IDEAS

Novel building Integration Designs for increased Efficiencies in Advanced climatically tunable renewable energy Systems

Work Package 6: User Community Engagement

Deliverable 6.2, In-depth Interviews Report

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1. Introduction

In-depth interviews are a qualitative social research method which allow to gather comprehensive information from stakeholders. This phase of the research within the WP6 is aimed at obtaining information on the factors that could drive or hinder the adoption of an innovative energy system such as the one proposed in the IDEAS project. The analysis entailed interviews with selected experts dealing with energy efficiency in the building sector, in the Irish and Italian territorial areas where the IDEAS pilot projects will be implemented. More specifically, the interviewees were representatives of the following categories: builders, architects and engineers, house owners, real estate agencies, the credit sector, the municipal administration.

In particular, the opinion of the representatives of real estate agencies, house owners association and building contractors was important to outline the real estate market current conditions, both as regards new and used buildings; and to gather their opinion regarding the relevant attributes of the dwelling taking into consideration by buyers/owners when the buy or renovate a house, with specific focus on energy efficiency requirements. Architects and engineers have been interviewed in order to obtain expert point of view on various technologies that can be used to achieve higher energy efficiency in buildings. The credit sector category is relevant to understand if and how banks or other credit institutions promote energy efficiency with specific products/initiatives, and to get a grasp of the criteria used when the loan is aimed at energy efficiency projects. Municipal administrations stakeholders were selected to provide an overview of the administrative procedures regarding energy efficiency in new constructions and in renovations in the two areas (Ferrara and County Mayo).

In order to facilitate the comparative analysis, the interviews had been semi-structured: the interview was based on an outline which was the same for the Irish and Italian stakeholder in each category, it was left to the ability of the interviewer to leave room for wider or deeper discussion on specific topics. The interviews were conducted between July and October 2019. The interviews have been all conducted face-to-face, but one, with the Italian architect, which was on telephone. In the Italian case, all stakeholders have been interviewed in Ferrara, but one in Modena (in the same region, Emilia Romagna); in the Irish case, all stakeholders have been interviewed in County Mayo, but one in Dublin.

The themes discussed in our in-depth interviews have been chosen on the basis of the results of the first stage of the research (Desk analysis). This report contains a commentary of the results, accompanied by selected excerpts of the interviews. The analysis is structured as follows: the next section summarises the stakeholders' opinion regarding people's awareness on energy efficiency issues; Section 3 deals with the current situation of the property market, and the factors that could push it or slow it down; in Section 4 we report the stakeholders' opinions on the effects of the regulation on new constructions, refurbishments and the promotion of energy efficiency; the credit sector and its role in

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supporting energy efficiency is discussed in Section 5; the views of our respondents on the technologies relevant to the IDEAS project are summarised in Section 6; finally, the suggestions proposed by the stakeholders to promote energy efficiency are summarised in Section 7, which concludes the report.

2. Awareness of Energy Efficiency Issues

In general, the stakeholders involved in our study seem to share the view that households do not perceive the importance of investing in energy efficiency. It is argued that if people were aware, they would ask for specific energy efficiency technologies, and the supply side in the housing market would respond; but "*the client... not always is yet aware*; ... *if nobody asks for certain things, nobody is going to make them*" (REA-IT). "*If the final user is not aware, energy efficiency cannot be a trigger for the housing market*" (B-IT). Cost concerns are prevalent, even when people have some awareness of the impacts that their energy consumption behaviour has on the environment: *"... I think that a lot of people are more aware of energy savings… You know, their responsibilities to [...] the environment. So, all of these things could be factors [...] but of course, as always, money concerns are number one, I suppose, for most people"* (B-IE). In fact, part of the demand for energy efficiency investments may be driven by the need to reduce costs (*"The most part of those demanding energy efficiency want no gas heating, so that they avoid the fixed charge of the gas utility"*, ARCH-IT; "*They want assurances that their home is energy efficient and... their utilities bills will be decreased*", REA-IE). In Ireland, the Building Energy Rating (BER) seems to be relevant for buyers: "*[…] it's a mechanism to gauge for the buyer […] how energy efficient their home is, so it's a tool for the buyer, an information tool"* (HOA-IE); as confirmed by the local auctioneer as well: *"[…] People are very, very concerned about […] So, yes, it's very important for people. It's the first question they'll ask you when they go into the house: 'What rating has the house'"* (REA-IE). Nevertheless, the same stakeholder, when asked *"Do you think that buyers are sufficiently informed on energy efficiency issues?"*, answers: *""No, I don't, to be honest"* (REA-IE), and others agree on this (*"Probably not informed enough"*, B-IE).

Also in the Italian case people do not seem to be fully informed of the advantages of energy efficiency: "*The private citizen is still lacking information*" (REA-IT). Investment on energy efficiency is thought not be worth the cost, unless we are dealing with new, high quality buildings: "*Customers interested in the energy rating are [those] looking for new buildings*" (HOA-IT). There seem to be a completely different demand for energy efficiency in the two markets of new and old buildings. People looking at new houses demand a certain quality also in terms of energy efficiency: "*Now, from a new build point of view, yes, they would be looking at to get an energy rating and, you know, an air tightness rating and all that type of thing*" (B-IE). *"...There is always a huge difference in the requirements between those who look at new rather than existing dwellings; ... the customer who looks at new houses expects*

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that the energy rating is high... let's say that if they look at new buildings it's because they give importance to this aspect" (REA-IT). In contrast, in renovations people are not so keen on investing money to achieve a high level of energy efficiency: "*In renovations, not so much, they'd be looking for it, but a good level of insulation... I don't think... Unless somebody was thinking about possibly selling, they might be looking to get that extra bit, so they'll get the extra few pounds. That type of thing, you know. It's not something that people think they are going to hang their hat on that they are going to hit a rating*" (B-IE); "*over 100 apartment renovations, 90 are only space restructuring, and 10 also include energy efficiency interventions. The numbers are not high*" (ARCH-IT).

Energy efficiency is indeed considered as a luxury good: "*People who can afford it may look at the energy rating*", but for people who "*are struggling [...] the energy rating is not taken into account*" (HOA-IT). The neglect for energy efficiency is even more evident in the rental housing market: in the Italian case, the current market conditions are such that there is no interest in investing in energy efficiency "*because there is no return to the investment*" (HOA-IT) given the current market rental prices. In the Irish case, a difference is made between urban and rural sites: for some, in rural areas energy efficiency receives more attention also in the rental market *"...In the rural outskirts, buyers are asking and tenants are asking for that information* [on energy efficiency]" (HOA-IE); others hold a different view: "*I think the urban dweller is a little bit more concerned about efficiencies I think somebody living in the country can... I think the urban dweller, I think yes, they are much more concerned with it versus the rural dweller"* (REA-IE).

Some say that energy efficiency is pursued only because it is a regulation requirement: "*The regulations say you have to put in some class of an energy saving device, energy creating device*" (ARCH-IE), so people put the minimum size required, such as 1 square meter, only to comply, but the application is "*not really thought through*" (ARCH-IE). *"*[In Emilia Romagna] *PV is now mandatory in deep renovated and new buildings, so... there are people who say 'okay, since I have to install some PV, I don't care, let's only put the minimal that I would need', and this can be done*" (ENG-IT). An interviewee says that the administrations should inform more thoroughly the various stakeholders and the general public on regulation regarding energy efficiency: "*It should be the Public Sector to inform on the specific regulation, it should give indications on the normative requirements*"; and more in general to increase awareness: "*Why don't the Public Sector conduct a sample survey, so that it can raise awareness in the private sector?*" (REA-IT).

