Upscaling urban residential retrofit for the EU’s low carbon future: Challenges and opportunities
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Glossary / List of Acronyms
1. THE CURRENT STATUS OF BUILDING RETROFIT: INSIGHTS FROM THE SMART CITY INFORMATION SYSTEM

1.1 IMPACT OF CURRENT PRACTICES

With respect to the EU climate and energy goals¹, a major challenge for EU cities lies within retrofitting the existing urban building stock. Hereby existing buildings represent a substantial potential for both (1) energy savings and (2) renewable energy production or intake. Substantial energy savings can be realized when buildings that were initially not or poorly insulated undergo a deep retrofit. Savings of more than 80% of the end energy needed for combined space conditioning and domestic hot water production are feasible, at least in the moderate to colder climates of the EU². If the remaining energy needs are subsequently filled in with renewable sources, the operational carbon emission reductions can reach 100%. In this case, the required level of building envelope retrofit leads however to important investment costs – for an average single family house the budget will quickly amount to over 50,000 Euro. Related payback times may equally mount to decades – 30 to 50 years is a common figure. Building owners may therefore turn to less ambitious renovation works. Not only will these result in proportionally smaller energy savings, a second round of investment in a deeper retrofit will often be delayed, complicated or even prevented.

Given the importance of energy renovation, many EU funded projects have a focus on (residential) building retrofit and experiment with new techniques and operational procedures, financing schemes, end user engagement strategies and governance process setups. These have led to a wealth of experiences and replicable successes that deserve to be maximally disseminated. The Smart City Information System (SCIS, https://smartcities-infosystem.eu/) follows up a group of 50 of these EU funded ‘smart cities and communities (SCC),’ ‘low-carbon energy (LCE)’ and ‘energy-efficient buildings (EeB)’ projects. Notably via its self-reporting tool, SCIS builds a view on the output of its projects in scope.

² In southern areas of the EU, buildings may have no or very limited heating systems. In this case, retrofit and introduction of a standard heating system may increase energy use because the increased comfort is taken for granted. Reversely, the cooling load in these regions may be the dominant space conditioning factor. This however comes with an advantage, where the cooling energy demand is at its highest with sunny summer conditions and thus when PV-energy is directly available for cooling purposes. The relatively low heating (and cooling) demands and the availability of solar energy for cooling make building envelope retrofit a less critical issue in the South of the EU compared to the moderate and colder climates in the rest of the EU. The insights in this report mainly refer to situations with a dominant heating demand.
From a set of nearly 50 building retrofit demonstrators monitored and documented through SCIS, it appears that half of the refurbishment projects realize savings of 50 to 75% of the total final energy demand, while one out of ten demonstrators saves more than 75%. Cases with hardly any savings as well as projects with almost 100% reduction appear, whereby the latter projects reach the NZEB standard through onsite renewable energy production. When the monitored results are compared to the design performance that is being stated as the initial goal, a quarter of the projects perform markedly better than projected while a third is underperforming.

EU funded projects are geared towards innovation. They operate, by definition, at the progressive edge of the market spectrum. Common practices however cover a wider spectrum, including a large volume of less ambitious or shallow retrofit that may also lead to suboptimal lock-in situations.

From this perspective, EU as well as member state policies need to address a double challenge: to eliminate the barriers for higher ambitions, innovation and upscaling, and subsequently to pull the entire market towards these increased performance levels.

1.2 INVENTORYING THE CHALLENGES

From the analysis of both projects and related professional and scientific literature, it comes forward that the massive uptake of retrofit for the residential building stock faces significant challenges, preventing real breakthrough scenarios to develop in practice. The identified main challenges may be summarized as follows:

1. A substantial share of the residential buildings has an atomized ownership structure at the level of privately-owned homes or the ownership is embedded in commonholds. Both situations lead to specific barriers for decision making towards retrofit investments and their actual financing;
2. Priorities of building owners rarely show energy performance in a lead position. In view of energy measures, residential building owners and tenants split up in different target groups, e.g. based on age, ownership structure or financial capacity;
3. Building envelope retrofit requires large upfront investments that only pay back on the long to very long term, up to the range of 30-50 years and more. Building owners often lack the investment means, as well as the investment horizon for undertaking such endeavours;
4. Compared to the extent and volume of the investments needed, the world of finance is not yet well prepared for supporting these, particularly in terms of addressing the fragmented target groups, assessing the risks and accommodating the very long payback periods.

3 Demonstrators are subprojects; most EU funded projects in scope of SCIS consist of a series of demonstrators that can have varying subjects, apart from retrofit, this can be new build, renewable energy production and storage, integrated energy infrastructures, mobility, smart solutions through ICT etc.

