Towards an Effective Energy Labelling Programme for Commercial Buildings: A Comparative Evaluation of the Green Buildings for Africa Programme in relation to International Experience

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Declaration

I declare that this thesis is my own, unaided work. It is being submitted for the Degree of Master of Architecture in the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

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On _____________ of ______________ year __________

Abstract

International experience indicates that energy labelling programmes are rapidly evolving as a valuable tool for energy efficiency awareness and practice in the built environment. Four years after the launch of the South African labelling programme, Green Buildings for Africa (GBfA), it became evident that implementation was not successful. This study evaluates the contribution of a range of factors towards the sustained implementation and uptake of energy labelling programmes for commercial buildings based on a comparative appraisal of relevant international case studies and the GBfA. The analytical process is based on three types of energy labelling categories (mandatory energy audit, voluntary energy audit and voluntary benchmarking scheme) and two categories of factors (contextual and programme-specific). The key finding is that government involvement and support is critical, if not a prerequisite, for successful roll-out of an energy labelling programme. Key recommendation is that a local programme be initially based on a voluntary benchmark programme approach.

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Abbreviations

ABGR	Australian Building Greenhouse Rating
AGO	Australian Greenhouse Office
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
BEARS	Building Environmental Assessment Rating System
BNA	Bureau of National Affairs
BREEAM	Building Research Establishment Environmental Assessment Method
BRL	Beoordelings Richtlijn (National Certification Agreement)
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CDM	Clean Development Mechanism
CEN	European Committee for Standardisation
CER	Certified Emission Reduction
CO_2	Carbon Dioxide
CSIR	Council for Scientific and Industrial Research
DEA	Danish Energy Agency
DEAT	Department of Environmental Affairs and Tourism
DEUS	Department of Energy, Utilities and Sustainability (Australia)
DME	Department of Minerals and Energy
DOE	Department of Energy (USA)
DPW	Department of Public Works
DSM	Demand Side Management
EBM	Energie, Bouwfysica & Milieu (Energy, Building physics and Environment – Dutch consultant company)
EC	European Commission
ECCP	European Climate Change Programme

ECSA	Engineering Council of South Africa
EIA	US Energy Information Administration
ELO	EnergiLedelsesOrdningen
EPA	United States Environmental Protection Agency
EP-ACT	Energie Prestatie Advies- en Certificerings Tool (Energy Performance Advice and Certification Tool)
EPA-U	Energie Prestatie Advies Utiliteitsbouw (Energy Performance Advice for Commercial Buildings)
EPA-W	Energie Prestatie Advies Woningbouw (Energy Performance Advice for Housting)
EPBD	European Union Energy Performance for Buildings Directive
EPPC	European Climate Change Programme
EPR	Energy Performance Refund
ERBM	Energy Rating Bench Mark
ESCO	Energy Service Company
ESETA	Energy Sector Educational and Training Authority
EZ	Economische Zaken (Department of Economic Affairs)
GBfA	Green Buildings for Africa
GBTool	Green Building Tool
GDP PPP	Gross Domestic Product Purchasing Power Parity
GHG	Green House Gases
HERS	Home Energy Rating System
HKBEAM	Hong Kong Building Environmental Assessment Method
HVAC	Heating, Ventilation and Air Conditioning
IEA	International Energy Agency
IESNA	Illuminating Engineering Society of Northern America
IIEC	International Institute for Energy Conservation
kWh/m^2	Kilo Watt hour per square meter
LEED	Leadership in Energy and Environmental Design
MJA	Meer Jaren Afspraken (Long Term Agreements)
MOU	Memorandum of Understanding
MW	MegaWatt

NABERS	National Australian Built Environment Rating System
NEEA	National Energy Efficiency Agency
NHER	National Home Energy Rating (NHER)
NSW	New South Wales (State of Australia)
OECD	Organisation for Economic and Co-operation and Development
PJ	Peta Joules
SABS	South African Bureau of Standards
SAEDES	South African Energy and Demand Efficiency Standards
SAEE	South African Association for Energy Efficiency
SANS	South African National Standard
SAPOA	South African Property Owners Association
SBAT	Sustainable Building Assessment Tool
StatsSA	Statistics South Africa
TPES	Total Primary Energy Supply
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
VABI	Vereniging voor Automatisering in de Bouw en Installatietechniek
VROM	Volkshuisvesting, Ruimtelijke Ordening en Milieu (Dutch Department of Housing, Spatial Planning and Environment)

1 Introduction

1.1 Background

In 1971, the Club of Rome published the report "The Limits to Growth" in which they captured the western nations' concern for the environment. Industrialisation and exponential growth in resource consumption and human population seriously jeopardised the continued existence of a safe, healthy, clean and diverse environment (Hattingh 2002). In 1979, during the First World Climate Convention, scientific evidence of human interference with the climate was presented to the international public arena (UNFCCC 2005a). The Second World Climate Convention in 1990 called for the creation of an international treaty, which resulted in the development of the United Nations Framework Convention on Climate Change (UNFCCC). The convention was opened for signature at the Earth Summit in Rio de Janeiro, Brazil in 1992. The convention provides a framework for intergovernmental efforts to tackle the challenge posed by climate change (UNFCCC 2005b).

Climate change or global warming is caused by increased emission and atmospheric accumulation of greenhouse gases, and especially carbon dioxide (CO_2). CO_2 is generated when burning fossil fuels, such as coal, oil and natural gas. To reduce or stabilise the levels of CO_2 in the atmosphere, people have to minimise energy consumption, use energy more efficiently and switch to renewable forms of energy in all economic sectors.

By signing the UNFCCC convention, world leaders committed themselves to stabilise the concentration of greenhouse gases in the atmosphere. The convention came into force in 1994 and the almost worldwide membership indicates the relevance of the climate change issue. The Kyoto Protocol, initiated in 1997, is an addition to the convention and has legally binding measures. The protocol states that countries should reduce emissions of greenhouse gases with an average of 5.2% in the period 2008 to 2012 with base year 1990 (UNFCCC 2005). The protocol came into force on February 16, 2005, ninety days after 55 Annex I parties[1], which are responsible for 55% of the total CO_2 emission, had ratified the protocol (UNFCCC 2005).

South Africa ratified the convention on August 29, 1997 and the protocol on July 31, 2002, and is categorised as a Non-Annex I or developing country, which means that it is not compelled to actively reduce the greenhouse gas emissions. Although legal interventions are only applicable to Annex I countries, the non-Annex I countries are required to report on national emissions and are encouraged to consider climate change issues in their national policies (EIA 2004).

1.2 Energy in South Africa

South Africa has a very energy intensive economy; it was responsible for 301.48 million metric tons of Carbon Dioxide (CO_2) in 2002, which is 40.6% of Africa's total CO_2 emissions, and 0.1% of the total world emissions (DME 2002; IEA 2004). South Africa's CO_2 emission per capita (6.65 ton per capita) is relatively high compared to other African countries, but lower than most developed countries, due to lower levels of automobile and home appliances per capita and

[1] The 189 participating parties have different commitments towards the objectives of the convention. Classification is according to their levels of economic development. *Annex I parties* consist of developed countries and economies in transition (Eastern and Central Europe). They have to submit regular reports on implementation progress and status of greenhouse gas emissions. *Non-Annex I parties* are all other countries that are not included in Annex I. These are mostly developing countries. They have commitments but fewer specific obligations. *Annex II parties* are a subset of Annex I, and consists of 24 highly developed countries. They are additionally required to (financially) support the developing countries in their efforts to reduce greenhouse gas emissions (UNFCC 2005b).

higher consumption of non-commercial energy (wood and paraffin). South Africa's CO_2 *intensity* was 0.75 kg CO_2/GDP PPP US$95, which is not only one of the highest in Africa, but also worldwide. According to the Department of Minerals and Energy (DME) there are two reasons for this inefficient energy consumption. Firstly, South Africa has an energy-intensive economy, which relies on coal reserves for primary energy supply. Secondly, low energy prices give rise to a lack of awareness and do not give an incentive for energy efficient measures (DME 2005). South Africa is one of the four cheapest electricity producers and has the lowest energy prices in the world (IEA 2004).

Currently, Eskom is producing 95% of the electricity generated in the country. However, as pointed out in the Energy Efficiency Strategy (DME 2005) the existing power generation capacity will be insufficient to meet the demand in 2007-2012. This has been confirmed by Eberhard (2004) who states that South Africa will experience serious energy supply problems unless a new energy policy is implemented. Operational generating capacity in South Africa currently totals just over 37 000 MW and the electricity consumption is estimated to be growing at 1 000 MW per annum (Nortje 2005). Current energy efficiency and demand side management targets are for approximately 150 MW per annum, which is a net growth of more or less 850 MW a year, outstripping existing national supply capacity around 2006/2007. This will affect future energy prices in South Africa, which are based on the costs of new production capacity and on the real costs of the distribution network to be able to deliver energy to consumers (Africon 2005).

1.3 Energy Efficiency in the Built Environment

The South African Government, through the DME recognises that South Africa should work towards energy efficiency in all economic sectors. The South African White Paper on Energy Policy states:

> *"Significant potential exists for energy efficiency improvements in South Africa. In developing policies to achieve greater efficiency of energy use, government is mindful of the need to overcome shortcomings in energy markets. Government will create an energy efficiency consciousness and encourage energy efficiency*

in commerce and industry, will establish energy efficiency norms and standards for commercial buildings and industrial equipment and voluntary guidelines for the thermal performance of housing. Targets for industrial and commercial energy efficiency improvements will be set and monitored." (DME 1998a)

DME developed and published the South African Energy Efficiency Strategy 2005, taking its mandate from the White Paper on Energy Policy (DME 1998a). The strategy sets energy efficiency targets for defined economic sectors, namely the industrial and mining sector programme; commercial and public buildings sector programme; residential sector programme; and transport sector programme.

