A GUIDE TO DEVELOPING STRATEGIES FOR BUILDING ENERGY RENOVATION

DELIVERING ARTICLE 4 OF THE ENERGY EFFICIENCY DIRECTIVE

BPIE

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A GUIDE TO DEVELOPING STRATEGIES FOR BUILDING ENERGY RENOVATION

Delivering the Energy Efficiency Directive Article 4 requirements on long term strategies for mobilising investment in renovation of national building stocks

"I believe that renovation of buildings to high energy performance standards could be one of the most cost effective investments a nation can make, given the benefits in terms of job creation, quality of life, economic stimulus, climate change mitigation and energy security that such investments deliver".

Oliver Rapf, Executive Director, BPIE

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INTRODUCTION

Buildings represent the largest untapped source of cost effective energy saving and CO_2 reduction potential within Europe, yet the sector continues to suffer from significant underinvestment. It is therefore timely that the Energy Efficiency Directive (EED, 2012/27/EU) adopted in October 2012 includes a requirement for Member States to develop long term renovation strategies for their national building stocks.

EED replaces two previous directives on energy services and cogeneration[1]. It seeks to promote energy efficiency across the European Union and was developed in order to help deliver the EU's 20% headline target on energy efficiency by 2020, as well as to pave the way for further improvements thereafter. EED contains a number of measures designed to deliver energy savings across all sectors, from overall national energy efficiency targets to the setting of energy efficiency obligations on energy companies.

Alongside EED, the Energy Performance of Buildings Directive (EPBD, 2010/31/EU)[2], recast in 2010, sets out numerous requirements including energy performance certification of buildings, inspection regimes for boilers and air conditioning plants, and requirements for new buildings to be nearly zero energy. EPBD sets minimum energy performance standards for buildings undergoing renovation.

Together, EED and EPBD provide a framework for Member States to drive the reduction of energy use in buildings, thereby delivering a range of economic, environmental, societal and energy security benefits. This paper focuses on one of the most significant elements of the EED targeting the building sector, namely Article 4 on Building Renovation, which requires that Member States:

"establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private."

Such a renovation strategy supports and reinforces many of the requirements set out in EED and EPBD, as demonstrated in Part 2.

BPIE has prepared this Guide in order to assist Member States in the process of developing their renovation strategies and in particular the first versions which are to be published by 30th April 2014. This Guide is structured as follows:

- In Part 1, we set out the multiple benefits that arise from improving the energy performance of buildings and highlight the existence of numerous challenges and barriers to the achievement of the potential benefits. In light of the wide ranging benefits, and given the significant challenges facing sustainable energy investments, we then argue the case for Member States to be visionary in setting out a long term strategy for building stock renovation;
- In Part 2, we describe the strategy development process in detail, including a description of the 5 key phases and a suggested list of actions Member States could take to underpin the strategy;
- Concluding remarks reiterate the key objectives of a renovation strategy;
- Annex 1 sets out the specific requirements contained in Article 4 of the Energy Efficiency Directive;
- Annex 2 sets out the key steps and information requirements for undertaking the technical and economic appraisal of the renovation potential in the building stock;
- Reference material is provided in Annex 3.

[1] http://ec.europa.eu/energy/efficiency/eed/eed_en.htm
[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0031:EN:NOT

PART 1

BENEFITS OF IMPROVING THE ENERGY PERFORMANCE OF BUILDINGS

Before outlining the strategy development process in detail, it is instructive to consider the wider impacts and benefits that can be achieved as a result of building stock renovation. When undertaking an economic appraisal of an energy saving investment for a building, the only benefit that is normally monetised by the potential investor is the energy cost saving, yet doing so undervalues the full impact. However, many benefits accrue to society at large and hence are not valued by individual investors. These benefits are discussed more fully below. Annex 3a) also includes a brief literature review of reports on the multiple benefits of improving building energy performance.

Broadly speaking, the impacts of undertaking sustainable energy renovation of buildings can be summarised under the headings:

- Economic Benefits
- Societal Benefits
- Environmental Benefits
- Energy System Benefits

> *"Every $1 spent on energy efficiency in Iowa produces $1.50 of additional disposable income"*
>
> United States Environmental Protection Agency[4].

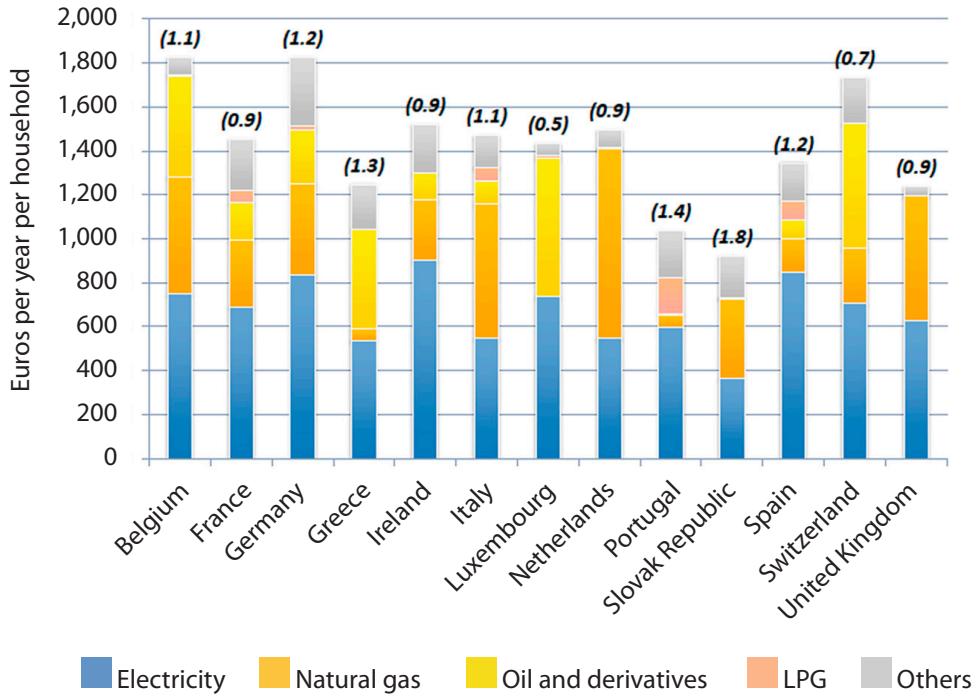
ECONOMIC BENEFITS:

- **Energy cost saving.** BPIE's analysis[3] of deep renovation scenarios (covering EU27, Switzerland and Norway) demonstrated the potential for net energy costs savings as much as €1300 billion (present value) arising to end users, i.e. the individuals and organisations undertaking the investment as a result of renovating Europe's buildings between now and 2050.

  For individual households, current energy bills typically range between €1000-1800 per annum, equivalent to around 1 month of median annual income, as illustrated in Figure 1. The increased disposable income that is generated through reduced expenditure on energy utilities leads to increased expenditure on other goods and services, producing economy-wide benefits.

[3] http://bpie.eu/eu_buildings_under_microscope.html
[4] Assessing the Multiple Benefits of Clean Energy: A Resource for States (2010). http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits.pdf

Figure 1 – Annual household energy spend in selected countries (source – IEA, Eurostat)



Figures in brackets indicate the median months of income that is expended on energy

- **Economic stimulus.** In order to achieve the energy cost savings of €1300bn identified earlier, a total investment of €940bn (present value) over the period to 2050 would be required to cover the cost of materials as well as labour. This would be a significant, valuable and lasting boost to the construction sector in particular, given the prevailing economic difficulties in many European markets. The employment generated could be on average as much as 1.1 million net additional jobs throughout the period to 2050. (source - BPIE)

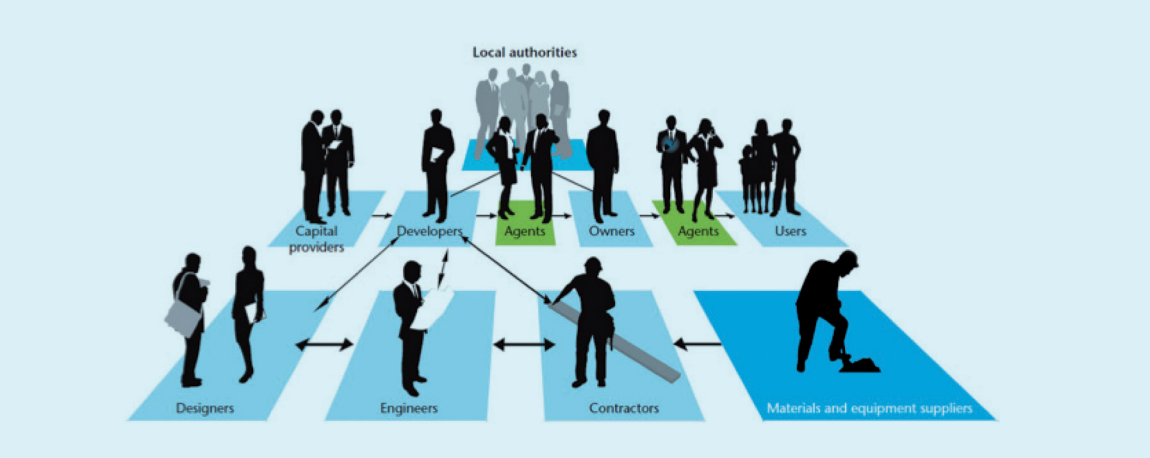
"Every $1 million in energy savings in Oregon produces $1.5 million of additional output and about $400,000 in additional wages per year"

(Grover, 2005)[5]

The employment and economic impact stimulated by investing in a more sustainable building stock can be seen across a wide range of players in the value chain, from manufacturing and installation through to provision of professional services such as financing and project management, as illustrated in Figure 2. (overleaf)

[5] http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits_ch1.pdf#page=11

Figure 2 – Schematic of building renovation value chain (source – WBCSD[6])



- **Impact on Gross Domestic Product (GDP).** The Commission's EED impact assessment identified that achieving the targeted savings would result in an increase in the EU's GDP of €33.8 bn in 2020 (+2.7% compared to baseline)[7].

