Energy-efficiency investment with special regard to the retrofitting of buildings in Europe

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Introduction

Addressing the gap between potential and realised energy-efficiency investment represents a key element of successfully risk-managing the EU's transition to a low-carbon economy. It is a core component of the strategy enabling the EU to meet its binding 2020 and indicative 2050 emission-reduction targets in a cost-effective and timely fashion. Failure to do this will mean the gap must be filled instead with higher-cost supply-side solutions.

One of the difficulties in assessing the energy-efficiency gap is that – unlike building power stations – the opportunities for efficiency improvement are fragmented and often hidden, and therefore hard to capture from an investment perspective. A comprehensive and stable policy framework is needed to establish an enabling environment for investment by sending the right signals to those who wish to finance energy efficiency.

This chapter discusses the energy-efficiency retrofit market in Europe with the final goal of providing guidance on how to increase current levels. More specifically, it starts by addressing the current investment reality and the barriers to and solutions for improvement, looking specifically at the effects of the recession on the retrofit sector. An overview is given of public and private retrofit investment programmes conducted in the member states, with a case study from Hungary. The chapter concludes by highlighting the employment-creation potential from energy-efficiency retrofitting, before making some final recommendations.

State of investment and untapped potential in the energy-efficiency retrofitting of buildings

There is no doubt that energy efficiency represents the largest untapped opportunity for emission reduction in the EU and that it could deliver up to 33 percent emission reductions across the EU economy by 2020. Buildings alone account for 40 percent of the EU's final energy consumption and have been identified by the European Commission (2009) as a very real and major opportunity to deliver greenhouse gas cuts. Analyses conducted by the Wuppertal Institute (EUFORES *et al.* 2009) indicate that up to 65 billion euros need to be invested in building retrofits each year to 2020 to meet the 20 percent energy-efficiency target. Looking beyond 2020, analysis by DG Clima (European Commission 2011) estimates that 4.25 trillion euros are needed for energy-efficiency investment across the economy between 2011 and 2050 in order to meet an 80 percent EU greenhouse-gas reduction target. DG Clima's analysis states that 759 billion euros need to be invested between 2011 and 2020 – and a steady increase in investment is assumed over the following decades to peak at 1.38 trillion euros between 2041 and 2050.

Yet despite the undoubted huge potential, energy efficiency continues to rank at the lower end of the spectrum of realised sustainable energy investment opportunities. In 2011 "energy smart technologies" – which include energy efficiency but also smart grid, power storage, and advanced transport – accounted for only 7 percent ($19.2 billion) of global clean-technology investment.

The current incremental approach to deploying energy efficiency is not working. Although commercial investors have woken up to the economic potential for energy efficiency, tangible project-based large-scale investment opportunities are limited. In addition, the investment identified by Bloomberg New Energy Finance's analysis which was focused on corporate research and development (R&D), venture capital and private equity, indicated that investment in retrofit projects in the real economy was limited. The public sector has done little better: nearly 8 billion euros of EU Cohesion Funds set aside for energy efficiency remained unspent as of December 2010.

The abundance of the investment potential and – according to the Marginal Abatement Cost (MAC) Curve by McKinsey & Co – the supposedly modest costs of energy efficiency compared to power generation

investments indicate the presence of very significant barriers affecting realisation of the energy-efficiency potential.

Barriers and solutions to increase financial investment for building retrofits

Raising the energy efficiency of buildings would reduce global energy demand by 31 quadrillion thermal units (QBTU) which is 20 percent more than the global use of energy by shipping and air transport combined. In Europe, there is the opportunity to reduce energy demand by more than 5 QBTU by improving the energy efficiency of buildings. Of that opportunity, nearly 70 percent is from improved building heating and cooling performance through retrofitting existing buildings. The remaining opportunity is split fairly evenly between improving the heating and cooling performance of new buildings and switching to more efficient lighting, appliances, and electronics. In many cases, there are very attractive returns from investing in retrofitting existing buildings. For instance, simply cleaning air-conditioning coils could reduce electricity consumption by more than 5 percent. More broadly, many basic retrofits have attractive internal rates of return of more than 10 percent.

However, investment in retrofitting buildings is constrained by a number of barriers, including the following:

1. Austerity policies that limit public investments and incentives;
2. a lack of awareness among financiers of opportunities for energy savings;
3. a lack of certainty that promised savings will be achieved;
4. split incentives between landlords and tenants;
5. a lack of available capital for investment in such projects;
6. a lack of technical expertise among financiers;
7. biased financial perceptions on the part of private investors about high-level initial investment costs and payback periods;
8. relatively high transaction costs due to small size of energy-efficient projects compared to other investments;
9. a lack of a systemic approach to bundling investments.

