



Commercial in Confidence

A REPORT PREPARED FOR

EuroACE

**THE EUROPEAN ALLIANCE OF COMPANIES FOR
ENERGY EFFICIENCY IN BUILDINGS**

**AN ASSESSMENT OF THE SIGNIFICANCE OF
ARTICLE 5 OF THE PROPOSED BUILDING
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1. EXECUTIVE SUMMARY

The need for greater focus on the renovation of existing building stock has been emphasised by recent studies conducted on the potential CO₂ savings arising from buildings. Although the European Climate Change Programme has sourced several of the existing studies in drawing up its plans for stimulating improved energy efficiency, it has been the emergence of the draft European Buildings Directive amid concerns over future energy security which has caught the clear attention of regulators.

There is self-evident political momentum to see this Directive in place by the early part of 2002 as it currently has support from both the existing presidency (Belgium) and the future presidency (Spain). The Directive focuses on commercial and public buildings in the service sector (e.g. offices, hospitals, retail outlets etc.) and, in Article 5 of the draft, sets out the qualifying criteria for existing buildings to have their energy efficiency upgraded as part of a wider renovation programme. The current text is as follows:

*'Member States shall take the necessary measures to ensure that the energy performance of existing buildings with a total surface area over **1000m²** which are being renovated, are upgraded in order to meet minimum energy performance standards in so far as these are **technically feasible** and involve additional costs that can, on the basis of the current **average mortgage rate** be recovered within a period of **8 years** by the accrued annual savings.*

*The principle shall apply in all those cases where the **total cost of the renovation** is higher than **25%** of the existing **insured value** of the building.'*

This report has studied the significance of the 'qualifiers' used in the current draft and has established several key conclusions. These are as follows:

- There are several Europe-wide indices for discerning 'average mortgage rates' in addition to the clearly available information at Member State level
- On the basis of referenced assumptions, the 8-year payback calculation allows sufficient investment limits to achieve significant savings (i.e. in excess of 20%)
- Sensitivity analyses show that investment decisions are particularly susceptible to variations in baseline energy consumption and fuel mix.
- In perfectly achievable scenarios, the maximum permissible investment cost per m² of total surface area approaches the Utrecht University threshold⁴ using the 8-year payback model. This implies that movement below an 8-year payback period will rule out significant groups of buildings which might be otherwise captured under the provisions of Article 5.
- Alternative methods of 'cost of capital' assessment exist which avoid the emotive reference to payback periods. A good example is the Internal Rate of Return.
- To maintain investment levels equivalent to the 8-year payback period, the target Internal Rate of Return would be approximately 3%.



- Internal Rates of Return which reflect the average mortgage rate would in current financial conditions reduce maximum permissible investment costs per m² of total surface area by one third.

This has led the authors of the report to make the following recommendations:

- That the ECB's 'greater than 1 year' lending rate for commercial enterprises be taken as the 'average mortgage rate' for the operation of the Directive. This is published monthly in the ECB Monthly Bulletin
- That an investment versus energy savings curve be drawn (possibly on a 'per sq. metre' basis) for each qualifying project under Article 5.
- That investments above the 8 year payback period should be considered where substantial incremental energy saving can be achieved.
- That an 8-year payback period be the minimum adopted for the operation of Article 5 in view of the sensitivities arising from both baseline energy consumption and fuel mix.
- That consideration be given to adopting an Internal Rate of Return (IRR) assessment to avoid the emotive language of payback periods.
- That any such minimum IRR be set at 3% per annum or less over 15 years for parity with the current 8-year payback provisions.

In summary,

- A centralised European index should be used in place 'average mortgage rate'
- The 8-year payback period is the minimum that can be used to capture the substantial range of existing commercial buildings
- Minimum IRR (3% per annum over 15 years?) should be used as an alternative to payback period to set investment levels.



2. PROPOSED BUILDINGS DIRECTIVE - ARTICLE 5 SPECIFIC TEXT

The proposed text for Article 5 of the Buildings Directive reads as follows:

*'Member States shall take the necessary measures to ensure that the energy performance of existing buildings with a total surface area over **1000m²** which are being renovated, are upgraded in order to meet minimum energy performance standards in so far as these are **technically feasible** and involve additional costs that can, on the basis of the current **average mortgage rate** be recovered within a period of **8 years** by the accrued annual savings.*

*The principle shall apply in all those cases where the **total cost of the renovation** is higher than **25%** of the existing **insured value** of the building.'*

In reproducing this text, we have taken the liberty of highlighting those items which clearly raise questions about the definitions to be adopted. Indeed, in some cases, it may prove necessary to challenge the underlying concept.

This report has a very tight and specific remit. Accordingly, it will not address issues such as the population of buildings in Europe above 1000 m² (This would be the subject of a full-scale impact assessment) or what constitutes 'technical feasibility'. However, it will address the following:

- (1) The selection of the 'average mortgage rate' and the possible definitions which could be applied.
- (2) The case for the selection of an 8 year payback period
- (3) Problems in defining the total cost of renovation
- (4) Other practical concerns of enforcement

2.1 Selection of 'average mortgage rate' and its possible definitions

The proposed Building Directive has sought to tie down the financial qualifications for an energy efficiency renovation by defining the two key factors:

- (1) The discount (or interest) rate to be applied
- (2) The period in which the investment (including interest) is to be recovered.

This is a standard approach for typical investments in the sector and, in itself, does not present any fundamental problems. However, the selection of the term 'average mortgage rate' is significantly more challenging. Several questions immediately arise:

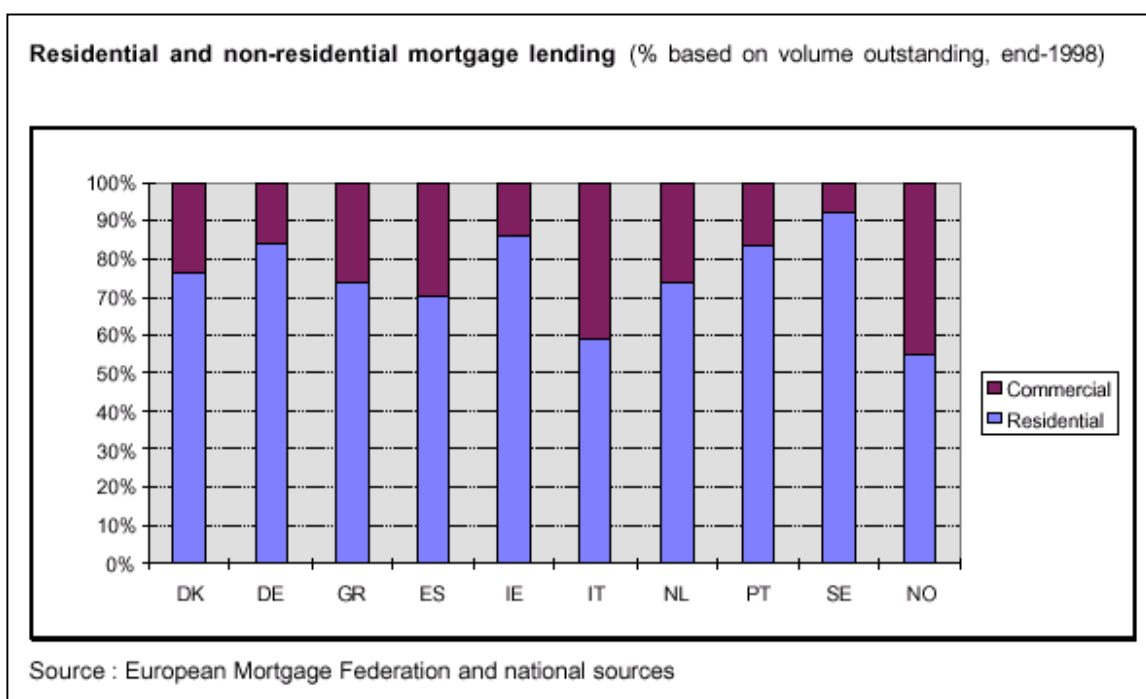
- The term 'mortgage' is more typically applied to residential home loans and may not be totally appropriate for commercial investments



- Is the ‘average’ referred to an average at Member State level or European level? If it is at Member State level does this challenge the concept of a level playing field across Europe?
- What reference source makes sense for the determination of the ‘average mortgage rate’?

In response to these questions, the following graph shows us that the proportion of mortgages offered for non-residential projects varies by European country but is generally fairly low. This raises the immediate concern that the adoption of a ‘mortgage’ based formula within the Directive might introduce influences that are not representative of the commercial lending arena.

Figure 2.1 – Proportions of Residential & Non-residential mortgage lending across Europe

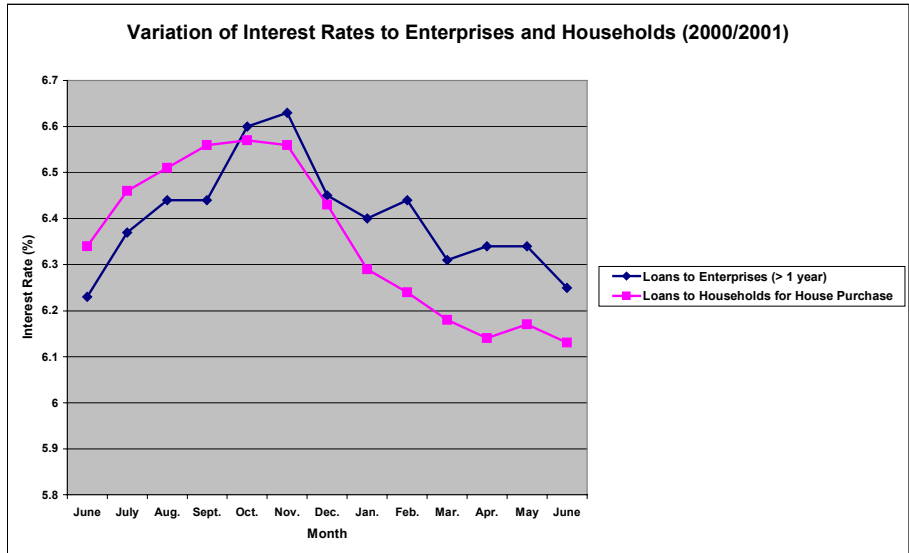


In reality, however, this aspect may be less of a concern than it first appears. Figure 2.2 overleaf shows the interest rates applying to commercial enterprises and to households for house purchase for the period from June 2000 to June 2001. It can be seen that there is no great difference between the rates being offered to each sector. Indeed, in the period in question, there is a juxtaposition in the relationship between the two rates indicating that there is no underlying structural factor which differentiates these two indices.

Nonetheless, the fact that these two rates can be identified separately and have different values month by month suggests that the Buildings Directive needs to be specific about its reference point. Bearing in mind the relationship of residential to commercial mortgage lending illustrated above, it would seem more appropriate to adopt a reference point which identifies specific commercial lending. Clearly the European Central Bank provides this at European level on a monthly basis through its Monthly Bulletin.



Of course, if the interpretation of the term ‘average mortgage rate’ is taken as referring to Member State interest rates, the range of sources and options increases substantially. However, for the most part, there appears to be data available on ‘average mortgage rates’ at national level as indicated by Figure 3.3 overleaf. This information is regularly published by the European Mortgage Federation.



Source: ECB Monthly Bulletin – August 2001

Figure 2.2 – Variation in Mortgage and Commercial Lending Rates

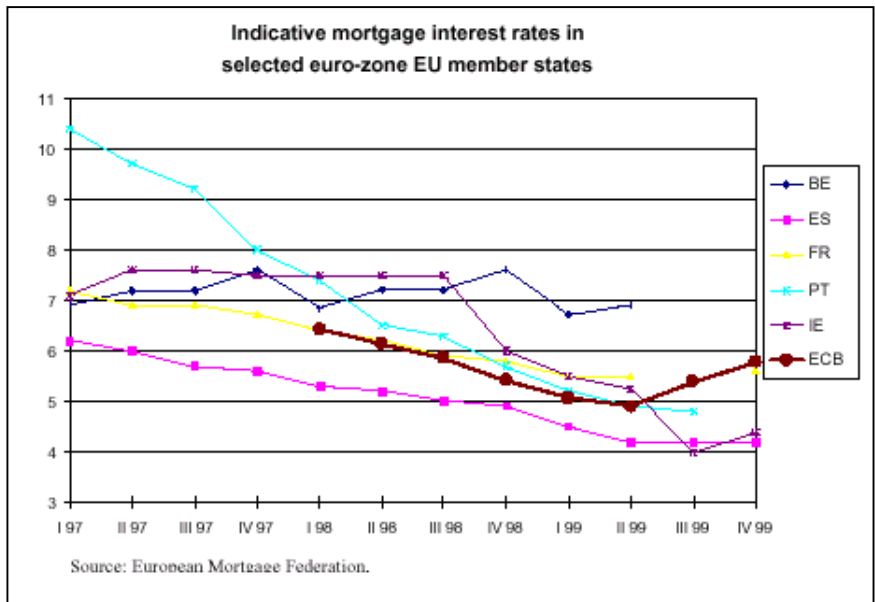


Figure 2.3 - Comparative Mortgage Lending Rates across Europe



From the range of mortgage interest rates shown in the European Mortgage Federation graph, it can be seen that adopting the 'average mortgage rate' at Member State level will not create a level playing field for investment across Europe as things stand. However, it is clear from the graph and from observations of other financial indicators that the introduction of the single currency is leading to a gradual harmonisation of interest rates and this trend can be expected to continue. However this leads to at least two further questions:

- How will those Member States outside of the single currency fare?
- How will those Member States joining the EU as a result of enlargement fare?