- **Property values.** There is an emerging body of evidence that buildings with high energy performance are more valuable (in terms of resale, the rent they can command and/or in terms of occupancy levels) than their less efficient counterparts[8].

"Our analysis of some 1,100 recent rental transactions in the Netherlands provides evidence that, on average, a less efficient, "non-green" office building achieves a 6.5% lower rent as compared to similar buildings with a "green" energy label.[9]

Evaluation of the KfW thermal rehabilitation programme in Germany has identified that, for every €1 of public subsidy, as much as €5 is returned to the public purse through reduced unemployment payments, increase tax receipts and other sources.[11]

- **R&D, industrial competitiveness & export growth.** By creating the drive towards ever more efficient ways to reduce energy consumption in buildings, a major programme of building renovation will spur research & development, leading to improved industrial competitiveness and export opportunities.

- **Impact on public finances.** According to a *Copenhagen Economics* report commissioned by *Renovate Europe*[10], investment in building retrofits, given prevailing high levels of unemployment in many Member States, will have a positive impact on public budgets, equivalent to 0.5-1.0% of GDP.

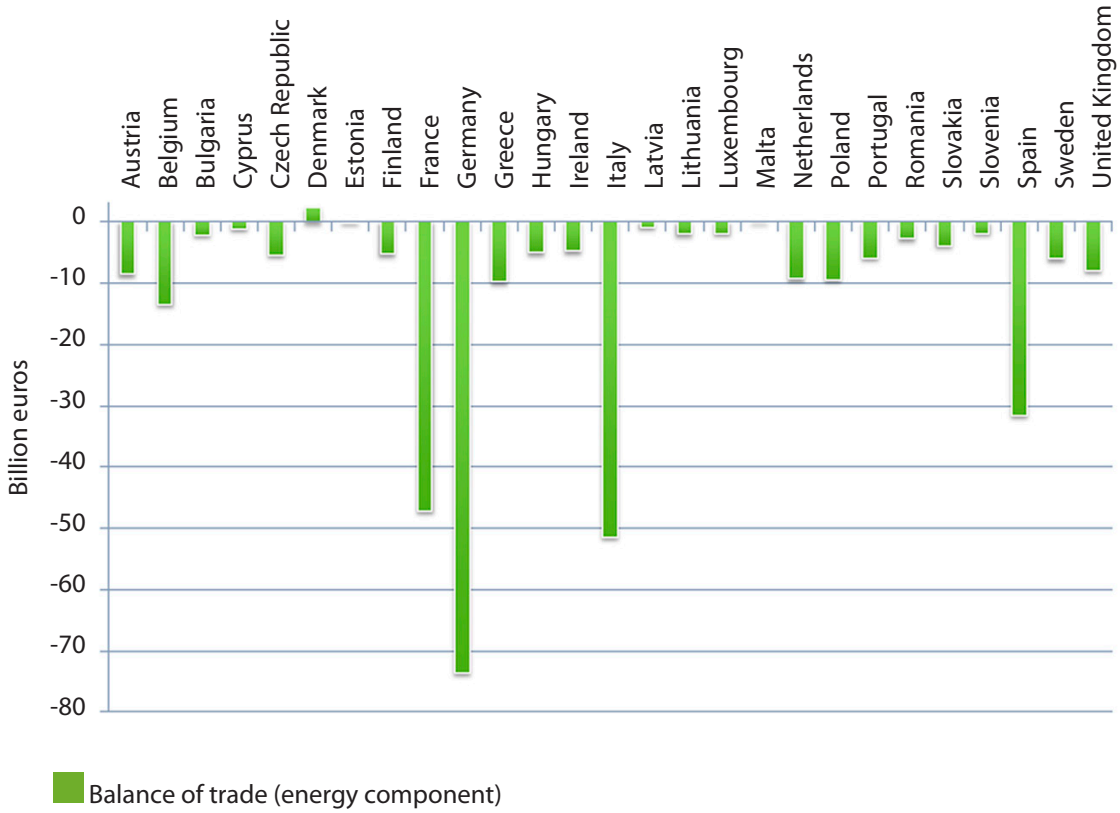
[6] "Energy Efficiency in Buildings", World Business Council for Sustainable Development, 2008
[7] http://ec.europa.eu/energy/efficiency/eed/doc/2011_directive/sec_2011_0779_impact_assessment.pdf
[8] BuildingRating.org, an initiative backed by The Institute for Market Transformation and the Natural Resources Defense Council in the US, lists in excess of 15 studies from Australia, Europe and the US which attest to this phenomenon (http://www.buildingrating.org/content/efficiency-property-value)
[9] "The Value of Energy Labels in the European Office Market", Kok & Jennen, 2011 (http://nilskok.typepad.com/KJ/KJ_NL_220511.pdf)
[10] http://www.renovate-europe.eu/uploads/Multiple%20benefits%20of%20EE%20renovations%20in%20buildings%20-%20Full%20report%20and%20appendix.pdf
[11] http://www.kfw.de/kfw/en/KfW_Group/Research/PDF-Files/STE_Research_Report.pdf

- **Energy import bill.** With virtually all Member States being reliant on energy imports to satisfy demand (see Figure 3) the energy savings achieved through building renovation will have a positive impact on a nation's balance of payments[12]. The EU already imports the majority of its energy needs, at a cost of €355 bn annually[13]. According to the latest IEA projections in World Energy Outlook 2012[14], this import dependency for both oil and gas is projected to increase substantially over the coming years.

"Achievement of our energy efficiency targets for 2020 could reduce Ireland's energy costs by €2.3 billion per annum."

Sustainable Energy Authority of Ireland[15]

Figure 3 – Energy bill import dependency in 25 EU Member States (Source – IEA, Eurostat)



[12] "The benefit from reduced energy import bills and the importance of energy prices in GHG reduction scenarios" (http://www.sciencedirect.com/science/article/pii/S0140988311003057)
[13] http://blog.ewea.org/2011/10/eu-energy-import-bill-amounted-to-e355-billion-in-2010/
[14] http://www.worldenergyoutlook.org/publications/weo-2012/
[15] http://www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/The_Case_for_Sustainable_Energy.pdf

SOCIETAL BENEFITS:

- **Reduced fuel poverty.** Improving the energy efficiency of homes has long been recognised in some Member States (e.g. UK, Ireland) as vital to achieving affordable warmth for families on low incomes. Between 50 million and 125 million people in Europe (10-25% of the total EU population) are estimated to be fuel poor, according to the *European Fuel Poverty and Energy Efficiency* study[16]. Deep renovation can provide the means whereby homes are "fuel poverty proofed" as a result of the affordability of the very low energy bills that arise after such a renovation.

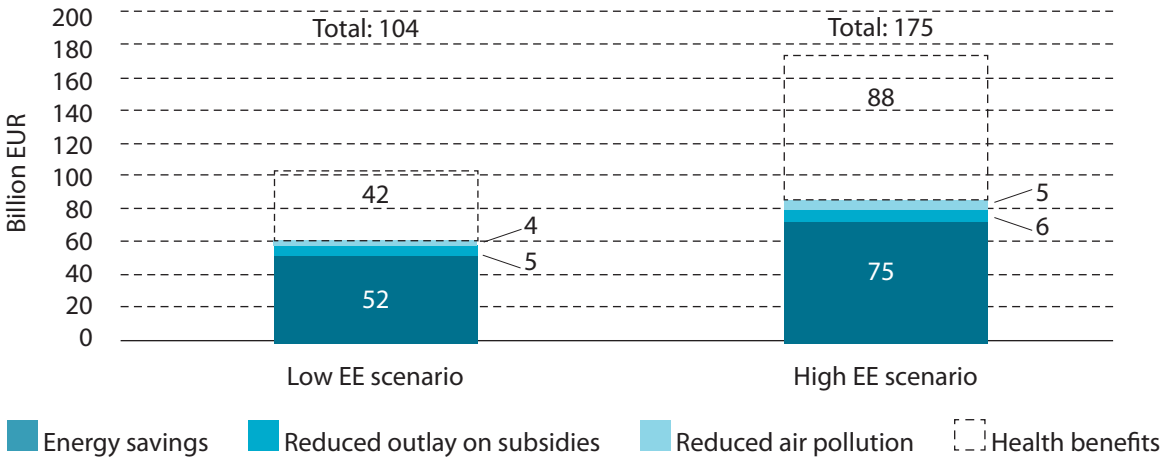
> *"…there are clear benefits from spending carbon tax revenues on improving energy efficiency in fuel poor households. Such a policy will provide macroeconomic benefits as well as the environmental and social benefits. If the carbon revenue is so invested it could create up to 71,000 jobs [in the UK] by 2015 and up to 130,000 jobs by 2027. It will also remove 87% of the 9.1 million households projected to be in fuel poverty in 2016 from that risk and reduce energy bills in all treated homes by over £200 a year."*
>
> UK Consumer Focus.[17]

- **Health.** Closely allied to reducing fuel poverty are the health benefits from warmer homes with fewer cold spots & draughts, less condensation/mould and improved indoor air quality. *Copenhagen Economics* estimate that the health benefits from energy retrofits could be worth more than the value of the saving in energy costs – see Figure 4. However, they acknowledge that the value of the health benefits is subject to considerable uncertainty.

  Another estimate from the UK Chief Medical Officer puts the saving to the National Health Service at £0.42 for every £1 invested in keeping homes warm, but notes that this figure is an underestimate since it does not include additional spending by social services, or economic losses through missed work[18].