5 A survey by Navigant & Ipsos Belgium concludes that ‘the relative annual primary energy savings per residential renovation (comparing the performance of the building before and after renovation), taking the average of all energy renovations across the EU28 that took place between 2012 and 2016, is estimated to be at around 9% (8.8%).’ Navigant & Ipsos Belgium (2019), Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU, Final report to the European Commission, https://ec.europa.eu/energy/sites/ener/files/documents/1.final_report.pdf, p. 20.
6 The knowledge base for this paper goes beyond the projects in scope of SCIS to include information from the wider scope of EU-projects, relevant and similar initiatives in practice, reports from organisations like the JRC or the IEA and scientific literature. Besides the SRT, SCIS has also thematic items around retrofit like https://smartcities-infosystem.eu/low-energy-retrofitting, https://smartcities-infosystem.eu/low-energy-districts, https://smartcities-infosystem.eu/energy/building-envelope-retrofitting and related subjects in the Stories section.
5. Whereas a residential building renovation rate and related primary energy savings of around 1% per year are common average figures for the EU, in order to reach the EU climate targets, these figures should increase. Given the current situation in the building sector, this leads not only to an unprecedented investment challenge but also to an increasing and even critical capacity problem.

6. In order to accommodate for the use of renewable energy sources and to allow for low temperature heating, the average depth of building retrofit must be increased. In the long term most buildings will thus have to undergo a deep retrofit. This adds to all the previous challenges.

7. The diversity in residential buildings makes it difficult to revert to standardized and industrialized processes with a view on upscaled building retrofit programmes.

In this respect, retrofitting the existing building stock is substantially different from new construction and the rollout of renewable energy infrastructures.

All new buildings in the EU must comply with tightening EPBD requirements and shall be NZEB as of 2021, making new-build fully future-proofed with a view on the low carbon transition, while at the same time being in line with the market.

Meanwhile, many renewable energy sources have become financially competitive with their fossil counterparts. This applies to solar energy infrastructures.

Closer observation of the above-mentioned barriers helps to reveal structural factors of the replication and upscaling deficit for deep residential retrofit.

1. Atonized owner structure and commonholds. Regarding residential ownership structure, the situation differs from country to country. Individual home ownership is however dominant in the EU and varies from just more than 50% in Germany to up to nearly 100% in Romania with an EU average around 70%.

Some countries stand out with a substantial share of social (rental) housing like the Netherlands with a rate of 30%.

Regarding the dwelling typology, 42% of the EU housing stock are apartments with national shares varying to an even greater degree. All in all, individually owned homes and privately owned commonholds make up for a dominant share of the market, while they are at the same time the most difficult sectors for addressing collective and upscaled retrofit. Indeed, we observe that most progress in this field is currently made in contexts where there is an institutional owner (e.g. a housing corporation) professionally managing a large stock of dwellings.

Moreover, in this case the concerned housing stock is often of a uniform shape, better allowing for an industrialized approach. A good example can be found with the Dutch Energiesprong and its related initiatives like the REnnovates project.

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7 This rate strongly depends on what is understood as ‘building renovation’. In their extensive survey of both energy and recently also for wind energy at their fossil counterparts. This applies to solar energy infrastructures.


For individual home or apartment owners, the situation is different. To cite one city coordinator in a FP7 smart city project\(^3\), “the combination of high investment, construction hassle, many multifamily buildings, lack of knowledge and difficulty to find and trust good advisors/constructors and last but not least other things on their mind makes that many home owners are not doing these high-level retrofits. Although we all know something has to change, the urgency is not felt on an individual level for most of us.”

For commonholds, the decision structure complicates setting up deep retrofit in such a way that legal changes have sometimes to be implemented in order to afford for compliance with the national EPBD translations\(^5\).

The situation where retrofit projects are most often set up on a building-by-building basis prevents that economies of scale can be realised.

2. For building owners in general, and for residential home owners in particular, energy efficiency is not a primary concern. Home owners are first of all confronted with competing investment priorities for the budget they have available, and short-term concerns will hereby often prevail\(^16\). When asked about motivations for (or the appreciation of) a retrofit, respondents may place the financial savings stemming from the reduced energy consumption somewhere between the first and the fifth position on the order of rank, while other aspects like increased comfort, enjoying a new kitchen or bathroom, and living in a healthier or a more beautiful home may be judged equally or even more important. Environmental concerns like reducing carbon emissions rarely take precedence, however. An additional difficulty for understanding the investment motivations is that available sources give diverging assessments of this aspect\(^25\). Furthermore, the lack of awareness plays a role in the poor attention for energy aspects\(^24\) and may be linked to the spheres of concern that can be distinguished in the citizens’ hierarchies of interests, see the SCIS policy paper on replication\(^19\) and Figure 2. A last complicating factor is the different target groups with profiles and interests that differ on the basis of age, family composition, financial capacity and housing history\(^22\). Renters are, through the split incentive syndrome, an even harder target group to reach. Here, the preferred strategy will rather consist of convincing the building owner to invest in retrofit, and subsequently earn the investment back through higher renting revenues. Structural aspects of the renting market however prevent a simple one-to-one outcome in this context.

3. Building envelope retrofit is an expensive operation, dramatically increasing retrofit costs compared to the more affordable renewable energy technologies like PV, solar boilers and heat pumps. Cases in practice indicate a deep energy retrofit cost of a single family home of typically 40.000-70.000 Euro in the Netherlands and 50.000-80.000 Euro in Belgium with budgets over 100.000 Euro being common as well\(^21\). In France similar figures appear, e.g. for the EU supported OKTAVE programme, with representative cases displaying a retrofit cost of 70.000 over 140.000 and up to 220.000 Euro, of which the energy measures part respectively amounts to 50.000, 90.000 and 65.000 Euro\(^22\). The H2020 co-funded Superhomes retrofit scheme in Ireland indicates a range of 35.000-75.000 Euro\(^23\). For apartments, the deep retrofit cost will be lower due to smaller floor surfaces and a smaller share of exterior facades versus a higher share of party walls and floors. Deep retrofitting of different types of apartments in the FP7 smart city project City-zen (Amsterdam, Grenoble) shows a typical range of 20.000-65.000 Euro per apartment\(^24\).