In addition, in buildings, a large variety of specifications on anything from the height of ceilings to staircase areas means that, in a number of

countries, construction projects are inefficient and expensive—another barrier to investment.

While the financial crisis has set a downward trend to real estate valuations, the retrofitting of the existing building stock could be a means of reversing the tendency. It is however regulatory uncertainty that appears to be the main barrier to increased energy-efficiency investment. In addition, improved standards in building codes, government awareness programmes, innovative financing methods, and support for the development of specialised energy-service companies are among the approaches that could overcome these barriers.

The Buildings Performance Institute of Europe (BPIE) has examined this matter in greater depth and distinguishes the following levels of renovation coupled with needed investments:

— Minor renovations: the implementation of 1 or 2 measures (e.g. a new boiler) resulting in a reduction in energy consumption of between 0% and 30% (with average investment of 60 euros/m^2).

— Moderate renovations: involving 3-5 improvements (e.g. insulation of relevant parts of the dwelling plus a new boiler) resulting in energy reductions in the range of 30%-60% (with average investment of 140 euros/m^2).

— Extensive renovations: in this approach the renovation is viewed as a package of measures working together leading to an energy reduction of 60% - 90% (with average investment of 330 euros/m^2).

— Almost Zero-Energy Building renovations: the replacement or upgrade of all elements which have a bearing on energy use, as well as the installation of renewable energy technologies in order to reduce energy consumption and carbon-emission levels to close to zero (with average investment of 580 euros/m^2).

The BPIE also concludes that little data is available about the number of renovation projects being undertaken, their extent, costs, effects, or indeed trends in renovation rates. Renovation rates (other than those relating to single energy-saving measures) are estimated between 0.5% and 2.5% of the building stock per year (BPIE 2011).

BPIE therefore assumes that the current prevailing renovation rate across Europe is around 1%. To meet the EU's energy savings target for 2020, this rate will need to double or even triple. According to BPIE (2011), 85% of all current renovations could be characterised as minor, 10% as moderate and 5% as extensive. The number of renovations leading to nearly zero-energy buildings is considered negligible.

Given the depth of the private investment crisis and its importance for the resumption of GDP growth in Europe, governments should focus on removing barriers to investment in sectors where this would have a measurable impact on GDP growth in the short to medium term. One such opportunity is indeed the energy-efficiency retrofitting of buildings.

Retrofit investment for public and private buildings

The financial crisis has made building owners more cautious about spending on energy-efficiency improvements. This is particularly the case with large commercial and public buildings.

Commercial and public buildings make up 25% of the existing building stock in Europe. While they are in a minority compared to residential housing, energy-efficiency improvements in commercial and public buildings pay back faster than in residential houses because the reduction in electricity bills is more substantial, making the return on the initial investment visible more rapidly. Hence, experts argue that upfront investments can be recovered fast and go beyond merely saving energy and reducing electricity bills. Surely, this should be enough to persuade public and commercial building owners to make the investment. However, the financial crisis and EU austerity policies have made them more cautious about making large up-front investments in energy-efficiency refurbishments.

Working on public buildings, for example, can indeed be very costly, since most have a historical value that makes it harder to carry out traditional energy efficiency improvements. In addition, public authorities see expenditure on energy efficiency as public spending that needs to be fit into the tight fiscal criteria defined by European austerity policy.

One of the reasons for reluctance towards energy-efficiency improvements is the often heavy up-front investment cost and the need to see

immediate results. However, the burden of the initial capital investment can be spread through specialised energy-services companies (ESCOs), like Germany's Kreditanstalt für Wiederaufbau (KfW), a government-owned development bank based in Frankfurt. KfW provides, through regular banks, long-term loans for residential houses, but also for public authorities and enterprises that want to refurbish their old buildings or make their production more energy-efficient. What makes the KfW scheme attractive for investors is that it also takes part of the investment risk, making it a leader in the field of energy-efficiency retrofits. For every euro spent, investors saw a return of 5 euros, calculated on the basis of the number of jobs created or the benefits brought to society and business.

Even so, the most frequent obstacle for investing in energy efficiency remains the long investment return period and the inability to secure the investments on acceptable terms. However, a cost-benefit analysis, after an initial energy-efficiency audit, can make public customers change their mind as in some cases the return on investments can be as fast as between two and five years.

Despite the more cautious attitude towards spending from public authorities in times of crisis, there are many private businesses and owners all over Europe currently undergoing energy efficiency improvements in their buildings. Whilst most of their reasons are economic, such as saving money on their electricity bill, end users opt for lower-energy buildings also because of the higher property value and comfort.

When economic or social reasons are not enough to convince a business to make their buildings green, then the pressure of public opinion might still work. In the corporate sector, reputation plays a central role. When they make energy-efficiency improvements, companies are able to adapt their corporate messages and showcase their responsibility in managing their carbon footprint. At times of crisis, energy efficiency at production sites is already a prerequisite for reducing costs and is even increasingly becoming a marketing argument.

