Innovative Market Framework to Enable Deep Renovation of Existing Buildings in IEA Countries

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ABSTRACT

This paper presents the IEA's recent research into existing energy efficiency financing programmes. The evaluation shows that most are designed to address each barrier individually with little or no consideration for the holistic approach needed to reduce the energy consumption of the buildings sector. It also shows that two-thirds of the incentives provided in IEA countries between 2011 and 2012 do not relate to measurable energy savings. And when tied to measurable savings, incentives usually target the implementation of solutions that are "low hanging fruit" such as the replacement of individual pieces of equipment or components. This problem is compounded when whole building and prescriptive programmes co-exist and are in competition for limited funding sources. As a consequence, savings potentials are locked for decades and the efficiency gap increases.

It is time to refocus; reducing the energy consumed by the buildings sector requires ambitious policies to create a sustainable market for low-energy buildings.

This paper presents an innovative market framework to enable deep renovation of the existing buildings stock in the IEA countries and beyond. The proposal considers the overall buildings stock and the objective already announced by several countries in their energy efficiency action plans to reach 80% reduction of the sector's energy consumption by 2050. The framework bundles successful building energy efficiency financing programmes and lessons learned from existing schemes.

Introduction

Buildings are major consumers of energy and represent an important potential source of energy consumption in the future. In most IEA countries, buildings currently account for more than 40% of the country's primary energy consumption. Under current policies buildings energy consumption in IEA countries is projected to increase by 229 Mtoe by 2035compared to 2010 (IEA, 2012). The residential sub-sector is expected to remain the largest consumer of energy, although the non-residential sub-sector will increase its share of the total slightly.

In IEA countries energy consumption in the buildings sector is largely dominated by electricity and natural gas, in 2010 consumption was 42% and 35% respectively. Consumption of electricity in particular has experienced significant growth from 1990 to 2010 increasing from 33% due to the high penetration of consumer electronics and cooling equipment, (Figure 1).

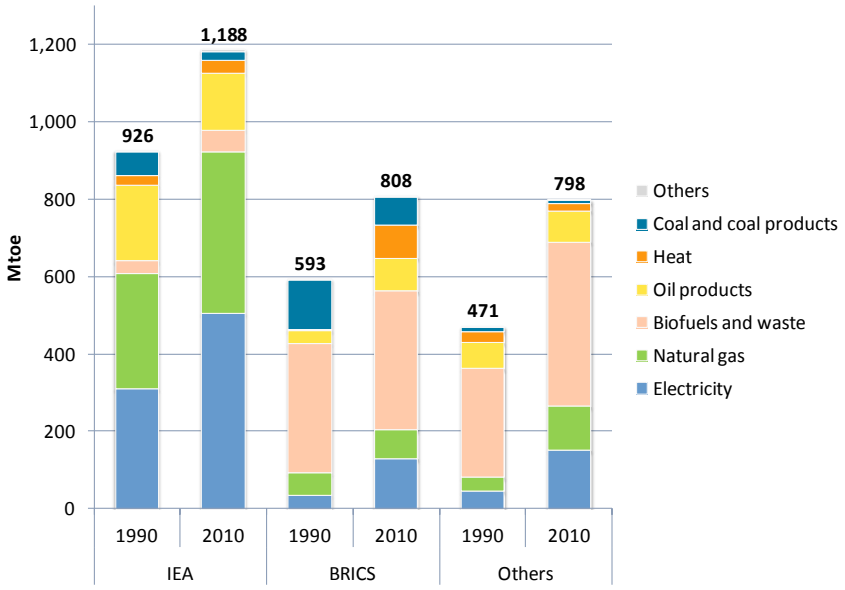

Figure 1. Final Energy Consumption of the Buildings Sector by energy carrier (IEA Statistics)

Natural gas is especially important in the context of the buildings sector since in many IEA countries it is the main residential energy carrier used for space heating and cooking.

