Market Failure and Energy Efficiency in the Building Sector

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ABSTRACT

Economic analyses of energy-efficiency technologies and programmes in the building sector have shown that many provide potential net benefits to society. Nevertheless, the evidence suggests that the market alone will not ensure an optimal takeup of these energy-efficiency opportunities. This paper explores the economic rationale for this failure of the market and outlines the policy interventions available to overcome this failure.

I. Introduction

Many cost-benefit studies have demonstrated that improving energy efficiency in the building sector makes economic sense. Indeed, it is often shown that energy-efficiency measures pay for themselves simply by savings in energy costs. Added to this benefit is the economic value of reductions in emissions associated with fossil-fuel consumption. These reductions in environmental emissions may also assist countries or regions to comply with their obligations under international environmental agreements such as the Kyoto (global warming) and Gothenburg (acidification) Protocols and to comply with EU Directives. Improved energy efficiency in buildings has also been shown to have the potential to provide health and comfort benefits. These studies are consistent with the view of the European Commission that the building sector offers one of the largest single potentials for energy efficiency and should thus be a major focus for action. However, despite the positive net benefits of some of these energy-efficiency technologies and programmes, it is generally recognised that there is a sub-optimal take-up of such opportunities. The purpose of this paper is to examine why the market fails to ensure that society captures the net benefits of energy-efficiency opportunities and to explore the role of various policy instruments in addressing this problem.

II. Why does the market fail to deliver an optimal level of energy efficiency?

The question arises as to why, if the benefits of the energy-conservation measures tend to outweigh their costs, these measures are not adopted. The principal causes are Market Failure and Government Failure.

- Market Failure
The first Fundamental Theorem of Welfare Economics builds on the observation of Adam Smith that, if markets are competitive, and individuals act in their own self-interest, a 'Pareto-optimal' equilibrium will be achieved where no one individual can be made better off without making someone else worse off. However, it is well recognised by economists that a market economy will fail to achieve optimal outcomes due to various market failures. Firstly, the market for a particular good or service may not be competitive. Secondly, the Theorem ignores the distribution of income and equity considerations. Third, the Theorem assumes no externalities. In reality, the actions of one agent in the economy may have real (non-monetary) consequences for the welfare of others. For example, the burning of fossil fuels to generate energy causes the release of various pollutants that impose costs upon those other than the energy consumer. The existence of 'externalities' will result in a suboptimal outcome if left unchecked. Closely related to the concept of externalities are those of 'property-rights failure' and 'missing markets'. These are particularly relevant in regard to the environment. In a market economy,
goods and services are allocated by the price mechanism which reflects underlying supply and demand. Many environmental resources are not owned and so do not have a price (or are under-priced). If environmental goods (such as the assimilative capacity of the atmosphere) are under-priced, they will be overused thereby resulting in a suboptimal outcome. Public goods (such as national defence and some forms of R&D) which are either perfectly or imperfectly non-rivalrous and non-excludable in consumption will not be provided by the unfettered market. Market failures also result from imperfect information in the market which may lead to sub-optimal outcomes. A further difficulty results from principal-agent-type problems whereby the objectives of staff or shareholders differ from those of the management.

- **Government Failure**
  Government exists to address these various market failures but may cause further distortions by its own behaviour. This usually results from perverse incentives being introduced by inappropriate pricing, by poor management or, in extreme cases, by corruption.

### III. Market and Government Failure with regard to Energy-Efficiency in Buildings

Failures in the market and by government provide a number of impediments to the take-up of energy-efficiency opportunities in the building sector despite the results of cost-benefit analyses demonstrating the net economic benefits of such opportunities.

- **The private and social benefits and costs may differ**

  A social cost-benefit analysis considers all the benefits to society of installing improved energy-efficiency technologies in the building sector. However, an economic agent (an individual, developer or firm) normally only takes account of the direct benefits to themselves, i.e. the private benefits of energy-efficiency measures. External benefits which are captured by wider society (e.g. reductions in environmental emissions) may not to be considered when a private individual is considering whether to invest in such measures. The payback periods and net benefits of various measures and programmes are adversely affected by the exclusion of non-private benefits. In addition, while some of the benefits may be private in nature, they may not be recognised or considered by those who benefit. Energy savings may well be considered but improvements in health, being non-monetary in nature, are often not known about or recognised when making financial decisions.