3. Property Market

The main issues in the Ferrara real estate market are: demographic stagnation, leading to a decreased demand for housing (HOA-IT; B-IT); excess of unsold existing buildings (HOA-IT, B-IT), due to the 2008 economic crisis; the role of the banks, that act like "competitors" of real

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estate agencies (B-IT) and do not offer credit access neither to potential homeowners, nor to builders (B-IT). In addition, "*the real estate is heavily taxed (excluding the first house) and it does not work, there is no profitability"* (HOA-IT), except in some cases (e.g. dwellings for students, or short term rent to tourists).

Looking at the national level, the market registered around 900,000 sales in 2007, touched the bottom in 2013, with around 400,000 sales, and at present it is just under 600,000 sales. So, in the last 4-5 years, there was an increase in the real estate transactions (including both the new and the second-hand market), that however has not been accompanied by an increase in prices, "*and when an economy increases only the sales but not the prices is not a good signal to me, absolutely"* (REA-IT).
If, in general, "*the real estate market in Emilia-Romagna is still stagnant"* (REA-IT), Ferrara (and its province), in particular, is having an even harder time, since it has suffered more than other cities (e.g. Bologna) (REA- IT). Indeed, *"the city has experienced a serious crisis since 2007",* and it is *"getting a little better only now"* (ENG-IT). *"The market has slowed down a lot, also in terms of prices [...] that, in any case, cannot be compared with those of Bologna or Ravenna. There has been a lot of building in the past, not anymore"* (MA-IT), so that, at present, "*there are no new constructions* (or *"very little",* REA-IT), *but only renovations"* (ARCH-IT).

More precisely, whereas in the city centre the housing market cannot be said that is going well, but at least it is coping, in the outskirts – with few exceptions - the situation is even worse, "*it's a disaster*" (B-IT); "*there is an excess of supply... there is no money, and the bank sector does not help those who do not have [financial] resources... the state of affairs isn't happy, neither in the short run, nor in the long run*" (HOA-IT). The city centre has been revitalised by the presence of students, while for them it would be a problem to reside in more peripheral areas: "*2 or 3 km from the city centre... there are not transport services, no opportunity of a social life*". The consequence is that the city centre has been transformed, with many "*old shops being replaced by food shops, take-away, chain restaurants"* (HOA-IT).

As regards the housing market for students, it is seen as a clear opportunity for rent seeking: "*Those who want to invest in this sector look for ugly old apartments that are cheap and do not renovate. They are 1960's apartments to be given to students without renovating at all",* since those who pay for consumption are the tenants, therefore landlords *"are not encouraged"* (HOA-IT). Policy instruments such as tax deductions are *"not sufficient to activate the renovation"* (HOA-IT).
And yet, another problem concerns the market value of existing buildings: "*The [HOA] associates"* are not selling their properties "*because if they sell now what they bought 10 years ago, today is worth half*". Those who bought a second house in 2007, when it seemed a security, used to think that with a small mortgage, and renting out the apartment, in 15 years they would have owned the house. But *"today 90% of our associates would sell if they found someone to sell to at a decent price"* (HOA-IT).

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The public sector should support the building sector through financial tools, but this is not happening (B-IT); financial support to energy improvements could help the sector, but investors require more certainty about the policy interventions: "*It's not nice to live day by day, so that every year you've been told 'this year you have this support, next year maybe not'... Uncertainty hinders any decision making... Should I or should I not? And for firms: should I plan or should I not?"* (REA-IT). The only market which is going well is the tourism short-term house rental, which has boosted proprietors' revenues (*"… from 500-600€ per month, that was the average rent, to 1500/2000€"*); so, they could be encouraged by policy measures to invest more money on renovation, also improving energy efficiency, and this would be an advantage for the whole housing sector (REA-IT).

As regards the general trend of the real estate market, a very similar situation can be found in the Irish case. The Irish stakeholders agree in saying that the property market, at the moment, is *"relatively slow"* (B-IE) and *"not great"* (REA-IE). It emerges that "*there isn't enough being built"* (ARCH-IE), not even in the larger towns, and that "*there seems to be a lot of older houses been bought up and renovated than new builds"* (B-IE). On the other side, however (and contrary to the Italian situation), there is a "*huge pent-up demand to start building*". But "*it's very hard getting the work done"* as *"there's a chronic shortage of building workers, a huge shortage",* due to the fact that*, "because of the recession, [...] all the Polish workers went back home"* (ARCH-IE). And, above all, "*there is a construction inflation at the moment. The cost of building is high in Ireland",* and this is probably retarding the potential in growth (ARCH-IE). In other words, *"we don't have any new development coming on the market at the moment, because they are telling us that it's too expensive to build a house at the moment. You can't make money on that"* (REA-IE). Uncertainty regarding future market trend plays an important role: *"The famous word Brexit has an impact"* as well (REA-IE); "*the banks are a little bit more careful in assessing the loan applications from the point of view that they don't know how safe some jobs are... So, yes, things have slowed down in the last 3 months, I think, particularly just waiting to see what happen with Brexit. It's a double-edged sword, that's people afraid what's going to happen if prices going to drop. And, I suppose, when a vision negativity comes into the Dublin market, it hits my part of Mayo very, very quickly*" (REA-IE). There is a huge shortage of houses, nationally and in County Mayo as well (HOA-IE). In particular, "*there isn't enough housing, especially for people who don't have very much money. The state has abdicated completely on their obligation to provide a certain amount of housing. Forty years ago, more than half of every house built in Ireland had an input from the State. That figure is now 5-10%".* This "*precipitous drop"* is *"exacerbated by the fact that, during the recession, we stopped building anything altogether. So, we're just so far behind now, we'll never catch up"* (ARCH-IE).

When asked about the most prominent sector in terms of investments in real estate, the stakeholders' opinions differ: some identify it with "*the housing market, by a long shot"* (REA-IE, HOA-IE), whereas the commercial or retail sector are seen as "*very very weak"*

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(REA-IE, HOA-IE); others say it is the public sector, since "*there are a lot of school and public works going on, whereas private work is slow*" (B-IE); "*and filling in brownfield and rebuilding existing buildings in the city… Very little going on outside the city* [Dublin] *[...] And it's not affordable housing".* (ARCH-IE). However, in perspective the drivers in the property market are identified with demand by households, due to the shortage of housing (HOA-IE), and with the fact that "*people are back at work and they're paying high rents, and they're trying to find a way to buy a property rather than have to rent it*" (REA-IE). The demand would be addressed in particular towards small dwellings (one to two-bedroom units), as opposed to larger homes, "*that are probably beyond the reach of families that are struggling"* (HOA- IE). The public sector is an important client for developers: "*60-65% of the work that we would do now would probably be public works*" (B-IE).

Tourism has an impact on the demand for housing in the residential sector, particularly in places where there is a high percentage of holiday homes (HOA-IE), and many investments would be linked to tourism: in fact, "*if you were talking per square foot, excluding Galway city, Westport would probably be the dearest and Kinvara in Galway the second dearest*" (REA-IE). As regards the impact on energy efficiency, the high percentage of second or third homes could be a deterrent to energy efficiency projects in the community, because these owners would not be interested; households and natural resources should be pooled together within a wider geographical area (putting applications together for SEAI – Sustainable Energy Authority of Ireland), to push forward renewable energy projects (HOA-IE).

4. Regulation

As regards the Italian case, the regional (Emilia Romagna) regulations[1] require that all new or deeply renovated buildings be NZEB. There are sticks and carrots; on one side, the regional regulation imposes that even for mild renovations the homeowners are required to produce energy efficiency certifications. On the other side, there are some measures introduced by the Ferrara municipality, through its Building Regulation, which benefit those who build with higher efficiency standards than those required by the Regional law: for example, they have milder requirements on Building Coverage ratio and green open space areas. A new regulation makes the reduction of development charges compulsory (MA-IT).