Gas imports place a significant burden on many IEA economies: they represent up to 3% of GDP in the Slovak Republic, and more than 2% in the Czech Republic, Hungary and South Korea (IEA, 2013). The expected energy demand increase in the buildings sector will therefore put substantial additional pressure on these economies.

Currently policies for improving buildings energy efficiency tend to be implemented through regulatory mechanisms such as codes and energy performance certificates, and financial incentive schemes.

In practice, all IEA countries have implemented building energy codes; most of them are either still prescriptive with specific requirements for insulation, heating and cooling equipment, or model-based with a primary energy consumption target varying per building reference. Neither the prescriptive nor the model-based building energy codes target an absolute reduction of the overall energy consumption of the buildings.

In the EU's 27 member states, building energy codes are complemented by mandatory energy performance certificates (EPBD, 2010). The aim is to provide information to investors and end-users on the energy consumption of each individual building.

Moreover, most governments provide incentives, mainly grants and loans, to improve the energy performance of new and existing buildings. The aim is to remove market barriers to the implementation of energy efficiency measures. Grants and low interest rate for loans are funded by public expenditure or more recently by energy savings obligation schemes. However, existing incentive schemes encourage individual actions; each of which has a limited impact on the overall energy consumption of individual buildings. Indeed two-thirds of the incentive schemes available in IEA countries between 2011 and 2012 were not tied to measurable energy savings (Figure 2). For example, incentives are provided for buildings performing 20 or 30 % better than building energy codes. In countries where building energy codes are prescriptive or model-based, it is not possible to measure whether the incentives lead to energy savings beyond the code requirements and the impact on reducing the overall energy consumption.

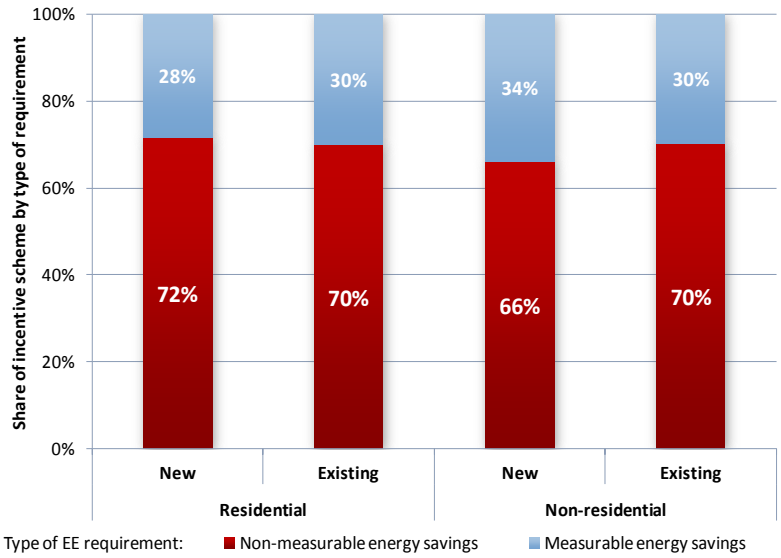

Figure 2: Incentive schemes between 2011 and 2012 in IEA countries

Analysis of the energy requirements that must be fulfilled to benefit from incentive schemes show that most incentives are provided for business as usual and sub-optimal solutions. Most of the existing incentives are solutions that can be financed over the short term and are cost effective for individuals with a pay-back period of less than five years, such as the replacement of windows or heating systems. This shows that energy requirements are not set with a long term perspective and the holistic approach described above is not taken into account.

As a consequence, the buildings sector achieves less than one-fifth of the economically available potential under the current policies (Figure 3) which leaves a significant portion of the energy efficiency potential untapped as shown in the efficient world scenario (IEA, 2012).