Effect of recession on retrofitting investment

This is the pattern we are now observing in Europe. Investment has dropped the most in countries (Greece, Ireland, and Spain) and sectors (construction and real estate) that have experienced the largest fall in

economic growth expectations. The bursting of the property bubble in some European countries, which has left a large amount of spare residential dwelling capacity, means that little new construction is taking place (let alone retrofitting) and has coincided with depressed residential real estate investment. The boom was fuelled by increases in household debt, which rose significantly as a share of GDP in some countries between 2002 and 2008; in Ireland it increased from 50 percent to 108 percent and in Spain from 49 percent to 82 percent. Corporate debt in the construction and real estate sectors also rose; by 2008, it was more than double its 2003 level.

The demand outlook in the construction and real estate sectors has weakened considerably since the bubble burst. Fixed investment fell by 18 percent between 2007 and 2011. This accounted for around half of the total drop in combined fixed investment, well above these sectors' one-third share of fixed investment. Sharp falls in Greece, Ireland, and Spain accounted for 30 percent of the total. Outside these countries, the percentage drop in investment in these sectors was comparable to that observed in other sectors, reflecting a broad loss of confidence. Sales volumes fell by 20 percent in residential construction and by 14 percent in non-residential construction but by only 6 percent in civil engineering.

Conversely and on the bright side, according to the Global Buildings Performance Network (GBPN), the long recession may sometimes also increase the attractiveness of energy-saving investments in buildings, according to a new survey of construction and real estate. "*Deep retrofits will be crucial to achieving lasting value*," the report says. As financial assets have grown more risky, investors have found that building renovations cut energy costs, increase rental values and prevent such assets from depreciating.

The GBPN (2013) report "Investing in energy efficiency in Europe's buildings" finds that the risk of asset depreciation on properties is compounded by a lack of data about the energy consumption and carbon footprints of buildings. Only half of the EU companies surveyed by the BPIE audited their energy use, although this figure is higher than in the US (30%), India (28%) or China (15%). Of those companies which have begun proactive evaluations, four lessons emerge, the report says:

— Deeper retrofits lower the risk of asset depreciation;

— Taking a portfolio approach to managing building stock helps large property owners increase the cost effectiveness of their energy efficiency efforts;

— Retrofitting should be strategic and Europe's oldest and most inefficient buildings should be renovated first;

— The scale of investment determines the speed of the retrofitting.

The findings suggested that investors were increasingly willing to invest in refurbishments of their own properties, because they had lost trust in other forms of investment. The depressing effects of the financial crisis had been felt most on the commissioning of new buildings. Unlike China and India which are experiencing a housing construction boom, new construction in Europe represents only around 1% of the total housing stock at present.

According to the Energy Efficiency Directive (EED) and the Energy Performance in Buildings Directive (EPBD), all new buildings in the EU should be "nearly-zero energy" consumers by 2021 but it is left up to member states to define what this means. The BPIE report also states that more definition of what is meant by "nearly zero-energy buildings" is needed. Member states must ensure that implementation of the directive is done effectively, and that they put a national renovation strategy in place that incentivises deep renovation.

In addition, a lack of EU-wide harmonisation of the directive's energy performance certificates was causing problems for private sector companies which operated transnationally. These certificates are supposed to give property owners and tenants information about the energy quality of buildings but, in the absence of common rules, it is difficult to compare the data across borders.

Public revenue benefits from buildings retrofitting

The creation of improvements in energy efficiency may offer a new source of tax revenue for governments. This includes revenue from direct taxes such as corporation and income taxation but also indirect taxation such

as value-added tax (VAT) on construction and installation services. Research by KfW Bankengruppe shows that for every euro of public funds spent on its Energy Efficient Construction and Refurbishment programme in Germany in 2010, the Federal Government received 5 euros in tax revenue. In total, the programme produced 5.4 billion euros in direct tax revenue from companies and employees in 2010. Additionally, the 340,000 jobs created by the programme in the same year reduced government spending on unemployment welfare payments, representing savings of 1.8 billion euros in 2010. The KfW Energy Efficient Construction and Refurbishment programme offered 8.9 billion euros in promotional loans, which crowded in further private sector investments worth 21.5 billion euros in 2010. The programme achieved returns of 12.5 percent on investment, which enabled KfW to offer 1 percent subsidies on their loan interest rates.

This example illustrates the potential for energy-efficiency programmes to generate substantial revenue for governments, a particularly attractive opportunity for economies that are currently operating below capacity because of the crisis. However, it will be important to consider revenue losses that may arise elsewhere as a result of structural change to the economy, an effect that is likely to be more pronounced in economies running at near optimal capacity.