To assess the significance of these questions, we have to ask how important it is for the qualifying criteria of Article 5 to be aligned with the current interest rates prevailing in a given Member State. A qualifying renovation project will have to be undertaken within a Member State no matter what the local interest rate is, if the calculation is based on a centralised index. This may cause less economic initiatives to be undertaken in certain circumstances. However, this is only the same as increasing the payback period by a short time. Bearing in mind that the chosen payback period is broadly arbitrary in any event (see later), this does not seem to be a fundamental argument for departing from a central index. Accordingly, it is our view that the preferred index should be the commercial enterprise lending rate quoted by the ECB on a monthly basis in its Monthly Bulletin for loans made in excess of 1 year.

2.2 The case for the selection of an 8 year payback period

By its own admission, the Commission recognises that the choice of an 8 year payback period was primarily an arbitrary one – reflecting the fact that some were arguing for a longer period while others were arguing for a shorter one! There is a need, therefore to try to anchor such a selection in reality and this is attempted below:

A model has been produced that attempts to reflect a possible investment scenario. The following assumptions have been made based on referenced information:

- The building is assumed to have a **total surface area** of 1,250 m²
- The average building in the commercial sector consumes 1.5 GJ¹ of energy per year per m² of floor area (Aggregate floor area assumed to equal total surface area – but depends on building shape)
- A commercial interest rate of 6.5%² applies throughout the duration of the project
- The average cost of direct fuel is € 14/GJ and for electricity is €39/GJ in 2005³. These prices are assumed to remain constant throughout the period of the investment.
- The building is assumed to use 65% direct fuel and 35% electricity.
- It is assumed that measures can be taken to save 20% of the energy used and 40% of the energy used respectively.

¹ Non-domestic Building Energy Fact File – DETR/BRE (1998)

² ECB Monthly Bulletin – August 2001

³ Conventional Wisdom scenario – Capros (1995)



Taking these factors into consideration, the key question arises as to how much can be spent on renovation in the 20% and 40% cases respectively. Figure 2.4 below illustrates that this is in the order of €50,000 for the 20% savings case and €100,000 for 40% case.

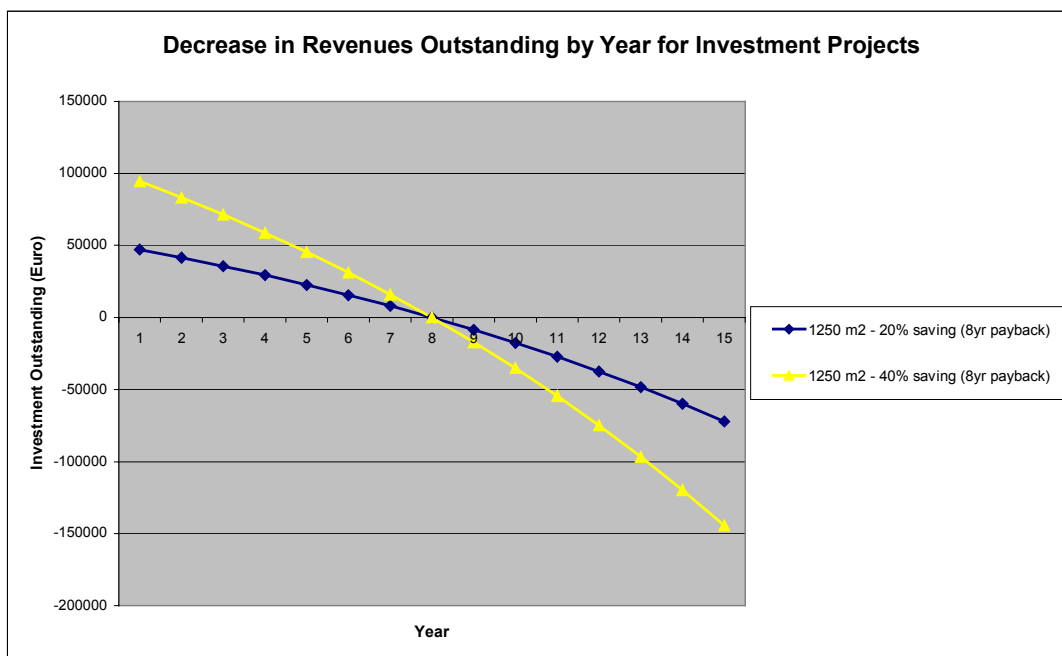


Figure 2.4 – Plots used to determine Maximum Permissible Investment Costs

In both cases, there are substantial savings to be had over a 15-year period. The maximum permissible incremental investment cost for these savings is **€42/m²** of total surface area for the 20% saving target and **€84/m²** for the 40% saving target using the 8 year payback model. This is encouraging, since Utrecht University⁴ assessed that the required investment to make a 20% energy saving was €~25/m² of total surface area for commercial (service) sector buildings and €~40/m² for the 40% target. Accordingly, with the assumptions made, it looks as though the 8-year payback period would support appropriate measures. Indeed, initially, it looks as though the 8-year payback period is more than is required to achieve the energy savings identified by the Commission. However, this is before any sort of sensitivity analysis has been applied on the assumptions (see Section 2.2.1).

Putting aside the debate over the 8-year payback period per se, it is clear that opportunities must be taken to optimise energy efficiencies when renovation work is completed and it is therefore relevant to understand what the investment limits would be when applying a more substantial 15-year payback period. Figure 2.5 illustrates the impact on these investment limits and shows that they would be extended to **€65/m²** and **€130/m²** respectively. This would permit the use of more substantive measures which might even increase the potential savings above the 40% figure.