DME recognises that commercial and public buildings can significantly contribute to the reduction of GHG emissions and securing ecologically sustainable development. In South Africa, the built environment is responsible for 21% of the total energy consumption (DME 2005). Although commercial and public buildings are responsible for only 4% of the total energy consumption in South Africa[2], significant energy savings can be made (DME 2005). The Energy Efficiency Strategy (DME 2005) sets the target for commercial and public buildings at 15% reduction against the projected energy consumption in 2015. Energy in this sector is used for lighting systems (29%), HVAC systems (47%) and other (27%) (e.g. office equipment). Low-cost and medium-cost technical interventions can reduce energy consumption by 25-30% (Grobler and Singh 1999).

Government bodies usually have a range of instruments to promote and stimulate energy efficiency in commercial and public buildings. Implementation instruments can be divided into four categories, namely regulatory instruments (e.g. laws, decrees, regulations), fiscal instruments (e.g. taxes, customs), economic instruments (e.g. subsidies, pricing policies) and communication instruments (e.g. information tools, awareness campaigns, labelling schemes) (Kuijsters 2004;

[2] According to DME's building classification, commercial and public buildings cover public buildings, office buildings, financial institutions, shops, recreation, and educational buildings

OECD 2003; Van Egmond 2001). Research (Kuijsters 2004; OECD 2003) showed that policy implementation can be effective when using a variety of instruments. Regulations can be a very effective strategy to make buildings more energy efficient. However, they only set minimum standards and are usually limited to new buildings. Furthermore, regulations do not stimulate innovative behaviour and best practice achievements. To achieve maximum performance, effective policy should therefore consist of a combination of regulatory instruments and non-regulatory instruments to improve energy efficiency of both new and existing buildings (which are not covered by regulations) (Kuijsters 2004; OECD 2003).

In South Africa, specific legislation and regulations regarding energy efficiency in buildings do not yet exist. DME started in 1997 with the development of the 'South Africa Energy and Demand Efficiency Guidelines (SAEDES)' (DME 1998b). However, a SAEDES pilot study indicated that the guideline was not user-friendly and empowering legislation is needed to make the guideline effective (Parsons 2004). The DME mandated the South African Bureau of Standards (SABS) to develop a South African National Standard 'SANS 0204: Energy Standard for Buildings with mechanically assisted ventilation systems', which is based on the SAEDES guideline. This standard needs to ensure that energy efficiency becomes integrated in new buildings, and will be included in the National Buildings Regulations as proposed in the energy strategy.

Fiscal and economic incentives to support investments in energy efficiency are limited. The energy strategy indicates that it is difficult to justify financial support from the government for energy efficiency when there are so many other pressing social and economic needs (DME 2005).

Communication instruments, such as labelling schemes, therefore play an important role in the implementation of energy efficiency in buildings. Labelling schemes for buildings are programmes that assess and label the energy performance of a building for building owners and/or tenants. Labelling is often referred to as certification or rating. The rationale is that the label provides the building owner with information regarding the energy performance of the building, which consequently should be a motivation for the building owner to improve the energy performance when the performance is deficient (Henderson et al. 2001). Furthermore, a labelling scheme can rate or benchmark the energy performance to be able to compare the performance with similar buildings.

In South Africa, there was a programme that can be recognised as a voluntary labelling programme, namely the Green Buildings for Africa (GBfA). In 1997, the GBfA was initiated by the CSIR in South Africa. Although the programme did not promote itself as a labelling programme, the processes involved are equivalent to labelling processes. The objective of the programme was 'to develop the infrastructure and resources to overcome the informational, financial and institutional barriers that are inhibiting the application of cost effective energy efficiency measures in the commercial sector' (Grobler and Singh 1999, p.188). Four years after the launch in 1997, it became evident that the implementation of the GBfA was not successful in South Africa. The programme is currently inactive.

In addition, there is a programme in development that can be recognised as a mandatory labelling programme. As part of the energy efficiency strategy for commercial and public buildings, DME wants to develop and implement mandatory energy audits (DME 2005). However, the development process only started recently and intends to be ready for implementation in 2015

1.4 Defining the Research

Although no study has scientifically proven that energy labelling schemes motivate building owners to improve the energy performance of their buildings, existing studies show a large difference in energy performance between labelled buildings and other buildings (OECD 2003). This indicates that it can be an effective instrument to stimulate energy efficiency in existing commercial buildings. In addition, international experience shows that energy labelling programmes are rapidly evolving as part of a strategy to create energy efficiency awareness and practice in the built environment. Mandatory energy labelling is currently implemented in Europe, while in Australia and USA voluntary labelling systems are more popular.

The question that arises from this is why the GBfA discontinued to operate in South Africa, while similar programmes seem to be reasonably successful in other countries. Moreover, would a mandatory approach be the solution? What mechanisms should be in place to ensure an effective voluntary or mandatory labelling scheme?

1.4.1 Research objective

This research aims to obtain a better understanding of labelling schemes and their potential for application in South Africa, as part of a strategy for improvement of energy efficiency in commercial buildings. It draws on international experience in order to identify strengths and weakness of the GBfA programme. The research identifies factors that need consideration in the development and implementation of a successful energy labelling programme in order to derive recommendations for further development and re-launch of the GBfA or an alternative labelling programme in South Africa. Ultimately, the conclusions and recommendations lead to a proposed framework for energy labelling of existing buildings in South Africa.

1.4.2 Research question

The research question is therefore as follows:

> *Which energy labelling approach is the most appropriate for implementation in the commercial building sector in South Africa's current context, and how does this explain the discontinuation of the Green Buildings for Africa programme?*

The following sub-questions arise from the overall research question:

- What key approaches to energy labelling programmes can be identified internationally?

- What are the strengths and weaknesses of the GBfA programme based on international experience of similar labelling programmes?
- What is the relationship between labelling schemes and the overall government support for energy efficiency?
- What are the drivers and barriers regarding the implementation of labelling schemes in the commercial building sector?

1.4.3 Relevance of the research

Scientific relevance

The scientific relevance of this research is the consolidation of knowledge relating to labelling schemes for commercial buildings internationally with a view to understanding their relevance in South Africa. Furthermore, the research translates this knowledge into practical recommendations for future development of the GBfA or any other mandatory or voluntary programme in South Africa.

Social relevance

South Africa is currently making efforts to improve its energy efficiency status. In order to meet future demand, an effective energy efficiency strategy is likely to be a cost-effective alternative compared to building new power plants. Significant improvements regarding policy and strategy developments were made in 2005. The publication of DME's Energy Efficiency Strateg*y* is a very important step towards a well-developed national approach to tackle the greenhouse gas emissions reductions. However, the total budget for energy efficiency is still very limited. This research acknowledges the limited budget and looks at an alternative approach to stimulate energy efficiency without the administrative costs for the government.

1.4.4 Conceptual definitions

Labelling schemes

A labelling scheme can be defined as a programme that facilitates building owners and/or tenants in the assessment of the energy performance of a building. The assessment varies from analysing the energy bill to a detailed energy audit of the building. Furthermore, a labelling scheme can provide the opportunity to rate or benchmark the energy performance and thus be able to compare the performance with similar buildings. The scheme presents the results in the form of a label or certificate. Labelling is often referred to as certification, performance rating or assessment.

Building owner - tenant

A building owner as used in this thesis refers to owners of commercial property. Commercial property can be owned by large insurance companies or pension funds, which have large property portfolios throughout the country, such as Sanlam or Old Mutual. A building owner can also mean an organisation that owns a building, such as Eskom owning Megawatt Park.

A tenant is a person or entity that pays rent to use or occupy the building, or other property owned by another. For this research, it is important to understand the relationship between the building owner and the tenant. Regarding energy efficiency or energy management in a building it is important to know whether the property owner or the tenant is paying the electricity bill. The building owner is usually the person or entity that makes decisions regarding major energy investments in the building. However if the tenant is paying the electricity bill, there is no incentive for the building owner to invest in energy efficiency. When the building owner is paying the electricity bill, the tenant does not have an incentive to consume energy efficiently.

Energy audit approach versus benchmarking approach

An energy audit can be defined as a systematic procedure that includes an assessment and evaluation of the energy consumption profile; identifies and scales the cost-effective energy saving opportunities and reports the findings (Väisänen et al. 2003). A benchmarking approach solely rates the energy performance of a building on a scale from 1-100, or A-M, or poor-excellent. The benchmarking approach is generic and only considers the basic building characteristics, whereas an energy audit is facility specific and produces a custom-made report for a facility. An energy audit needs to be carried out by a qualified energy consultant, while benchmarking schemes provide self-assessment tools. Because the energy audit is more comprehensive and facility specific, it is obvious that this approach is more costly to execute and roll out as a national policy programme.

Energy performance in buildings

Energy performance is defined by CEN (European Committee for Standardisation) as *'the annual consumption by the building of all fuels, district heating and cooling, electricity, etc. under the appropriate conventions – each separately measured and where necessary combined into a single number using an appropriate weighting system'* (Bordass 2005). Energy performance can be expressed by an energy performance indicator, which is usually expressed by the consumption divided by a measure of extent of the building, e.g. KWh/m^2, CO_2/m^2, KWh/bed (hospital). Square metre is a widely used measure of extent, however the implication is not immediately clear. It can cover net internal area, conditioned area, useable area etc.