\(^{15}\) An example in Belgium. https://www.gebouwbeheerder.be/renovatie-appartementsblokken-stilaan-ontward/


\(^{19}\) Smart City Information System, Why may replication (not) be happening - Recommendations on EU R&I and regulatory policies, SCIS, 2018, https://smartcities-infosystem.eu/library/publications

\(^{20}\) Marketing research documented in Oktave (2018), p. 21


\(^{22}\) Oktave (2014), p. 39

\(^{23}\) https://superhomes.ie/what-is-deep-retrofit/

\(^{24}\) City-zen deliverables 5.1 Retrofitting of Amsterdam towards zero energy buildings and 6.2 Retrofitting of Grenoble social housing buildings, http://www.cityzen-smartcity.eu/home/reporting/deliverables/

For any type of building, total retrofit costs may shoot up because extensive interior refurbishment is taken on or be-cause specific challenges must be addressed, like renovating heritage buildings or the need to remove asbestos.
Taking into consideration that energy cost savings of 1,000 to 2,000 Euro per year are a good performance for a single family home\(^25\), one understands that the payback time quickly amounts to the order of several decades. Given the high costs of deep building retrofit, many building owners will revert to a less performant project or do the works in phases. This brings on a substantial risk of suboptimal lock-in, whereby the executed renovation works delay, complicate or even prevent later upgrades to a higher, fully futureproofed level of energy efficiency.

4. Lack of (access to) appropriate financing is a barrier systematically coming back in project reporting and studies\(^26\). First, there are indications that the financial sector is not sufficiently aware of the level of the challenge. For example, at the 2019 Covenant of Mayors Investment Forum, the European Mortgage Federation put forward a range of 10,000-20,000 Euro to be accorded in plus to home buyers when the latter want to proceed with retrofitting upon acquiring the home\(^27\). Higher amounts were judged as generating too much risk. Second, many building owners effectively lack the financial capacity to take on large additional mortgages. This implies that alternative financing schemes must be developed, but most efforts in this sense are still at the experimental stage. Third, from the public policy point of view, subsidizing and taxing may have to be reconsidered in order to better realize the related overall, societal goals and to guarantee a socially just transition through appropriate redistribution mechanisms. Public authorities should hereby fully account of the many secondary benefits that come with building retrofit operations. This holds amongst others for reduced health expenditures, reduced energy poverty and increased local economic activity. Vulnerable groups will profit most of the secondary benefits of energy retrofitting\(^28\).

5. A critical, quantitative and qualitative capacity shortage in the EU construction sector: sampling the EU construction observatory’s 2018 reports brings forward a systematic message: there is a critical lack of labour force in both numbers and skills. This is the case both in Western and Eastern Europe with only individual cases like Greece and Italy standing out from the trend. It may hereby be suspected that the transfer of construction labour force from the Eastern member states to their Western counterparts adds to the generalisation of the capacity problem throughout the EU. Regarding (energy) retrofit of the existing building stock, this challenge is often appearing as even more critical, especially in terms of required skills and competences. The aging construction work force is another problem across the EU and indicates a low attractivity for young people to step in. Because of supply shortage, housing prices are generally on the rise – if they do not soar out of control with observed increases of 10 to 15% in just two years (2015-2017). In this way, the access to affordable housing becomes a real pain point.

\(^{28}\) This has been extensively documented in OECD/IEA (2014), Capturing the Multiple Benefits of Energy Efficiency, IEA. The impact of secondary benefits can hardly be underestimated. The report states, for example, that “[w]hen quantified health and well-being impacts are included in assessments of energy efficiency retrofit programmes, the benefit-cost ratio can be as high as 4:1, with health benefits representing up to 75% of overall benefits.” (p. 97).
The insufficient availability of qualified contractors, and most notably installers, is echoed in other recent research29. The construction sector is furthermore hampered by low growth in productivity and fragmented value chains. Somehow linked to these problems of capacity, fragmentation and low productivity is the high failure rate in the construction sector, further jeopardizing its output and clients’ confidence in building and installation contractors. Failures may occur as a consequence of bad work, but also through lack of communication, design errors, parties not honouring their contractual obligations, etc. High failure rates seem to be systematic and persistent in the construction sector, both in periods of low and high conjuncture. It may hereby be suspected that the widespread shortage of (qualitative) supply on the market enables contractors to at least partly transfer the cost of failure to their clients, thus making the sector to consider the situation as acceptable. It is difficult to supply a sharp overall figure for the EU, but failure costs may well be averaging between 10 and 15% of the sector’s turnover with some country estimates going over 20%. Hereby reported costs may remain an underestimate of the real costs of failure in the building sector30, and it is unclear how much poor quality is accepted without further being accounted of.