Energy-efficiency improvements – particularly those requiring retrofits – are often a "hidden" investment opportunity. Just like carbon emission reductions, up-front time and effort need to be put into seeking out many of the opportunities. A complete energy efficiency upgrade of the EU's building and wider industrial and utility infrastructure is therefore likely to happen only if governments start to regard identification and delivery of energy efficiency as being on the same level with other major infrastructure delivery, and if they provide fair and equivalent treatment to supply- and demand-side solutions.

The successful delivery of large and complex retrofit programmes will require a multi-faceted and sustained focus because, just like other critical infrastructure programmes and projects, delivery will involve many major investment decisions and multiple stakeholders. Issues affecting successful delivery will include those of a systemic nature such as planning and, in some countries, energy-pricing policy – which will affect programmes as a whole – and project specific issues, such as the commercial arrangements between stakeholders. Government action can

help to pave the way for the necessary investments to be made, whether projects or programmes are being delivered by the public or the private sector or by both in partnership.

Retrofitting investments programs from the member states

Programmes investing in the retrofitting of buildings to make them more energy-efficient can be found in a number of EU countries. These tend to cover private households, but some countries have chosen to finance this kind of retrofitting work in public and industrial buildings as well. Belgium, the Czech Republic, Germany, Estonia, France, Ireland, Italy, Latvia, Lithuania, Hungary, Austria, Poland, Romania and Slovenia all have building retrofitting initiatives in place. Although job creation may not be the primary aim of such initiatives, these programmes are recognised (BPIE 2011) as having positive employment effects in a sector which often has been severely affected by the economic crisis (construction). They may also grant social benefits by improving the buildings and thereby the living/working conditions of their inhabitants/employees.

In the Czech Republic, for example, the "Green Savings" (Zelena Usporam) programme was launched in late 2009. This large-scale project operated by the Ministry of Environment focuses on achieving savings in heating energy through the installation of additional thermal insulation. The programme has subsidised new insulation for family houses and apartment buildings, including the replacement of windows and doors, the replacement of environmentally unfriendly heating devices, as well as the construction of new houses which meet the passive energy standard and solar energy technology, primarily in residential housing. Since 2011 the programme has paid out almost CZK 20 billion (EUR 792 million), as over 250,000 households were able to use the programme support to insulate their dwellings, and supported 19,000 jobs per year. A second programme, the "Panel Programme", focused on heat insulation in panel technology for concrete apartment buildings inherited from the communist era. The insulation projects supported by the Panel Programme created about 6,000 jobs annually. In addition, it is suggested that the fiscal multiplier effect of the "Green Savings" programme has been larger than those of other public expenditures thanks to the requirement for co-financing of each insulation project from private funds.

Austria's programme for the thermal reconstruction of buildings project was also effective in terms of employment generation, specifically in the construction sector, where more than 20,000 jobs were secured or created in 2011 and 2012 alone.

In Belgium, according to estimates from the Construction Federation, the energy renewal of existing buildings (excluding wall and floor work) should provide jobs for a total of 13,500 people over the next 10 years (Plasman *et al.* 2013). More rigorous criteria will result not only in an increase in green jobs but also in a greening of existing employment, given that these regulations have an impact on the working methods and kinds of activities required by these jobs (technological modifications, choice of materials, replacing the maintenance of heating systems with that of a far more substantial ventilation system in passive houses, etc.).

Germany's building retrofitting programme, which was promoted by the trade unions and employers' organisations, is the biggest programme of its kind worldwide. It mobilised around EUR 100 billion in the past decade and – besides enhancing energy efficiency – created around 300,000 direct jobs per year. The programme is supported by loans from the German development bank KfW.

In Romania one of the objectives of the government scheme to improve the energy efficiency of large multi-storey apartment buildings was to support the construction industry at a time of crisis. The ongoing "Green House" initiative in Romania, which started in 2009, aims to promote energy efficiency among households and business establishments by providing subsidies for the installation of heating and power plants using renewable energy sources (RES). The measure encourages the use of RES while in the meantime supporting employment in a specific sub-sector of the construction sector and also providing an incentive for training in green qualifications. The scheme encourages individual and community initiatives and promotes entrepreneurship. In 2011 some 11,000 households and 170 businesses benefited from the initiative.

An important instrument for the UK government is the "Green Deal", which came into full effect in autumn 2012. The basic idea is that consumers can improve the energy performance of their homes by using the services of the so-called "Green Deal Providers". There are no upfront costs for installing energy-saving measures; rather, those costs are covered by the energy savings on their energy bill (the Pay-As-You-Save

principle). The measures can include loft and cavity wall insulation, energy-efficient glazing, innovative hot-water systems, condensing boilers and controls, solid wall insulation, as well as micro-generation systems. At the heart of the Green Deal Policy is the "Golden Rule", which determines the amount of money that consumers can borrow. It limits the amount of Green Deal finance that a provider can attach to the electricity bill, which is related to the estimated energy bill savings that are likely to result from the installation of measures in the Green Deal plan.