Energy performance of a building is dependent on the **building performance** and **building management.** This is important distinction when developing your labelling scheme. Building performance is determined by the technical and design characteristics of a building, and the performance is limited by the standards to which the building has been built and the energy performance of the installations and fabrics used. Building management is the effectiveness of the management practices in operating, controlling and monitoring the building and its installations (Zimmerman et al. 2002).

The calculation of energy performance of a building can therefore be in two different ways (Boonstra et al. 2005):

- **Asset calculation,** which is a calculation based on building characteristics and available building services corrected for a standardised use of the building.
- **Operational calculation,** which is a calculation based on the actual energy use of the building

Energy efficiency[3]

Energy efficiency means receiving the same performance from a product or process with less energy input, or receiving higher performance with the same energy input (UNEP and EPA 1997). Energy efficiency can also be defined in monetary terms and then energy efficiency means providing the same output but in a more cost effective way. This research uses the following definition for energy efficiency ‘using less energy (minimise input) without compromising the performance of the building (maximise output)’. This can be achieved by reducing unnecessary energy consumption (waste) and replacing inefficient equipment with more efficient equipment or technologies, which permanently reduces consumption during all operating periods. Load management in a building means that you remove the peak demands into periods of lesser demand. This brings about costs savings, since energy prices are often higher during peak hours, but not necessarily energy efficiency.

Effectiveness

The dictionary defines a product or process effective when it is producing the desired effect. In the case of a labelling scheme, the desired effect is that organisations adopt and implement the labelling scheme to their facilities to obtain an understanding of the energy performance of the facilities. Effectiveness of a labelling scheme can therefore be defined as the number of buildings labelled by the scheme or by the number of organizations which have adopted and implemented the labelling scheme. However, effectiveness of a labelling goes beyond the number of buildings or organisations. The ultimate goal of a labelling scheme is to establish energy savings and emission reduction. Therefore, effectiveness of a labelling is also a function of the potential energy savings of the building and the extent to which building owners upgrade their buildings and improve the energy performance of the buildings.

[3] Energy is considered in two categories - primary and delivered. Primary energy is energy in the form of natural resources (renewable or non-renewable), which is consumed at the beginning of the energy chain. Delivered energy is the energy delivered to the customer, measured at the meter or in terms of the energy content of the fuels delivered.

Market transformation

Market transformation is defined as the process of changing market behaviour to induce desired procurement of certain products or consumption. This is often related to changing the market from buying products associated with negative attributes, towards preferred products associated with positive attributes. Energy labelling is a tool to trigger market transformation within the property market towards more energy efficient buildings.

1.4.5 Delimitation of scope

The research is solely concerned with the role of a labelling scheme in supporting energy efficiency in commercial and public buildings. Other dimensions of energy efficiency and the built environment are not included in the study (e.g. residential buildings, renewable energy).

Regarding the assessment scope of labelling, this research focuses on energy aspects only. The research does not cover the broader environmental or socio-economic dimensions as often integrated in environmental and sustainability assessment tools.

The thesis is not an evaluation of technologies and interventions, or their effectiveness regarding energy saving for commercial buildings. It focuses on the logistics (i.e. opportunities and constraints) in the development and implementation of a labelling scheme. Consequently, no attempt is made in the research to determine if the case study schemes actually contribute to effective improvement in energy efficiency of the labelled buildings or overall energy savings in respective economies.

The research has no intention to be comprehensive in labelling schemes internationally but rather aimed to select precedent cases. Focus is on case study schemes from which data is readily available and where additional information could be accessed with minimal resources in terms of time and financial costs.

2 Theoretical and Empirical Framework

2.1 Literature Appraisal

This section provides a literature appraisal, which facilitates the linkage of secondary information sources to the research. It indicates the knowledge gap and need for this study. Labelling is a new subject; therefore most academic literature consists of conference papers and articles. This appraisal shows the nature of information available at an international level, while also revealing the limited relevant literature from regional (African) and national (South African) sources.

2.1.1 Policies and instruments to support energy efficiency in the built environment

The Organisation for Economic Co-Operation and Development (OECD) executed an extensive research during 1998 and 2002 regarding policies to stimulate environmentally sustainable buildings. The research consisted of an evaluation of all relevant policies in the OECD countries[4]. Part of the research covered policies and challenges regarding energy efficiency in the built environment.

The main conclusions regarding policy instruments for reducing CO_2 emissions from buildings are threefold. Firstly, the effectiveness of regulations is limited, as it is complicated to set standards that are stringent enough to have a significant

[4] OECD member countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Finland, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States, ,

impact. Regulations set minimum standards to eliminate worst practice; they do not stimulate best practice and innovative behaviour. Secondly, the potential impact of energy taxes is doubtful and further research is recommended. Thirdly, energy audit programmes are recognized as a useful policy instrument to stimulate energy efficiency investments (OECD 2003).

The research points out the high energy-savings potential of the existing building stock and the lack of government intervention in this sector. It therefore recommends placing more emphasis on energy efficiency improvements in existing buildings. However, it acknowledges that it is more difficult to implement effective measures for the existing building stock.

Energy audit programmes were identified as useful instruments to stimulate energy efficiency investment in existing buildings. However, implementation of energy audit programmes entails considerable administrative costs by government. The research also notes that although voluntary environmental labelling schemes show a potential role, no empirical evidence has yet demonstrated that these schemes stimulate investments in energy efficiency.

Sunikka (2001) carried out similar research and examined national strategies for sustainable buildings in five European countries. It covered strategies to achieve energy savings, materials and waste management, and water conservation. The research outlined the national strategies and evaluated the implementation of the strategies. Finally, it elaborates on the social housing sector to assess the impact of the strategies.

The major conclusions from the research are that national strategies primarily address energy saving and waste management. Moreover, in line with the OECD research, it appeared that the strategies focus mainly on new buildings, even though the potential of the existing stock is much larger. The research stated that the lack of appropriate tools for the existing buildings is a serious disadvantage. Sunikka (2001) therefore emphasised the importance of the development of tools to support sustainability, especially in areas that are not covered by building regulations; such as renovation and existing building management.

Although both studies focussed merely on the residential sector, they provide much valuable information and insight into options for government intervention to stimulate energy efficiency in the built environment. However, they only assessed and addressed developed countries and presumed that there is sufficient budget available for implementation. Moreover, because the studies were carried out before 2002, they did not take into account the implementation of the Energy Performance for Buildings Directive (EPBD) in Europe (EC 2002). The EPBD is expected to dominate future development of government policies and intervention in built environment, especially regarding energy consumption in existing buildings.

2.1.2 Environmental and energy labelling schemes

Environmental assessment schemes have been extensively discussed and researched during the last ten years. At the 2005 Sustainable Building Conference in Tokyo, Japan (SB'05), 72 papers (i.e. 10% of total number of papers) were categorised under Building Environmental Assessment Tools. This indicates that the field of environmentally friendly buildings has become increasingly important and that environmental assessment schemes are seen as potent instruments to achieve this.

Kaatz et al. (2002) carried out an evaluation regarding the suitability of different environmental assessment methods for South Africa. The evaluation covers three international environmental assessment tools, namely LEED (USA), BREEAM (UK), GBTool (collaboration between several countries) and one South African tool, namely the Sustainable Buildings Assessment Tool (SBAT). The research points out that the international tools could not be implemented without being modified to the South African context. Modifications are mainly required regarding suitable benchmarks and an appropriate weighting system. Furthermore, the research suggests that a more comprehensive approach is required to address socio-economic and cultural aspects of sustainability besides environmental aspects.

Although much has been written about *environmental* labelling, its impact and application rate can been questioned. Environmental assessment of a building covers a whole range of issues such as water, waste, materials, site, and energy. The comprehensive scope of this assessment makes the schemes less sophisticated and applicable to only a small segment of the market. More focussed labelling schemes (e.g. energy labelling schemes) are easier to comprehend by the market and are easier and more practical to use. Furthermore, most environmental rating schemes merely address the design of new buildings. Although, supplementary versions are being developed for a range of building stages and building types, (e.g. LEED for Existing Buildings, LEED for Commercial Interiors) their application is currently limited (USGBC 2006). It is noteworthy that *environmental* assessment schemes are developed and aimed at the commercial building sector, specifically public buildings and offices. The residential sector is neglected due to the difficulty of justifying the costs of the *environmental* assessment against the commercial value of the certification (Howard 2005).

With regard to *energy* labelling or energy certification of buildings, there are many conference papers available, of which the majority were published in the last five years. These papers are from primarily European sources, due to the current implementation of the EPBD, which requires mandatory energy labelling of buildings. Several research programmes are initiated and financed by the European Union to support the development and implementation of the EPBD. The research programmes are usually a partnership between consultancy companies, individuals and/or governmental institutions from different member countries.

Aho (1999) argues that energy certification can play a significant role in changing consumer behaviour and ultimately lead to market transformation. This paper is written as a response to the very early developments of the EPBD. Certification is seen as an information tool; the certificate provides the owner with information regarding energy performance of the building, which ideally changes the owner's behaviour towards more energy efficient behaviour. Aho (1999) furthermore argues that although certification itself does not directly cause a reduction of energy consumption and related emissions, *raising awareness* of owners and occupants is a *key* issue in reducing unnecessary energy use and introducing energy saving technologies. A survey among property investment companies was conducted and revealed that one third considered themselves as active in environmental issues. The research concluded that labelling will have great energy saving potential among the group of building owners and investors who are already interested in environmental issues.