Figure 4 – Annual gross benefits to society from energy efficient renovation of buildings (2020)

(Source – Copenhagen Economics)



[16] http://www.fuel-poverty.org/files/WP5_D15_EN.pdf
[17] http:// www.consumerfocus.org.uk/files/2012/11/Jobs-growth-and-warmer-homes-November-2012.pdf
[18] http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty

SELECTED FINDINGS OF THE UK MARMOT REVIEW TEAM ON THE HEALTH IMPACTS OF COLD HOMES AND FUEL POVERTY[19]

- Countries which have more energy efficient housing have lower Excess Winter Deaths.
- Excess Winter Deaths are almost three times higher in the coldest quarter of housing than in the warmest quarter.
- Children living in cold homes are more than twice as likely to suffer from a variety of respiratory problems than children living in warm homes.
- Mental health is negatively affected by fuel poverty and cold housing for any age group.
- More than 1 in 4 adolescents living in cold housing are at risk of multiple mental health problems compared to 1 in 20 adolescents who have always lived in warm housing.
- Cold housing increases the level of minor illnesses such as colds and flu and exacerbates existing conditions such as arthritis and rheumatism.
- Cold housing negatively affects children's educational attainment, emotional well-being and resilience.
- Fuel poverty negatively affects dietary opportunities and choices.
- Cold housing negatively affects dexterity and increases the risk of accidents and injuries in the home.

- **Increased comfort and productivity.** Whilst those in fuel poverty are likely to witness the greatest improvement in terms of increased comfort, building occupants across the spectrum can benefit from homes and workplaces that are easier to maintain at comfortable temperatures, avoiding both overheating in summer as well as underheating in winter as a result of thermal renovation. It is well established that a better working environment leads to increased productivity[20].

"Thermal discomfort caused by high or low temperature had negative influence on productivity." [21]

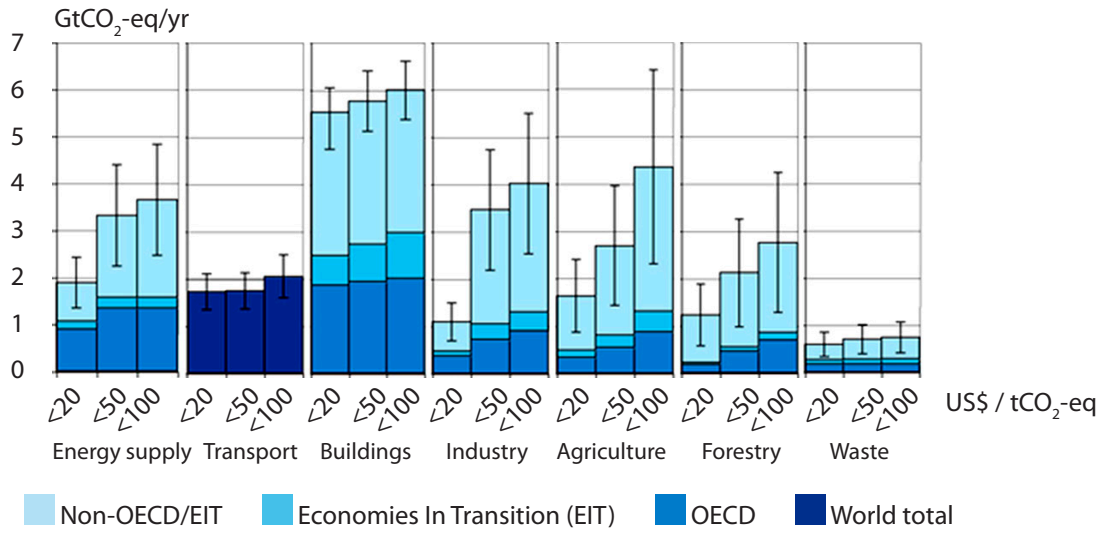
[19] Ibid.
[20] http://gpichub.org/activities/policy/projects/indoor-environmental-quality-occupant-behavior/lighting/sub-folder/indoor-air/thermal-comfort/productivity-job-satisfaction
[21] Lan, L., Z. Lian, and L. Pan. "The effects of air temperature on office workers'well-being, workload and productivity-evaluated with subjective ratings;" Applied Ergonomics. (2003)

ENVIRONMENTAL BENEFITS:

- **Carbon saving.** According to BPIE's analysis under the deep renovation scenario, carbon emissions from regulated energy use[22] in the building sector across the EU-27, Norway and Switzerland could be reduced by between 730 and 930 $MtCO_2$/a in 2050 (a reduction of between 71% and 90%), depending on the rate of decarbonisation of the energy system. The monetary value of this environmental externality is estimated at €830 bn[23].

  The importance of the building sector in achieving carbon savings is amply illustrated by the analysis of the Intergovernmental Panel on Climate Change (IPCC), as presented in Figure 5. In all world regions, and at all carbon prices up to at least US$100/tonne of CO_2 equivalent, buildings hold the greatest potential for cost effective carbon emission reductions.

Figure 5 – Comparison of cost effective CO_2 reduction potential in 2030 by sector, at different carbon prices (source - IPCC 2007)[24]



- **Reduced air pollution.** By reducing the need for energy production from fossil fuels, there is a reduction in the amount of pollutants such as SO_2, NO_x and particulates that are damaging to health, to buildings and the environment[25].

"Our commitments to building a low carbon economy as set out in the UK and Scottish Climate Change Acts will reduce air pollution, but choices about the route we take to 2050 will affect the scale of improvements to air quality. Factoring air quality into decisions about how to reach climate change targets results in policy solutions with even greater benefits to society. Optimising climate change policies for air pollution can yield additional benefits of some £24 billion (net present value) by 2050."

UK Department of the Environment, Farming & Rural Affairs[26]

[22] Regulated energy use = heating, cooling, hot water and fixed lighting
[23] Externalities derived from http://www.eea.europa.eu/data-and-maps/indicators/en35-external-costs-of-electricity-production-1
[24] IPCC "Climate Change 2007: Mitigation of Climate Change". NOTE – EIT = Economies in Transition; OECD includes most EU Member States
[25] http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits_ch4.pdf
[26] http://www.defra.gov.uk/publications/files/pb13378-air-pollution.pdf

ENERGY SYSTEM BENEFITS:

- **Energy security.** Reducing energy demand as a key component of energy security is acknowledged in *"A Strategy for Competitive, Sustainable and Secure Energy"*[27] published by the European Commission, where top priority is ascribed to achieving the biggest energy saving potentials, namely in buildings and transport.

- **Avoided new generation capacity.** According to Commission estimates[28], achieving the 20% energy efficiency target would avoid the construction of the equivalent of 1000 coal fired power stations[29] or 500,000 wind turbine installations[30].

- **Reduced peak loads.** Energy demand reduction measures save a disproportionate amount at times of high demand (through reduced winter heating and summer cooling). By avoiding use of the most expensive generation capacity which is required to meet peak demands, and also lowering the load, and hence the losses, in the transmission and distribution systems, all electricity users benefit from reduced system operation costs[31].

"A study of widespread energy efficiency deployment in the Southwest used the calculated potential energy savings to estimate avoided capacity investments of about $10.6 billion by 2020".

Southwest Energy Efficiency Project (US)[32]

SUMMARY OF BENEFITS:

The above discussion identifies the wide array of benefits that can be achieved as a result of renovating buildings to higher energy performance standards. Some are tangible and readily quantifiable, while others are less so and may be difficult to assign a monetary value, like the social cohesion and sense of civic pride that comes with the renovation of an apartment block or a district which has undergone regeneration.

In evaluating their renovation strategies, Member States are advised to consider mechanisms whereby the mismatch between the benefits experienced by individual investors and those that accrue to other parties can be addressed. For example, providing funding for renovation activity could be seen as being of strategic national importance in terms of the savings it provides for public health expenditure and reduced social security payments, in addition to being a cost effective means of cutting energy import bills and meeting climate commitments.

In undertaking the cost effectiveness appraisal of The Green Deal and Energy Company Obligation, the UK Government took account of some of the associated benefits of energy saving investments. In addition to direct energy savings of £15bn, a further £10.6bn worth of quantified air quality, increased comfort and carbon reduction benefits were included[33].

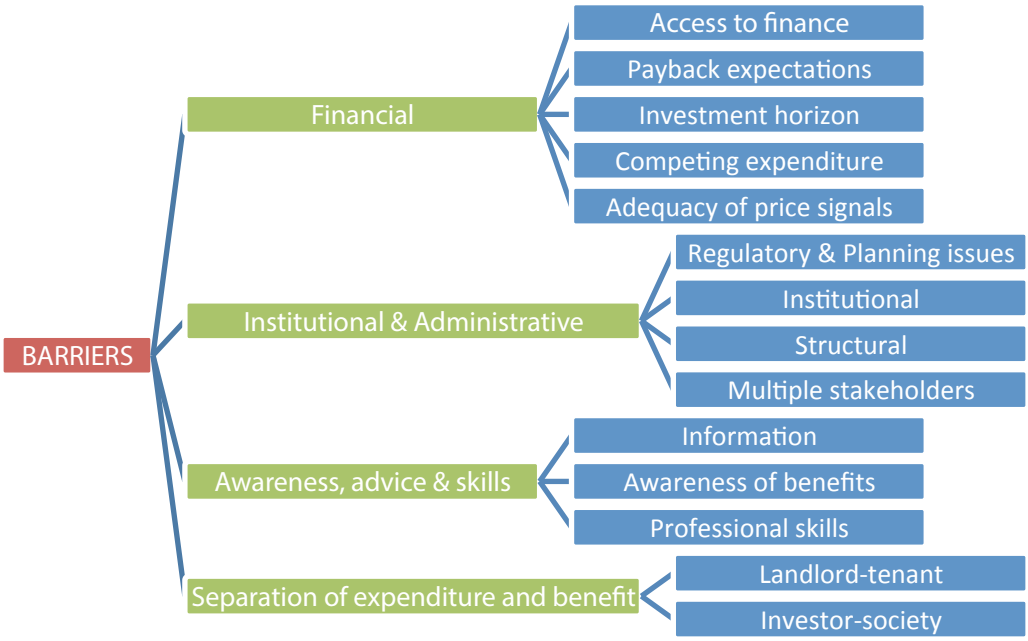
Put simply, renovating the nation's buildings improves the health and the wealth of its citizens.