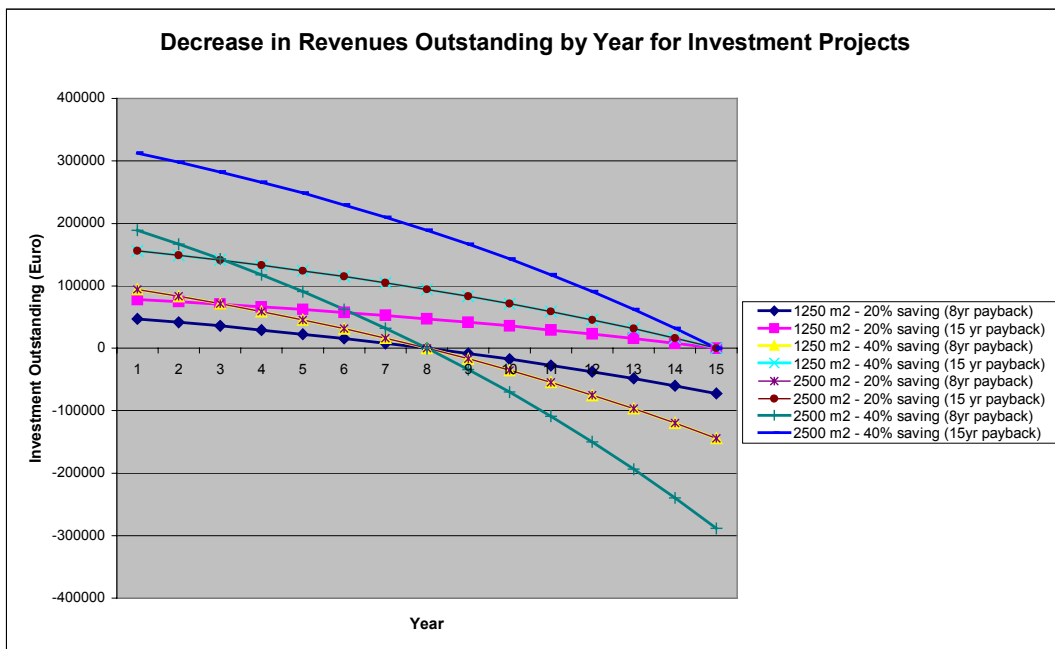
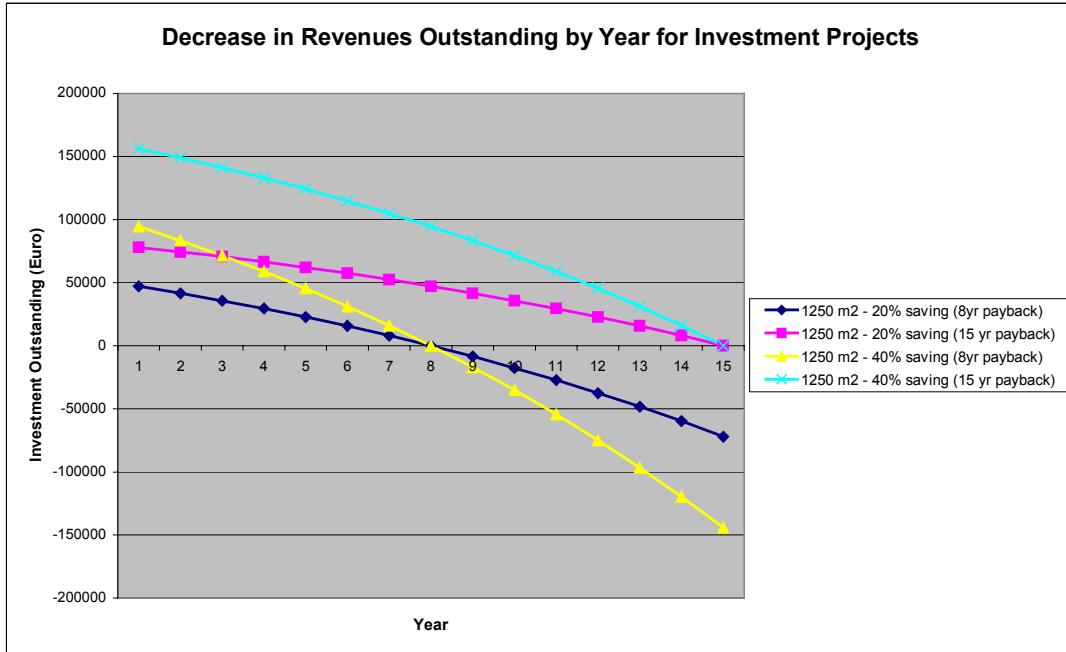
An interesting fact is that, using this model, the investment limits are independent of the size of the building since all of the parameters are based on a 'per metre' assessment (see Figure 2.6). Of course, in reality, the relationship between current energy consumption and building size would not be linear and there would be other factors to consider such as fuel price changes (see later) and variations in interest rates. It is however,

⁴ [Policies and Measures to Reduce CO₂ Emissions by Efficiency and Renewables – WWF/Utrecht University \(1997\)](#)



clear that an indication of overall investment limits is a key and that a graph of investment/m² versus percentage saving should be derived for each project in order to optimise the impact of the proposed Buildings Directive.

Figures 2.5 & 2.6 – Comparison of 8-year and 15-year payback scenarios –1250m²& 2500m² TSA





2.2.1 Variables Impacting 8-year Payback Assessment

One of the problems in dealing with sensitivity analyses on these types of models is that the number of potential permutations rapidly exceeds our capacity to make rational assessments. Accordingly, in this section, the 8-year payback assessment has been used to assess impact of a variety of variables and these are covered in the following sub-sections.

2.2.1.1 Energy Prices

Figure 2.7 below illustrates the effect of a 10% increase and a 10% decrease on assumed energy prices.