Research reported by Henderson et al. (2001), commissioned by the European Union, compared five *energy* labelling schemes for residential buildings in Denmark, Ireland, Netherlands, UK and Vermont (USA). The analysis included technical, institutional and financial characteristics of the labelling schemes. Unlike Aho (1999), Henderson et al. (2001) concluded that labelling, when used in isolation, would not be sufficient to change building users' and owners' decisions towards energy efficient investments. Labelling can only be effective when used in combination with other institutional measures, which promote energy efficiency investments and upgrading. The research suggests that the market alone cannot sustain the use of labels; government support is a pre-requisite for achieving CO_2 reduction through labelling. A critical note must be made here. The market driven paradigm hypothesizes that building owners, when properly informed, are likely to invest in energy efficient upgrading. This might not be applicable to the residential sector, as suggested by Henderson et al. (2001) but there is potential in the commercial sector. The label can provide a competitive advantage for a commercial building owner who is performing very well and presents opportunities for market recognition of the environmental friendly behaviour of the company.

At the SB'05 conference, two papers discussed the effectiveness of energy certification and labelling on the existing residential building stock (Beerepoot 2005; Sunikka 2005). Energy certification and labelling processes are according to EPBD procedures; meaning that an energy label is required when a building changes owner. According to Beerepoot (2005), energy labelling itself will have a limited effect on energy investment, since energy efficiency is only a minor criterion when buying or renting a building. It should therefore be combined with other policy instruments to become successful. Beerepoot (2005) categorises energy labelling as a communicative policy instrument, which aims to persuade people to behave in an environmentally friendly manner by providing information to reshape people's opinions and attitudes. Consequently, communicative instruments can be very effective in addressing information barriers. However, lack of information is just one of many market failures in the building market.

Sunikka (2005) agrees with Beerepoot (2005) on the limited effect of labelling without interaction with other policy instruments. Labelling will increase public awareness, but labelling is not likely to change purchasing or renting decisions in a market where housing shortages are common. Sunikka (2005) developed a modelling technique to examine how the certificate would encourage people to implement energy efficiency improvements. Three implementation scenarios were studied, differing in levels of supporting policy instruments. Sunikka (2005) came to the conclusion that implementation of labelling will increase public awareness, but to achieve significant CO_2 reductions labelling needs to be enforced and energy upgrading encouraged by fiscal incentives.

2.2 The Concept of Labelling

2.2.1 Appliance labelling

Labelling of buildings is derived from labelling of appliances. Appliance labelling is not a new phenomenon and is successfully implemented in Europe, Australia and USA among other countries and regions. 'Energy labelling should provide a market *pull* effect by which the selective purchasing of more efficient products encouraged through the provision of energy efficiency information to consumers, acts to ‘pull’ the overall energy efficiency distribution of product sales towards higher efficiency levels’ (Waide 1999). Labelling is seen as a means to provide information; it helps to overcome information barriers regarding energy efficiency of appliances; and it directly addresses information problems in purchasing decisions. Appliances are fitted with an energy label assisting the consumer make a decision based on the energy consumption of the appliance. Furthermore, the manufacturer of appliances can use the label as a marketing instrument to emphasise the energy performance of the appliance.

However, there are some fundamental differences between labelling of appliances and labelling of buildings. In case of the appliance labelling, a certification body evaluates and rates the energy consumption of an appliance and provides the manufacturer with the appropriate label for this appliance. The manufacturer sells the appliance fitted with the label. In the case that the energy efficiency of the appliance is very good, the manufacturer can use the label as a marketing instrument. The information regarding energy performance, enables the customer to compare different procurement options.

In the case of building procurement, specifically office buildings, customers focus on matters such as costs, location, security, amenities, and building prestige. There are several arguments for the fact that energy efficiency is not yet a decision-making factor in building procurement. Firstly, energy costs are not a significant part of the operating costs of the company. Second factor is the demand and supply problems of the building stock. In case of a shortage of office spaces, the client does not have the luxury to select on energy efficiency; the customer is not spoiled for choice. Thirdly, there are too many stakeholders in the process; there is not a clearly identified manufacturer of buildings, which should provide the label, and therefore the label cannot be used as a marketing instrument. Finally, payback times for energy efficiency investments can be long due to low energy prices.

It is clear that the lack of information regarding energy efficiency is just one of many market failures in the built environment (Beerepoot 2005). As a result, the concept of labelling buildings is more complex than labelling of appliances.

2.2.2 Labelling as a communication and benchmarking tool

Labelling is an information instrument, which provides building owners with information regarding the energy performance of the building. It can become a decision making aid when there is a lack of information and a demand for information resulting from increased awareness. A labelling programme does not necessarily set minimum requirements for the energy performance of the building and has therefore no direct influence on the improvement of the energy performance.

Energy labelling is considered an important tool for market transformation (Henderson et al. 2001). Labelling can bring about market transformation by providing relevant information regarding the building's energy performance. Building owners or tenants can incorporate this information into their decision-making during procurement or management of buildings. Labelling supports tenants and prospective buyers to select and demand more energy efficient buildings and it furthermore stimulates building owners to upgrade their buildings with cost-effective improvements (Bordass et al. 2004). In the absence of energy performance labels, decision making is often impaired by the lack of information on the energy consumption of the building.

Labelling schemes should not be confused with design tools. Design tools are tools, which attempt to give guidance during the design while labelling assesses the energy performance of the building and provides the property owner with information regarding the energy performance of the building. Labelling programmes can give recommendations on how to improve the performance, but they do not impose these recommendations. Labelling programmes do therefore not have a direct influence on the improvement of energy performance of a building. Labelling schemes provide decision makers with technical information translated to practical understandable information, which should increase their level of awareness.

Usually labelling programmes rate the performance, which means that the programme sets certain benchmarks for different levels of performance. For example, the building performance can be classified from poor to excellent or from one star to five stars. This enables property owners to compare their building performance among each other, which can trigger competitiveness. Competitiveness can act as an incentive to improve the building performance and increase the rating. This comparative and competitive nature of the labelling suggests that its potential impact is highest in the middle and high end of the market (Aho 1999). In these market segments, the building owners and potential buyers or tenants are already interested in energy issues. Building owners can compete and differentiate themselves by supplying buildings with better energy performance, while potential buyers and tenants can require a certain level of energy efficiency performance of a building.

In order to understand the potential role of energy labelling it is helpful to visualise it. Figure 2-1 categorises the type of building owners and links this to a certain energy performance of their buildings. It shows that the building regulations set the minimum standard for energy performance of the building for those property owners who are not interested in energy efficiency. Labelling tries to stimulate best practice behaviour among the majority and the front-runners, who are building owners who are open-minded towards energy efficiency. Here labelling will have its greatest potential impact.

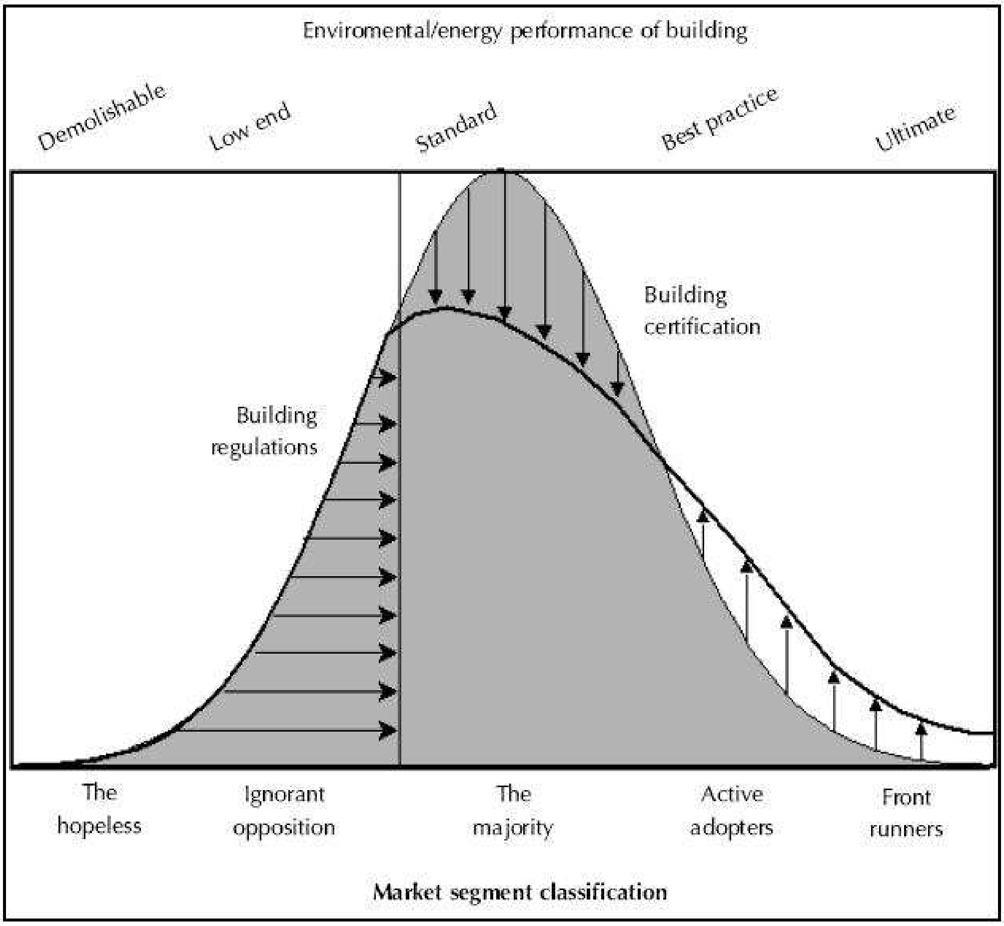

Figure 2-1: Theoretical impact of building labelling (Aho 1999)

2.2.3 Review of existing labelling programmes

Building labelling schemes differ widely regarding the range of issues included in the assessment. The trend is that the labelling schemes focus on a range of environmental issues, namely energy, waste, water, indoor quality, the so-called Green Building Labelling schemes. These rating schemes are mostly voluntary, because they use prescriptive requirements. Schemes such as BREEAM, LEED, GBTool are well established labelling programmes, while Green Star; Green Globes, and LEED Canada are the more recent schemes. Labelling schemes are also rapidly developing in South East Asia, such as the Comprehensive Assessment Scheme for Building Environmental Efficiency (CASBEE) in Japan and the Building Environmental Assessment Method (HK BEAM) in Hong Kong. The LEED labelling programme is also developed for countries such as India and Taiwan.