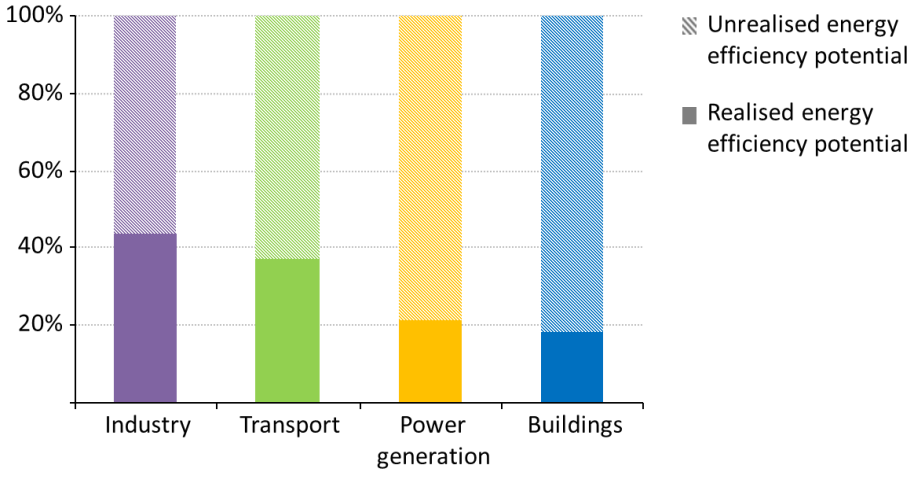

Figure 3. Economic savings potential under current policies (2011-2035) (IEA, 2012)

Given the impact of the buildings sector on energy consumption, and the impact of increasing energy demands on a country's energy security and economy, the design of buildings energy efficiency policies

must be holistic. Such policies need to go beyond building-specific energy considerations to take into account broader economic development, environmental protection and energy security objectives (Figure 4).

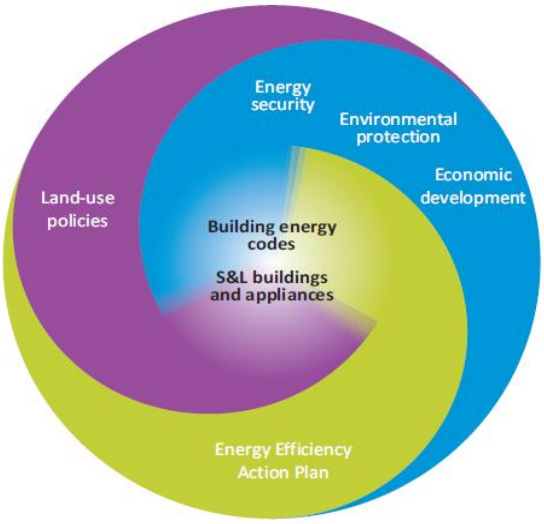

Figure 4. Policies to consider in the design of buildings energy efficiency policies (IEA, 2013)

This paper describes the methodology followed to analyse existing buildings energy efficiency financing programmes and their interactions with building energy codes and standards and labelling (S&L) policies. The objective was to understand what worked and what did not work and why. The methodology is inspired by the theory-based policy evaluation approach developed by the Californian Energy Commission to assess their market transformation programme (C. Blumstein et al. 2000).

The paper summarizes the main findings and proposes an innovative market framework to enable large scale deep renovation of the existing buildings stock in IEA countries. Finally, the authors draw some early recommendations on how to make low-energy buildings stock a reality in IEA countries by 2050.

Methodology

The work was carried out in several stages starting with gathering information on buildings energy efficiency financing programmes in IEA countries and a review of literature evaluating the programmes where they exist. The objective was to understand which barrier each of the programmes addresses and the factors for the success and/or failure of each policy instrument. The ultimate goal being to enable the authors to make recommendations on how to adjust or redesign buildings' energy efficiency financing programmes in order to create a sustainable market for the demand and the supply of low-energy buildings.

The literature review included background information on the barriers that programmes needed to overcome, the expected benefits of the policy instruments as well as the financing mechanisms, and where available the overall cost of the scheme to the government and the ex-post evaluation. Also it was an opportunity to identify the key stakeholders at national, local and regional levels to interview at a later stage.