In addition, errors in planning and execution may also lead to higher energy consumption during the operation of the buildings. In the GrowSmarter project, it was estimated that energy consumption could go up with 10 to 20% due to such errors31.

6. An industrialisation deficit: compared to other industries, the construction sector stands out by functioning on a laborious project-by-project basis, and by operating through fragmented value chains. Although this is mostly due to the nature of the product – a building is not a consumption good like an appliance –, there is a lack of innovative capacity to be perceived in the sector as well. The capacity problem in terms of labour force also leads to contractors having their order books filled whether they innovate or not: the demand is there in any case. This further weakens the incentive to innovate. And finally, where industrialized production is envisaged, the diversity of the building stock still limits the possibilities of working at scale and speed.

Figure 2: spheres of concern: citizens tend to pay more attention, and attach more value, to aspects that affect their living environment directly and sensibly. (Renewable and/or own) energy production may approach these central focus areas of attention, but energy use and carbon emissions are both invisible and not directly sensible, hence more difficult to incentivise.

2. IDENTIFYING SOLUTION PATHWAYS

2.1 MOTIVATING AND SUPPORTING THE BUILDING OWNER TOWARDS WELL-INFORMED RETROFIT

From project experiences and research, it emerges that unburdening the building owner is an essential strategy for increasing the uptake of building renovation. This includes several aspects among which:

- Providing non-partial, neutral advice regarding the best possible retrofit strategy for the building. This advice does not only identify the preferred technical solutions for both increasing energy efficiency and installing renewable energy production, but also their possible roll-out in time. If works cannot be done in one operation, phased interventions should indeed be foreseen, according to an appropriate building roadmap. Such a building roadmap sheds full clarity on the building’s future-proofing over time and must help to avoid that the building owner creates a suboptimal lock-in situation, whereby the executed works at one stage jeopardize further energy-related improvements at a later stage. The advice may also account of the varying situation and needs of specific target groups (e.g. young families, empty nesters or owners of a multi-apartment dwelling);

- Providing support for acquiring the appropriate finance. The financing method can differ from a traditional mortgage, as a series of alternative financing schemes have started to emerge on the market, see also further;

- Taking away organisational burdens from the building owner, like carrying out administrative procedures, prospecting subsidies, reviewing offers, selecting contractors, managing building site processes, controlling the quality of the works, following up on bills and the like;

Four major axes of intervention are discussed for their potential of bringing relief to the barriers inventoried higher.

32 In the Innovate project, this concept comes forward as the ‘customer journey’, guaranteeing that interventions are coherent and consistent with the long term future-proofing of the house (Covenant of Mayors Investment Forum, 2019, Parity Projects presentation). In Flanders, BE, the digital home passport (digitale woningpas) is set to become a roadmap for the building’s future-proofing (https://www.energienparen.be/woningpas).

33 One example of such lock-in occurs where windows are being replaced without considering a later external façade insulation package. In order to avoid thermal bridges, this package must connect to the windows in an appropriate form and thickness, reducing the net available window opening. The window frames must be designed for this smaller net opening.

34 See e.g. the segmentation exercise performed in REFURB, cf. Covenant of Mayors Investment Forum, 2019, REFURB presentation, with six identified high potential segments: young families, owners of houses in post war suburbs with detached houses, empty nesters, owners of terraced houses with a high energy bill, convinced energy savers and owners of multi-apartment dwellings.
2.1.1 A PERFORMANT RETROFIT VEHICLE: THE ONE STOP SHOP

In optimal conditions, all these aspects can be taken care of through a one stop shop (OSS). One stop shops have meanwhile started to emerge in practice, and the concept is also advocated by the European Commission through the ‘Smart financing for smart buildings’ initiative and the latest update of the EPBD – Energy Performance of Buildings Directive 2018/844/EU. The EU Joint Research Centre (JRC) has studied the setup and produced a structured overview of case studies. JRC defines the OSS as follows: From a customer perspective, the integrated solution becomes a one-stop-shop (OSS) service in the building sector, when asset owners that would like to realize energy renovation of their buildings are aided in more than one step in the process. An OSS service transforms a cumbersome and complex set of decision-making/actions by non-experts into a single entry, customer-friendly offer.35

The French OKTAVE scheme discussed higher represents a well-elaborated example of the OSS concept. It is conceived as a public-private ESCO and provides technical, financial and legal assistance. OKTAVE also trains local contractors and sets up contractor pools to enhance the supply side. It moreover supplies a cash advance on the available public subsidies, so that building owners with limited financial capacity have this budget available before the works, rather than after. Another example grouping a series of 11 OSS in different member states is the Innovate project.36

An OSS setup may come with specific additional benefits. First, more trust and confidence from the demand side can be obtained if the OSS is (co-)managed by public entities, in particular local or regional authorities (e.g. Innovate). Second, impartial quality assurance is equally of high value for building owners, financiers and insurance companies alike (e.g. OKTAVE, HouseEnvest). One Innovative demonstrator has a retrofit coordinator as ‘custodian of the truth’ – a hint to the lack of confidence that generally hampers the standard renovation market. Certifications may support such quality assurance, like the NOM keur (Zero on the Meter certificate) developed by Stromversnelling in the Netherlands37.

Third, bundling of projects and contractors, as well as pooling of the associated risks, can generate a stronger business case, with better rates for financing.