The Building Insulation Programme in Slovakia was launched in mid-2009 as part of the government's stimulus package to mitigate the negative impacts of the economic crisis. The idea was to use revenues from emissions quota sales to improve energy savings and reduce housing costs for households by way of subsidising the thermal insulation of residential buildings built before 1989. Support was provided to applicants in the form of interest-free loans of up to 100 percent of the costs provided projects led to heating energy savings of at least 20 percent. A government evaluation report (Government of Slovakia 2011) confirmed the creation of approximately 8,000 job opportunities and rated the programme one of the most cost-effective stimulus measures. Applications significantly exceeded available funds and the government decided in 2011 to extend the programme.

In France, the "Grenelle Plan-Batiment" required that by 2012 all new buildings would be low-power and by 2020 they will all be energy-positive. The plan includes progressively scaling up capacity to renovate 400,000 units in 2013 and 800,000 houses using the most energy by 2020.

In conclusion, the type of future real-estate investment will differ from country to country. In some parts of Europe, including Spain and Ireland where property booms have left large housing extensions, additional private investment could still occur through efforts to boost energy efficiency in new buildings and from retrofitting. If Europe were to meet its 2020 energy targets, retrofitting existing buildings and improving the energy efficiency of new buildings, including the installation and use of more energy-efficient materials and equipment, could lead to roughly 37 billion euros a year of additional investment between 2010 and 2030.

Case study: investments in energy-efficiency retrofitting in Hungary

A specific focus on Hungary has been chosen because of the availability of one expert study that demonstrates the benefits of deep retrofitting within the context of a less ambitious country-wide energy-efficiency programme. The results of this study, coupled with the carrying out of specific retrofit projects suggested by it, may provide useful guidance for other member states wishing to invest in similar retrofit programmes.

A study (CEU, ECF 2010) on the impacts of a large-scale deep building-energy-retrofit programme in Hungary has demonstrated that up to 85% of Hungarian heating energy use, and the corresponding CO2 emissions, can be avoided by a consistent and wide-spread deep retrofit programme in the country. This, in turn, can substantially improve the country's energy security: by 2030 a deep renovation scenario could save up to 39% of annual natural gas imports and up to 59% of natural gas import needs in the most critical month from the perspective of energy security, namely, January.

At the same time, the study has also highlighted the major risk associated with less ambitious retrofitting programmes. If renovations aim at keeping today's retrofit depth in the manner of those implemented by existing programmes (i.e. reducing around 40% of present energy use in existing buildings on average), this results in a significant lock-in effect. This sub-optimal renovation scenario saves only approximately 40% of final heating energy use, locking in approximately 45% of 2010 building heating-related emissions at the end of the programme, around 22% of 2010 total national emissions. This means that it will become extremely difficult, as well as expensive, to achieve the ambitious mid-term climate targets, such as the often quoted 75-85% reductions that are needed by 2050.

The realisation of a sub-optimal rather than a deep renovation scenario results in other compromises too, such as in terms of energy security enhancements. Instead of saving up to 39% of national natural gas imports, it saves just over 10%; and the peak consumption (January import needs) is reduced merely by 18% as opposed to the 59% reduction in the deep scenarios.

With regard to the employment effects, the results of the study clearly indicate that adopting a high efficiency retrofitting standard – close to

'passive house' – would result in substantially higher employment benefits than the business-as-usual and sub-optimal renovation alternatives.

In particular, the study has demonstrated that a large-scale, deep renovation programme in Hungary could create, by 2020, up to 130,000 net new jobs, as opposed to 43,000 in the sub-optimal scenario. These figures include the workforce losses in the energy-supply sector – which is likely to be hit especially hard in district heating in the deep renovation scenarios. It is important to highlight that up to 38% of the employment gains are due to the indirect effects on other sectors that supply the construction industry and the induced effects from the increased spending power of higher employment levels.

As highlighted above, the study has demonstrated that from a socio-economic and environmental perspective it is important that the government supports a deep renovation programme rather than a sub-optimal one.

Strictly from an employment benefit perspective, a first scenario brings the best results: 131,000 jobs as opposed to the 78,000 of a second and 52,000 of a third scenario – the scenarios aiming at equally ambitious renovation levels, but with more gradual implementation rates (150,000 and 100,000 dwelling-equivalent per year, as opposed to 250,000 in the first scenario). However, the corresponding annual investment needs are also significantly higher (up to 4.5 billion Euro/year for the first scenario in the initial phase of the programme as opposed to 2 billion for the second, and 2.8 billion for the third scenario). While it may be possible to free up and allocate the requisite capital for the purpose, more significant re-channelling and drastic changes in both material and labour markets would – as well as representing a major shock to the labour market – have more negative effects, as described in the study. Therefore a more gradual, longer-term implementation of a deep renovation programme is desirable from these perspectives.