All these schemes have an energy component in the assessment scope, but it is not a dominant factor and therefore not addressed in detail. The argument is that the wider the assessment scope, the less sophisticated the assessment method for energy efficiency. Some of the assessment methods include specialised external energy ratings for the energy component of the assessment. Environmental assessment programmes such as LEED refers to the ENERGY STAR rating for the energy component of the scheme. The Australian environmental assessment scheme Green Star requires an ABGR rating for the energy component. BREEAM allocates extra points when a building owner executes a building energy audit.

Unlike for environmental assessment tools, labelling schemes focussing solely on energy are not widely available for commercial buildings. There are a number of energy labelling schemes developed for the residential sector, such as Energy Rating Bench Mark (ERBM) in Ireland; Energy Performance Advice for housing (EPA-W) in the Netherlands; National Home Energy Rating (NHER) in the UK; and the Home Energy Rating System (HERS) in Vermont, USA. In spite of the fact that there are not *many* energy labelling schemes for commercial buildings, the existing ones comprise of some well-established and successful programmes.

The ENERGY STAR (USA) programme started with a Green Lighting programme and slowly extended its range of labelling products. In 1995, it established a label for residential buildings, followed by a label for commercial buildings in 1999. Another well-established programme is the Australian Building Greenhouse Rating (ABGR) programme for office buildings, which started in 1997. Both programmes are voluntary using web based rating schemes.

In Europe, energy labelling of buildings is a current topic of discussion, due to the implementation of the European Union's Energy Performance Building Directive (EPBD) (EC 2002). This directive requires all member countries to have energy certification for buildings in place from January 2006. The EPBD came into force in January 2003 after it was adopted in December 2002 with overwhelming support from the Member States and the European Parliament. The directive is inspired by the energy labelling scheme in Denmark, where energy labelling became mandatory for all buildings in 1997.

2.3 Categorising Labelling Schemes

In the last decade, a wide variety of labelling schemes and methods have been developed. Generally, they can be distinguished according to the following considerations:

- Building types (e.g. schools, offices, hospitals)
- Building stages (e.g. new or existing buildings)
- Nature of the hosting organisation (e.g. non-governmental, governmental)
- Scope of assessment (e.g. energy audit, benchmarking)
- Implementation approach (e.g. voluntary, mandatory)
- Level of supporting instruments (market forces, government driven)

2.3.1 Building types

Buildings can be categorised according to the activities in the buildings, ranging from residential buildings to warehouses, and from educational buildings to hospitals. Because each building has different energy requirements, it is important for a labelling programme to select a certain building type, or group of building types. Labelling schemes that cover a range of building types usually provide different benchmarks for the different buildings.

2.3.2 Building stages

A labelling scheme can either be applicable to new or existing buildings, and some schemes cover both. There are three different situations in which a label might be required, namely sale or rental, disclosure and display, and new or refurbished buildings. Table 2-1 relates the types of calculation to the building stage.

In the case where labelling is applied when the building <u>changes ownership</u>, the asset calculation is most appropriate, since user behaviour is irrelevant. In such a situation, the rating should allow for comparison between buildings in order to help potential buyers to compare buildings regarding the energy performance. This means that the labelling programme needs to establish base figures and benchmarks.

Table 2-1: Relation between calculation type and building state (based on Boostra et al 2005)

	Existing buildings		New or refurbished buildings
	Change of building owner	For public display (and market recognition)	
Asset calculation	X	X (additional)	X
Operational calculation		X	

In the case where labelling is used for public display, a calculation based on operational consumption figures is appropriate. However, an asset calculation can provide additional insight in the energy performance of the building.

For recently-completed buildings, or refurbished building there will be no operational data available, which means that an asset calculation is most applicable (see Table 2-1). Because new constructed buildings may differ significantly from the design predictions, the asset rating might not reflect the operational energy consumption during occupation. These differences occur because e.g. the design assumptions do not reflect the actual situation (occupation hours, number of people, etc); not all the end-uses are included; and poor building commissioning can lead to lack of energy management during occupation (Bordass et al. 2004). To verify the asset calculation of the new building, the labelling programme should commit the developer or owner to execute an operational calculation after two/three years of occupation.

There is a wide range of design tools available for new buildings as well as tools that support sustainability in the design of the building. However, there is a lack of instruments, which are applicable to existing buildings. According to Sunikka (2001), the lack of appropriate tools for existing buildings is a serious problem, since building regulations also do not cover existing buildings, and yet there is a great energy saving potential in the existing building stock.

2.3.3 Nature of the hosting organisation

The nature of the hosting organisation does have an effect on the development and implementation of the labelling scheme. Usually the labelling scheme is a governmental initiative or alternatively, the labelling scheme is implemented by a semi-governmental or non-profit organisation, which is heavily subsidised by the government. It is however unlikely that a labelling scheme is implemented by a commercial entity, since a labelling scheme is of such a nature that it does not provide profits.

2.3.4 Scope of assessment

Labelling schemes differ in their scope of assessment, some include an energy audit, and others provide an energy-benchmarking tool. This is an important distinction, since it has consequences for the design of the programme and the implementation strategy.

A *building energy audit* is defined as a 'systematic procedure to obtain adequate knowledge of the energy consumption profile of the building; identifies and scales cost effective energy saving opportunities and reports on the findings' (Lytras and Gaspar 2003, p.3). There are several energy audit models (e.g. walk-through audit, targeted audit, comprehensive model), which differ in aim, scope and thoroughness. The energy performance calculation is mainly based on a so-called asset data, including building characteristics and available service systems. However, it is also common to include operational data as supplementary data. The suggestions for energy savings are specific for the facility under assessment.

An *energy-benchmarking tool* on the other hand merely provides the energy performance of the building. This performance calculation is based on operational data (the energy bill data), and therefore the suggestions for improvement (if available) are more general and not facility specific.

The building energy audit is a more comprehensive approach than the benchmarking tool and it is more facility specific. Both approaches have their advantages and disadvantages but eventually the context of application determines the most appropriate approach.

2.3.5 Implementation approach

Labelling schemes can be implemented on a mandatory or voluntary basis. The mandatory approach includes a legal obligation to execute the labelling process. However to be effective, the label should be accompanied with strong enforcements and sanctions in case of non-compliance. In principle, no other supporting instruments would be necessary when a labelling scheme is mandatory. Mandatory labelling can be applied in two ways. Firstly, the government can impose labelling when the building changes ownership such that the building owner needs to provide a label to the new owner (this is how the EPDB is implemented). Secondly, the government can require building all building owners to label their buildings and renew the label regularly such as bi-annually (this is how labelling is implemented in Denmark). It is obvious that the target group in the second option is much larger than in the first option.

A labelling scheme, which is not mandatory, is by definition voluntary. A voluntary approach faces many challenges, due to the market-based approach. It has to offer the building owner a relative advantage, which means that it has to raise incentives for the building owners to rate their buildings. Voluntary approaches therefore usually reward best practice.

Both approaches aim to increase awareness regarding energy performance of the buildings, but the voluntary approach strives for best practice, while the mandatory approach solely requires building owners to label the building.

2.3.6 Supporting instruments

When the labelling programme is a governmental programme, the government may decide to support the labelling programme by means of other policy instruments. For example, the government could grant the building owner a tax rebate when he/she obtains an energy performance label. Alternatively, the government provides a subsidy to the building owner to finance energy efficiency improvements. The labelling scheme can also be integrated into other government programmes, for example, a long-term agreement between the government and a specific sector, whereby that sector is required to obtain an energy label for its buildings. It is assumed that supporting instruments increase the adoption of the labelling scheme by owners.

2.3.7 Labelling categories

In the previous sections, the criteria for categorising energy labelling schemes were discussed. However, the first two criteria, building types and building stages, are not seen as critical for the development of a programme. Programme developers should consider the issues very carefully, although the criteria do not influence further development of the scheme.

Three criteria to categorise labelling schemes are seen as critical, because decisions made regarding these issues influence further development and implementation of the labelling programme. These critical factors are the *scope of the energy assessment*, the voluntary or mandatory *implementation approach* and the availability of *supporting instruments*. Figure 2-2 gives an overview of the eight theoretical categories to group the labelling schemes.