As suggested by the theory-based policy evaluation methodology (C. Blumstein, 2000), the main characteristics at each step of the implementation process for each programme were identified.

The information gathered was entered in an internal database that includes information on the efficiency improvements (those targeted and when available those achieved), the nature of the measures implemented, the investment cost (CAPEX), the financing mechanism, the source of capital, the stakeholders involved and their role, the non-energy impacts of the programme (e.g. job creation) the measurement of the success and/or failure of the project, the replication of the project if any.

The mapping exercise described above was followed by the design of a questionnaire to collect more information and data through interviews of policy-makers, implementers and practitioners to fill in the gaps in the literature review. The interview period was longer than expected because of the difficulty that most of those interviewed had in assessing the success of the overall programmes and the length of discussions on the criteria to define best practices.

Overall, the mapping and the interviews allowed us to gain a better understanding of the barrier each programme tried to address and the adjustment stakeholders would consider in a similar programme in the future.

The analysis of the data gathered helped to identify the best practices used to overcome each of the barriers perceived by market actors. The best practices were analysed and brought together in the market framework proposal described below.

The last step was to share the market framework proposal with stakeholders at conferences and workshops to generate feedback and capture implementation implications at national and local level which can subsequently be integrated in policy guidance in case countries decide to implement it.

Analysis of barriers and existing incentives used to overcome them

Numerous studies have analysed the nature, categories and occurrence of the barriers to energy efficiency improvements in the buildings sector (Brown, 2001; DeCanio, 1993; Sorrell et al., 2004). These barriers include the structural characteristics of the political, economic, market and energy systems (Geller, 2006), the ratio of investment cost to value of energy savings for individuals (J. Deringer, 2004), as well as the perceived risk to investors (WBCSD, 2010).

For the purpose of this paper, we consider on one hand the barriers that prevent owners from borrowing to retrofit their buildings and on the other hand the barriers that prevent banks from providing loans for energy retrofit. For each barrier the financing programmes implemented to overcome the barrier were analysed.

Regarding the low demand for low-energy buildings, it is well-known that owners do not usually ask for loans to improve the energy performance of their building even when the interest rate for such retrofits is low while they do ask for loans to modernise their properties or buy a new car. There are at least three possible explanations for this reluctance. First, the split incentive barrier between owner and occupier, second, the repayment of the loan in cases where the property owner changes and third, the lack of confidence in the predicted energy savings.

The “split-incentive” barrier refers to the situation in which the investor behind an energy retrofit is not the one who will benefit from the resulting reduction to the energy bill. One way to overcome this barrier is to attach energy loans to properties rather than individuals as was implemented first in the US under the PACE (Property Assessment Clean Energy) (S. De la Rue de Can, 2013, G. Kats, 2012) programme and more recently in the UK Government’s Green Deal (J. Rosenow, 2013, DECC 2012 & 2010) .

The second barrier concerns the mechanisms to ensure that any remaining balances are paid off in the case the property is sold before the end of the loan term. Governments overcome this barrier in two ways, either using on-bill finance programmes paid through energy bills or by using property taxes to pay off the loan. This latter mechanism was used in the US PACE programme (G. Kats, 2012). The Green Deal will use on-bill finance in the hope it will also raise awareness among consumers about the need to consume energy in an efficient manner and help in overcoming the behaviour barrier as consumers can see the impact of the retrofit in their reduced energy bill (DECC, 2012 & 2010).

