refurbishment of buildings should be divided to projects that renovate exterior walls and those that focus on HVAC. There are companies that are interested in doing energy refurbishment but not interested for example in doing projects that improve energy efficiency of building walls.
- District-scale refurbishment is still quite unfamiliar idea and way of working.
- District-scale approaches can be indirectly influenced also the refurbishment of private buildings. Eco-fund can give up to 30% money for private buildings because of energy refurbishment.

5.2 Case Riihimäki

The assessment workshop was organised in Riihimäki on June 28th 2018. Attendees in the workshop were as follows:

- Anniina Korkeamäki, Municipality of Riihimäki, planning manager
- Matti Sinisalo, Kotikulma Oy (rental housing company owned by the municipality of Riihimäki), project manager
- Tarja Mäkeläinen, VTT

The main features of the Peltosaari district / Riihimäki Case are as follows:

- Peltosaari is a suburb in the centre of the city of Riihimäki located 70 km north from Helsinki. Peltosaari is located next to the railway station and the centre of the Riihimäki. Approximately 10 % (around 2 700 persons) of the total population of Riihimäki (around 29 000) live in Peltosaari.
- The district of Peltosaari was built during 1970's and 1980's as a pilot area for electric heating in multi-storey houses. Generally, all the electricity expenses have been included in the rent or service fees, which has led to relatively high living costs in the area. Most of the buildings need refurbishment and the privately-owned housing companies have already renovated for example facades and roof.
- The buildings represent typical concrete apartment buildings of the time of construction. The strengths of the area are the excellent location, near-by nature, spaciousness and uniform building stock, luminous and car free inner yards, and full-grown vegetation.
- The weaknesses include the technical condition of buildings, architecturally monotonous image, and lack of privacy in the base floor apartments.
- The housing stock can be divided into western and eastern parts. Houses in the eastern side are technically simple and easier to refurbish as a large-scale refurbishment project enabling reproducibility, smooth processes and improved quality control of design, planning and implementation, in line with energy efficiency and cost reductions. Western Peltosaari has more variety in shape, structures and building services. The oldest buildings are coming into age where at least some refurbishment is required, and thus many both privately owned and social housing have already been refurbished for better performance and energy efficiency.
- The social housing owned by the municipality of Riihimäki situates in the western side of the area. Centralized social housing and biased population structure causes social problems. The market prices of the apartments in the area are remarkably lower than in other areas with similar location in relation to station and services.
- An architectural competition for development ideas for Peltosaari was arranged in 2010 -2011. The winning idea was further developed by the city planners and a new general plan was introduced after

discussions with residents and other stakeholders. The new plan provides an opportunity to build approximately 45 000 m² of new residential buildings in the area.

- The district has lost its position as an attractive place to live. Socio-economic problems have increased, and the property value has decreased at the same time. The unemployment rate in Peltosaari is very high compared to any other neighbourhood in Finland.

During the validation workshop, the following conclusions were made:

- The school and sports hall in Peltosaari will be renovated during coming years by the municipality. The school will become a community centre and it is expected that it will improve the attractiveness of the district.
- The municipality does not believe that extensive district-scale energy-saving projects will be made but instead the renovations will proceed step by step and with the help of individual projects. Each property is a financial unit. However, a concept of block-level refurbishment might be interesting.
- Kotikulma Oy might carry out advanced energy refurbishment in their own buildings showing example and good models of well-organised projects. Kotikulma could also test different kinds of potential refurbishment technologies.
- The municipality would also welcome actors that would provide local renewable energy. For example building roofs could be made use of for solar energy supply.
- The most probable business models are primary project owner, local distributed renewable energy system and traditional design-build.

6 Conclusion

The purpose of this task was to assess and validate the business models developed by MODER project. The validation of delivery and business models was carried out with the help of three procedures.

First, all described delivery / business process models were assessed in terms of 12 essential aspects as follows: Market understanding and unique insight, Selected target segments / customers, Understanding of the competitive landscape, Product and service defined, Value proposition defined, Customer relationship and channels defined, Way of working and organisation defined, Identified synergy with other businesses, Sustainable competitive edge, Confirmed business case (profitability), High commitment decisions made and conviction to act, and Action plan and resources in place. This assessment was done earlier and the results are presented in MODER report “Business models for district level refurbishment”⁴. In accordance with the results, a district-scale refurbishment always includes several stakeholders. Therefore, business models for various delivery processes are needed. However, the assessed models are suitable for different kinds of customer situations and those require different kinds of market understanding and ways of working.

In the next phase, the suitability, strengths and weaknesses of those models where the activator has an essential role were assessed with reference to the characteristic aspects of districts. The purpose was to find more understanding about the validity of the models for different kinds of situations. The assessment was done with the help of a series of internal workshops organised at VTT. The results of the stakeholder interviews were used as background knowledge. Interviewed stakeholders were on the other hand potential activators (contractors, project managers, engineering companies, and RE system providers) and on the other hand representatives of municipalities and energy companies. The interviews focused on the potentials and possible value propositions of different business models of activators that initiate district level refurbishment⁵. The models were assessed against characteristics including the Building stock (types of buildings, age structure, property value and building protection issues), Ownership structure of buildings, Ownership structure of plots, Location type (urban/ suburban) and transport connections, City development strategy and active role of the municipality, Local RES potential, Potentials for infill building, Local housing management and/or local maintenance service company, and Local associations representing local citizens. On the basis of the results, the validity of each model depends on the quality and essential features of the district. All models are not suitable for all districts, but especially the ownership structure, similarity of building types, and potential for local RE solutions affect the validity of different models. The strategic goal of the city and the active role of the municipality are important with regard to all assessed models.

The suitability, strengths and weaknesses of selected business-process models were also assessed with reference to two real cases: Case Riihimäki in Finland and Case Kranj in Slovenia. The both cases were assessed in external workshops together with invited stakeholders of the cases. On the basis of the results, a Special Purpose Vehicle established as a consortium, where everybody has to sign the contract, would be the most potential model for the Kranj Case while primary project owner, local distributed renewable energy system or traditional design-build were seen best fit for Case Riihimäki.

In summary, all defined models were assessed valid but the relevance varies with certain essential characteristics of districts.

⁴ Business models for district level refurbishment. Available on <http://www.vtt.fi/sites/moder/Pages/Reports-and-papers.aspx>

⁵ The results of interviews have been reported in the final seminar of MODER and in Wels conference. The presentations are available on MODER web page www.moderproject.eu