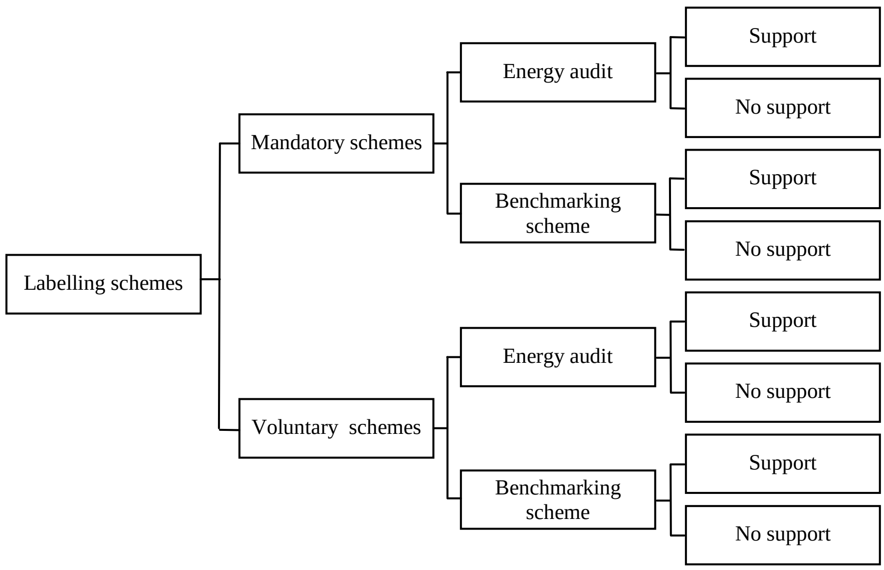

Figure 2-2: Eight possible theoretical categories for labelling schemes

2.4 Research Framework

A research framework is developed to give the theoretical solution of the problem. The research framework is always a simplification of the reality, since only key variables are included. Figure 2-3 visualises the theoretical framework for this research. It shows that there are internal factors , such as programme design and label characteristics that have an effect on the development and implementation. Furthermore, there are contextual factors that have an effect on the development and implementation of a labelling scheme.. The following sections describe the issues related to each of the factors in the research framework and results in the development of an assessment framework, which will be given in section 2.9.

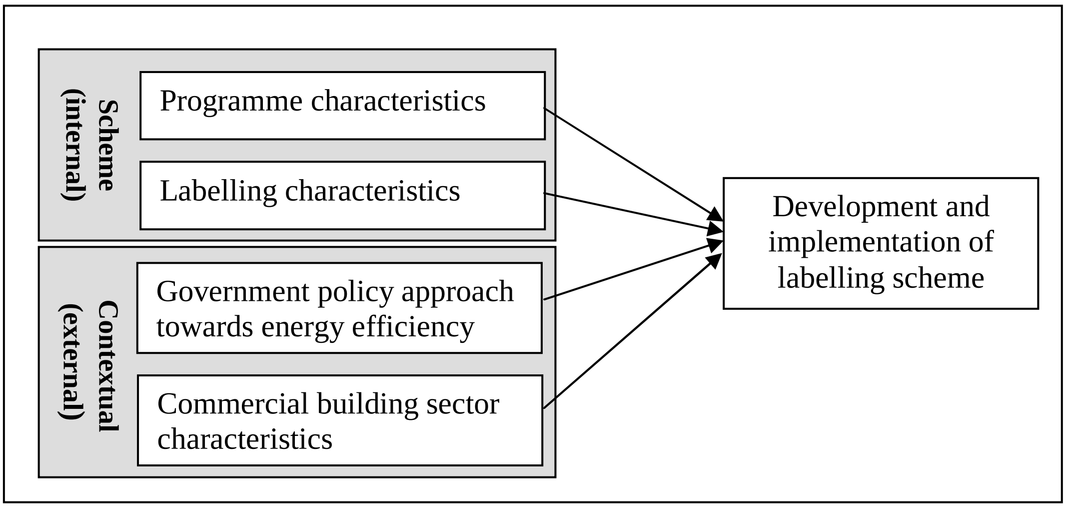

Figure 2-3: Research framework

2.4.1 Internal factors

A well-designed programme is key to successful implementation. Programme design aspects include programme goals and objectives; organisational structure; market and implementation approach. Label characteristics cover the relative advantage; complexity and triability of labelling. Sections 2.5 and 2.6 describe in more detail what is important regarding the programme and label characteristics in relation to the development and implementation of a labelling programme. The analysis of the internal factors results in an overview of the strengths and weaknesses of the different programme and label characteristics.

2.4.2 Contextual factors

The context or setting in which the labelling scheme is being implemented has its effect on the development and implementation. The development of the labelling scheme should be in line with the goals and objectives of the national framework to improve energy efficiency in all economic sectors, but especially in the built environment. Research has shown that labelling can be an effective tool as part of an integrated programme of institutional measures to encourage energy efficiency investments (Henderson et al. 2001). The fundamental issue here is whether the labelling scheme is complementary or conflicting with the strategy towards energy efficiency in the commercial sector. The analyses of the contextual factors result in an overview of the opportunities and threats for the labelling programme. Sections 2.7 and 2.8 describe in more detail the overall government policy approach and the characteristics of the commercial building sector.

2.5 Labelling Programme Development

This section deals with the issues regarding the development of a labelling programme. According to the 'Guidebook for Energy Audit Programme Developers' (Väisänen et al. 2003) there are twelve basic elements of an energy audit programme as shown in Figure 2-4. Although labelling schemes are not always classified as an energy audit programme, the twelve building blocks can be used to select appropriate assessment criteria. These twelve building blocks are the result of a four-year study initiated by the European Union evaluating energy audit programmes in 27 countries in Europe.

Not all the twelve building blocks are relevant for this section. The boxes 'energy audit models' and 'auditors' tools' are discussed in section 2.6 regarding labelling characteristics. The boxes 'legislative framework' and 'subsidy policy' are discussed in section 2.7 regarding the role of the government. The remaining eight boxes are described and discussed in this section.

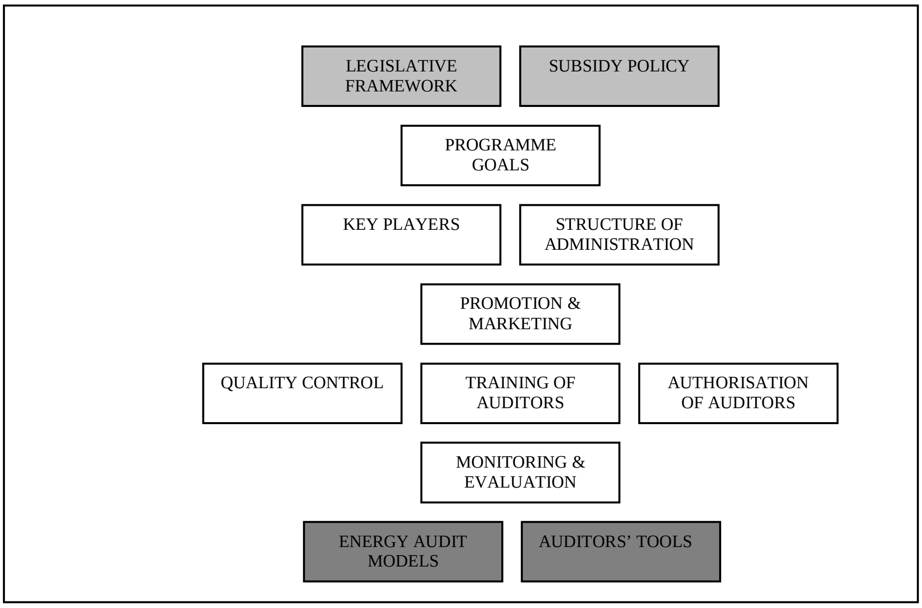

Figure 2-4: Building blocks for energy audit programmes (Väisänen et al. 2003)

2.5.1 Programme goals

The guidebook as well as UNEP and EPA (1997) state that well-defined programme goals are the key to successful implementation. Evaluation of a programme always examines if the programme has achieved its goals and objectives. Ideally, programme goals are expressed in numbers, e.g. the annual number of total energy labels issued. The programme goals also define the target group, it should be considered that the more homogeneous the target group, the less complex the programme implementation process will be.

2.5.2 Administrative structure and key players

Four key players can be identified in a labelling programme, which all have their own roles and responsibilities.

- Administrator: this is often the national policy maker and the initiator of the programme;
- Implementing agent: agency that manages and implements the programme;
- Auditor: the technical person who is carrying out the benchmarking or energy audit;
- Client: building owner who is under obligation (mandatory) or voluntarily decides to obtain a label for his/her building.

There are a range of operational activities that need to be carried out and maintained, e.g. financing, reporting, support, marketing and promotion. The programme manager determines its administrative structure by allocating roles and responsibilities between the key players.

2.5.3 Implementation costs

For this research, it is important to create an understanding of the financing systems of labelling schemes. Financial support is the most important issue regarding the sustainability of the labelling programme. The assessment creates an understanding of how the case studies are sustained and where the financial support comes from.

2.5.4 Promotion and marketing strategy

The implementation strategy comprises of marketing and promotion of the labelling programme, including other supporting activities to implement the labelling programme. The target group will not participate in a labelling programme when they are not aware or informed about it. Whether a programme is voluntary or mandatory, a certain level of promotion and marketing is required. The approach towards the target group is dependent on the characteristics of the group. Promotion can be defined as activities to maintain awareness and good publicity. Marketing are activities to sell the product, in this case the label. Marketing should stimulate people to join the programme. The implementation strategy should take maximum advantage of other enabling instruments available on the market. Regulation and subsidies can stimulate the implementation of the labelling scheme and the implementation strategy should be in line with those instruments.