The lack of confidence in expected energy savings, the third barrier, stems from two main sources. Firstly a lack of compliance-checking which creates uncertainty and mistrust in the quality and performance of any retrofitting materials used. Secondly, the fact energy savings are expressed in terms of energy efficiency rather than as an overall reduction in energy use. Energy efficiency is the ratio between the service delivered and the energy used to deliver the service, but does not equate to a reduction in absolute energy used. This means it is not clear whether the consumer will see lower energy bills, or benefit from the improved energy performance of their building for the same amount of energy used, and therefore means that owners are not confident in the return investment of an energy retrofit. Energy performance contracting can help to overcome this barrier if a guarantee of the savings is included over the life-time of the contract. Such a guarantee should run over the period where energy savings are paid through the energy bill. To ensure that the estimate of this period is based on the real savings that the efficiency measures will deliver, some programmes like the KfW programme in Germany included the assessment of the measures by an independent third party (Clausnitzer, 2011, Diefenbach, 2011).

When we looked at the supply of finance to implement energy efficiency measures in the buildings sector, we noted that local banks are very reluctant to finance such measures. The reasons for this reluctance include the perceived credit risk, the lack of secondary markets and the high transaction costs.

The perceived credit risk is explained by finance institutions as stemming from the lack of practices and methodologies to measure and verify energy savings. This is compounded by the lack of confidence in the actual energy savings that the measures will provide and uncertainty over the behaviour impact on savings, all of which hinders the inclusion of energy efficiency investments in property mortgages. From interviews with lenders and the case studies analysed, it appears that energy performance contracting which have guaranteed savings (clear measurement, verification and quality assurance) and clearly defined responsibilities in case of failure partially mitigate this risk without removing it completely (Bleyl & all, 2010).

Another area of concern is the fragmentation of the buildings sector which is characterised as a sector of numerous owners, building types and construction periods. The fragmentation increases the range and number of measures that need to be implemented and make it difficult for financial service providers to have a clear understanding of the variety and cost of different measures. There is therefore a need for an up-front analysis to be conducted to have a better understanding of energy efficiency measures to be implemented by construction period for each building type. This should be followed by estimates of the cost for the package of solutions to be implemented for each building type per construction period. These costs estimates will make it easier to develop standard loans for each package of measures. This in turn, will make it easier for commercial banks to sell energy retrofit loans on secondary markets for example to institutional investors. To overcome this barrier, a guarantee fund is needed to enable the development of a secondary market for energy retrofit loans. Existing energy and carbon taxes such as the savings obligations on energy providers implemented in the US and the EU could be used to feed such a guarantee fund.

A related barrier perceived by lenders is the scale of renovation. So far, existing energy efficiency financing programmes target individual end-users and as such individual homes or buildings. As a result the loans do not usually exceed 10,000 US$ which makes the transaction costs for providing each individual loan too high to make them attractive for the commercial banks (K. Palmer, 2013). It also raises the cost of the loan for property owners, making the loans less attractive for the owners such as in the Green Deal (Rosenow, 2012). Transaction costs can be reduced by bundling energy retrofit projects as it has been done successfully through the KfW programme in Germany (Clausnitzer, 2011, Diefenbach, 2011).

Key findings

Successfully managing the energy demand of the buildings sector has benefits that go beyond making savings on energy bills for end-users. It can help energy importing countries to reduce their energy dependency and lessen the negative impact of such imports on governmental expenditures and the environment as described in Figure 4 above. This could be achieved by adopting a renovation strategy that sets clear targets for an absolute reduction of the energy demand and energy consumption of the overall buildings stock by 2050.

All IEA countries are already implementing energy efficiency financing programmes to achieve low energy buildings stock by 2050. However, the increase in the energy consumption of the buildings sector in IEA countries makes it clear that current policies will not achieve this objective and that most of the savings potential is in danger of remaining untapped as shown by the world efficient scenario in Figure 3. The design of policies based on individual measures for individual buildings is clearly a failure that has created several roadblocks on the path to a low-energy and low-carbon buildings stock. There is a need for a paradigm shift in the way that energy efficiency policies for the sector are designed.

The first modification needed is the alignment of energy requirements across different policy instruments as it was done by the KfW scheme (Clausnitzer, 2011, Diefenbach, 2011). This will help to avoid contradictory and unrealistic targets while ensuring that targeted savings are measureable.