[27] Figures derived from the European Environment Agency (http://ec.europa.eu/energy/wcm/fpis/ressources-ese/docs/2-2011_energy2020_en.pdf)
[28] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0772:FIN:EN:PDF
[29] Assuming each power station has a 600 MW capacity, operating 7000 hours/a
[30] Assuming each turbine has a 4MW capacity, operating 2300 hours/a
[31] http://www.raponline.org/document/download/id/6103
[32] http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits_ch1.pdf#page=11
[33] http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf

BARRIERS AND CHALLENGES

Set against the multiple benefits described above are numerous obstacles to the uptake of renovation. During 2011, BPIE undertook a detailed survey of the barriers and challenges to building renovation across 29 countries. For a full discussion, please refer to Part 2 of "*Europe's buildings under the microscope*". Figure 6 presents a schematic summary of the main categories of barriers identified in the BPIE study.

Figure 6 – Main types of barrier encountered in building renovation (Adapted from BPIE [34])



In designing renovation strategies, it is essential that Member States assess the particular barriers affecting the renovation market in their country. Action to address these barriers must then be taken if the strategy is to achieve the desired outcome and increase the propensity for building owners to undertake deep renovation. These measures include, but are not limited to, new policies and regulatory initiatives targeting particular building sectors, as well as removal of existing barriers which may be holding back the renovation market.

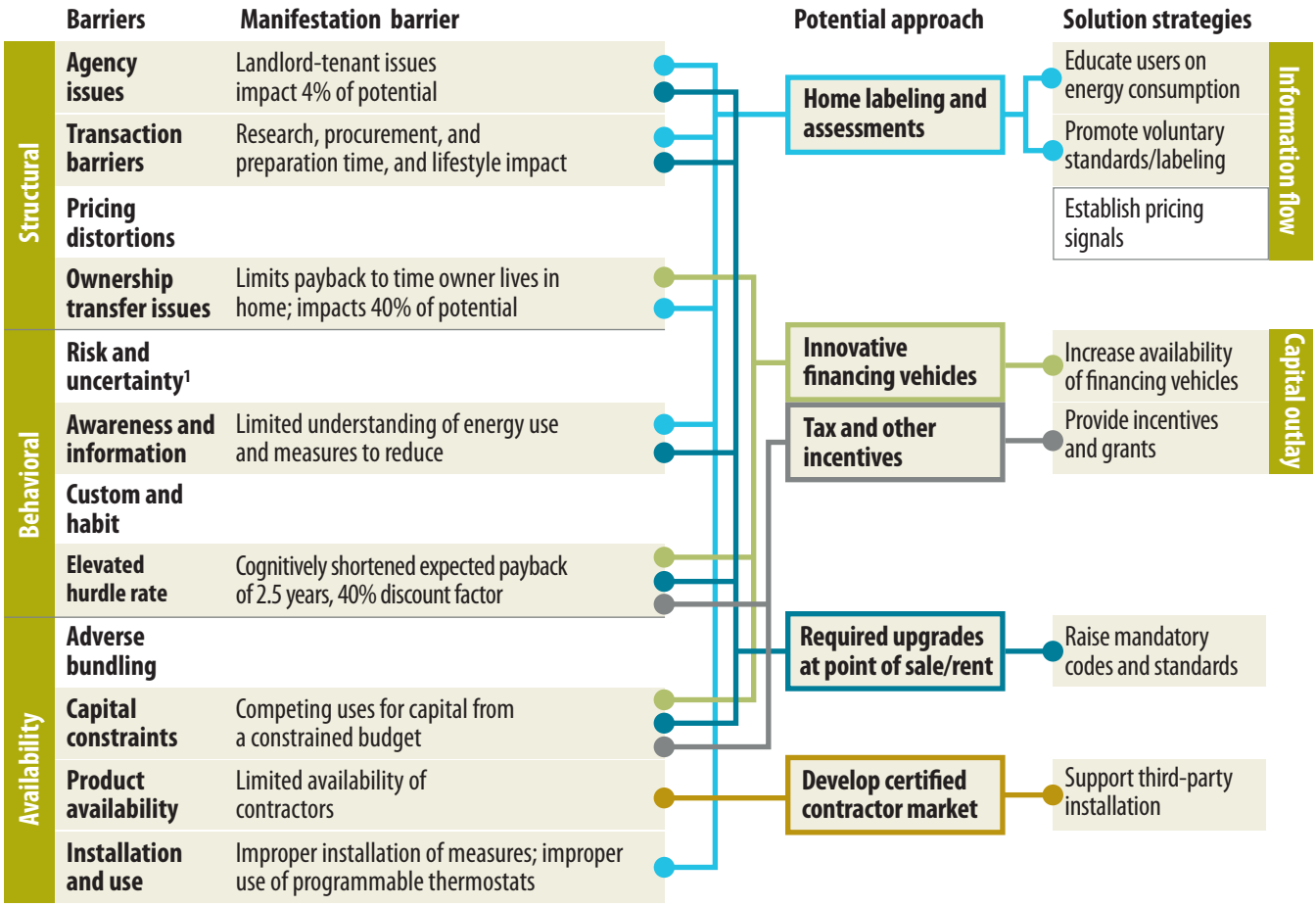
It is important to tailor the policy response to the specific barriers affecting different market sectors. Accordingly, the policy mix will need to encompass a range of measures that, collectively, address all building categories, ownership profiles and tenures.

To reinforce the importance of this issue, Article 19 of the EED requires Member States to evaluate and take appropriate measures to remove regulatory as well as non-regulatory barriers to energy efficiency.

[34] http://bpie.eu/eu_buildings_under_microscope.html

In its report "*Energy Efficiency: A Compelling Global Resource*", McKinsey likewise argued the importance of a systematic appraisal of barriers and, more importantly, identification of solutions to these barriers. An example of the process of identifying issues that are holding back investment and then proposing a package of solutions to address the suite of barriers is visualised in Figure 7.

Figure 7 – Example of how to develop a holistic policy response to barriers (Source – McKinsey)



VISION FOR A NATIONAL LONG TERM RENOVATION STRATEGY

Given the challenging set of barriers that is hampering the achievement of the wide range of benefits identified previously, we believe it is incumbent on Member States to set out a long term vision for the renovation of the nation's building stock to very high energy performance levels by the middle of the century. The level of ambition ought to be consistent with achieving greenhouse gas emission reductions of 88-91% from the building sector compared to 1990 levels, in line with the European Commission's "*Roadmap for moving to a competitive low carbon economy in 2050*"[35]. Interim milestone targets in 2020, 2030 and 2040, consistent with achieving the 2050 target, will provide key reference points for review of progress.

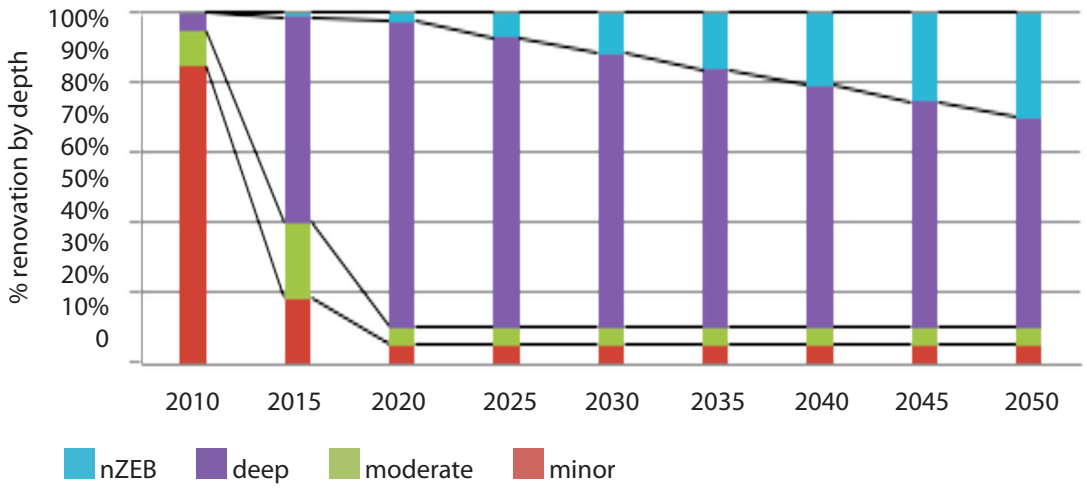
The timeframe of 2050 is also consistent with typical replacement cycles of major building equipment and components, which suggest that it will take 30-40 years to substantially renovate national building stocks. This corresponds to a renovation rate of around 2.5-3% p.a., a significant increase from the prevailing rates of around 1% p.a. in most countries, (as identified by BPIE's 2011 survey).

Most renovation activity at the moment achieves only modest energy savings, perhaps 20-30%, but this needs to increase to deep renovations of at least 60% if the full economic potential is to be realised.

The impact of different renovation pathways on the resulting energy and carbon savings was modelled by BPIE in its 2011 publication "*Europe's buildings under the microscope*". This showed that only in those scenarios where both the rate and the depth of renovation were substantially increased, alongside rapid decarbonisation of the energy supply system, could the carbon saving ambition for the building sector set out in the Commission's 2050 Low Carbon Economy Roadmap be achieved.

The figures below and overleaf demonstrate the scale of the challenge in terms of ramping up activity rates if the EU is to meet its long term CO_2 saving ambition, derived from BPIE modelling. They illustrate, firstly, that the depth of typical building renovation needs to shift from the majority currently being at a "shallow" level (i.e. up to 30% energy saving) to either "deep" (i.e. 60-90% saving) or increasingly "nZEB" (i.e. nearly zero-energy buildings, saving 90% or more) for the period 2020-2050.