2.5.5 Quality assurance and control

The most important product of a labelling programme is a reliable energy report, which provides the client with adequate information for decision-making. A distinction is made between quality assurance and quality control. Quality assurance is defined as all actions necessary to provide adequate confidence that the product optimally fulfils the clients' expectations. This means that actions are taken *upfront* to ensure quality of the product. Quality control is defined as systems for ensuring the maintenance of proper standards of end-products. This also means that there is a procedure in place to verify the quality of the end-product *after* it has been completed.

Assurance of good energy report delivery is dependent on the capabilities of the auditor, authorisation of good auditors and a well-developed quality control system. Training can be an instrument to ensure the capabilities of the auditors. However, it requires financial means and human capacity. Authorisation ensures that only competent people are working for the programme, which can be closely linked to the training. Quality control covers the verification of the auditor's work, which can be achieved by e.g. standardising the process and/or random report checks.

Quality assurance and control are important in obtaining credibility and acceptance of the users and potential clients, and thus contribute to the success of the scheme. Quality assurance should lead to a uniform method of the labelling process, to minimise errors made during data collection, and calculation of the energy performance. Quality control verifies that work is done in compliance with the guidelines and defines a minimum level for the quality of work. Assurance of good energy label delivery is largely dependent on the capabilities of the auditor.

Quality assurance is assessed on three levels:

- Quality assurance of the auditors or organisations
- Quality assurance of the labelling process
- Quality control of the end product

Quality assurance of the auditors or organisations

The main question here is how to ensure the people are competent to execute the work that needs to be done. Three types of quality assurance are identified, namely training, pre-qualification and examination. Training can be used to ensure the energy consultants are adequately equipped with sufficient knowledge. Training contributes to the quality of the information and recommendations provided by the label. Instead of training, or in addition to training, the programme can require a certain level of pre-qualification of the auditor. A third option is that the energy consultant needs to take and pass an examination in order to qualify for the role.

Authorisation means that the consultant receives an official approval, in the form of a certificate or licence, which indicates that he/she is adequately equipped to execute the work required by the programme. Authorisation can be based on one or a combination of the previous mentioned types of quality assurance for people or organisations.

Quality assurance of the labelling process

There are several ways of assuring the quality of the labelling process. Developing process procedures is common, as well as standardised forms, checklists, and report templates for the consultant. These tools are designed to ease the work of the consultant, but more importantly to maximise the process quality.

Quality control of the end product

Quality control of the end product covers evaluation of the end-product. There are various ways of doing this. ***Random*** quality control is not a systematic quality control, but is triggered by internal or external impulses, such as complaints from clients, or consultants, but can also be initiated by the programme and some random enquiries among clients. ***Systematic*** quality control means it is standard procedure and is part of the programme design. Systematic quality control often implies structural report checks and site visits to verify the results, but these checks vary widely in thoroughness and coverage.

2.5.6 Monitoring and evaluation

Governments are setting targets and goals for CO_2 reduction in the different sectors and therefore monitoring and evaluation are of crucial importance to indicate the impact of the programmes. Monitoring can be defined as 'continuous or repetitious activity running in parallel with other activities over the lifetime of the project in order to keep control and obtain information on the impact/result' (Väisänen et al. 2003). This is especially important in the field of energy efficiency and energy savings, when the programme is able to indicate its impact and can apply for international funds and support, or apply for Clean Development Mechanism (CDM) projects. Energy audits generate information; information which is normally not available. Monitoring the results of the energy audits can give the programme the ultimate opportunity to build a national database. Additional, monitoring should not stop when the energy audit or labelling is complete. It is an added advantage to monitor building upgrades and their impact on the energy consumption.

There are different levels of monitoring programmes and their impacts. Figure 2-5 indicates the different levels of monitoring and the information value and costs. It is evident that the more detailed the information value the higher the costs of the monitoring. The first two levels are easy to obtain, with minimal additional costs. Energy savings potential is more complex but depending on the programmes reporting format and database, this can be relatively easy to obtain. The upper three levels of information are complex, more difficult to obtain and therefore have cost implications. This needs be to done by means of questionnaires, site visits and on-site metering.

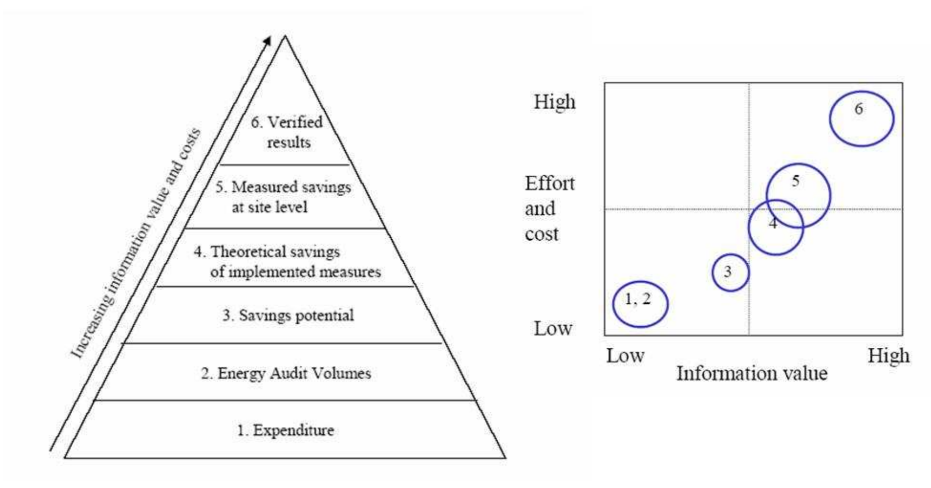

Figure 2-5: Information value and costs of monitoring levels (Väisänen et al. 2003)

Evaluation can be defined as ‘an activity, which is undertaken with regular intervals over the lifetime of a programme with the purpose of considering the usefulness/achievements of the programme and possible measures to improve it’ (Väisänen et al. 2003). Evaluation and monitoring are linked to each other; the quality of evaluation is dependent on the extent and quality of monitoring (Väisänen et al. 2003). Evaluation is normally carried out by a third party to assess the impact, usefulness and operation of a programme. Evaluation normally takes place 2-3 years after the start and aims to indicate if there is a need to continue, make adjustments, or close down the programme.

2.6 Label Characteristics

This section of the research looks in more detail at the **characteristics of the labelling scheme** itself. This will be done according to the identified characteristics, which have an effect on the adoption of the scheme/innovation. In this analysis labelling is seen as an innovation. These characteristics are derived from ‘diffusion of innovation research’ executed by Rogers (1995) and which are proven characteristics affecting the rate of adoption of an innovation.

2.6.1 Relative advantage

Relative advantage is defined as ‘the degree to which an innovation is perceived as better than the product it supersedes, or competing products’ (Rogers 1995, p. 212). Relative advantages point out the **benefits** and the **costs** resulting from adopting the label. The degree of relative advantage can be expressed in economic terms (e.g. economic profitability, initial costs), but social prestige, convenience and the immediacy of the reward are also important. What matters is whether an individual perceives the innovation as advantageous. The relation between relative advantage and effectiveness of labelling is positive, meaning that the greater the perceived advantage, the more effective the labelling scheme will be. This factor explains why preventive innovations (such as energy labelling) generally have an especially low rate of adoption. The building owner has difficulties in perceiving the relative advantage of preventive innovations.

2.6.2 Compatibility

Compatibility can be defined as 'the degree to which an innovation is perceived to be consistent with the existing values, experience and needs of potential adopters' (Rogers 1995, p. 224). The relation between compatibility and effectiveness of the labelling scheme is positive. A labelling scheme can be compatible or incompatible with socio-cultural values and beliefs; previously introduced ideas and clients need for the innovation. The adoption of an incompatible innovation requires adoption of a new value system, which is a relatively slow process.

2.6.3 Complexity

Complexity can be defined as 'the degree to which an innovation is perceived as difficult to understand and use' (Rogers 1995, p. 242). The level of complexity of a product is negatively related to it's rate of adoption. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings.

2.6.4 Trialability

Trialability can be defined as **'**the degree to which an innovation may be experimented with on a limited basis' (Rogers 1995, p. 243). An innovation that is triable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.

2.6.5 Observability

Observability can be defined as 'the degree to which the results are visible to others' (Rogers 1995, p. 244). It is assumed that when adoption of an innovation is visible to others the implementation and adoption of the innovation is easier.

2.7 Role of the Government

Irrespective of the difference between developed and developing countries, reduction of greenhouse gases is a collective responsibility and the role of the government is considered critical for success.

Most countries have policies in place to reduce greenhouse gases and stimulate energy efficiency in the built environment. There is a range of policy instruments available, which determines the approach of the government and which makes the distinction between governments. Each policy instrument has its strengths and weaknesses, which should be taken into consideration when designing an implementation plan. Policy instruments can be applied either to the demand side or to the supply side of the market.

According to Kuijsters (2004) and OECD (2003), the implementation instruments are categorised into:

- Direct regulation: which is ‘command-and-obligation’ regulatory measures, such as current laws, standards and regulations. Mandatory labelling schemes also fall under this category.
- Indirect regulation: this refers to two economic instruments, namely internalisation of externalities through raising costs, e.g. eco-taxes, and the creation of positive incentives for action, e.g. subsidies, loan programmes.
- Self-regulation/information instruments: this refers to creation of voluntary change in behaviour. The government can stimulate self-regulation by providing information and partnerships between government and the building sector. Information tools and voluntary labelling schemes fall under this category.

Table 2-2 gives an overview of possible policy instruments for new and existing buildings.