[1] The EU Directive on energy end-use efficiency and energy services (2006/32/EC) established that, starting from December 2018, all new or deeply renovated buildings had to be Nearly Zero Emission Buildings (NZEB). Emilia-Romagna, with the Resolution no. 1715 of 24 October 2016, has become the first – and, at present, the only - Italian Region that has introduced an obligation for new buildings to be NZEB, bringing it forward 2 years as compared to the European regulation. Therefore, the obligation for all new public buildings to be NZEB started on January 1st, 2017, and the one for private buildings on January 1st, 2019.

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In Ireland, counties or municipalities cannot establish specific regulations on energy efficiency: *"Not really. It really comes from national policy, particularly building regulations, but what we can do, at a local level, is maybe assist in our land-use planning, dedicate areas for renewable energy, and we can designate decarbonisation zones or initiatives, low emissions zones for park, for transport"* (MA-IE). Hence, the role of municipal or county administration is associated with demonstrative projects, rather than regulatory activities: *"Where we can have a role is as an exemplar to our communities, we can deliver this stuff and then show them [...] how it works, [...] the value from both financially and from living point of view"* (MA-IE). Mayo County Council, as all local administrations, has to comply with national regulations: *"I suppose all the local authorities have that 33% target, so we're pretty close to that at the minute"* (MA-IE).

In both countries, the regulations entail the obligation of an energy certification for most buildings: "*It's a requirement for the local authority to have a BER in their own housing stock… In the social housing sector, the housing stock has to have a BER... it's law that when you're selling your house you have a BER"* (HOA-IE), with some exceptions: *"[…] legally, we are obliged now when we put a property on the websites, it is not saying everyone is complying – they're probably 90% compliant - every property we have on a website unless it's not applicable in some cases of very old building or a Georgian property"* (REA-IE). But, in Italy, some stakeholder disapproves the way in which the obligation has been presented: *"[…] when it came out, it came out in a way that, to get people to do it, it was taken the example of Lombardy that was subjecting people to sanctions… 'If you don't do it, you get the fine, and so you have to do it for this reason'... If it had been presented in a fairer way […] it would have been better understood and accepted..."* (REA-IT). In addition, the achievement of specific energy classes is required and, since contractors have to comply with the regulations, the new buildings have to get a high energy class: *"Every new build […] would be hitting a B anyway. And that's driven by the Local Authority"* (B-IE).

In the Italian case, the implementation of the new regulation on NZEB entails important consequences for the real estate market. For example, the NZEB requirements imposed by the Regional Government were supposed to push the renovation market; however there seems to be a clash between the Regional policy and the municipal administrations' interest to get revenues from building/renovation charges: *"The Regional government would like to support restorations, and deter new constructions through increased development charges... city councils decide that for renovations the charges are the same as before, and for new buildings they increase exponentially*" (HOA-IT), so that in practice new constructions are inhibited, but also renovations are not supported by the municipal policies. Moreover, the renovation of existing buildings can be more difficult, especially if they are located in the historic centre or if they are classified as "historical buildings" (REA-IT, ARCH-IT), while the construction of new dwellings "*it's faster, you start from scratch and that's it"* (REA-IT). In fact, as regards historical buildings, "*it's okay not to demolish historic houses, it's okay not to occupy new territory with new constructions, but you can't do a 'pigpen museum'. Some*

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homeowners change the damage class [the stakeholder refers to buildings damaged by the earthquake that hit Ferrara in 2012] *from 4 to 5 (total destruction), so they do not have to restore everything. Restoration imposes too stringent obligations, and the homeowners do not restore... The regulation does not consider the market demand. People do not transform buildings anymore and the market is not moving"* (ARCH-IT).

As regard the location, the buildings situated in the historic city centre have to comply with regulations that limit the use of some technologies: in the city centre of Ferrara, in fact, it is not possible to install neither the solar thermal nor the PV on the roof, "*because of their high visual impact"* (MA-IT). In order to get round this issue, it is possible to apply horizontal photovoltaic panels on pergolas, but this is less efficient; in addition, it is possible to employ the Integrated PV but only on roofs, not on facades. In contrast, it is noticed that the air conditioner splits are widespread (also on the roofs), "*because for an installation below 5 kW no building permit is required, and therefore there is no communication to be made to anyone"* (ENG-IT).

Generally, "*if you want to renovate, at the minimum you need a surveyor [...] It's difficult to put in a wall insulation, change the windows or fix the system without making a little project"* (ENG-IT). And the new regulations, in this regard, are "*quite stringent"*: for example, "*if you replace a window, you have to bring me an energy certification as required by Law 10, and if you don't think about it you'll have a 900€ fine. That's a bit too much; it would be sufficient to have calibrated compensatory measures*" (MA-IT).

Another aspect underlined by the stakeholders is related to the construction cost (ENG-IT, HOA-IT).

In the Ferrara territory, this cost is already usually higher than the market value of the building, and referring to the NZEB standard, someone worries: "*You can imagine what will happen with this thing"* (HOA-IT). However, other stakeholders think that the increase would be contained, since compliance to the NZEB will basically involve the application of a thicker thermal insulation ("*It will probably imply a 10/15% increase in price",* ENG-IT). Anyway, whether home buyers like it or not, the cost will be higher if they are building a new house, unless they build a wooden house, that would cost "*a third, a fourth... The costs are very low*" (ENG-IT).

From a consumer point of view, the impression is that people tend to do the bare minimum to comply with the Emilia-Romagna regulations on energy efficiency, installing just what is strictly necessary (ARCH-IT). In other words*, "the renovation is carried on up to the subsidy threshold"*: e.g., *"since the minimum required by the legislation in order to get the 65% of the grant is a 12 to 14 cm wall insulation, the clients are pushed towards this solution"* (ARCH-IT). But, on the other side, it emerges that *"with regard to new buildings... the minimum is always largely exceeded, to get the subsidies and achieve a higher level of self-sufficiency through renewable energy"* (MA - IT).

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In this sense, regulations play an essential role in promoting energy efficiency: *"Fortunately there are rules that oblige people to respect some construction criteria related to energy efficiency, because the private citizen who has to make a choice on his/her own is not sufficiently knowledgeable as yet"* (REA-IT).

In particular, as regards the tools provided by the Government to promote energy efficiency (i.e. the Ecobonus, the Sisma [Quake] bonus etc.), the opinions among interviewees are quite heterogeneous: on the one hand, it emerges the idea that these tools are known by citizens, but they are not achieving what they were supposed to ("*Substitution of a boiler when the system is not set to make the new boiler work at full efficiency, does not make sense. The same as regards the air conditioner. The Ecobonus used to install a new air conditioner does not make sense. Maybe to replace an old air conditioner with a new one is OK, but as far as I know it is used also to install new air conditioners. It is allowed even to people who simply buy a new system, as long as it's heat pumps*", HOA-IT). On the other hand, the idea is that, even though they would be important to achieve quality and to make renovations, these policy instruments are not well known, not even by professionals: "*If you ask professionals, little do they know*" (B-IT). The measures are seen as being too complex, and not precisely targeted: "*The credit assignment has been implemented, but among those who could actually start the process, i.e. the condominium managers, it is perceived as a burden. So, they do not push for it, because it's another thing to do for their clients... maybe they think that their own gain is not enough*" (B-IT). It is suggested that the credit assignment policy should be changed "*so that people get it in advance, and not after 10 years*" (B-IT). As regards the Sisma bonus, "*if it had been created shortly after the 2012 earthquake, people would have shown a greater interest; but, 7 years later, there is a psychological detachment from both the earthquake and the energy efficiency issue"* (B-IT). Another important issue highlighted by the Italian stakeholders concerns the lack of certainty about the rules and the incentives system (ARCH-IT, REA-IT). The problem is that *"uncertainty makes the initiatives complicated"* (e.g. for firms) (REA-IT). *"The rules change continuously. Even in the construction market itself. If I demolish and rebuild a dwelling, I've a 10% VAT, but on the new I've a 4% VAT: why?"* (ARCH-IT).