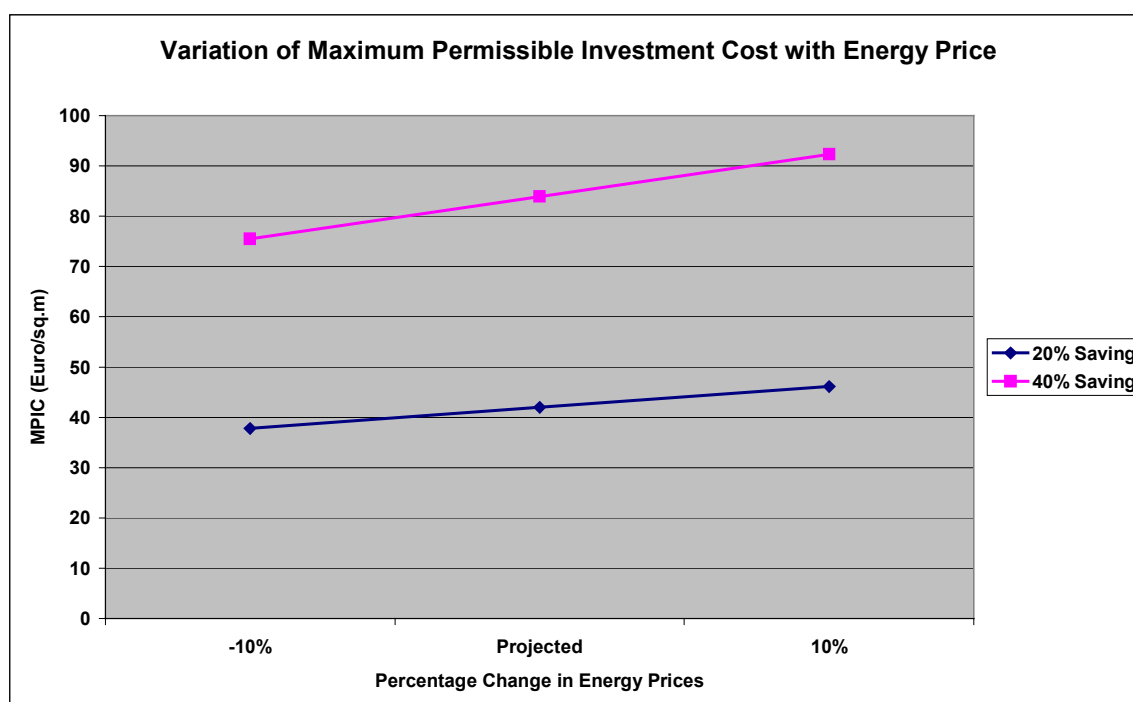


Figure 2.7 – The impact of Energy Price on Maximum Permissible Investment Cost

The slopes of the respective lines suggests that the models are not highly sensitive to energy price and it would appear that energy cost reductions of >30% would be required before the maximum permissible investment cost dropped below the Utrecht University threshold.



2.2.1.2 Fuel Mix

Figure 2.8 below illustrates the effect of fuel mix on the maximum permissible investment costs determined by the model.

It can be seen, that the impact of electricity in the mix is substantial because of the high differential cost between this and other fuels. Accordingly, it is likely that the enactment of a financially driven building selection procedure under Article 5 will favour the prioritisation of electrically heated and cooled buildings. More importantly, those buildings completely reliant on direct fuels are less likely to be prioritised, even though their CO₂ impacts could be substantial.

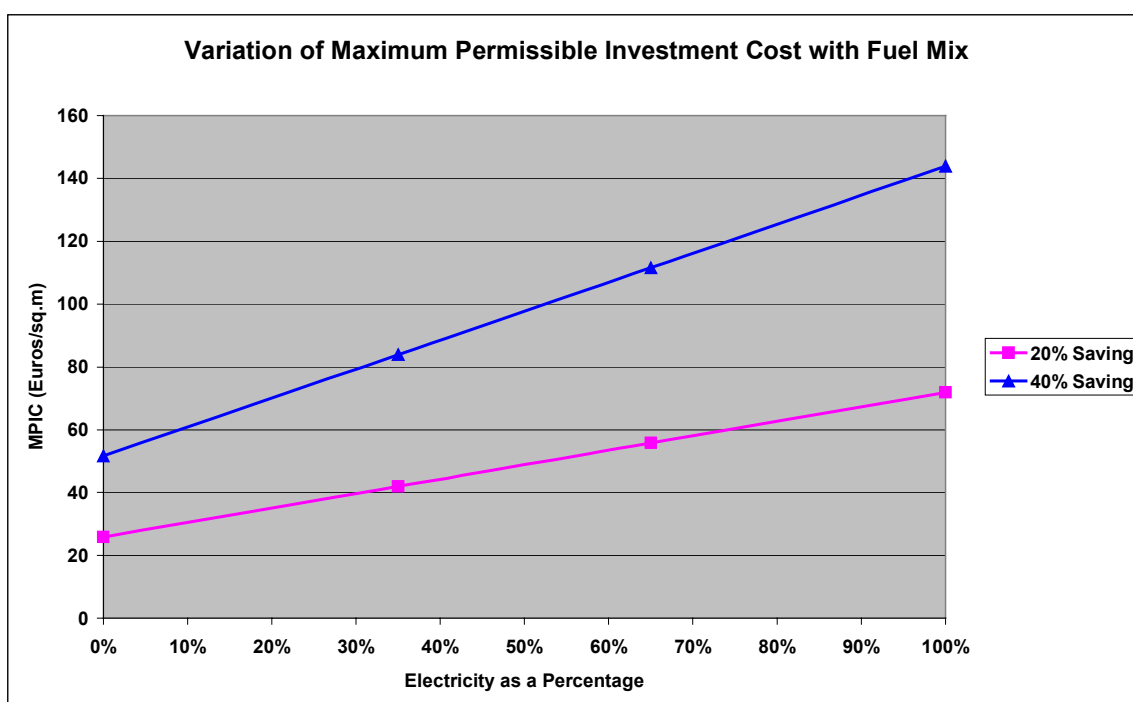


Figure 2.8 – The impact of Fuel Mix on Maximum Permissible Investment Cost

It can be seen that low levels of electricity usage, the maximum permissible investment costs approach the Utrecht University threshold for the achievement of 20% savings.



2.2.1.3 Interest Rates

The effect of interest rates on investment is a point of particular interest in any regulatory mechanism based on a financial model. As with previous sensitivity assessments, Figure 2.9 below illustrates the effect of several alternatives – in this case 5%, 7.5% and 8.75% interest rates.

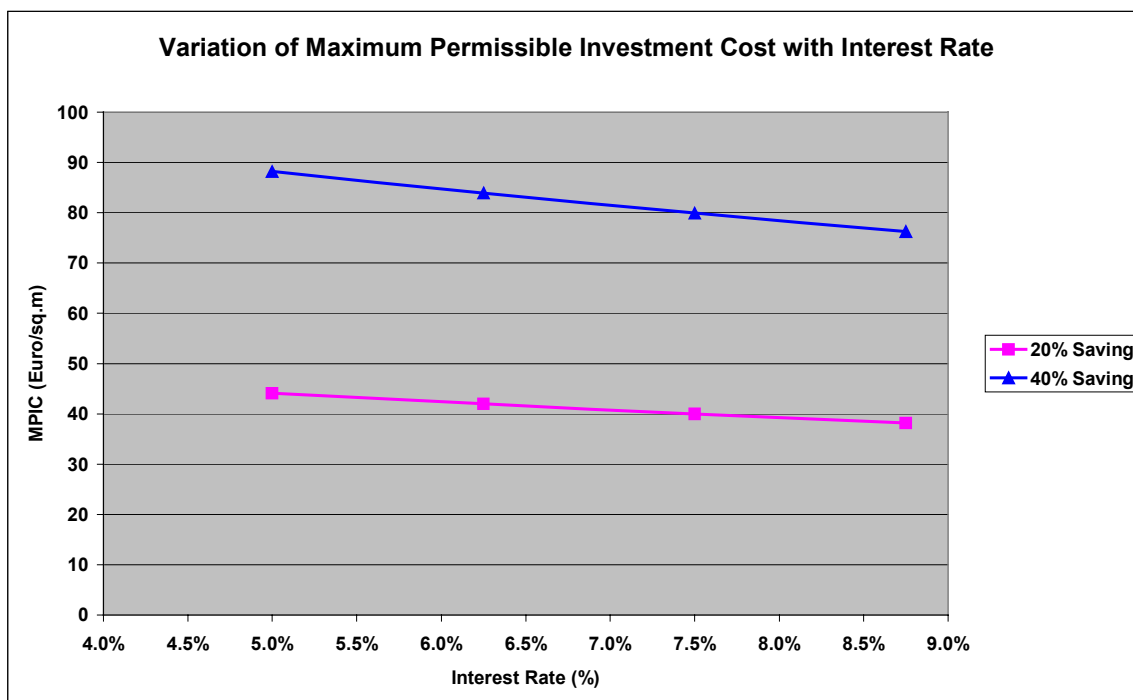


Figure 2.9 – The impact of Interest Rate on Maximum Permissible Investment Cost

It can be seen that there is less sensitivity to likely interest rate changes than to fuel mix. Accordingly, such changes are not seen to be significant in the setting of financial ‘qualifiers’ for Article 5.