The research has also found that redirecting the current energy subsidies and making wise use of available EU funds would make available around 1 billion Euro per year, an amount that would, by itself, practically cover, during the first years of the programme, the full annual costs of renovating Hungarian buildings at a rate of 100,000 units per year.

Viewed from a total cost perspective, what is more, a more gradual implementation of a deep renovation programme is considerably more attractive. Due to the relative inexperience with deep renovation know-how and technologies, initially these will undoubtedly be more expensive than after a learning period when experience will have been built up and more mature markets and competitive supply chains established. As a result, a more aggressive renovation programme (i.e., 250,000 renovated per year instead of 150,000 or 100,000) results in higher overall costs of renovating the Hungarian building stock: 60 billion euros for the first, 50 for the second and 44 for the third scenario. On the other hand, the implementation of a more aggressive programme would result in a faster harvesting of energy-saving benefits: by 2050, the total accumulated undiscounted benefits of the first scenario would amount to 97 billion euros, whereas the second and third scenarios would have produced 80 and 60 billion euros of energy savings respectively.

On the qualitative aspects of the new jobs created, it is believed that the length of the programme ensures that the jobs created are long-term, and the fact that the whole building stock is considered for renovation implies that the new jobs are likely to be distributed throughout the country, as renovations are usually carried out by local small and medium enterprises spread throughout the country.

To create the conditions for a smooth implementation of the programme, the public administration should be decisively involved in the planning and the financing of the retrofit programme, to promote initiatives that would reduce the risks of supply bottlenecks (such as labour, material or finance supply) and to ensure that the renovations deliver the expected energy savings, so as to ensure the financial practicability of the intervention.

The example of Hungary shows that viable means exist to unlock the potential for creating additional jobs while reducing the energy costs of households and public buildings and making further contributions to mitigate climate change. Among the scenarios presented in this case study, the results indicate that deep (i.e., passive house-type) renovations are recommended as compared to sub-optimal ones. High-efficiency renovations create more jobs, save more energy, reduce more emissions and decrease to a larger extent the energy dependency of the nation.

Employment creation from investment in energy-efficiency retrofitting

Energy-efficiency improvements can be implemented wherever energy is consumed in the production process. This can include energy-efficiency improvements to major infrastructure, residential and commercial buildings, equipment used in residential and corporate buildings, and transport required for logistical purposes. Installation of energy-efficiency improvements tends to be implemented on a localised basis, by engineering, construction and installation companies. This provides substantial and diverse job-creation potential.

In some cases jobs related to implementing energy-efficiency improvements are more labour-intensive – i.e. less productive – than alternatives and this might reduce whole economy output. However, in the current demand-deficit environment this is not an issue – and may actually generate an advantage in terms of job creation and boosting income. It should be noted also that many jobs in this sector involve the deployment of innovative technologies – including high-tech industrial process technology; district heating and combined heat and power systems; smart meters and smart grid; advanced heat pumps; laser measurement technologies; and infrared technologies to assess thermal loss from buildings – that enhance productivity and so should be encouraged. In parallel to running programmes focused on retrofitting for energy-efficiency improvement, therefore, EU economies should focus on driving innovation and growth in higher-productivity sectors to avoid low-skill and low-growth lock-in.

There is no doubt that member-state-led energy-efficiency retrofitting programmes will provide localised low-carbon jobs. The labour-intensive nature of the work also means it has the potential to provide extensive employment – a critical requirement in European economies that are operating under capacity. However, over the medium term a stimulus programme focused on energy-efficiency retrofitting could start to have an adverse impact on growth because a proportion of it is classed as low-productivity work. Many of the technologies needed – insulation, variable speed motors and so on – are mature and well understood. But further innovations around smart technologies, energy storage and retrofitted building insulation are needed to improve energy management and increase productivity. So governments should also have a focus on driving technological innovation, securing localised manufacturing bases and

ensuring that in the medium-term higher growth levels are secured. These technologies have a strong potential to contribute to growth both through the learning effects of developing and diffusing new technology and through further improved energy management. Switching to energy-efficient technologies through directed technical change can lead to dynamic gains in both carbon savings and welfare gains that continue to accrue over time. Early action by member states to develop expertise in the next generation of energy-efficiency technologies could allow them to capture innovation clusters and high value R&D and manufacturing jobs. The extent to which this happens locally will depend on the successful design and implementation of member state and European industrial policy.