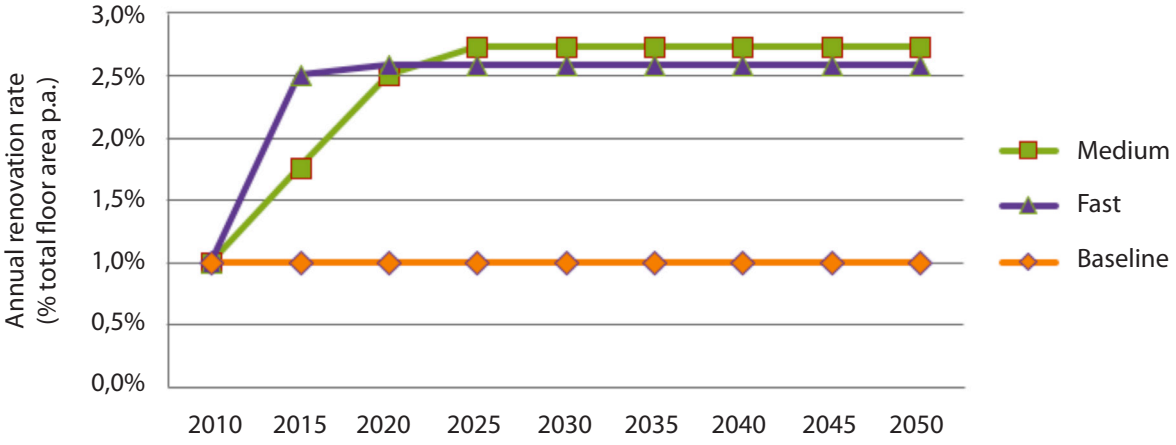
Figure 8 – Required increase in renovation depth to achieve 90% CO_2 saving (Source – BPIE model)



[35] http://ec.europa.eu/clima/policies/roadmap/index_en.html

At the same time, the renovation rates need to ramp up from the prevailing rate of around 1% of total floor area renovated annually, to between 2.5% and 3% p.a. from 2020 onwards. The final renovation rate is determined by the speed with which activity is ramped up, as illustrated below.

Figure 9 – Required increase in renovation rate to achieve 90% CO_2 saving (Source – BPIE model)



An effective building stock renovation strategy will engage building owners as well as the supply chain, including the investment community. Member States need to consider the policy landscape that is necessary in order to increase renovation activity, including removal of barriers that are currently holding back investment.

In addition to the long term objective and interim milestones, the strategy should set out a detailed plan of action for the next 5-10 years, focusing on the policies and measures that are needed to scale up renovation activity and identifying priority sectors.

Efforts to increase the rate and depth of renovation will stimulate the development of new technologies and techniques to deliver energy savings. Therefore, it is important to factor in the technological dimension into the long term strategy, as well as the cost reductions that can be achieved through scaling up activity levels. Thus, assumptions about the future costs and renovation potential must not be limited by today's technologies, construction techniques and costs.

In addition to setting a long term vision, a renovation strategy needs to be transformational and dynamic in nature. The wider benefits arising from energy saving renovation need to be taken into account. At the same time, the significant challenges, not least the issues of dealing with the inertia among building owners and the classic tenant-landlord barrier, need to be addressed.

Some Member States have already set out a long term vision for the evolution of the building sector:

- France's Plan Bâtiment Grenelle sets out an ambition to reduce carbon dioxide emissions from buildings by 50% by 2020[36]
- In Germany's National Energy Efficiency Action Plan, the stated vision is to achieve an almost climate neutral building stock by 2050[37]
- Denmark has a long tradition of active energy policy ever since the oil crises of the 1970s. In 2012, widespread political support was secured for a further package of measures, including building retrofitting, that brings the country closer to the ultimate goal of eliminating fossil fuel use in the energy and transport sectors by 2050.[38]

[36] http://www.legrenelle-environnement.fr/leplanbatimentgrenelle
[37] http://www.bmwi.de/English/Redaktion/Pdf/zweiter-nationaler-energieeffizienz-aktionsplan-der-brd
[38] http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2013/Energy%20Policy%20in%20Denmark.pdf

PART 2

DEVELOPING THE RENOVATION STRATEGY

Here, we consider the key steps in the development of a renovation strategy. They have been divided into 5 phases:

1. Identifying Key Stakeholders & Information Sources
2. Technical & Economic Appraisal
3. Policy Appraisal
4. Drafting & Consulting on the Renovation Strategy
5. Publication & Delivery

Figure 10 illustrates the main phases including the key steps within each phase

Figure 10 – Simplified process flow chart for strategy development

Alongside the detailed description of each phase below, an indicative timescale is provided. Clearly, circumstances will vary from country to country, and it is realistic to undertake certain phases simultaneously. BPIE believes it could take up to a year for Member States to develop their first renovation strategies, as indicated in Figure 11 and discussed more fully in each phase.

Given the EU delivery deadline of April 2014, **Member States are advised to commence their renovation strategy development process during the first half of 2013.**

Figure 11 – Indicative timeline for building renovation strategy development

Month	1	2	3	4	5	6	7	8	9	10	11	12	year2+
PHASE 1 - Identify key stakeholders & information sources													
PHASE 2 - Technical and economic appraisal													
PHASE 3 - Policy appraisal													
PHASE 4 - Drafting & consultation													
PHASE 5a - Finalisation & publication													
PHASE 5b - Delivery													Ongoing thereafter

PHASE 1

IDENTIFYING KEY STAKEHOLDERS & INFORMATION SOURCES

Key to successful delivery of an ambitious yet achievable renovation strategy are preparation, planning and leadership. Given that the strategy will influence an important sector of the economy for decades to come, a strategy development team needs to be pulled together to include input from representatives of Government ministries with responsibility for policy on energy, the building sector (including housing/communities), regions, industry, finance and the economy. Lead responsibility also needs to be clarified. Input from external stakeholders such as sectoral experts, the finance community and representative industry bodies will also be invaluable within the project team.
In addition to establishing a project team, the preparation phase should include the following information and data gathering to underpin subsequent phases:

- Sources of information on the building stock disaggregated by typology, energy use and current level of energy performance;
- Literature review to identify the existing knowledge base of the barriers;
- Literature review of the effectiveness of existing or previous initiatives to increase the uptake of sustainable energy improvements in the building stock;
- Identification of relevant stakeholders.

The preparation phase is likely to take 1-2 months.

PHASE 2
TECHNICAL AND ECONOMIC APPRAISAL

In this phase, the technical potential for improving the energy performance of the building stock is determined and the range of renovation options appraised and costed. The starting point is to gain a full understanding of the building stock through a bottom-up summation of the different building typologies, construction styles, ages, climatic zones, occupancy, ownership patterns and the like. The reference buildings developed by Member States for cost optimality purposes may serve as a guide for the number and type of building categories.

Analysis of the building stock and the range of possible renovation measures provides the basis for assessing the technical potential for energy savings. The economic potential can then be determined, using a range of assumptions regarding the evolution of energy prices and the costs of renovation.

In appraising the economic potential, a key component that is frequently overlooked is the monetisation of the benefits that arise alongside the energy cost savings. The issue here is that most of the other benefits discussed previously accrue to society at large, rather than to the investor. Member States should quantify these benefits and factor them into the economic appraisal of the renovation strategy at a national level. In this way, the cost of any public subsidy provided to stimulate deep renovation could be more than offset by the national economic benefits that result from, for example, increased employment or reduced health expenditure.

Notwithstanding the difficulties of quantifying the wider benefits, many Member States have acknowledged their existence at a qualitative level and have used arguments such as increased employment to support the case for renovation programmes, even if the full economic impact has not been explicitly appraised.

In any economic appraisal, the discount rate, or rate of return applied, is a very significant consideration. Here, it is important to recognise the disparity between discount rates used by building owners and other potential investors which are typically far higher than societal discount rates. The challenge is to design a support regime that increases building owners' underlying propensity to invest in renovation. While financial support programmes can bridge some of the gap, inevitably regulatory measures will need to be developed and used extensively to require renovation of, for example, the least efficient building stock or at change of ownership. The range of potential measures is discussed more fully in Phase 3.

In summary, the detailed steps of the technical & economic appraisal are:

1. Building stock analysis;
2. Cost effectiveness appraisal of renovation options;
3. Quantification of energy saving potential;
4. Development of a long term investment horizon; and
5. Quantification of other benefits.

These steps are further elaborated in Annex 2.

The methodology presented above and in Annex 2 broadly reflects the approach taken by BPIE in developing its scenario analysis for a Europe-wide renovation strategy, described more fully in "*Europe's Buildings Under The Microscope*". Data on the existing European building stock, used in the modelling work, is now available at www.buildingsdata.eu.

One of the key challenges when undertaking the economic appraisal is access to good quality data on the costs and savings of renovation activities, and also forecasting these forward over the next 30-40 years. Available information on the costs of deep renovation may be limited to demonstration or pilot projects, which may not be representative of the costs in a larger scale rollout. Inevitably, certain assumptions will need to be made based on incomplete data. In order to improve the knowledge base for future revisions and updates to the strategy, it is recommended that Member States introduce or enhance data gathering processes to enable a more accurate picture of the true costs and benefits of building renovation to be built up.

The economic appraisal will identify the scale of investment required to deliver the strategy. Financing sustainable energy investment has traditionally been one of the main barriers, so it is vital to the success of the strategy that potential funding sources are identified and mobilised. Whilst many economies within the EU are still feeling the effects of the economic downturn, it is important to recognise the long term nature of the strategy, spanning 30-40 years, and so it needs to be resilient to the fluctuating market conditions that will be encountered over time.