Or yet, regulations may *"not even [be] restrictive, but every day, every week, there's something new. You can't never come full circle"* (ENG-IT). For example, the introduction of new obligations (e.g. the one to reclaim hot water from showers in some types of buildings) "*makes hard to understand what the software... is doing and what I'm asking it"*, because there are too many parameters to be taken into account (ENG-IT). Therefore, more generally, the problem is that if the laws are not applicable, they damage the economy, since *"they create an illusion, the idea of being able to get something that in the reality of facts no one can achieve"* (B-IT).

In Ireland as well, as regards the financial tools to support energy efficiency (e.g. the Home Energy Saving Scheme), not all the stakeholders believe that people are aware of them

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(HOA-IE does, while B-IE and ARCH-IE do not), nor they can say if they have been effective (MA-IE) or "*whether [they are] sufficient or not in terms of addressing fuel poverty*" (HOA-IE). The same applies to regulations: "*Everyone will say 'yes that's all building regulations' and so on, but they're not really known. [...] If somebody get into a building, he/she doesn't know what… whether it's right or wrong... Whether it complies. [...] It's very hard to quantify, very hard to say, you know, 'this building does comply with the regulations'. I mean, all you can do is look at it and say 'Yes, it probably does'*" (ARCH-IE).

As regards the effect of the regulations (including the new national regulation that was announced in September and that establishes that if homeowners are renovating or adding an extension with an area of 25% of the existing footprint, they now must raise the building energy rating at B2 or higher), *"it's not just about the climate change, what you're going to have is a building that is a nicer place… a healthier place to live in and so... It's just about getting people on board of that, that whole vision. People are saying to me 'Oh, I won't be able to afford to do things' but there are grant schemes out there to assist them on that and they have to look at the longer term"* (MA- IE).

5. Credit Sector

Generally speaking, financial support is considered as an essential tool to promote the adoption of energy efficiency innovations. People refer to financial support in two ways: public institutions grants or facilitated credit conditions. The latter involves the role of the credit sector.

In both the Italian and the Irish cases, we discussed with the Credit Sector representatives the products related with energy efficiency improvements offered by their employer institution.

As regards the Italian case, the product targeted on energy efficiency was created with the financial support of the European Union, and it is addressed to companies and firms, in particular to "*those sectors that, according to a market analysis realised by one of our technical consultant, [...] could be of interest, such as energy-intensive companies, the ceramic industry, the pharmaceutical one…"* (CS-IT). The idea is that, in the future, dedicated products could be created for each category of clients, including households and condominiums. The product at issue cannot be used to finance new constructions, but only to improve energy efficiency in existing buildings. External consultants support the bank in evaluating complex projects, but the decision to grant a loan is fundamentally made on the guarantees that the individual or firm can offer: "*The bank requires an in-depth expert evaluation but that is more a fiduciary aspect than of correctness in the technical implementation of the project... then the bank will do - but this regardless of the type of product, the type of intervention - the credit analysis on the company, but there it becomes a bank investigation... I mean, I can do the most beautiful project in the world but then if I - as*

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a company, as a private individual - I do not... I do not deserve credit, however I do not have access to credit... But this is a normal thing..." (CS-IT). No difference is made, for example, if the contractor is going to build a Class A or Class C building.

So, basically – as it emerges on the other stakeholders' opinion as well - the final decision on granting the loan depends on the borrowers' ability to repay the loan (CS-IT, HOA-IT, PA-IT): *"I think that loans for energy efficiency are still considered as a risk... there is not much awareness yet..."* (HOA-IT)*; "Already at the time of the purchase of the first house it is a problem. The value of the mortgage is not taken into account, guarantees are needed, the banks look only to the applicant's income. It is not considered the property, but only the payslip and they ask for the guarantee of retired parents"* (HOA-IT); *"Banks could help, they could find ad hoc products to activate these mechanisms [...]. Banks should change the way they relate to each other because today they only ask for additional guarantees to cover the credit"* (PA-IT). The stakeholders' opinion about the Italian banks is generally not positive and they agree in underlining the banks' lack of interest in supporting and promoting energy efficiency: "*The banks nominally are the salvation of the local economy, but if you ask the operators they are the condemnation. Banks are not interested in intervening in technological innovation related to construction. They have fixed parameters that date back 20 years ago that have been updated downwards after the crisis, so a property that 15 years ago was appraised for 1 million euros, today is appraised for 600,000* (B-IT)*".* Another problem is related to the role of guarantees in some particular cases: "*If the company certifies the construction of wooden houses, you may obtain a subsidized loan in some cases. There are protocols. The problem is, what if the company goes bankrupt? The 10-year guarantee does not come into play ... there are securities that help, but only up to a certain extent. Unfortunately, there is this problem in the construction market. There are companies that first open and then close. And the guarantee goes away. And the customer is afraid"* (ARCH-IT).

It is suggested that public authorities could act as a guarantor, especially for small investments, because in these situation it is not possible to request strong guarantees such as mortgages (*"Different is the case when one has to renovate... because if one has to replace the windows does not mortgage the house... and therefore from the point of view of fiduciary credit you have to find a suitable tool... We are working on this... What the banks are asking for - even in institutional committees [...] - is that the institutions do have to play a role..."* (CS-IT).

In contrast with the Italian case, the Irish product is not financed by EU, and it is addressed to households (*"Our loan… This is for your home, for residential property, so we don't do this for commercial properties"*, CS-IE), whereas as regards companies, "*we are allowed to lend to firms, but we haven't a significant presence or promotion of that"* (CS-IE). It is pointed out that, at the moment, "*under current products",* there is not a specific interest towards energy efficiency (*"So… How do we relate at energy efficiency…? We don't at all, under current products",* CS-IE). But, looking at the new product that will be shortly launched, it

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emerges that it is based on a mechanism that takes into account energy efficiency and allows to promote it in the residential sector. Indeed, it is true that it won't focus on the specific intervention that the client is going to implement in his/her house (*"As you said, I'm agnostic on what is in the building"*, CS-IE); but *"it's all about the BER*": the achievement of at least a B-rating, along with a "*movement of a minimum one point on the grading system",* is what will allow the client to obtain a more favourable interest rate: *"I just want to know that your home has achieved a better BER rating than it had before, in terms of simplicity for us to administer and for the member to understand. [...] Members will be required to provide a BER certificate before they commence to work. And then they will be required to provide a BER certificate after the works are done. And if the BER cert after the works are done showed B or better, and there's a minimum of a movement of a minimum one point on the grading system, like from C to B or B to an A, then you retain the interest rate that we have allowed you* [lower than the standard rate]*"* (CS-IE). The objective is to *"keep it simple"*: *"So, what simple piece of paper would get the loan draw down, they just show us at the outset that: this is the building I have, this is the BER certificate for it. Because I'm going to get a cheaper rate [...]. This is what I have to give in to get that. [...] And then afterwards, if you want to retain the rate, there will be a post draw down condition that within x period of time, 3 months or something, they show us the revised BER certificate. So, then an expert over there is going to decide to grade it A or B or C or D or E or F".* As the interviewee specifies: *"That's who we rely on to keep us all right in terms of being effective at improving the energy efficiency of the house. [...] You know, why would we get into reading a certification, document or going out doing site inspections, that's not our remit"* (CS-IE). The same philosophy will apply to a new product aimed at promoting the purchase of hybrid or electric cars, which is however not associated with other energy efficiency investments, so that every product is a stand-alone (CS-IE).