2.2.1.4 Existing Energy Usage per m² of Total Surface Area

Figure 2.10 below illustrates the impact of existing energy usage assumptions on the minimum permissible investment cost for insulation upgrade measures. It can be seen that at baseline energy usage levels of 1GJ/m²/year and below the maximum permissible investment for 20% savings reduces to close to the required investment level defined by Utrecht University.

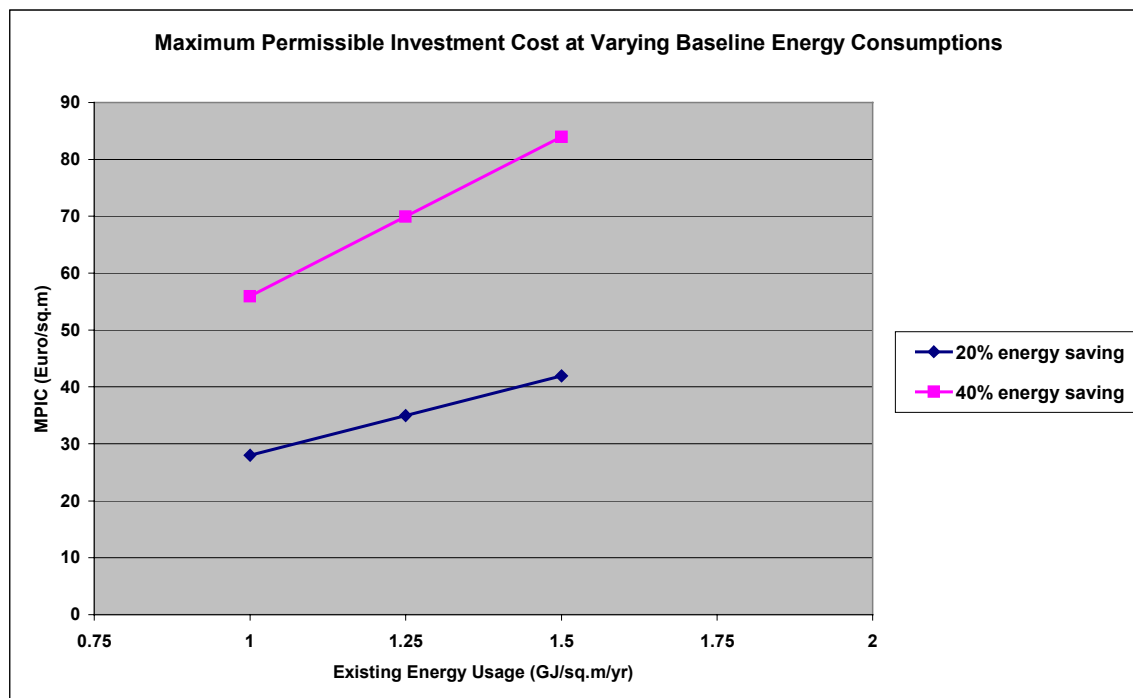


Figure 2.10 – Impact of Baseline Energy Usage on Maximum Permissible Investment Cost

This implies that any reduction below the 8-year payback period would jeopardise the possibility of making improvements under Article 5 on any buildings displaying an existing energy usage of 1 GJ/sq.m/yr.

In all of these sensitivity analyses, it should be noted that no attempt has been made to assess the compound effects of such variables. In reality, it is very unlikely that one variable will impinge on the situation in isolation and assessing combinations is therefore a more appropriate approach. In the light of the sensitivities already exposed, the combination of baseline energy consumption and fuel mix seems to be amongst the most fundamental. This is therefore dealt with specifically in the next section.

2.2.1.5 Compound effects of low baseline energy consumption and fuel mix

It is self-evident that those operating buildings with lower baseline energy consumption will have greater difficulty in identifying areas for improvement. However, this is not to say that cost-effective opportunities for improvement do not exist. Accordingly, it would be inappropriate to rule out buildings of this type from the scope of the Article 5 of the Buildings Directive. The situation is compounded where the average cost of



fuel is low because of low electricity content in the fuel mix. Under these circumstances, it is quite possible that the criterion for inclusion within Article 5 (i.e. the 8-year payback period) could be missed by a substantial proportion of the existing building stock. This is illustrated in Figure 2.11 below:

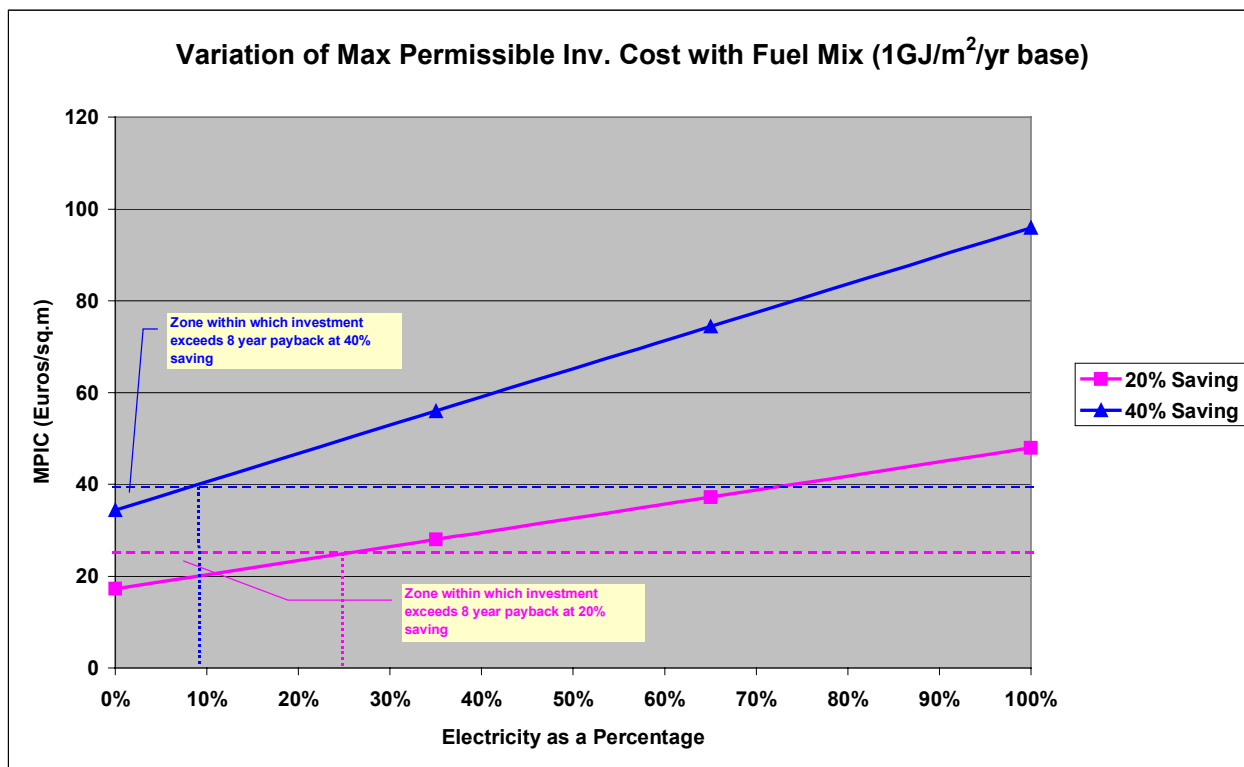


Figure 2.11 – The impact of combining Low Baseline Energy Usage with Fuel Mix

As can be seen, if 20% savings on energy usage were made under the circumstances of low baseline energy usage, all buildings with electricity component of the fuel mix below 25% would be excluded from the scope of Article 5 using the 8-year payback cut-off point. Although it can be argued that fuel mixes with low electricity contents have lower CO₂ emission implications and that priority should be given to those buildings with poorer baseline energy consumptions, the Commission needs to think carefully about excluding significant proportions of the building stock. Accordingly, the 8-year payback period is probably on the lower limit of the payback period that should be adopted and some could justifiably argue that it is already too low.



2.3 Problems in defining the ‘total cost of renovation’

The proposed Buildings Directive provides a qualifying relationship between the ‘total cost of renovation’ and the ‘insured value’ of the property. Effectively, the total cost of renovation must be at least 25% of the ‘insured value’. However, this qualifier has within it several pitfalls which need to be noted:

- (1) ‘Insured values’, unless indexed, can fall far below the actual replacement cost of a building over time
- (2) The ‘total cost of renovation’ will require tight definition to avoid the following:
 - The omission of costs which should be included in the renovation assessment
 - The breaking down of a larger renovation project into smaller individual projects
 - The agglomeration of two clearly separate and distinct renovation projects

Clearly much depends on the motive involved. In some cases, the cost associated with the upgrade will be a barrier to the implementation of energy efficiency measures – particularly where the owner of the building is not responsible for the operating costs. On the other hand, in Member States where governmental financial support may be available to assist in the upgrade, the temptation could be to seek inclusion under the Directive where it is not fully justified.

It is currently understood that the ‘total cost of renovation’ will include the following:

- All costs of materials whether associated with energy efficiency measures or not.
- All labour involved in supporting the project, including specification and project management
- Certain equipment replacement where this contributes to the energy efficiency of the building.

The nature of a Directive is such that individual Member States will draft their own laws to achieve the relevant requirements. It is viewed as highly important that a shared interpretation of ‘total cost of renovation’ is applied to avoid significant distortions in the application of Article 5.

2.4 Other practical concerns over enforcement

In many Member States, a renovation project which equates to at least 25% of the insured value of the property will almost certainly be monitored under the relevant building control regime. Accordingly, there should not be a problem in enforcing an upgrade provided that information on the energy consumption and costs of the existing building are known. This is not always the case, and it may be necessary to introduce a compulsory energy audit on the current building to extract the necessary information.

There could be additional complications where the building has been unused for some time or there is a significant change of use and rulings need to be made to cover these.

Finally, in Member States where no formal building control regime exists, the proposed Buildings Directive may naturally act as a stimulus to the formation of such a regime. However, the Commission will need to give consideration to circumstances where the situation persists. This will also apply to energy performance certificates.



3. ALTERNATIVE METHOD FOR 'COST OF CAPITAL' ASSESSMENT

In the analysis to date, we have considered exclusively the impact of various assumptions on the determination of maximum investment limits. This is useful in determining what types of measures can be applied. However, it does not take into account any consideration of return on investment per se. If we are considering return on investment of a 15-year period, it is self-evident that employing a 15-year payback period will give us a return on investment of zero. Effectively, we have set the parameters to breakeven after 15 years.

For an 8-year payback period, however, we have already noted that we will see some additional return from energy savings over a 15-year time horizon. This can be quantified in several ways, but one of the most useful is what is known as the Internal Rate of Return (IRR). This approach effectively assesses the annual interest rate which would need to be applied to the initial investment to provide the overall saving achieved at the end of 15-years. However, there is a need to consider a discount rate when determining the value of future energy savings and this can be applied using the 'average mortgage rate' when making the calculation. Figure 3.1 below illustrates the principles at work for the base case used earlier in section 2.2:

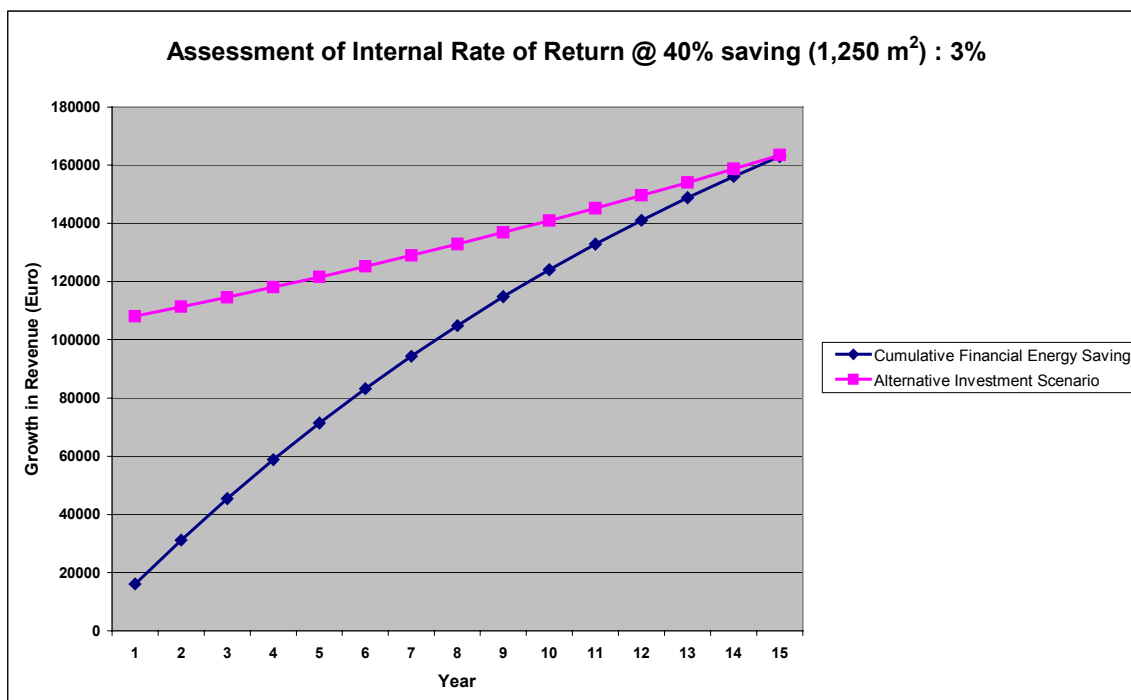


Figure 3.1 – Internal Rate of Return as an alternative to Pay-back

Using this analysis, it can be seen that the Internal Rate of Return (IRR) provided by the 8-year payback period base-line model is 3%. A figure of this, or some other, value could be used to define the minimum criteria for investment.

The value of using this type of approach to the assessment of investment is that it *does not require the nomination of a specific payback period* and will automatically adjust to the variables applied to it. However, it



should be noted that, if the IRR is set at the 'average mortgage rate', the maximum permissible investment cost is reduced to around € 70,000 or € 60/m² for 40% savings (see Figure 3.2 below)

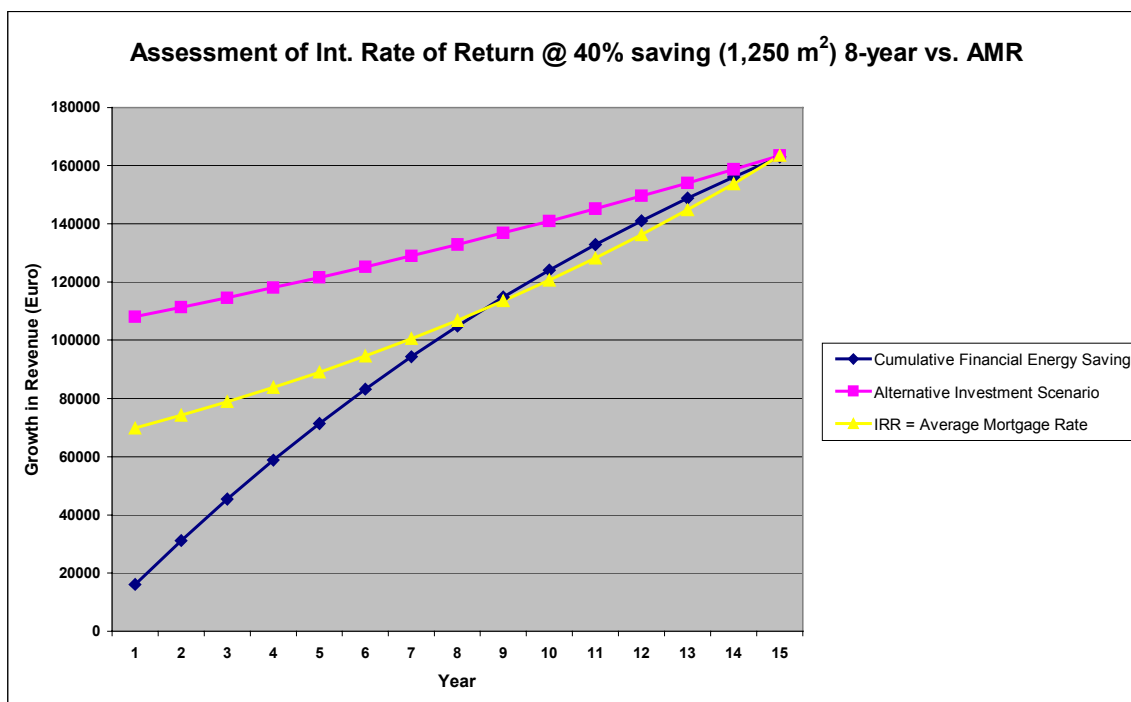


Figure 3.2 – Using the Average Mortgage Rate as the Target Internal Rate of Return

4. CONCLUSIONS

The following conclusions can be drawn:

- There are several Europe-wide indices for discerning 'average mortgage rates' in addition to the clearly available information at Member State level
- On the basis of referenced assumptions, the 8-year payback calculation allows sufficient investment limits to achieve significant savings (i.e. in excess of 20%)
- Sensitivity analyses show that investment decisions are particularly susceptible to variations in baseline energy consumption and fuel mix.
- In perfectly achievable scenarios, the maximum permissible investment cost per m² of total surface area approaches the Utrecht University threshold⁴ using the 8-year payback model. This implies that movement below an 8-year payback period will rule out significant groups of buildings which might be otherwise captured under the provisions of Article 5.



- Alternative methods of 'cost of capital' assessment exist which avoid the emotive reference to payback periods. A good example is the Internal Rate of Return.
- To maintain investment levels equivalent to the 8-year payback period, the target Internal Rate of Return would be approximately 3%.
- Internal Rates of Return which reflect the average mortgage rate would in current financial conditions reduce maximum permissible investment costs per m² of total surface area by one third.

5. RECOMMENDATIONS

The recommendations arising out of the is report are as follows:

- That the ECB's 'greater than 1 year' lending rate for commercial enterprises be taken as the 'average mortgage rate' for the operation of the Directive. This is published monthly in the ECB Monthly Bulletin
- That an investment versus energy savings curve be drawn (possibly on a 'per sq. metre' basis) for each qualifying project under Article 5.
- That investments above the 8 year payback period should be considered where substantial incremental energy saving can be achieved.
- That an 8-year payback period be the minimum adopted for the operation of Article 5 in view of the sensitivities arising from both baseline energy consumption and fuel mix.
- That consideration be given to adopting an Internal Rate of Return (IRR) assessment to avoid the emotive language of payback periods.
- That any such minimum IRR be set at 3% per annum or less over 15 years for parity with the current 8-year payback provisions.

6. CONSOLIDATED REFERENCES

1. 'Non-domestic Building Energy Fact File' – *DETR/BRE (1998)*
2. 'ECB Monthly Bulletin' – *August 2001*
3. 'Conventional Wisdom scenario' – *Capros (1995)*
4. 'Policies and Measures to Reduce CO₂ Emissions by Efficiency and Renewables' – *WWF/Utrecht University (1997)*