Notwithstanding the long term nature of the strategy, the action plan over the next 5-10 years ought to be explicit about how the financing of renovation activity is to be achieved. Public budgets are under pressure, yet Member States should recognise the potentially significant resources that are available through EU Structural Funds and the Cohesion Fund[39] under the Multiannual Financial Framework 2014-2020. One of the recommendations of the Commission is to increase the proportion of climate-related expenditure to at least 20 %[40]. This represents a potentially very large pot of funding from which to secure resources for programmes to support the renovation strategy, particularly given that buildings have the largest potential for carbon reduction (see Figure 5) and the many other benefits that can be attained as a result of improving the energy performance of buildings.

At the same time as maximising the allocation of EU and other public funding sources to the renovation of buildings, it is important for Member States to identify ways to achieve high leverage levels of private funding, be that building owners' own resources or those of the investment community.

The technical and economic appraisal is the core analytical phase of the strategy development process, so Member States can expect it to take around 4-6 months.

[39] http://ec.europa.eu/regional_policy/thefunds/cohesion/index_en.cfm
[40] http://ec.europa.eu/budget/library/biblio/publications/2011/mff2011/MFF_2011_en.pdf

PHASE 3
POLICY APPRAISAL

The purpose of the policy appraisal phase is, firstly, to review in some detail the current policy landscape affecting building renovation, and secondly, to identify the changes to policies and additional policies that will be necessary to unleash the building renovation market.

The specific policy mix required to deliver the long term renovation strategy will vary from country to country, according to national circumstances. In addition to reviewing their own policy mix, Member States might find it instructive to undertake an appraisal of the relevance of policies used in other territories. A good source of reference is BPIE's data portal – www.buildingsdata.eu.

The main point to note here is that, while the existing policy mix in a given Member State may have been effective in increasing deployment of particular types of improvement measures (whether individual technologies or a package of measures), no Member State currently has the policy measures in place to gear up renovation activity to the extent required to effect a transformation in national building renovation activity.

BPIE analysis indicates that delivering the long term renovation strategy will require a fundamental review of the policy landscape and the introduction of new policies and measures on a scale not previously witnessed. For this reason, BPIE has developed a checklist of possible actions which, together, provide a solid policy framework on which to base the renovation strategy - see table overleaf.

The suggested list of measures may not be applicable in all Member States, and it is unlikely that all could be introduced within a single policy cycle. Nevertheless, the list illustrates the wide range of actions that should be given serious consideration to facilitate a successful delivery of the renovation potential.

Checklist of actions to underpin the renovation strategy

STRATEGIC	Establish support across the political spectrum for deep renovation of the building stock
	Establish an independent committee to monitor and report progress on the strategy on an ongoing basis, including making recommendations for improvements and periodic updates
	Undertake systematic appraisal of barriers to renovation in each segment of the market and develop policy responses to address each barrier
	Establish objective to eradicate fuel poverty through energy performance improvements to the housing stock
	Develop holistic cross-policy targets that integrate with and deliver on goals in related fields, e.g. sustainable urbanisation, resource efficiency, sustainable construction etc.
	Establish a wide stakeholder group as a forum for consultation, policy formulation and feedback on practical issues and barriers to renovation
	Demonstrate leadership through accelerated deep renovation of public buildings, thereby developing supply chain capacity and providing a knowledge base for private/commercial renovation activity
LEGISLATIVE & REGULATORY	Identify trigger points and develop respective regulation that could be used to encourage, or require, building energy performance improvement[41]
	Design Energy Efficiency Obligations that encourage the delivery of deep renovation
	Facilitate the upgrade of all social housing to high energy performance levels
	Address restrictive practices concerning local deployment of low/zero carbon technologies to ensure that a positive environment for buildings integrated renewables is established
	Remove or implement measures to overcome restrictive tenancy laws which disincentivise or otherwise inhibit energy performance improvement
	Mandate improvement of least efficient stock to higher energy performance level, e.g. through restrictions on sale or rental of buildings in lowest energy performance categories
TECHNICAL	Develop renovation standards that are progressively and regularly strengthened in response to experience and new technological solutions
	Analyse potential for district heating systems to provide efficient, low carbon energy
	Ensure proper monitoring and enforcement of compliance with building codes
	Develop packaged solutions that can be readily replicated in similar building types
	Introduce quality standards/certification systems for installers & products (including packaged solutions)
FISCAL/FINANCIAL	Secure sources of finance, including those identified in EED Article 20 and EU/international funding sources, and develop mechanisms that effectively leverage private capital
	Factor in monetary value of co-benefits (e.g. health, employment) in public funding decisions
	Develop funding vehicles, tailored to specific market segments, that provide a simple ("one-stop-shop") and commercially attractive source of finance for deep renovation
	Develop mechanisms to encourage deep renovation via third party financing, e.g. ESCOs, EPCs
	Strengthen energy/carbon pricing mechanisms to provide the right economic signals
	Remove fossil fuel subsidies to eliminate perverse incentives that discourage investment
	Consider "bonus-malus" mechanisms, e.g. property taxation systems (which reward high energy performing buildings while penalizing poorly performing ones) and energy pricing
COMMUNICATION / CAPACITY BUILDING	Establish publicly accessible databases demonstrating energy performance of renovated buildings and information on how to undertake deep renovation
	Gear up skills and training programmes covering the key professions and disciplines
	Establish knowledge and experience-sharing networks across regions/Member States
	Encourage development of local supply chain industry for maximising macro-economic benefits and to minimise embedded CO_2 emissions
	Develop promotional and dissemination activities that sensitise building owners to opportunities for deep renovation and that provide stepwise support throughout the renovation process
	Communicate regularly and publicly on progress with the renovation strategy
R&D	Support research, development and demonstration projects into new & improved technologies and techniques to deliver deep renovation, including how to scale up best practice to multiple buildings

[41] Example trigger points include: Audits; Issue of Energy Performance Certificates; Boiler & air conditioning inspections; Change of ownership or tenancy; Change of building use; Other building work (e.g. extensions)

EED provides further reference points for Member States to gear their policy package towards the delivery of the long term building renovation strategy, including:

- **Article 3 (Energy efficiency targets) –** A significant component of each country's target is likely to be required through energy savings in the building stock.
- **Article 5 (Exemplary role of public bodies' buildings) –** The 3% central government buildings renovation target provides the ideal platform on which to build a national renovation strategy.
- **Article 7 (Energy efficiency obligation schemes – EEOs) –** While most existing obligation schemes have been successful in achieving the "low hanging fruit" of low cost measures with rapid paybacks, the opportunity exists for Member States to design EEOs that encourage the development of whole building (or even community-wide) solutions that deliver deep renovation.
- **Article 8 (Energy audits and energy management systems) –** Energy audits can be the instrumental first step to stimulate investment in energy savings. Member States should consider what support measures need to be put in place to ensure that audits lead to deep renovation.
- **Articles 9 (Metering), 10 (Billing information)** and **12 (Consumer information and empowering programme) –** Raising awareness of the cost saving potential of building renovation can be achieved through judicious use of the regular communication channels (i.e. meters and energy bills) to bill payers, as well as through other ways of engaging with building owners and energy consumers.
- **Article 14 (Promotion of efficiency in heating and cooling) –** Provision of heating and/or cooling from a high efficiency cogeneration plant, whether large or small scale, could be an important component of a deep renovation, particularly at community scale through a district heating system.
- **Article 15 (Energy transformation, transmission and distribution) –** Regulatory structures, tariffs and incentives in the energy supply system need to be assessed to ensure they are conducive to investment in demand side energy saving measures, including the connection of micro-energy generators such as buildings integrated renewable technologies and combined heat and power systems.
- **Article 16 (Availability of qualification, accreditation and certification schemes) –** Concern over the competence of equipment installers can be a significant barrier to undertaking renovation. The existence of an effective national quality scheme, backed up by guarantees of workmanship and performance or technologies, can help to address this barrier and overcome inertia.
- **Article 17 (Information and training) –** The availability of trustworthy information and advice, as well as an adequately trained workforce, is a necessary prerequisite to a scaling up of national renovation activity.
- **Article 18 (Energy services) –** For some sectors, notably the non-residential market, provision of energy services and financing of measures through energy service companies (ESCOs), and energy performance contracts (EPCs), can be an effective way of stimulating the uptake of energy saving measures. However, several Member States have reported that the treatment of such contracts in the public sector as public debt is a significant barrier to their wider deployment. Even in territories where there is a thriving market for ESCOs, consideration should be given to structuring contracts such that they achieve deep renovation, including the implementation of higher cost measures, rather than simply focusing on those which achieve the greatest return to the ESCO/EPC provider.
- **Article 19 (Other measures to promote energy efficiency) –** The main thrust of this Article is the review and removal of barriers, both regulatory and non-regulatory, which, as mentioned earlier, is a key component of the renovation strategy.

- **Article 20 (Energy efficiency national fund, financing and technical support) –** With the need for large scale investment in the building stock in order to deliver the potential benefits, development of appropriate financing vehicles and other technical support measures are a pre-requisite for a successful and effective renovation strategy.

Furthermore, EPBD contains a number of measures that are complementary to the renovation strategy, as summarised below.