The reason behind such a strategy is that *"on the loan transactions, people ... just want basic information. What do I need to get this? How I get a cheaper rate is this bit... That's it, keep it clean and simple and short" [...] "I suppose that sometimes I think the message is too broad and people get lost in the whole thing, you know. [...] I don't think I have to explain to people that 'if you do this then the European Union will do that and somebody else will do this, and here's the form...', you know… Just get out a guy to examine your house at the start, get him to examine it at the end and here is the few bits that you need to do to get from an E to B. [...] So, I suppose if you're talking in accountancy terms and somebody's wondering about an investment in a capital project, traditionally, they have the phrase 'top line, bottom line'. So, I would say the top line is 'you spend eight grand', bottom line 'you will save 2 grand a year'. They are the two figures they want to know". [...] "Well, economics drive[s] behaviour ... more effectively than anything else, you know. Everybody can have a social conscience, but bottom line is how do I have more for my family and less to have to pay out on everything else"* (CS-IE).

In the Irish case, it seems there is a stronger collaboration between the credit and the public sector, which is not seen as a competitor (*"So, when you say the grant provider, are we*

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opposed to them, no, they are just another ancillary service provider", CS-IE), to the point that the loans granted by the credit sector can be combined with the public subsidies for energy efficiency: *"… and this can be done in a way that complements the SEAI grant, so somebody might get part funding of 35% of the SEAI as well. ... If they subsequently get a grant for the same work, there's no penalties if you want to lodge in and clear the loan. So, it gives them the money and then they could get a grant to clear off a chunk of the money"* (CS-IE).

But, similarly to the Italian case, the loans granting criteria strictly depend on individual affordability for the loan. The validity of a project, the expected energy savings are not taken into account in the credit assessment, that is actually *"based on your current affordability for the loan"* (CS-IE); *"Well, I'd say that ... the number 1 criteria for them would be to make sure they'd be getting their money back" (*B-IE).

Finally, we notice that not all the Irish stakeholders are aware of the existence of financial instruments targeted on supporting energy efficiency investments (HOA-IE is, B-IE is not), or believe that the support offered by the credit sector to household and business firms that want to invest in energy efficiency is sufficient *("[The system should be] streamlined, so that people know what they can do and what they can't do to qualify, or to get a more efficient house",* REA-IE).

6. Technologies

6.1 Photovoltaic and Solar Thermal

For the majority of Italian respondents, the photovoltaics adoption trend has been negatively affected by the relinquishment of financial support from the Government: "*There has been a very important increase in the demand for panels until 4 or 5 years ago, as long as there were government subsidies of a certain level, but as the subsidies have plunged, so the demand has plunged […] The photovoltaic… we do not hear any longer about it. There was no decrease in costs, perhaps a little, and then the subsidies have gone down, so it is no longer of interest"* (HOA-IT)*; "When the government financed solar thermal or photovoltaic... it was advantageous, and there had been many applications"* (B-IT).

However, other stakeholders say that new technologies and new regulations are actually promoting the use of photovoltaic: *"Photovoltaics is now a must, especially in renovations and in new buildings"* (ENG-IT). In new constructions, the PV system is necessary so that the software can recognise it as an alternative source, as requested by the regulations: "*A methane gas heat pump […] is not recognised as […] renewable system*" (ENG-IT). In renovations the requirements are less stringent: "*... in renovations normally they modify the heating system with floor radiant panels, and convectors for cooling. Then those who manage to upgrade the rooftop also install the photovoltaic panel, and so obtain that, at*

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least during the daytime, part of the energy is produced by the panel" (MA-IT). This hybrid system would meet all energy needs, although it involves a higher investment cost: "*The mechanical ventilation with independent photovoltaic system to meet all energy needs is required, although the cost, in this case, rises and the customer must be willing to spend*" (ARCH-IT). However, it is expected that the cost will decrease after the technology is scaled up, "*like the mobile phone that when I took it in '96 was priced 2 and a half million liras*[2] *and now the price is 100 euros... It will happen ... also with photovoltaic, or the geothermal, possibly...*" (HOA-IT).

There are conflicting opinions about the solar thermal technology among the respondents interviewed in Italy: some respondents believe that a high demand for solar thermal still exist, especially in renovations. They outlined that it can be easily integrated within different heating systems: *"Now the solar thermal is demanded in renovations, because I go to support my traditional system, even with underfloor heating"* (HOA-IT). Other respondents see the solar thermal as outdated: "*There was a time ... the building company would include the solar* [thermal] *panel already in the package of the product on sale, and provide the set up to install photovoltaics..."* (REA-IT); but the hybrid option heat pump/PV seems preferable: *"It depends on what you need... […] or solar thermal system or heat pumps... A solar thermal system for a bath or two costs 3500 euros, the heat pump costs 800 ... Stop*" (ENG-IT). Moreover, there are some issues with the thermal panels (overheating), that can be solved using new solar thermal technologies: *"...when they reach the highest temperature darken and the boiler no longer heats up... if I'm on vacation and I have panels heating the water and I don't use it... the valve opens and empties"* (ENG-IT).

Also in the Irish case the hybrid system combining heat pumps with PV is deemed an interesting solution, better than solar thermal: "*Sometimes it's water, solar panels for heating water, but I think most are now PV... I think PV and I think there is a huge, huge market there*" (ARCH-IE); "*put in what we call the triple-glazed windows now and the pumped insulation and everything else that goes with it. Some people are switching from heat water and using solar. Not that overly common in our area, we have some of it, but we don't have a lot*" (REA-IE); "*The solar thermal panels are not as popular as they were*" (B-IE); "*The technology that is most frequently requested and installed is the cheapest, PV*" (ARCH-IE); *"From an E up to a B. We put in, we put PV panels on the roof"* (ARCH-IE).

Though, there are those who express the opinion that PV panels are not so interesting as they were before, since the payback of the investment is meagre: *"They are not as, well say 'popular', as they were... The PV panels some of the ones we're encountered now are not brilliant, and so people are not inclined towards them. For some of them for the outlay, for what you get back..."* (B-IE). And those who point out that PV panels can be seen as a sort of conspicuous consumption: *"There's no real 'photo-op' in putting double-glazed windows in, you know... as opposed to solar panels on a roof"* (MA-IE).

[2] About 1300 euros

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A respondent in Ireland raises the issue of the lack of independent sources of information to citizens (for example experts who provide indication useful to select the most suitable technology for a specific individual situation) and, in the end, it is mainly the salesman who gives the information: *"...every solar panel, a double glazing, insulation, they're all tied into manufacturers. So, you're not getting impartial advice. […]you're getting a salesman. And a salesman can only say, what he is commissioned to sell you"* (ARCH-IE).

Respondents from both countries doubt about the use of batteries to store the excess of energy produced by PV panels. "*The solar system payback time is 5 years. 7 years if there is a storage battery, which costs a lot more and needs to be changed after 3 or 4 years. It's a technology that still needs to be developed, fine-tuned. I have it ready at home, but it is not economical, it costs from 5 to 6.000 Euro and it lasts 3 or 4 years. Too little. I can't amortize it. It's not economical*" (MA-IT); "*Unfortunately the cost of batteries is high, and installing a photovoltaic system is expensive. But it is an interesting solution*" (ARCH-IT); and beyond the cost, there is a space issue *"...they are still expensive ... It isn't the car-type batteries, uh, that take up little space… in residential homes we need space ... It is difficult already to find a space where to put all the technical appliances ... let's talk clearly, we do beautiful things, technologically advanced, but the space is lacking*" (ENG-IT).