Industrial policy always raises questions of whether and when governments can effectively sponsor the creation or competitiveness of new industrial sectors. Thus a green-growth programme focused on energy efficiency faces the same set of challenges that industrial development has always faced. More important is effective structuring of the skills base (education and training provision) and provision of capital (through grants but also public financing institutions) through the supply chain to provide durable comparative advantage in competitive world markets.

There are several estimates of the employment-creation potential of energy-efficiency investment programmes. The EU Energy Efficiency Plan states that 2 million jobs will be created in the EU buildings sector by 2020 if EU targets are achieved. An analysis by the European Trade Union Confederation (Syndex 2011) estimates that up to 2.59 million jobs could be created in the EU buildings sector by 2030. These estimates include the direct employment effects – those blue-collar jobs created within the buildings retrofit installation sector – as well as the indirect employment effects – those manufacturing and white-collar jobs created along the buildings retrofit supply chain.

Another way to approach this issue is to look at the "local economic multiplier effect" – creating local employment opportunities and retaining investment in the local and regional economy. The "local economic multiplier effect" encompasses further economic activity (jobs, expenditure or income) associated with additional local income, local supplier purchases and longer-term development effects. For example, in terms of job creation, when four dwellings are refurbished to high

energy-efficiency standard, this creates the equivalent of one full-time job per year. Therefore, to this direct effect on employment must be added the multiplier effects:

— A supply multiplier which comes about due to purchases made as a result of the project and further purchases associated with linked firms along the supply chain;

— An income multiplier which is associated with local expenditure as a result of those who derive incomes from the direct and supply linkage impacts of the project.

As a result, it is estimated that for every ten direct jobs created in the framework of a retrofitting programme, seven additional jobs are indirectly created in the community and elsewhere.

Energy-efficiency activities are more labour-intensive than manufacturing. The leverage of public and private funding is often between ten and five to one, meaning that one million euros of public money can lead to investment of between five and ten million euros. This means the creation of between 85 and 190 jobs for one million euros of public money spent.

Changes in household income, due to reduced energy bills for householders as a result of the energy-efficiency measures, will affect employment in the wider economy, contributing to increases in jobs in sectors providing consumer goods and services in which consumers will spend the money saved on their lower energy bills. At the same time, the reduced energy demand will reduce the level of employment in the energy-supply industry. The employment effect of an investment of one billion euros in housing renovation in the European Union is the creation of 25,900 full time jobs: 15,000 direct jobs and 10,900 indirect jobs.

For instance, the consultancy company ECORYS (2014) estimated that increasing the annual eco-efficient refurbishment rates to 4%, the equivalent of 800,000 units in Europe's social and cooperative housing stock, would alone create 250,000 jobs annually and make a significant contribution to reaching the EU's energy-efficiency targets. The estimated annual expenditure requirement for this refurbishment boom is 16 billion euros.

For maximum impact of the Energy Efficiency Directive there must be a parallel jobs strategy to ensure a comprehensive approach to implementation. In the referred study by ECORYS it is stated that in 2009 the European insulation industry had 232,050 full-time jobs (61,250 in manufacturing and 170,800 in installation) and it is hoped that the recast of the European Building Performance Directive (EPBD) would spur investment in public and private buildings. Based on market studies and the impact assessment for the EPBD, the assumed annual growth is as follows: 1.2% in a low-growth scenario; 2.2% in a medium-growth scenario; and 5% in a high-growth scenario. The turnover of the industry in 2020 is expected to range between 23.7 billion euros in a low-growth scenario and 34.3 billion euros in a high-growth scenario. In employment terms, the range is from 261,400 jobs in the low-growth scenario to 378,000 in the high-growth scenario.

The referred studies confirm that changes are occurring in the labour market as a consequence of climate change. They also find that, in respect of the energy-efficiency and retrofitting initiatives, skills shortages are binding constraints and that it will continue to be difficult to source workers with the right skills to undertake the volume of work required to meet the emission-reduction targets. These changes are a reflection of the requirement for the industry to adapt to the new conditions; they illustrate the scaling up required to undertake the work that will reduce the energy consumed and the volume of emissions for which the constructed environment is responsible. ILO research (ILO-EU 2011) attributes the problem to an underestimation of growth in the small and medium enterprise sectors, the general lack of scientists and engineers, national skills structures that do not meet demand, and the low reputation of some occupations.

Green construction will add occupational profiles and new occupations that will require new sources of labour to supplement the existing workforce. The ILO envisions the emergence of additional functions such as assurance, financing, research, education and policymaking. Gleeson *et al.* (2011) assert that construction teams will require competent emissions assessors, project managers, assessors, appraisers, skilled labourers and auditors. Austrian research identifies the additional competences required of a new green plumber or tradesperson as including customer orientation, the ability to communicate and make decisions, to consult and sell, planning competencies, a high level of independence, and global thinking.