- **Article 4 (Setting of minimum energy performance requirements) –** The need to ensure that minimum energy performance requirements are set with a view to achieving cost-optimal levels applies to existing as well as new buildings. Minimum energy performance requirements need to be reviewed and updated at least every five years, taking into account technological development in building materials and systems.
- **Article 7 (Existing buildings) –** When buildings undergo major renovation, the energy performance of the building or the renovated part need to be upgraded in order to meet minimum energy performance requirements.
- **Article 8 (Technical building systems) –** The overall energy performance of efficient, appropriately sized and controlled equipment providing heating, hot water lighting, air conditioning and ventilation is a key component of reducing energy consumption, particularly in non-residential buildings such as offices, hospitals and hotels. Automation and active, intelligent systems can enhance the savings achieved. Member States are required to set technical building system requirements accordingly.
- **Article 9 (nearly Zero-Energy Buildings) –** The requirement for Member States to draw up national plans for increasing the number of nearly zero-energy buildings has the greatest synergy with the renovation strategy and reinforces the key message about the level of ambition (i.e. energy saving) that should be sought when renovating buildings.
- **Article 10 (Financial incentives and market barriers) –** In a similar vein to Articles 19 & 20 of EED, the importance of addressing market barriers and providing appropriate financial incentives is fundamental to improving the energy performance of the building stock.
- **Articles 11-13 (Energy Performance Certificates) –** An effective EPC regime raises awareness as to the actual energy performance of buildings and the opportunities to improve performance.
- **Articles 14-16 (Inspection of heating and air conditioning systems) –** The inspection regime provides the basis for identifying opportunities to improve or upgrade the performance of these essential energy systems.
- **Article 17 (Independent experts) –** Having a suitably trained cadre of experts, qualified within the framework of a recognised independent certification/accreditation system, is another key component of ensuring the correct certification of buildings and energy systems and the identification of renovation opportunities.

In addition to the complementary nature of the various provisions in EED, EPBD and other EU legislation to support a holistic approach to developing renovation strategies, Member States should consider the role that national legislation such as energy planning or regional development plans can play in support of the renovation objective.

Overall, the policy appraisal phase might take around 4-6 months, though this could run concurrently with the technical & economic appraisal.

PHASE 4
DRAFTING & CONSULTING ON THE RENOVATION STRATEGY

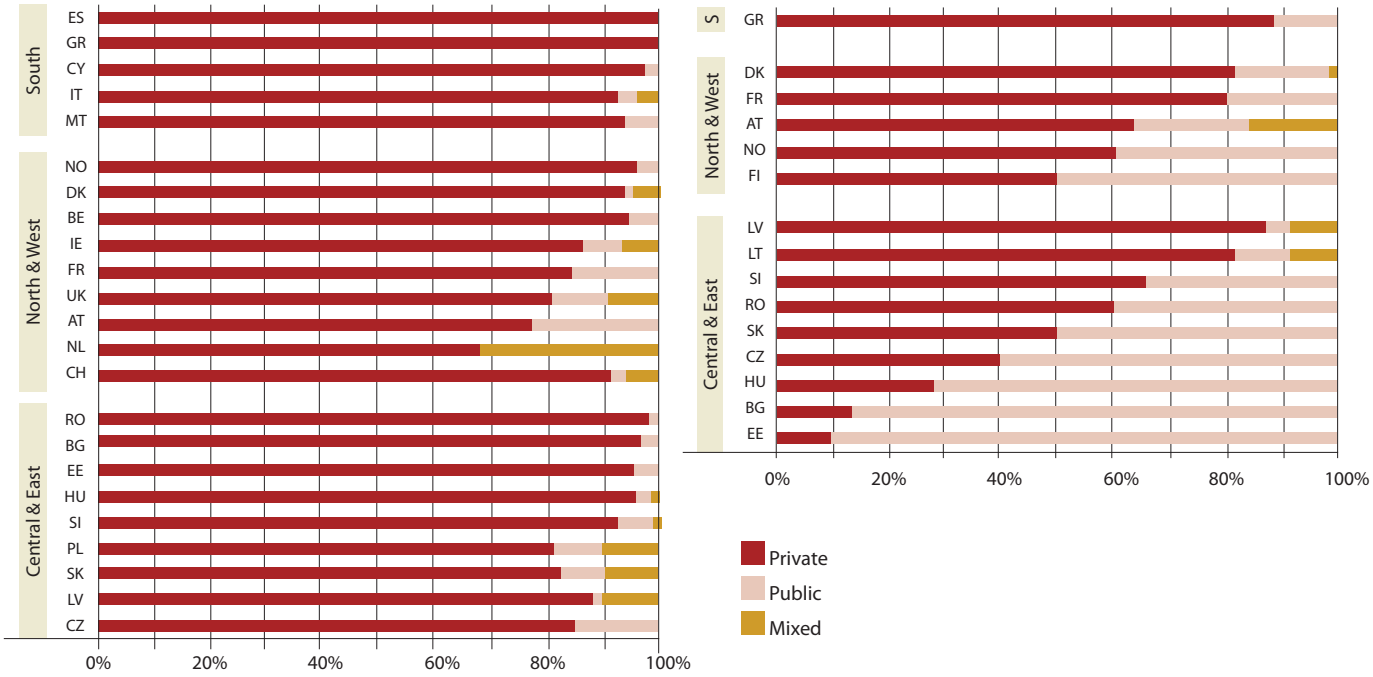
This phase brings together the technical and economic appraisal undertaken in phase 2 with the review of policy options in phase 3 in order to generate a range of possible future pathways or roadmaps for the long term renovation of the national building stock. Depending on the timing and strength of different policy levers, different rates of renovation can be modelled and the resulting investment and benefits horizons profiled and quantified.

Clearly, the building stock in any given territory is not a homogeneous entity, so the response to particular policy signals will vary according to building ownership and type. Some measures may have no impact on a particular sector. For these reasons, the policy options need to be mapped against the energy saving potentials in different building sectors identified in phase 2 in order to ensure that, ultimately, measures are brought to bear to influence the renovation rate, and depth, across all building sectors.

Given the requirement in Article 5 of EED for national governments to demonstrate an exemplary role through renovation of 3% of the central government estate annually, with effect from 1st January 2014, it is likely that Member States will need to prioritise this sector in the national renovation strategy. At the same time, Member States are advised to apply a similar level of ambition throughout the rest of the public sector, both regionally and locally, including to the significant property portfolios such as health, defence, education, public administration and leisure services. Publicly owned or managed housing stock should also be in the vanguard of the renovation strategy, given the ability of central government to influence this sector directly.

Ultimately, all sectors need to be addressed through policies and measures to stimulate building renovation. By focusing initially on the public sector, Member States will facilitate the build-up of the necessary skills, expertise and workforce that will be required to renovate the larger privately owned stock. The residential sector is predominantly privately owned in all Member States, though the picture is more mixed as regards the non-residential sector (Figure 12). It is the privately owned stock, together with mixed tenure ownership, that has traditionally been the most difficult to influence in terms of undertaking building renovation work, yet this is the most important sector given its size and energy use.

Figure 12 – Ownership profile of buildings in selected countries: residential (left hand) and non-residential (right hand) (Source – BPIE)



Based on the analysis undertaken in the previous phases, the renovation strategy should aim to be a comprehensive document that brings together, in a strategic and holistic way, the full range of levers and tools that can be brought to bear in order to effect a significant and sustained increase in both the rate and the depth of renovation of the national building stock to improve its energy performance. Many of the necessary levers are already in place, but may be under-utilised or otherwise not as effective as they might be. These include provisions in existing directives such as ecodesign[42], labelling[43] and high efficiency boilers[44], as well as measures such as the EU-US Energy Star Agreement[45] on high efficiency office equipment and other voluntary initiatives at EU or Member State level.

Once the strategy has been drafted, perhaps with a range of options, it is highly recommended that a consultation exercise be undertaken with the key national stakeholders. Representatives from the entire value chain, from the research community and professional service providers through to energy utilities, equipment manufacturers, installation companies and bodies representing skills and training, need to be included within the scope of the consultation. Given the comments made earlier on the importance of identifying sources of finance, the finance community will be a key stakeholder group, not just during the consultation process but on an ongoing basis thereafter.

In terms of timescales, compiling the draft strategy and then undertaking the public consultation could take up to 4-5 months.

[42] http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm
[43] http://ec.europa.eu/energy/efficiency/labelling/labelling_en.htm
[44] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0042:EN:NOT
[45] http://ec.europa.eu/energy/efficiency/office_equipment_en.htm

PHASE 5
FINALISATION, PUBLICATION & DELIVERY

Taking on board the feedback from the public consultation might require a further 1-2 months before governments are in a position to publish the national renovation strategy by the deadline in Article 4 of 30th April 2014.

At this point, the risk is to consider that the exercise has been completed, whereas in reality, this is the time to mobilise the necessary resources to implement the strategy. At government level, the launch of the strategy should mark the commencement of the policy revision process which, depending on the particular legislative mechanisms in a given country or region, could take several months or even years before the necessary measures have been enacted or restrictive legislation repealed. Notwithstanding the time taken for new legislation to be developed, governments need to make clear to stakeholders their intentions regarding the delivery and implementation of the renovation strategy, and demonstrate their own commitment and contribution to the strategy by instigating the renovation of the public estate.

For industry, the main issue is to respond to the signals, targets and measures within the strategy and gear up for the increased activity of the coming years. In some Member States, existing fora are already in place to do so while in others, it would be appropriate to consider establishing a government-industry task force with the remit to take on board the downstream delivery and implementation actions. Communication with the respective target audiences will also be required.

Equally important is the long term dimension of the renovation strategy. EED requires that national renovation strategies be reviewed and updated every three years. Such a review needs to be grounded in a sound evaluation of the impact of policies and measures to date, and an appraisal of further options to amend the policy landscape.

CONCLUDING REMARKS

Long term strategies for mobilising investment in the renovation of national building stocks provide a potential springboard for Member States to achieve multiple benefits. The requirement contained in Article 4 of the Energy Efficiency Directive is both:

- Timely in that renovating the building sector is the key to achieving a wide range of benefits;
- Necessary in that it is clear that existing drivers are insufficient to achieve the potential.

Given the long term nature of the renovation process, the strategy needs to be seen as a living document that is regularly reviewed and updated. The period to 2020 will be a steep learning curve for many Member States. It is a period in which policy packages will need to be tried and tested, and for learning and sharing of experience across the EU. Building owners will need to be sensitised to the importance of building renovation, while the supply chain will need to gear up to be in a position to deliver the increased activity levels.

Beyond 2020, by which time Member States should have broadly established the necessary policy framework, effort will need to be focused on maintaining the momentum of renovation activity alongside continual improvement through the deployment of new energy saving technologies and techniques.