  Cost-benefit analyses exclude transfers. In addition, prices may be adjusted to reflect more closely the true opportunity cost of using resources. However, private agents face actual market prices and taxes and the cost of any labour required is the market wage (a cost-benefit analysis may reduce labour costs to reflect underemployment). Thus, the actual costs of adopting energy-efficiency measures may be higher than reflected in cost-benefit figures.
• The private and social rates of discount may differ

The consideration of time is usually of considerable import when assessing the net benefits of energy-efficiency technologies or programmes. There is no agreement on an appropriate figure for the social rate of discount which would be used in a cost-benefit analysis. Most such studies employ a range of discount and use a Government test discount rate (often around 5 or 6%) for the purpose of public policy recommendations. While this might be considered the appropriate rate for the social cost-benefit analysis, it is less applicable to the private agent. Those who are considering improving the energy-efficiency characteristics of a building are likely to carry out a financial analysis. The market interest rate is likely to be used in these calculations as it reflects the opportunity cost of capital. These rates may be somewhere in the region of 10% which would reduce the net present value of future energy savings and thereby increase the payback period and possibly result in a negative return.

• Those who make the decisions may not reap the rewards

In addition to the problem of external benefits being excluded, there may be market inefficiencies as regards the incentives for developers to adopt improved technologies. This can result because those making the decision as to whether to upgrade the energy-efficiency standards of a new building may not be the occupiers of the completed building. In some cases, the fixed costs of installing improved energy-efficiency technologies may outweigh the cost of traditional measures. The variable costs (the costs of running the systems) may be lower, i.e. there will be a payback period of a number of years. If the market were to work efficiently, part of this discounted saving (see below) would be appropriated by the developer. However, the market may fail in this regard, principally, due to information asymmetries. If the benefits of the technologies cannot be adequately communicated to the purchaser or renter of the building, there is little incentive for the developer to bear the fixed costs.

• Principal-agent problems may exist

Related to the above, it may well be that those who make the decisions regarding whether to install the better technologies or whether to rent or purchase a building which embodies these technologies, may not be those who occupy the building day-to-day. For example, if the management of a large corporation is not to occupy the new building, it may not adequately consider the effects of its energy-efficiency characteristics on the work environment of the occupants. If the technologies have some health or comfort benefits, the extent to which this recognised by the management will depend upon how clearly they associate a healthy work environment with the productivity of the corporation.
• The distribution of income may be an inhibiting factor

Socio-economic considerations play an important role in relation take up of energy efficiency opportunities in the household / domestic sector. The least energy-efficient households are more likely to be lower income households\(^4\) Such households are much less likely to have available funds and, thus, are most likely to have to resort to a loan. They are less likely to be in the position of accessing credit (particularly at the market rate of interest\(^5\)) and they are more likely to have more pressing alternative uses for any extra funds. They may, additionally, have an aversion to borrowing funds, as has been reported by Salvage (1992). It has also been shown that low-income households tend to have higher discount rates, i.e. they exhibit myopic tendencies whereby they place a greater value on income now as opposed to in the future, partly resulting from the higher degree of uncertainty about the future stemming from their financial instability.

• The public-good characteristics of innovation may result sub-optimal R&D effort

Research and development can be a costly business for a private agent in the short term whereas the benefits, if there are any, may only arise well in the future. A high private discount rate and risk of failure will discourage R&D effort. In addition, inadequate patent protection may lead to a sk of the innovator being unable to appropriate sufficient benefits to reward their effort. This provides a rationale for state-aid for R&D.

• There may be considerable information asymmetries

With suboptimal R&D effort, we may simply be unaware of the opportunities for energy savings in buildings. Sometimes the full nature, extent and magnitude of the benefits of energy efficiency in the building sector are a matter for speculation. Even if the technologies have been invented, it may be that the economic analyse showing the net benefits of their implementation have not been completed. This is often presented as the necessity for public funding of R&D.

An additional reason for state funding of research is because there is often a 10 to 20-year delay in between the dissemination of public knowledge and its eventual effect on industrial processes (US National Science Board, 1996) which affects the rate of return to R&D. The most extreme case would be in the domestic / household sector where there would likely be very incomplete knowledge amongst householders of the opportunities available\(^6\). This information gap is likely to be greater in low-income households where the benefits would be greatest. In addition, an information asymmetry

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\(^5\) See Weber (1990) for more on this issue.
\(^6\) Lack of information is seen as a key reason for market failure in the UK according to Williams and Ross (1980) and Carlsmith et al. (1990) and in Ireland by Healy and Clinch (2003).
between buyers and sellers of energy-efficiency measures may occur, leading to adverse selection of such technology\(^7\).

If the market worked effectively, the monetary value of the energy-efficiency measures would be reflected in the value of the buildings and this would provide an incentive for the technologies to be implemented. Information asymmetries inhibit this function of the price mechanism.