6.2 Ground Source Heat Pumps

Most respondents, both in the Italian and the Irish cases, are not very familiar with the Ground Source Heat Pumps technology; and its diffusion in either country is still scant. *"Geothermal... is as yet little known"* (ARCH-IT); *"We heard about it so many years ago, then... I don't know if it has remained so, blocked, if it has been... if it was, let's say, methods that had little to do with these technological innovations or were things that were an end in themselves... Because we begin to enter a little bit in technicalities that see me a little unprepared in the speech of geothermal energy [...] if today I'm asked about photovoltaic or geothermal, I've never heard of geothermal, by anyone..."* (REA-IT). *"No pumps, I repeat, pumps, both well and superficial type, I repeat, I have seen very few of them in public building competitions... We installed one three years ago [in the private sector]"* (ENG-IT). *"I don't know enough about it in detail"* (ARCH-IE); *"In County Mayo, the GSHP systems would be in a small minority. I assessed a project including GSHP systems for my own place"* (MA-IE).

In fact, some respondents are not acquainted with GSHP and discuss of large scale geothermal power plants. "*If you put in a District Heating Scheme with a great borehole, now you don't have energy problems with these mad old Victorian buildings. And I don't think the investment is all that big. […] I have never seen one, well, except one, because in Italy, in the area just south of Pisa, they all have geothermal generation stations. […] And they're all generating electricity*" (ARCH-IE). "*The geothermal is now saturated, […] because*

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they no longer have... available range - I'm talking about the geothermal of [NAME]... once there was the boom of geothermal stations, so 'let's all go geothermal'... Many households tried it and then have gone back, in the sense that in many condominiums they had seen that they were paying more with geothermal than with the gas utility" (ENG-IT).

GSHP are considered still expensive and/or complicated compared to other available technologies: "*House owners could be interested, if the price were lower"* (HOA-IE)*, "but well heat pumps or at least geothermal are a mirage, at least to me... I don't believe it from the point of view of market possibilities* (ENG-IT). *"I've had only experience of 2 and I felt that were very, very expen*sive" (REA-IE); "*Geothermal was popular maybe 7 or 8 years ago, but since air to water systems have come in, it is not that common anymore. The air to water units are a simpler system and they seem to be very efficient"* (B-IE).

Respondents outlined also some technical aspects that could hinder the adoption of this technology: on one side, the space requirement for the horizontal probe system type, and, on the other side, the unknown effects of the cooling accumulation in the soil, especially for the vertical probe system type. "*As regards the 'horizontal systems' ('tennis courts'), people don't have the room. It's like the electric car problem, where are you going to plug it in"* (ARCH-IE)*; "I prefer the vertical... For the horizontal you need to have spaces of a certain type... Then even if I have the spaces of a certain type, I can no longer put plants... it's a problem, there are constraints... I can do it on a football pitch, just to say..."* (ENG-IT); "*I was in one house that had it. They were very pleased with it. I don't know that she wouldn't end up cooling down your half acre. And the efficiency would go down. I'm not sure*" (ARCH-IE).

However, some are aware of the benefits related to GSHP, i.e. the future savings for heating/cooling purposes, especially if GSHP is inserted in an integrated system that includes also heating pumps, solar thermal and PV technologies. The problem is the investment cost, but the payback seems worth: "*It costs... some time ago… a well cost was 1500 euros per kW... So, I made one of 17 kW... about 20 thousand euros only the wells... Then we put the heat pump, then after there was a 17 kW photovoltaic system, plus the solar thermal system was complete... in fact the client now spends very little*" (ENG-IT); "*Investments are more expensive, but have an immediate return, even after 5 years. Even the renovations*" (MA-IT); "*I've only experience of 2 and I felt that were very, very expensive. Being an estate agent, I do valuations for the banks, so it's always a bit of a shocker to a bank that you might include 35,000 euros for a heating system… Both cases they have told me it is working very, very well for them. I think 90% of them, if not 95%, is air to water, you know"* (REA-IE). The stakeholders' opinions on geothermal and air-water heat pumps are somewhat divergent: "*the air to water units seem to be very efficient. So I'd say they are a simpler system* [compared to the geothermal one] *and they are efficient enough"* (B-IE); so that "*nearly every house we do now is air to water*" (B-IE). On the other hand: "*I don't think they are very good a lot of them. Some of them are good, but an air to water heat pump can't, really be up too much in Ireland*" (ARCH-IE); but there is agreement on the diffusion:

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"*there's a good number of heat pumps right now, yes. It's a lot more common than it was*" (ARCH-IE).

Looking at the different types of heating/cooling appliances, according to one of the Italian stakeholders (ENG-IT), *"the best is the radiant ceiling, absolutely, […] for both heating and cooling"*, that would be *"perfect"* even from a comfort and health point of view ("*If it were my house, I would do it that way… radiant ceiling, maybe made of wood…*"). The advantages of using it is that "*you have the right net surface, not occupied by anything*". On the contrary, the problem of the wall insulation is that it requires room and "*when you have some piece of furniture, some closet in front of it, it stops working, […] it does not radiate anymore*". Also the underfloor radiant panels require some attention: for example, they cannot be placed under furniture, and there might be problems in the kitchen: "*… there are those who forget to disconnect it in summer, so the kitchen is cold and when you cook it condenses…*" (ENG-IT).

Nevertheless, in some cases (e.g. in some public buildings), the radiant floor panels are "*almost a forced choice*", because it is not possible to insulate the ceiling. An interviewee recalls that during the period 1997–2004 he realized a number of ceiling and wall radiant panels installations in the private sector, but, at the moment, the average customer *"does not go beyond the radiant floor"* (ENG-IT).

As regards costs, "*by now, doing a radiant floor* [heating] *system costs right about as a radiators system*", so its price is very competitive, whereas the price is still quite high if you want to cool as well (the control system, in particular, is "*quite expensive"*) (ENG-IT).

6.3 Cooling Systems

There is a marked difference between the Italian and the Irish case as regards the demand of cooling technologies in buildings, due to the different climatic conditions, which are expected to diverge even more in the future: the forecasts for the period 2070-2100 show a strong increase in the average number of Cooling Degree Days (CDD) in Italy, while no change is predicted for Ireland (see Figure 2.24 in IDEAS Deliverable 6.1: Desk Analysis Report). In the Italian case all stakeholders agree that it is an important characteristic of the dwelling: "*By now, even in the market of used houses we easily find... cases of houses, dwellings, that are already endowed with these types of cooling systems"* (REA-IT). In the case of new buildings, customers expect that either the cooling system is present or at least that the wiring system is set for the installation of the equipment (REA-IT). This happens because of "*both the local climate and advertising, and a raising awareness on global climate conditions"* (HOA-IT). It is relevant also in the rental market: *"the air conditioning is appreciated by those who want to rent, also because our real estate is dated from the 1950's and 1960's, with big problems of overheating in summer. So it is almost necessary"* (HOA-IT), also because the climate is humid: "*we'd need to dehumidify a bit"* (ENG-IT).

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In contrast, the Irish stakeholders agree on the fact that people in County Mayo and, more broadly, in Ireland are not interested in cooling technologies (HOA–IE, B–IE, REA–IE, ARCH-IE) and do not need them, at least in the residential sector. "*In office environments we probably do because there's a lot of people inside"* (B-IE) and even in the industrial sector there would be a potential, "*but not on the same scale as in various other parts of the world"* (ARCH-IE); also, there is an increase in demand for cooling systems for **"***the data rooms for a lot of the public buildings. We have seen energy use just spike and we've narrowed it down to those particular rooms and then, I suppose, last summer we would have seen a number of offices complaining about the heat"* (MA-IE).

6.4 Thermal Insulation

In Italy, "*people mainly adopt solutions concerning the fabric, the coatings"* (ARCH-IT) (*"In my case, they concern the fabric, by change of insulation, replacement of windows/doors"*, ARCH-IT), along with "*the solar thermal and the photovoltaic*" (REA-IT).