The second and potentially most important change in all IEA countries is to make low-energy buildings a 'business as usual' scenario by 2050. This requires a change in policy design.

For this purpose, we propose an innovative market framework (Figure 5) to shift the focus from the individual building perspective to examine the overall building stock. In our approach, the renovation of the existing building stock is made mandatory by governments with the aim to achieve green growth (OECD 2011), reduce energy dependency, and reduce the associated impacts of energy production on health and the environment.

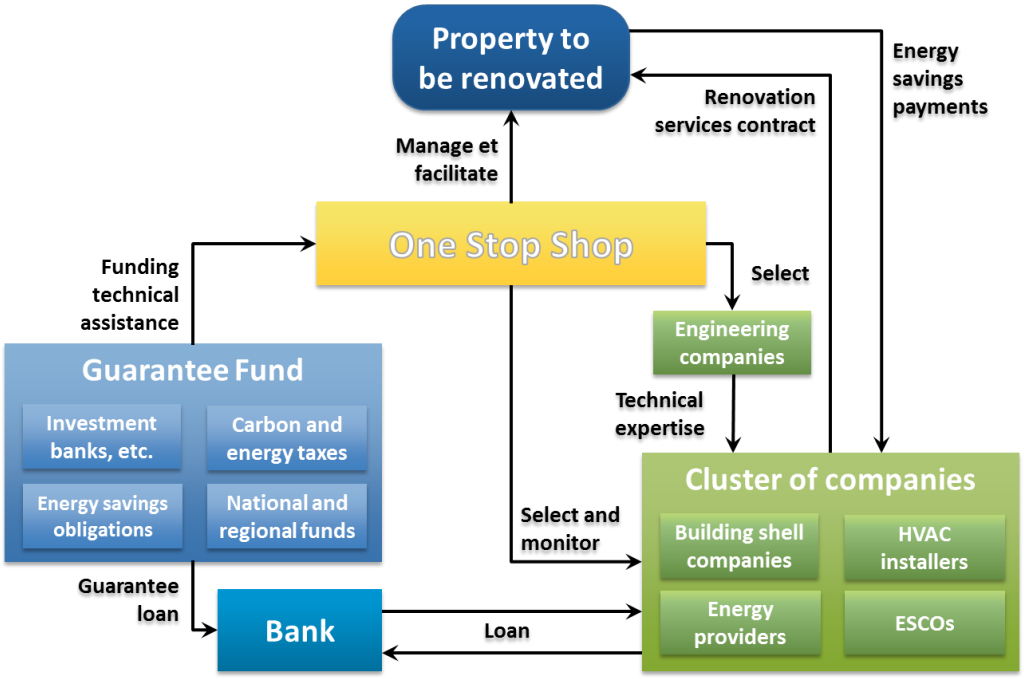

Figure 5. Market framework proposal to enable and scale-up deep renovation

The proposed market framework draws on lessons learned through the UK's Green Deal, the KfW programme in Germany as well as the utilities programmes in the US. It proposes to establish two new policy instruments to effectively remove the barriers described above, namely a One-Stop-Shop, and a Renovation Guarantee Fund.

The "One-Stop-Shop" has to be an independent third party which has a strategic overview of the buildings stock, to maintain its independence it should not be involved in proposing solutions or conducting renovations. Its role could be fulfilled by local energy agencies where they exist. However, existing agencies will need to develop new technical capacities and expertise. The "One-Stop-Shop" should oversee the prioritising of which buildings to target first; of tendering and selecting engineering firms to conduct the technical analysis and gives recommendations on the measures to be implemented and companies to implement the energy efficiency measures agreed by different stakeholders; and of monitoring the overall renovation programme. It needs to provide and implement a framework of quality assurance, compliance, and co-ordination that has the flexibility to enable the fast expansion of a deep retrofitting market across market segments.