And last, a well-designed OSS can overcome a major shortcoming of (commercial) ESCOs, being the short investment horizon. It is indeed improbable that purely private ESCOs could be a preferred one stop shop vehicle for realizing upscaled retrofit ambitions since their service offering will always be based on a positive business case with typical payback times for realized investments limited to 10-15 years. This would favour the unwanted lock-in effect. Moreover, ESCOs find it difficult to penetrate the residential market.38

The optimal technology choices for a building concept, like the European Energy Efficiency Fund with its combined financing and technical assistance; the HouseEnvest project, a public-private collaboration for increasing EE in multifamily dwellings by providing financial and technical support; the BE-REEL project with building passports/renovation advice, professionals training, certifying and collective retrofit demonstrators; and the REFURB project with its ‘compelling offer’. A further, more complex development of the concept could consist of setting up a special purpose vehicle that also manages interventions like urban restructuring or densification through demolition and reconstruction. A variant of this concept consists of ‘topping up’ existing buildings with a new floor while retrofitting them, so that the entire real estate operation (energy retrofit plus supplementary dwelling units) provides for an attractive business case. The H2020 supported project Abracadabra has researched such setup, widening it to ‘add-ons’ or ‘high quality volumetric additions’ that can be attached to any side of the retrofitted building.39

2.2 THE IMPORTANCE OF A GUIDING FRAMEWORK FOR URBAN RETROFIT:

CITY ENERGY VISION AND LOCAL AREA ROADMAPS VERSUS BUILDING ROADMAPS

The optimal technology choices for a building concept, like the European Energy Efficiency Fund with its combined financing and technical assistance; the HouseEnvest project, a public-private collaboration for increasing EE in multifamily dwellings by providing financial and technical support; the BE-REEL project with building passports/renovation advice, professionals training, certifying and collective retrofit demonstrators; and the REFURB project with its ‘compelling offer’. A further, more complex development of the concept could consist of setting up a special purpose vehicle that also manages interventions like urban restructuring or densification through demolition and reconstruction. A variant of this concept consists of ‘topping up’ existing buildings with a new floor while retrofitting them, so that the entire real estate operation (energy retrofit plus supplementary dwelling units) provides for an attractive business case. The H2020 supported project Abracadabra has researched such setup, widening it to ‘add-ons’ or ‘high quality volumetric additions’ that can be attached to any side of the retrofitted building.39

36 http://www.financingbuildingrenovation.eu/
37 https://nomkeur.nl/over-nom-keur/
39 A project fact sheet explains: Adding usable space through building extensions increases the real estate value of an existing property and is a way to finance the renovation of the whole building, making it more affordable to building owners. The idea behind this is that high-quality volumetric additions, which can be attached to an entirely new building, could be sold or rented out and thus reduce the initial investment allocated for the renovation. http://www.abracadabra-project.eu/wp-content/uploads/2019/02/ABRA-Fact-sheet.pdf See further http://www.abracadabra-project.eu/case-studies/
2.3 TAPPING INTO ALTERNATIVE FINANCING MECHANISMS

Building renovation, and most notably building envelope retrofit, requires a substantial, long term investment with correspondingly long payback times. Classical loans and mortgages are designed for this type of investment but may not bring the appropriate solution in many cases where retrofit is desirable.

Second, there is a need to evolve from a building-by-building approach to larger schemes, both for reasons of upscaling the renovation effort and for creating the possibility of upscaled, de-risked financing mechanisms to operate.

In this sense several existing or emerging financing methods can be identified.

In the realm of bank solutions and funding schemes these are, amongst others:

- **Dedicated funding through promotional banks, development banks, green investment banks**: these banks operate in areas where classical banks do not (usually) invest, by overcoming specific barriers or market failures that cause the problem. These failures can be, for example, unapplied external costs, uncertainty over future policies, asymmetric information or risk aversion.

  In Germany, KfW (originally Kreditanstalt für Wiederaufbau) is a public investment bank with a specific legal status that allows to issue, for example, soft loans (see also further). KfW has a longstanding tradition of financing sustainability measures such as energy retrofit of buildings and is able to achieve high leverage factors (up to a factor 20 of private to public investments triggered)41. In the case of retrofit, KfW smartly increases the financial support according to the level of energy savings achieved, thus stimulating investors to raise their ambitions.

  KredEx is a similar and highly relevant example in Estonia. In particular, KredEx set up a revolving fund issuing soft loans for increased energy efficiency in multifamily apartment buildings42.

  The common characteristics of these banks are their public ownership, a specific societal mission, a special legal status and the ability to finance ‘difficult’ projects through their non-profit character and special operating conditions, in particular by providing low interest rates and specific guarantees.

- **Dedicated credit lines (soft loans)**: public bodies offer the dedicated financing scheme at interesting conditions; ideally, they can refinance it one on one with private bank loans. Banks may however require too stringent guarantees from the public body. This in turn could be addressed by including **guarantee funds** in the operation. Soft loans may accommodate for long payback periods and their potential could be maximized by combining them with a one stop shop set up by the same public body that is issuing the soft loans. Soft loans may also well be combined with grants/subsidies, further easing the investment for the building owner. In the latter case, they may be regarded as a leveraging instrument, but practice seems to indicate that the leverage factor typically remains under 1044.