The solutions related to the thermal insulation are – by themselves - sufficient to reduce consumptions: "*In 2009, in Ferrara city centre, some clients put in internal insulation, with interesting materials, and in the first year they reduced their gas bills by 50%. […] If you put double glazed windows, replacing the single glazed ones, you can immediately save up to 30% on gas"* (ARCH-IT).

More broadly, as regards the Italian stakeholders' opinion on what is worth investing on, the fabric is considered as the most important. Indeed, *"the energy performance is given almost only by the fabric"* (ENG-IT) and "*it is worth investing a lot on the fabric rather than on advanced technologies, because with the fabric you'll gain very quickly, while with the technology you can only refine. The customers look more at […] the advanced technologies like the smart control systems, but, in plain words, you save more on the fabric than on the system. Clearly, if there's the possibility, then I'll change the technology as well, I'll refine with the technologies"* (HOA-IT).

However, some issues arise when talking about insulation.

The first is related to the fact that *"the more you insulate, the more a mechanical controlled ventilation (MCV) is required"*. In this case, the users' behavioural answer should be taken into account, in order not to limit the individual freedom. "*You have to explain the lady she must not open the windows. A colleague of mine – an architect – realised his house with just one window that can be opened; the others cannot really be opened. Fixed MCV. […] I think these technologies are wonderful, perfect in theory and in practice as well… But then, in my opinion, they clash with people's reality… because women, in winter, are used to… Where do you hang the laundry? […] Maybe in the hallways or… And there the moulds go... If it's all closed, and I didn't do the MCV, on the cold walls where the steam goes when you dry*

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laundry... […] I think it's essential to find the right union between the house usage and its, let's say, real performance. […] I mean, once you've done the insulation, you've observed all those parameters, you've installed the windows as they have to be […] … let's do the MCV too... but let's give people the chance to open the windows…" (ENG-IT).

Secondly, "*the healthiness is ignored […], which is a big problem for us due to the characteristics of our climate, as a result of which very often we have internal humidity in our buildings. The energy efficiency interventions that have been done in the last years have sometimes made the problem more serious"*, i.e. when "*building fabrics and super-performing windows"* have been put in 1950s or 1960s homes, without MCV. *"We see it with the students who rent the apartments, […] students who come from the south, not accustomed to our climate, who dry their underwear on the radiator… But I have airtight windows, I have the insulated fabric because the apartment building has been renovated.... A few months later there are scary moulds and quarrels with the house owner"* (HOA-IT).

The Irish stakeholders attribute a huge importance to both the thermal insulation and the heating system (HOA–IE, B–IE): "*Well, I'd say, most important would be the thermal insulation, anyway, because that's obviously going to limit the amount of heat that you're going to need in the first place and then, of course, you would need a good heating system*" (B-IE); "*the whole design of the house and the retrofit of the house is based on the heating system and thermal insulation"* (HOA-IE).

Looking at the most adopted energy efficiency measures, "*it depends on the building type. I would say that domestic the first thing we'd probably look at is the wall and ceiling, for we do that in the social housing, and the larger buildings, public buildings we'd probably look to the heating system as much as anything"* (MA-IE).

Putting double glazing in the windows could be quite expensive: "*This house is a monster, it consumes about 3 grand's worth of gas every year to keep it in warmth in the winter"*, but "*it would cost about 3 grand a window"* to install double glazing (ARCH-IE). And yet, "*the obvious thing with every house, and in fairness it's one of the things that SEAI has done: somebody comes to you and says 'I want to save energy' and they think of windmills, and when you say 'insulate', their eyes instantly glaze over. Cause there's nothing sexy about insulation"* (ARCH-IE). So people do not request fabric insulation, but "*if you can do external it's great, it's fantastic. It can be difficult, but it's really fantastic. You still have the mass of the house and you're stopping the heat escaping from it. It's like a tea cosy"* (ARCH-IE). The Phase Change Materials (PCM) seem not to be much used nor known, either in Italy and Ireland: "*Honestly, I use few of them. I tend to do safe interventions, that is to say interventions I have experienced over time and that have shown proof of being efficient*" (ARCH-IT); "*I know them but I've never used them, even because in my opinion they're still little competitive*" (ENG-IT); *"I don't know…"* (ARCH-IE).

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In the Italian case some stakeholder introduced the wooden fabric topic in the discussion: "*It is better than the brick fabric. […] The wooden houses are beautiful, they are comfortable…"* (ENG-IT). "*My clients […] initially want the brickwork for seismic reasons, but after an initial proposal in which I explain the advantages, then they opt for the wooden house. A phase of scepticism must be overcome. And you have to consider that with a wooden house, being equal the gross volume, the net surface is greater, recovering even up to 20 cm per side. And the prices are interesting. […] The wooden houses are competitive and maybe they are the market of the future*" (ARCH-IT). In addition, in some cases they allow to get access to a subsidised loan (ARCH-IT). But, as regards the potential users' interest, if some stakeholders think that the wooden houses are still too far from local habits ("*Here it's still weird to ask for a wooden house. Sometimes they are being built, but then they are covered with plaster, so that they lose the visual impact we see at certain latitudes*", HOA-IT), others talk about an increasing demand: "*In recent years, wooden houses are gaining ground, with cutting-edge technology"* (MA-IT)*; "Finally, for wooden houses there is an increase in the percentage of realisation. If before they were 60%, now they are 80% of the market. And they embrace the philosophy that they are homes with a better energy efficiency and that they're better for the consumer"* (ARCH-IT); *"Wooden buildings have a positive trend in the market, they are the majority"* (ARCH-IT). Divergent views emerge also with reference to the investment cost: some say it is higher (*"They cost more, but if you consider the cost over a 10-year period, it is interesting"*, ARCH-IT); others lower ("*It costs a third, a fourth… […] The costs are very low*", ENG-IT) compared to other types of constructions.

6.5 Smart Control Systems

In the Italian case, some interviewees had experience of projects that include smart control systems for weatherization, but it is a niche of the market ("*A rich house owner wanted the control of the heating system from the mobile phone, because she lives in Monte Carlo*", ENG-IT). Nevertheless, not all the people that in theory could be interested – mainly because "*influenced by advertising*" (HOA-IT) - will actually realise them, because of their cost. Another issue concerns the people's ability in using them: "*But it will be necessary […] to spend two days explaining people how it works... But then that's not enough, because once you've explained it to her, she tries... […] and then it doesn't work anymore... 'What happened...?'… So, or […] the users are enough, let's say, quick in learning and therefore they know the technology, they are young, etc. etc., but the elderly people…"* (ENG-IT). A similar concern emerges with regard to public versus private situations: *"All these technologies allow to improve our lives and save energy, but you must also be able to control them... And able to accept them. I do not exclude that one can control the house with smart systems. But only the private citizen, not the public. The private individual is more efficient, he/she works with apps, smartphones and he/she is used to using them. We have had*

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problems in verifying such technologically advanced buildings" (MA-IT). Lastly, from a technical point of view, the appliances need to be perfectly calibrated, because if they are not, they can cause important economic damages: "*We do not have an internal office that verifies building conformity, but we have […] external technicians to do that. And these external technicians have had to draw up very heavy insurances because very often, by trying a plug or something else, they have blown up the smart system of a house, with significant economic loss (2 or 4,000 euros)*" (MA-IT).

In Ireland, a common opinion emerges about the smart control systems for weatherization. They are considered as a "*huge opportunity"* (ARCH-IE) and they "are *going to become very important in the future"* (REA-IE). Homeowners are interested and are already using them (MA-IE, ARCH-IE, HOA-IE, B-IE, REA-IE): "*It's not even an interest now, there's expectations that everyone is able to turn on their heat remotely through the mobile phone or through the laptop or whatever it might be, control the temperature etc. So, it's everyday practice*" (HOA-IE). If on the one hand, they "*just makes life easier for people"* (HOA-IE), on the other hand "*there is an appetite and people want to know"* (ARCH-IE), they would like to hear, from a consultant, what would be efficient. Younger people, in particular, are interested, because they are "*more into* and *very, very smart on those things"* (REA-IE). Moreover, *they are looking at their investment over 25 or 30 years, where an older couple might say 'Ah, it doesn't need to be that'"* (REA-IE).