The "Renovation Guarantee Fund" could be a public or public/private fund fed by existing funding provisions for renovation. The Renovation Guarantee Fund would have two main purposes, first to finance the "One-Stop-Shop" and second to guarantee loans that commercial banks would provide to companies involved in the renovation.

Contracting could be based on Energy Performance Contracting (EPC) with some modifications. To take into account the long-term perspective, EPCs should be extended for a longer period of time and to non-public buildings. The contracting period would vary by project, but initial estimates show that it would be less than 30 years (IEA-DSM, 2012). In other words, the improvements would generate energy cost savings over that period sufficient to pay off the cost of the implementation of energy efficiency measures. The contracting should be attached to the property instead of the individuals to avoid the obstacles of split incentives and frequent change of property ownership.

To ensure that the building envelope will be tackled, the EPC should be contracted by a consortium or cluster of companies (construction companies, companies providing building products and equipment…) and should be related only to the implementation of energy efficiency measures. The measures to implement should be defined by a third independent party such as engineering firms to ensure measures will be based on the highest savings potential available instead of measures that are cost-effective for each individual company. Currently energy efficiency measures implemented by EPCs usually target functionalities such as lighting or heating systems and very rarely the building envelope. Two reasons may explain this fact. First, measures targeting functionalities can in most cases be refinanced through energy savings with a period of less than 5 years while building envelope measures require more time.

Holistic improvements to the building envelope will need to be covered by the EPC with the upfront costs of such renovations being met through a combination of loans underwritten by commercial banks to the consortium of companies and guaranteed by the guarantee fund and core budget of the consortium of companies. Co-financing projects through loans provided to the consortium of companies is therefore needed to implement measures targeting deep renovation

The consortium of companies would guarantee a certain amount of energy savings over a specified period of time during which the appropriate energy efficiency measures are implemented.

EPC contracts will allow the payment for the implementation of energy efficiency measures. The property occupant pays the full energy bill as if the consumption did not decrease, and the consortium of companies would be paid from energy savings achieved through the renovation. After the full cost of the renovation has been paid back to the consortium through energy savings, the property occupant will benefit

from the real reduced energy bill. By the end of the contract the property will have benefitted from the savings. In this way, the up-front cost obstacle is removed as the whole operation is financed through debt incurred by businesses – the contract remains in the realm of business to business relationships.

When adapting the proposed market framework to a national or local economic context, conflicts of interest could arise for some existing organisations that may fulfil the "One-Stop-Shop" role. As noted above, to make the overall scheme successful, the "One-Stop-Shop" should not be involved in conducting renovation works or in proposing solutions for their implementation. It should be entirely independent. Also annual evaluations of the overall scheme are needed adjust the scheme to local technical capacities and economic circumstances based on lessons learned.

While the objective of the market framework is to create the development of a business driven market for an energy efficient building stock, there is a further role for regulation. Mandatory energy efficiency renovation rates would be instrumental in speeding up progress.

Conclusions

It is clear that moving towards a low-carbon future requires a significant reduction in the energy demand of the building sector. While current policies have been effective in ensuring marginal improvements in the energy efficiency of new construction, the largest challenge facing energy efficiency policy makers today is how to improve the energy performance of the existing buildings stock. A component based approach to energy efficiency and policy making will not enable the level of reductions required.

Up to now most financial instruments have been limited in scope and insufficiently aligned with energy efficiency policies and targets. Based on an in-depth analysis of barriers and the actual factors and mechanisms that block the creation of a market for energy efficiency, the proposed market framework provides an integrated approach that breaks constraining boundaries and supports the development of innovative financial products that are of benefit to the financial sector, intermediaries, the construction business, building owners and inhabitants and ultimately the society and the environment.

At the outset, governments have a key role to play in creating the framework conditions needed to enable a functioning market for deep renovation of the existing buildings stock, as well as in providing regulatory drivers to stimulate the market.

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