- **Transactions’ costs**

  Closely related to the information problem is that of the fixed costs of learning about, and administering, energy-conservation measures. Examples of transactions’ costs include the time agents must spend to learn about the various options, oversee the work, deal with any disruption etc. Such costs are not reflected in Cost-Benefit Analyses. The amplitude of these transactions’ costs may overwhelm the potential pay-off of such an effort, acting as a performance-inhibiting ‘wedge’ which prevents the implementation of cost-effective energy-conservation measures. These transactions’ costs are difficult to measure, but are potentially the key factors in explaining the slow take-up of financially viable measures, especially in the domestic sector (Convery, 1998).

- **Property-rights failure**

  Tenants are not generally responsible for the energy-efficiency standards of the buildings they occupy. This is also a particular problem in the domestic / household sector. For example, some of the least energy-efficient houses in the UK and Ireland are tenant-occupied (Boardman, 1991; Brechling and Smith, 1992; Brophy et al., 1999). Tenants may feel that they are not responsible for undertaking investments in energy efficiency or authorised to do so, i.e. there is a non-appropriability of benefits. Indeed, it is not financially sound for a tenant to invest if they expect to move out in the short to medium term. Likewise, landlords may feel that the benefits to them of such investment may not be recouped if they are unable to raise rents. Also, if investment does take place in a multi-occupancy dwelling, ‘free-rider’ incentives may exist in relation to the financing of this public good (Smith, 1992).

- **Government Failure**

  The structure of government may contribute to the lack of take-up of energy-efficiency measures whereby, under institutional arrangements that prevail, there is no one institutionally or politically positioned to ‘champion’ them. Policy responsibility for energy efficiency may be spread across a variety of ministries and agencies. In addition, there may be inadequate policy instruments to address market failures. Energy policy traditionally focused on supply-side interventions and neglected demand-side options. Without appropriate incentives to ‘internalise’ the externalities associated with

energy use, such as via carbon taxes or emissions-trading systems, there is little incentive to take such environmental emissions into account.

IV. Policy Measures to Address Market Failure in regard to Energy Efficiency

There are a number of instruments available to policy-makers to correct for market failure. These include:

- **Regulation**
  Regulation, also known as command-and-control, endeavours to improve the performance of the market via the setting of standards e.g. building regulations. Non-compliance with a standard results in a penalty, usually in the form of legal action and/or fines. Regulation is likely to be most effective for new buildings where minimum standards can be set.

- **Taxes and charges**
  Environmental taxes and charges are forms of market-based instruments. These instruments are put in place by a policy-maker to alter market signals to encourage or discourage certain activities or behaviour. A tax on energy generated from fossil fuels may be part of a strategy to reduce emissions of greenhouse gases. This would provide an incentive to invest in energy-conservation measures. However, energy tends to be price-inelastic and so, when the substitutes for energy generated from fossil fuels are limited, such a tax may not be effective unless combined with other policy instruments.

- **Tradeable permits and offsets**
  Emissions Trading is also a market-based instrument. Rather than being a price instrument (like a tax), it is a quantity-based instrument. In the Kyoto Global Warming Protocol, compliance with the greenhouse emission quotas can be achieved, in part, by purchasing from others who have a quota to spare. A price emerges for the permits which reflects the scarcity value of the environment. If such a system were introduced within a country, it would be important that the building sector be included in some way. However, the practical implementation of such a trading system might prove difficult.

- **Subsidies and tax relief**
  Removal of subsidies, if any, on energy products would enhance the incentives for energy efficiency. Tax relief and grants for energy-conservation measures are other potential instruments.

- **Voluntary approaches**
  A voluntary agreement (in place of an implied threat of alternative government regulation) by developers that information on the thermal specifications of buildings be included in sales literature would have had potential if it had not already been overtaken by the EU Energy Performance Directive (see below).
• **Institutional development**

While not a policy instrument as such, institutional issues are very important. Energy efficiency is usually the concern of a number of government departments. In order to mobilise the policy process, it is helpful if a focal point for energy-efficiency is established to reduce government failure.

**V. Conclusion**

There are a number of reasons why economically-efficient energy-conservation measures may not be taken up by private agents. These result predominantly from market failure in the form of differing private and social rates of discount, the fact that those who make the decisions may not reap the rewards, other principal-agent problems, the distribution of income may be an inhibiting factor, the public-good characteristics of innovation may result sub-optimal R&D effort, and there may be transactions costs and property-rights failure.

Of considerable importance is a further market failure, that is, the persistence of information asymmetries. This provides the economic rationale for investment in research to improve the flow of information on the potentials for improved energy efficiency in the building sector.
References