- **Energy performance contracting and ESCOs**: whereas the principle of an ESCO (energy services company) or the related EPC (energy performance contracting) is straightforward and attractive, a major shortcoming of current (private) ESCO/EPC schemes is that these only support investments that pay themselves back over a maximum of 10 to 15 years, see also the discussion of the one stop shop concept.

- **On-tax financing and on-bill programmes**: in the case of on-tax financing, the repayment of the investment in building related measures (both EE and RE) happens through an additional property tax bill, and thus goes via the (local) authorities. The public character of the scheme reduces risks and enhances trust building.

  The EuroPACE project is set up to experiment with this principle; the mechanism is already more common in the US46. EuroPACE projects are funded through the issuance of bonds. The annual repayments shall not exceed the yield of EE or RE measures. An EuroPACE scheme is moreover intended to stay with the property and not with the original building owner in case of sale (as does the property tax). However, this project envisages project times of up to 20 years which must be considered as a handicap in many cases (namely, for interventions with payback times of more than 20 years).

The public guarantee is essential in helping to de-risk the scheme. An additional advantage will be that public authorities guaranteeing such bonds will restrain from causing regulatory instability and hence, more financial risks, as they have now all the reasons to limit the latter.

A relevant example of soft loans provided for EE investments comes with the Nationaal Energiebespaaringsplan44.44

- **Local or regional dedicated public schemes and funds**: the principle is the same as for dedicated banks, but these are (conglomerates) of local and/or regional authorities that set up a scheme for dedicated financing, eventually with the inclusion of a guarantee fund. They will hereby revert to proper financiers where needed. The set-up may deliver extended services and even function as a complete one stop shop. An example of the latter is Picardie Pass Rénovation45.45

- **Grouping green loans or bonds into an aggregated portfolio** could be a variant of this approach. In a similar way, risks and transaction costs can be reduced and economies of scale may be exploited. One example is the very successful Swedish Kommuninvest Green Bond initiative for local authorities46.46 Single cities can equally work out soft loan schemes or they can alternatively be created at the national level47.

- **EU support funds**: The EU has developed several financial and/or process related support mechanisms through, amongst others, the European Structural & Investment Funds (ESIF), the European Fund for Strategic Investments (EFSI), the Private Finance for Energy Efficiency (PF-EE) and the European Energy Efficiency Fund (BEF).

Besides this, alternative financing solutions exist. Some of the most relevant instances are:

- **Dedicated credit lines (soft loans)**: these are amongst others:

  - **Dedicated funding through promotional banks, development banks, green investment banks**: these banks operate in areas where classical banks do not (usually) invest, by overcoming specific barriers or market failures that cause the problem. These failures can be, for example, unapplied external costs, uncertainty over future policies, asymmetric information or risk aversion.

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  KredEx is a similar and highly relevant example in Estonia. In particular, KredEx set up a revolving fund issuing soft loans for increased energy efficiency in multifamily apartment buildings42.

  The common characteristics of these banks are their public ownership, a specific societal mission, a special legal status and the ability to finance ‘difficult’ projects through their non-profit character and special operating conditions, in particular by providing low interest rates and specific guarantees.

- **Dedicated credit lines (soft loans)**: public bodies offer the dedicated financing scheme at interesting conditions; ideally, they can refinance it one on one with private bank loans. Banks may however require too stringent guarantees from the public body. This in turn could be addressed by including **guarantee funds** in the operation. Soft loans may accommodate for long payback periods and their potential could be maximized by combining them with a one stop shop set up by the same public body that is issuing the soft loans. Soft loans may also well be combined with grants/subsidies, further easing the investment for the building owner. In the latter case, they may be regarded as a leveraging instrument, but practice seems to indicate that the leverage factor typically remains under 1044.


On-bill programmes work following the same principle but in this case the finance supplier is paid back through a surplus on a utility bill, currently the energy bill. The finance supplier may be the utility itself or a private lender. This leads to two variants: one where the money comes from a (semi-)public body and is provided with very low interest rates, and one where private third parties supply the finance. In the latter case, the interest rate will still be lower than the typical market loan rates as the security of the scheme is enhanced by the link to the utility bill. This method is applied in the US since the 1990s.

On-billing has been suggested as one solution to overcome the split incentive syndrome in the residential rental market50.

**Loans or mortgages attached to the building** can be considered as a variant of the on-bill or on-tax schemes. The advantage is that the owner does not carry a financial charge for a building that is no more his or hers, thus providing for additional flexibility on the housing market.

**Special purpose vehicles** may be set up with a wider scope of investing in EE and/or RE, housing, energy infrastructures or other projects with a societal goal, thus going beyond the mere financing aspect. Two examples in the fields of energy, climate and sustainability are presented below:

- **Climate funds, revolving funds**: important drivers for setting up a climate fund are (1) to group and de-risk investments through the set-up of a structured and neutrally controlled pool of resources (societal rather than commercial objective, professional risk management, mixed shareholders open to professional investors as well as local enterprises and citizens); and (2) in this way, to allow for the financing of unprofitable yet socially important projects by redistributing the yields of profitable projects within the same pool of resources. The second aspect is thus instrumental in securing a socially just transition.