In summary, Member States should envisage an ambition level for a renovation strategy that:

- Sets out a long term framework to 2050 for the renovation of the nation's building stock to very high energy performance levels;
- Mobilises building owners, whether individuals, corporate entities, public sector or real estate portfolio holders, to undertake deep renovation of their buildings;
- Mobilises the supply chain, from manufacturers and installers to professional service providers, to invest in the equipment, services, and a suitably skilled workforce necessary to deliver high quality renovations;
- Mobilises the investment community to develop financial products and vehicles to fund the programme of building renovations and upgrades;
- Stimulates research and development into techniques and technologies that deliver greater energy savings at lower cost, and to provide solutions that are appealing to building owners;
- Achieves energy savings and CO_2 reductions consistent with the 2050 Low Carbon Economy Roadmap, as a key contribution to national, EU and international targets;
- Delivers a host of other economic, environmental, societal and energy system benefits;
- Is evaluated on an ongoing basis and reviewed/updated every three years;
- Meets the requirements of Article 4 of the EED.

ANNEX 1

ENERGY EFFICIENCY DIRECTIVE: ARTICLE 4 - BUILDING RENOVATION

For ease of reference, the text of Article 4 of the EED is reproduced below.

Member States shall establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private.

This strategy shall encompass:

(a) an overview of the national building stock based, as appropriate, on statistical sampling;

(b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;

(c) policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;

(d) a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;

(e) an evidence-based estimate of expected energy savings and wider benefits.

A first version of the strategy shall be published by 30 April 2014 and updated every three years thereafter and submitted to the Commission as part of the National Energy Efficiency Action Plans.

ANNEX 2

STEPWISE SUMMARY OF THE TECHNICAL AND ECONOMIC APPRAISAL

1) GATHER NATIONAL DATA ON THE BUILDING STOCK

Note - *Where data exist at a sub-national level (e.g. by region) it is useful to retain this breakdown*

a) Identify main building categories, for example[46]:

i. Single-family houses
ii. Blocks of flats/apartments & other multi-residential dwellings
iii. Offices
iv. Educational buildings
v. Hospitals/health establishments
vi. Hotels & restaurants
vii. Sports facilities
viii. Warehouses & retail premises
ix. Other types of energy-consuming buildings

b) Identify key age bands which have a material bearing on building energy performance, e.g.:

i. Traditional construction types, including historic/heritage buildings (typically pre-1900)
ii. Buildings constructed prior to regulations on energy performance (e.g. 1901-1960)
iii. Early phase building regulations (1961-1990)
iv. Mid phase building regulations (1981-2000)
v. New (2001-2012)

[46] These are the building categories identified in Annex 1 of EPBD

c) Identify main climatic zones which have a material bearing on building energy performance

d) Quantify the number, type, size (treated floor area) of each combination of building type and age band. On an illustrative basis of 9 building types and 5 age bands, this results in a matrix of up to 45 combinations. However, it will be possible to group many of the non-residential building types/age bands, so the number of combinations will in practice be less than this.

e) Ownership and Tenure

i. Identify the split by owner – public, private or mixed
ii. Identify the split by tenure – owner occupied, rented, mixed

f) (if appropriate) Split by location:

i. Urban
ii. Suburban
iii. Rural

g) Identify the energy use and performance characteristics of each building combination:

i. Construction type and U-value of main building elements:
    1. Floor
    2. Walls
    3. Windows & External Doors
    4. Roof

ii. Air infiltration rate

iii. Technical building systems (in all cases, please identify typical replacement lifecycles):
    1. HVAC system type/performance level/controls
    2. Hot water provision
    3. Lighting systems/controls

iv. Maintenance regimes (e.g. mandatory annual safety checks/servicing)

v. Energy use for:
    1. Heating
    2. Cooling
    3. Hot water
    4. Lighting
    5. Appliances

vi. Energy carriers
    1. Gas (natural gas or LPG)
    2. Liquid fuels (oil etc.)
    3. Solid fuels (coal etc.)
    4. Renewable fuels
        a) Solar hot water
        b) Solar PV
        c) Wind
        d) Heat pump (type and Coefficient of Performance)
        e) Biomass
        f) Biogas
        g) Other (specify)
    5. District heating (identify energy carriers)

2) APPRAISE RENOVATION OPTIONS

a) Identify opportunities for retrofit of energy efficiency measures for each building category:

i. Fabric measures
ii. Windows
iii. HVAC plant - heating/cooling/hot water
iv. Air infiltration
v. Lighting
vi. Appliances

b) Identify opportunities for retrofit of renewable energy measures:

i. Solar hot water
ii. Solar PV
iii. Passive solar
iv. Shading
v. Wind
vi. Heat pumps
vii. Biomass
viii. Biogas

c) Identify the opportunity to connect to a district heating system;

d) Identify packages of measures that can achieve at least 60% energy saving, or at least up to the prevailing energy performance requirements for new buildings of the same category

e) Determine whether deep renovations are undertaken as a single package, or staged over a period of time

f) Identify cost effectiveness of the different packages of measures using cost optimality methodology:

i. Costs – the total installed cost of renovation measures, less any avoided cost due to end-of life replacement or by undertaking renovation alongside other building maintenance, new construction or modernisation measures
ii. Consider the transaction costs, including costs of temporary relocation of occupants
iii. Quantify, wherever possible, the following benefits (and identify the beneficiary – building owner, building occupier, society at large):

Economic Benefits: Energy Cost Savings; Economic Stimulus; Impact on GDP; Property Values; Industrial Competitiveness; Impact on Public Finances; Energy Import Bill

Societal Benefits: Reduction in Fuel Poverty; Health Benefits; Increased Comfort/Productivity

Environmental Benefits: Carbon Saving; Air quality improvement

Energy System Benefits: Energy Security; Avoided New Generation Capacity; Reduced Peak Loads

g) From the above cost appraisal, determine a prioritised set of renovation packages for each building category, and a timeline for implementation.

i. Consider the exemplary role of the public sector (at all tiers of government, as well as public services such as public housing, defence, health and education) in leading the drive towards deep renovation, and in exerting influence of citizens and businesses
ii. Consider targeting the least energy efficient building stock as a priority
iii. Consider different scenarios as to the rate of change of key parameters

3) MAP OUT THE INVESTMENT HORIZON

a) Quantify total annual investment requirements, mapped out over the period to 2050, in order to deliver the identified renovation opportunities

b) Identify existing sources of funding for building energy renovation

i. Owners' private equity
ii. Public purse
iii. EU Structural/Cohesion funds
iv. Banks and other sources of finance, e.g. pension funds, investment trusts

c) Identify possible new funding sources and mechanisms to meet the investment profile from the above list

4) QUANTIFY THE EXPECTED BENEFITS

a) Identify the attractiveness, to building owners, of their direct energy cost saving benefits

b) Identify the societal benefits arising from deep renovation

c) Identify ways in which externalities (e.g. societal benefits from reduced CO_2 emissions, increased energy security etc.) can be internalised for the benefit of the investor

ANNEX 3

REFERENCES AND FURTHER READING

a) Reports quantifying the multiple benefits of investing in sustainable energy renovation of buildings

Consumer Focus – "Jobs, growth and warmer homes - Evaluating the Economic Stimulus of Investing in Energy Efficiency Measures in Fuel Poor Homes" http://www.consumerfocus.org.uk/files/2012/11/Jobs-growth-and-warmer-homes-November-2012.pdf

Copenhagen Economics – "Multiple benefits of investing in energy efficient renovation of buildings - Impact on Public Finances" http://www.renovate -europe.eu/uploads/Multiple%20benefits%20of%20EE%20renovations%20in%20buildings%20-%20Full%20report%20and%20appendix.pdf

E3G – "The Macroeconomic Benefits of Energy Efficiency - The case for public action" http://www.e3g.org/images/uploads/E3G_The_macroeconomic_case_for_energy_efficiency-Apr_2012.pdf

IEA - "Spreading The Net: The Multiple Benefits Of Energy Efficiency Improvements" http://www.iea.org/publications/insights/ee_improvements.pdf

KfW – "Impact on Public Budgets of KfW Promotional Programmes in the Field of Energy-Efficient Building And Rehabilitation" http://www.kfw.de/kfw/en/KfW_Group/Research/PDF-Files/STE_Research_Report.pdf

Marmot Review Team – The Health Impacts of Cold Homes and Fuel Poverty http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty

SEAI – "Economic Analysis of Residential and Small-Business Energy Efficiency Improvements" http://www.seai.ie/Publications/Statistics_Publications/Energy_Forecasts_for_Ireland/Economic_Analysis_of_Residential_and_Small-Business_Energy_Efficiency_Improvements.pdf

SEAI – "The case for sustainable energy", http://www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/The_Case_for_Sustainable_Energy.pdf

US Environmental Protection Agency – " Assessing the Multiple Benefits of Clean Energy: A Resource for States" http://epa.gov/statelocalclimate/resources/benefits.html

UK Department of Energy & Climate Change – "Final Stage Impact Assessment for the Green Deal and Energy Company Obligation" http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf

b) Other useful source material

BPIE – "Europe's Buildings Under the Microscope" http://bpie.eu/eu_buildings_under_microscope.html

BPIE – "Financing energy efficiency in European buildings" http://bpie.eu/financing_energy_efficiency.html

BPIE – "Cost Optimality" http://bpie.eu/cost_optimality.html

BPIE's Data Portal on Energy Performance of Buildings - www.buildingsdata.eu

ECF publications list: http://www.europeanclimate.org/en/publications/energy-efficiency

GBPN - "Best Practice Policies for Low Carbon & Energy Buildings" http://www.globalbuildings.org/global-projects/

RAP – "Residential Efficiency Retrofits" http://www.raponline.org/docs/RAP_Neme_ResidentialEfficiencyRetrofits_2011_05.pdf

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