6.6 Passive Houses

Although some of the Italian respondents affirm that *"there is no interest"* toward passive houses (HOA-IT), from other interviews it actually emerges that in the market of new constructions "*passive houses do exist, with a combined use of solar thermal and electrical energy, i.e. solar panels and photovoltaic. […] And then the geothermal probes... also because, even with a low PV use, through the probe I become self-sufficient… And there is an increasing use of wall insulation in the external parts"* (MA-IT).

A similar reaction is observed in the Irish case, where some stakeholders have never met customers interested in passive houses, "*probably because they are not on the market"* (REA-IE); or never assessed projects of that kind (MA-IE). In contrast, other respondents think that householders and builders are very interested in passive houses (HOA-IE); but "*they maybe think they are, but they don't understand it maybe, you know. So, it's not usually really… you know"* (B-IE). The problem is that the cost of passive houses dissuades customers from really realising them ("*… but looking at how expensive they are to build, it's not really accessible to go and to do it"*, HOA-IE), even because it is not that easy to get credit access ("*It's more of a buzzword than anything. And apart from anything else, the banks are still not… it's very hard for people to get money at all, and if they're looking for excess for, you know, to go the extra step… It's even harder again"*, B-IE).

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The Italian respondents point out that the regulations in place in the Emilia-Romagna Region and in the city of Ferrara act in some cases as a driving force, while in others as an obstacle to the spread of these technologies. In fact, if on one hand, the obligation to use renewable sources for the coverage of at least 50% of the sanitary water uses leads to the use of photovoltaic, solar thermal and GSHP in the renovation and the obligation to build NZEB is a driving force on the new building: "*You have the obligation of 50% of the sanitary, so either solar thermal system or heat pumps*" (ENG-IT); on the other hand, the numerous regulations for the protection of the historical city centre and historical buildings limit its diffusion in some areas of the city: "*What is now being built pays close attention to solar thermal, the photovoltaic system and the thermal probe for heating. All those elements that allow you to make a house with zero energy. Whoever builds a new house spends more but does very energy efficient interventions. The high sector of the real estate market is oriented towards a house with very high energy efficiency*" (MA-IT). Ground Source Heat Pumps are considered one of the most important elements, combined with photovoltaics and solar thermal for obtaining a passive house: "*There are some passive houses, with combined use of solar thermal and electrical energy, i.e. solar panel and photovoltaic. Yes, there are some of these experiences. And then the geothermal probes. Also because in this way, even with a little photovoltaics, with the probes* [the house] *becomes self-sufficient. [...] And it is increasing the use of thermal insulation in the building exterior"* (MA-IT).

7. Policy indications

The demand for advanced energy systems such as the IDEAS technology is dependent on the prospective real estate market. The in-depth interviews with stakeholders in the housing sector indicate that in both the Irish and the Italian territorial areas of our study (County Mayo and Ferrara), the market has not yet recovered from the 2008 financial crisis. In both countries it is difficult for many households to find affordable good quality housing; in the Irish case, although there seems to be a growing latent demand for housing, the market does not clear at current prices. In the Italian case, although there is an excess of unsold buildings, the prices do not decrease. On the supply side, the complaint is that charges and regulations have the effect of increasing costs, either in new constructions and in renovations, so that the supply price cannot be lowered if the firm wish to keep some margin of profit. So, the gap between reservation prices in the supply and demand side of the market cannot be bridged, unless there is some public intervention: either in providing in-kind housing services (social housing); or subsidising the housing market, for example facilitating credit access to households.

Hence, energy efficiency requirements are seen both as a possible hinder and as a possible driver for the housing sector: it depends on the role that the Governments (at different levels, from European to local) will decide to take. Now, the effect of such requirements is negative: *"the only thing it's going to put the price up and it's not achievable [...] to sell*

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houses. People can't get the money to buy them" (B-IE); *"...if entrepreneurs have to make [an investment] with their own money, then it is tuned to the selling price. If I make high quality [product] but then it doesn't sell, given the cost it's a harm to yourself. It is necessary to understand that public intervention is necessary to support [this kind of] building. But this is not happening*" (B-IT).

Italian stakeholders emphasise the importance of clarity in regulations and in the design of subsidies, also in terms of the duration of the policy measure. The Government intervention should be aimed at reducing uncertainty, rather than aggravating the problem: *"To make the market start again, there shouldn't be all this uncertainty about financial support. The rules are ever changing"* (ARCH-IT); *"It's not nice to live day-by-day, when every year they say 'this year you'll get this benefit, next year maybe not"* (REA-IT). Indeed, if *"the existence of both financial and regulation measures would be desirable*" (REA-IT), it is essential "*to have more certainty, more clarity, more long-term programmes in favour of these initiatives* [e.g. the Ecobonus and other financial tools]*"* (REA-IT).

From a financial point of view, contributions and grants would be essential to persuade homeowners to make their houses more energy efficient (as in the case of tax allowance for renovations, that are often used, for example, to replace windows and/or doors) (ENG-IT). In particular, less affluent households should obtain higher support for energy efficiency investments: "*not granting the same amount of money to someone who has a 30,000€ income or a 100,000€ income"* (MA-IT). More generally, *"there should be a tax reduction on the property, there should be the possibility of having deductions in case I do energy efficiency. […] So 'derived real estate taxation': I produce an improvement for the community, the community through taxation enacts a monetary compensation for my compliance. But these big and fast transformations must have legislative, economic, financial instruments [implemented by] the... [Government], otherwise the results are sporadic and like wild fire. The ... [Government] must take action"* (MA-IT).

Moreover, since *"at present the client has no money to do energy efficiency [and] it is lacking an energy efficiency culture"* (B-IT), the final user must be engaged to get awareness of the benefits and the economic saving he/she can obtain in return, as it happened "*when the solar thermal or the PV came on stage: they have been advertised, they had benefits, there was public funding, so there was a parallelism with the financial sustainability and a lot of interventions have been realised*" (B-IT). The Public Sector should play a more important role in informing people about the regulation: "*It should be the Public Sector [...] to inform on the specific requirements of the laws, it must give indications on the limits that the law imposes"* (B-IT).

The availability of funding is important also in the opinion of the Irish stakeholders. Energy efficiency could stimulate the demand and it would be possible to "*bring back a lot of houses if there was a proper structure in place for people to actually do them up and encourage them… If* people *could get a reasonable grant for doing it up the property to*

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make it energy efficient... and broadly-based, not just the heating but windows, everything else that goes with it, insulation in the walls and everything like that, I think it would actually promote a lot of those properties" (REA-IE). Finding policy tools that could encourage energy efficiency investments by home owners *"it's very difficult. I mean, given that the three things that sell the house, are 'location, location, location', when people are buying a house, they're so terrified they're not going to get it, but they'd overlook almost anything in order to get it [...] And again, it's like the climate change thing, of course they wish to do it right… but they don't know how. […] In order to improve that, you can keep plugging away and that's what SEAI are supposed to be doing is raising awareness all the time…"* (ARCH-IE). "*There has to be some incentive there, but if you can demonstrate through policy, through education, awareness, the benefits locally even here to the climate, to the householders how the energy utility bills would be reduced and looking at payback periods, then those are the policies tools that should be employing, deploying if you like, to encourage homeowners to invest in their properties. But homeowners are investing anyway. It's self-interest for themselves to renovate their own homes"* (HOA-IE).

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