- **Public-private partnerships** (PPPs) are a proven concept for mobilising both public and private capital for investments of public or mixed public-private interest. A PPP must realize its win-win goal in order to be effective. An interesting example of a climate-dedicated PPP is ProjectZero in Sonderborg, Denmark51. Its set-up is as represented in Figure 3.

![ProjectZero: a public-private CLIMATE partnership](image)

**Figure 3**: functional structure of ProjectZero in Sonderborg, Denmark. Scheme taken from Peter Rathje, ProjectZero - a full scale Living Lab for Green Energy and Climate solutions, presentation given at the IEE REQUEST Closing Event, 05/08/2012, Stockholm.

Independent from the opportunities that alternative funds and financing provide, the JRC opinions that financial institutions ‘could and should intervene through provision of risk guarantees priced against the real as opposed to the perceived risk profile’ of energy efficiency investments in buildings. ‘Initially, guarantees would encourage banks to explore default risk beyond their current conservative horizons with respect to energy efficiency lending. The banks would then gain from the reduced risks, and in the long run this should lead to a greater willingness to lend to energy efficiency and more favourable lending terms, stimulating greater demand for loans without the need for guarantees’52,53.


51 http://www.projectzero.dk

52 Zancanella, P., Bertoldi, P., Boza-Kos, B. (2018), Energy efficiency, the value of buildings and the payment default risk, JRC, p. 34.

Regarding the roll-out of innovative technology solutions (or combinations of solutions), a **double challenge** can be identified:

- Deploying the **4th industrial revolution for the building (retrofit) industry** through digitalisation, automation and prefabrication which concerns mainly the individual building level; and

- Deploying **community/district energy infrastructures** that allow groups of (retro-fitted) buildings to generate, use, store and exchange energy (heat, cold and electricity) which concerns mainly the district/community level. This aspect is related to the development of Local Energy Communities (LECs), Positive Energy Districts (PEDs) and the peer-to-peer electricity market.

Smart industrialization of the retrofit process implies reverting to customized industrial production in order to evolve from the artisanal project-by-project approach characteristic of the current building sector towards a maximum of factory-prepared and (semi-)automated output. This includes quality standard metrics, pre-defined retrofit project approaches, efficient coordination of participating home construction contractors and measurement and verification of energy savings. These process standards are often produced as a by-product by the public(-private) OSS vehicles, based on the field experience gained through the latter’s project portfolios.

An example of this approach is demonstrated through the REnnovates project. A new, prefabricated skin is placed around existing houses in 3 working days, while the residents continue to occupy their home. The new skin includes PV panels for onsite renewable energy production, allowing the homes to reach a Net Zero Energy standard. A technical module with a heat pump, domestic hot water production and storage, HVAC provisions, a PV converter and a battery for electricity storage is added as an external, stand-alone component and connected to each house. Through a smart grid setup, the building also exchanges electricity with a district battery, thus providing flexibility services to the community.
Retrofitting existing buildings is not an obligation. Requirements related to the energy performance of an existing building will only apply, e.g. when a building undergoes major works that need a building permit or when it is rented out. By contrast there are, at the level of the EU EPBD directive, currently no obligations to retrofit a building when it is sold. The EPBD does however recommend such, pointing to ‘trigger points’ in the life cycle of the building, where an energy retrofit has more chances of being executed at affordable cost and in the best practical circumstances. Member states should in general ‘stimulate cost-effective deep renovation of buildings, including staged deep renovation’ through appropriate strategies, action plans and support mechanisms (Art. 2a).

From the policy point of view, and given the slow current renovation rate of the existing building stock, this implies that the stock to prepare it for the 2050 energy and climate goals will much depend on stimulus.

This implies that actions at different policy levels (local, regional, member state and EU) are recommended to (1) eliminate as much as possible the barriers identified under section 1.2 and section 1.3 and (2) support all contributing factors of the solution pathways discussed under section 2. This holds in particular for institutional and regulatory barriers on the one hand (for example, regulation forbidding to increase the social housing rent proportionally to the operational savings realized after a retrofit) and institutional and regulatory facilitation on the other hand (for example, creating the legally favourable context for the implementation of local energy communities and peer-to-peer energy trading), see also the previous policy paper “Why may replication (not) be happening?”.

From the above analysis it has become obvious that local and regional authorities can play a pivotal role in facilitating and upscaling the retrofit effort.

3. POLICY RECOMMENDATIONS:
SUPPORTING INCENTIVES FROM THE LOCAL TO THE EU LEVEL
3.1 GENERAL EU POLICY OUTLOOK

The adoption of a European Green Deal by the new European Commission, taking up function as of November 2019, promises a favourable policy context for addressing the EU building stock retrofit challenge. Hereby a housing renovation programme will be ‘one of the flagships’ of the upcoming Green Deal, according to an Euractiv press report. The report continues to precise that ‘funding from the European Investment Bank (EIB), which recently overhauled its energy lending policy, could also be mobilised to ensure residents don’t have to find tens of thousands of euros upfront – which they simply don’t have, (as Vice-President of the EC) Timmermans suggested’.