A labour market plan is a key responsibility of EU governments and industry if the transition to a low-carbon economy is to be smooth and effective. This involves not merely the single dimension of labour and skills shortages but also the re-crafting of occupational profiles and the emergence of new occupations involved in the delivery of a low-carbon installation.

Conclusions and recommendations

The current focus of much of Europe's growth strategy is austerity combined with structural reform. This type of reform alone will not drive economic recovery in the short term, however important it may be in the longer term. Demand is also crucial and this requires more expansionary macroeconomic policies. Without them the European economy faces stagnation.

As the focus shifts from austerity to how to drive growth and boost flagging member state economies, the opportunities presented by energy-efficiency improvements are compelling. A new stimulus programme – targeted to boosting demand for energy efficiency through providing financial incentives to improve the economics of projects and combined with regulation (including minimum standards on buildings) focused on ramping up standards – will send a signal to supply chains to gear up and to business to invest and create jobs. The focus on regulation will be important to ensure that long-term costs to governments are minimised by ensuring that there is a long-term tangible financial value for energy efficiency that can in time be financed solely by the private sector.

Such a programme, set up to complement wider structural reform, could provide a convincing roadmap to European recovery. A positive signal in this direction has been given by the European Council and European Parliament which agreed an ambitious Energy Efficiency Directive that includes, at the very least, binding economy-wide 2020 targets and requirements to create national frameworks that drive demand at scale.

The key findings of this chapter include:

— The financial crisis, which has caused downward pressure on real estate valuations across much of the EU, has highlighted the need for refurbishment of existing building stock. This will be needed to

maintain and even increase the value of portfolios; deep retrofits will be crucial to achieving lasting value.

— EU companies are relatively active in retrofitting buildings compared with their counterparts in other regions, but efforts need to increase twofold if they are to meet EU energy-efficiency goals by 2020. A BPIE 2012 survey revealed that 43% of EU respondents in the building sector focus on retrofits, more than in the US (37%) and in China (23%), for example. The majority (57%), however, still focus on new buildings, with energy-efficient retrofits still accounting for only a meagre 1 percent of existing stock.

— The EU has taken some positive steps to improve regulation, but ambiguity regarding definitions of what constitutes a deep retrofit and a "nearly zero-energy building" affects implementation at national levels. Indeed, regulatory uncertainty is a barrier to pursuing energy-efficiency investment. Furthermore, implementation of energy-efficiency-related directives varies from one country to another, limiting the ability of property owners to achieve economies of scale across the region.

— Regulatory uncertainty should not be an excuse as waiting on the sidelines in anticipation of better laws exposes companies to the risk of asset depreciation. Large property owners are starting to audit their portfolios to identify where they can achieve the most cost-effective energy-efficiency measures.

— The deeper the retrofit, the lower the asset depreciation risk. Attracting large institutional investors in retrofit finance will require aggregation of energy-efficiency projects. Aggregators can be public or private and can appear as a result of either regulation or client demand. To be effective, however, they require clear energy-performance objectives, standardized contract structures that allocate responsibility for performance, and data collection and transparency about results.

— Up to 2.59 million jobs could be created in the EU buildings sector by 2030. These estimates include the indirect as well as the direct employment effects.

To reach EU 2020 efficiency targets, retrofits will need to double from about one percent of existing stock today to between two and three percent. This will require a combination of regulatory push and market pull.

The EU has more than one hundred public financing mechanisms to promote energy efficiency in the building sector. Most of them rightly focus on existing stock. The financing, however, largely comes through grants and subsidies which, in a context of cash-strapped governments still dealing with a public debt crisis, are not the most effective use of limited public funds. Instead, public money should be used to leverage more private finance.

Companies can also help attract large investors by aggregating projects. Large property investors could establish green building funds, for example. Demand for these funds can be strong. Such was the case for IVG's Premium Green Fund, a 500-million-euro fund for new energy-efficient buildings in Germany which closed in one day.

Both companies and member states will need more data on the performance of their energy-efficiency investments if they want to attract large investors. Another important aspect will be to value the depreciation effect of neglecting retrofits. The first step, measuring the gains, will be crucial to attracting large investors. The second, measuring the loss inherent in depreciation, will be important to motivate shareholders to invest in order to maintain value today and increase the long-term worth of their portfolios. Finally, both valuations should go beyond the simple energy dimension and try to put a monetary value on other co-benefits to energy efficiency such as increased comfort to occupants, lower maintenance costs, etc. Once again, aggregating projects is critical to large-scale financing, as is proving the value-add of energy-efficient upgrades at the portfolio level. Clear performance objectives, good data collection, standardized contracts and regular independent audits should all help in this direction.

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