In line with this, it could be recommended to align the ‘best of class’ in developing the One Stop Shop concept or other integrated value chains in the retrofit sector with structural funding (EIB, EEEF, ESIF, EFSI, PF4EE... ) in order to inject finance where it is best spent. This would mean that such innovative setups can evolve from ‘niche’, as labelled by the JRC in 2018, to mainstream practice.

3.2 REGULATION DERIVING FROM THE EPBD AND THE EU ENERGY MARKET RULES

Output from SCC Lighthouse Project Group workshops has made clear that policy makers could adjust regulations to facilitate permitting for energy retrofitting and to allow and promote energy exchange between buildings. It is ‘suggested to apply regulations related to building properties on the building level and energy supply regulations on a community level.’ From the combined GrowSmarter-Remourban-Triangulum end conference (Brussels, 8 October 2019) it was recommended to ‘reconfirm that national taxes and regulations support and do not restrain the production of local sustainable energy from photovoltaics, wind, biogas and encourage uptake of excess heat’. SmartEnCity advises further to ‘set up requirements to facilitate the connection to the district heating or establishing conditions on the (retrofit) funding which make connection a pre-requisite’ i.e. making sure that enough individual buildings connect to the local, collective district energy systems in order to make the latter feasible and profitable. It continues with advising to ‘take a more holistic approach to urban retrofitting not solely focusing on the energy frame of the single building, but the overall energy consumption of cities and districts and the most cost-effective way to bring down energy consumption/or obtain RES supply’. This may go against the unbundling and choice of energy provider principles that have been embedded in the EU energy market rules, implying that the latter may have to be revised, see also the corresponding analysis in the previous policy paper ‘Why may replication (not) be happening?’.

In addition to the current barriers for rolling out real P2P electricity trading, the data privacy regulation is often mentioned as another factor complicating the effective development of district energy management systems (DEMSs), virtual power plants (VPPs) and the like. A similar reflection holds for the energy consumption data of individual buildings, where the privacy rules complicate the assessment and the communication of building performances and, up to a certain level, the effective roll-out of collective actions.

Policies within the member states should address the retrofit challenge through properly designed redistribution mechanisms, assuring that fragile target groups are on board, and by fully incorporating secondary benefit accounting, such as reduced social expenditures stemming from better housing conditions. Once the diverse societal benefits of deeply retrofitting the existing building stock have been considered, the ‘business model’ for deep retrofit can be assessed from a correct verification basis. Hereby the benefit for society will be more than the sum of the profits of the individual business cases, as win-win situations will occur.

In the context of the EPBD, it is hereby important that effective area measures are not hindered by restrictive building measures that have been conceived from a too narrow, single building perspective. It is therefore recommended that both mutually coherent building roadmaps and area roadmaps, in particular heat zoning plans, are developed throughout the member states. For their part, consistent building roadmaps shall also help to avoid sub-optimal lock-ins when gradually retrofitting buildings to a future-proofed standard.

In the domain of Positive Energy Districts (PEDs), it will be rewarding to put a strong focus on retrofit PEDs – PEDs developed within the existing urban tissue. They present in fact many more challenges than PEDs newly developed in green-fields or re-constructed brownfields.

3.3 POLICY INCENTIVES AT THE MEMBER STATE LEVEL

The combined GrowSmarter-Remourban-Triangulum policy paper recommends allowing local authorities to set higher requirements than national energy-related regulations, e.g. regarding retrofit ambition levels. This principle might be extended to the domain of LECs and peer-to-peer trading of energy. In this way, a positive and upward competition between cities can also be enhanced.

SCC Projects ask furthermore for a stable or predictable legal and institutional environment with ‘stable incentives and programmes for deep retrofit’. As such, Remourban recommends a ‘National Government...’

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56 https://smartcités-infosystème.eu/low-energy-retrofitting
58 Stendorf Sørensen, S. et al. (2016), Review of regulatory gaps and recommendations to facilitate city transformation processes (project deliverable 2.1), SmartEnCity, https://smartenicity.eu/media/smartenicity_d2.1_review_of_regulatory_gaps_and_recommendations_to_facilitate_city_transformation_processes_v1.0_1.pdf, p. 32.
59 Garcia-Fuentes, M.A. et al. (2019), op. cit., p. 3.
Policy that is constant and does not lead to “boom and bust” pricing around external retrofitting and also does not focus on the cheapest options – such as insulation in isolation of other interventions.” SmartEnCity advises that (energy supply) ‘support schemes should have a long continuity in order to promote trust of investors.’

The previous policy paper already indicated that the market needs additional price signals to evolve in a sustainable direction. Green tax shifts, and implementing carbon taxing in particular, are hailed as effective measures to reach this goal.

3.4 A NEW MOMENTUM FOR THE CONSTRUCTION SECTOR

The capacity problem in the construction sector demands specialist intervention. From the above analysis, it may be clear that, apart from preparing the sector for Industry 4.0, it is necessary to make it attractive for young and highly skilled professionals. Indirectly, this also implies that professional education shall be enhanced in order to respond to the major challenges ahead. This demands a concert-ed effort from actors in the construction industry (e.g. industry federations) and the education system. It is however beyond SCIS’ competences to advise on the details of such concerted action.


61 Stendorf Sørensen, S. et al. (2016), op. cit., p. 32.
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