Research (Kuijsters 2004; OECD 2003) showed that policy implementation could be effective when using a mix of instruments. Regulations can be an effective strategy to make buildings more energy efficient. However, regulations only set minimum standards and does not stimulate excellent design. Furthermore, regulation and standards are often limited to new buildings. Effective policy consists of regulatory instruments, which are combined with non-regulatory instruments, economic and self-regulation, which can improve energy efficiency of buildings not covered by regulation to achieve the maximum performance (Kuijsters 2004; OECD 2003).

Table 2-2: Overview of possible policy interventions for new and existing buildings (OECD 2003)

Policy instrument	Stimulate energy efficiency in NEW buildings	Stimulate energy efficiency in EXISTING buildings
Regulatory instruments	• Technology-based standards for the design of building • Performance based standards for the design of buildings	• Technology-based standards for the design of building *(major renovations)* • Performance based standards for the design of buildings *(major renovations)* • Imposition of obligation on utility companies
Indirect Regulation	• Energy taxes • Tradable permit schemes • Capital subsidy programmes • Tax credit schemes • Premium loan schemes	• Energy taxes • Tradable permit schemes • Capital subsidy programmes • Tax credit schemes • Premium loan schemes
Information instruments	• Mandatory labelling schemes • Voluntary labelling schemes	• Energy audit programmes • Mandatory labelling schemes • Voluntary labelling schemes

Self-regulation can play an important role in the implementation of energy efficiency in buildings when government is not able to finance economic instruments. Voluntary labelling programmes for energy efficiency in buildings can be very successful, because they use market-based forces to create a win-win situation, where both parties, the environment and the participant, can benefit (UNEP and EPA 1997). However, labelling will be more effective when it is integrated in a programme of institutional measures to enable energy efficiency investments in existing buildings (Henderson et al. 2001).

2.8 Commercial Building Sector

This part of the research takes a closer look at the target group of the labelling programmes, namely the commercial building sector. The section seeks to create a better understanding of the energy consumption in commercial buildings.

An exploration of drivers and barriers of building owners to participate in labelling schemes is carried out. Moreover, opportunities and threats faced by the commercial building sector for the implementation of a labelling programme are identified. These drivers and barriers are categorised in four types (Kuijsters, 2004), namely:

- Institutional barriers or opportunities: government, policy and institutional structures
- Economic barriers or opportunities: market and financial factors that present a driver or barrier;
- Socio-cultural barriers or opportunities: knowledge and attitude
- Technological barriers or opportunities: technology and process

2.9 Assessment Framework

The assessment framework is a more detailed version of the theoretical framework and gives the factors, which need to be assessed in order to come to findings and conclusions of the study. The assessment framework is developed based on the issues discussed in the previous sections and presented in Tables 2-3 to 2-6.

Table 2-3: Assessment framework for programme factors

Programme factors	
Programme goals	What are the goals of the programme?
	Did the programme achieve its goals?
Organisational structure	Identification of administrator, implementing agent, auditor and client?
	What are the roles and responsibilities of the actors
Implementation costs	Where does the funding come from?
	Is governmental support necessary?
	What does the labelling cost?
Promotion and marketing strategy	Scope of the target group?
	Types of promotion and marketing?
	What are the incentives of joining the programme?
Quality assurance	How is the quality assurance guaranteed?
	Inspection/verification?
	Auditor requirements?
	Training of the auditors?
	Authorisation of auditors
Monitoring and evaluation	Monitoring Systems in place?
	Continuous Evaluation?

Table 2-4: Assessment framework for label characteristics

Label characteristics	
Relative advantage	What is the relative advantage of participating in energy labelling programme?
	What are the programmes doing to increase the relative advantage of labelling?
Compatibility	Is labelling compatible with the needs of the building owner?
	Is labelling compatible with existing values or past experiences?
Triability	Which steps are involved in a labelling process?
	Can the building owner test the labelling before committing to the programme?
Complexity	What is the level of complexity of the labelling programme?
	Is a specialised energy consultant involved in the labelling process?
Observability	To what extent is labelling of buildings visible to the public?

Table 2-5: Assessment framework for national context

National context	
Energy efficiency framework	International framework for energy efficiency?
	National framework for energy efficiency?
	Framework for the built environment?
Stakeholders	Who are the most important stakeholders?
	What are the roles and responsibilities of the stakeholders?
Regulatory framework for the built environment	Implementation plan: time and budget
	Direct regulations
	Indirect regulations
	Self regulation
	Interdependency of the instruments?

Table 2-6: Assessment framework for commercial buildings

Commercial building context	
Drivers for market transformation	Socio-cultural: knowledge/attitude
	Economic: market/financial
	Technological: process/technology
	Political: government/policy
Barriers for market transformation	Socio-cultural: knowledge/attitude
	Economic: market/financial
	Technological: process/technology
	Political: government/policy

2.10 Empirical Issues

This section covers the empirical issues of the research, which evaluates the GBfA programme against international experience.

2.10.1 Research method

The research aims to obtain an understanding of how labelling schemes can be implemented in South Africa based on international experience and therefore the case study method is identified as the main research method. The case study method can be defined as ‘an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used' (Yin 1989, p.23). Case study method is suitable when an explorative, in-depth investigation is needed. Case study method is often selective, focussing on a small number of fundamental aspects to understand the system being examined.

To reach a certain level of validity ('does the research measure what it intends to measure') of the research, multiple data sources must be used. This research method is useful to obtain an understanding of how labelling schemes work and the requirements for success derived from international experiences with labelling schemes. A variety of data sources have been explored. This includes books, conference proceedings, internet sources, documentation, archival records, and interviews.

2.10.2 Case study requirements

As outlined in section 2.2.3, which reviewed existing labelling schemes, there is a wide range of labelling schemes available in the world. However, this research limits itself mainly to energy labelling for commercial buildings. Selection requirements are success of the labelling scheme which is measured by the rate of adoption (= number of certifications), and maturity of the scheme (= years of existence). Whereas it would have been useful to include an energy labelling scheme implemented in a developing country as a case study, efforts to find such a scheme were unsuccessful.

2.10.3 Case study selection

The Green Buildings for Africa (GBfA) is the first case study, since it is the central focus of the research. The GBfA is furthermore the only energy labelling scheme for commercial buildings developed in South Africa. Four additional case studies are selected based on the above-mentioned requirements. The additional case studies are:

- Australian Building Greenhouse Rating (ABGR);
- Danish EnergiLedelsesOrdeningen (ELO-scheme);
- United States ENERGY STAR businesses programme;
- Dutch Energy Performance Advice for non-residential buildings (EPA-U).

The following sections provide a brief description of each of the case studies. The appendices contain more detailed information on each of the case studies.

Green Buildings for Africa (South Africa)

Green Building for Africa was initiated in 1997 by the Council for Scientific and Industrial Research (CSIR). The programme initially originates from the development of an assessment tool in 1996. The tool, Building Environmental Assessment Rating System (BEARS) was adapted from BREEAM, which assessed energy, water, waste, and indoor air quality issues in a building. From the start, property owners were not very receptive to the system since they were afraid of negative results and publication. Therefore, the CSIR decided to bring it in a different form, namely the Green Buildings for Africa programme.

The programme aimed at supporting and promoting the environmentally responsible use of facilities by the property owners, facility managers and tenants. However, during the implementation of the programme the focus was mainly on energy issues. The main objective of the programme was to develop the infrastructure and resources to overcome the information, financial and institutional barriers that are inhibiting the application of cost-effective energy-efficiency measures in the commercial sector. The programme aimed at existing commercial buildings in the beginning, but the team intended to extend the programme to other sectors as well. It started with a showcase programme consisting of 10 buildings, including some under Eskom, Old Mutual, and Sasol ownership and/or operation.

In 2000, the programme became part of a different business unit within the CSIR, whereby the strategy of the programme was redefined and from thereon the GBfA consisted of technical workshops to provide information and raise awareness among property owners.

Although the programme did not depict the GBfA as an energy labelling programme, the processes involved are similar and is therefore perceived as a labelling programme. The case study is evaluated in its original form, which means the programme as executed in the period 1997-2000.

Australian Building Greenhouse Rating (Australia)

The Australian Building Greenhouse Rating (ABGR) was developed and implemented in 1999 by Department of Energy, Utilities and Sustainability (DEUS) of the state of New South Wales (NSW) as an energy performance labelling programme. In September 2000, the programme was launched nationally. The ABGR is a voluntary labelling scheme and it rates office buildings from one to five stars whereby five stars represent exceptional greenhouse performance. It is an online performance system based on the operational performance of the building, using a twelve months' energy data. The ABGR programme aims to assist building owners and tenants across Australia to benchmark their greenhouse performance and to provide market recognition for low greenhouse gas emitters. To date 263 offices building have been labelled; 36% of the potential office buildings in NSW have been rated and 23% of the potential buildings nationwide.

EnergiLedelseOrdningen Scheme (Denmark)

The EnergiLedelseOrdningen or ELO-scheme is a mandatory labelling scheme embedded in the Danish regulations. The responsible organisation is the Danish Energy Authority, which is an administrative entity under the Danish Ministry of Economic and Business Affairs. The scheme came into force in 1997 through the 'Act to promote energy and water savings in Buildings No 485 of 12 June 1996'. There are two schemes developed, one for small buildings (EM-scheme) and a scheme for buildings larger than 1 500 m^2 (ELO scheme). This research focuses on the latter, because a significant part of the commercial building are categorised as larger buildings. Due to its mandatory nature, the application rate is high. In 2001, 15 000 buildings were rated under the ELO-scheme, which represents 52% of potential building area and 42% of potential buildings.

ENERGY STAR (United States of America)

ENERGY STAR programme dates back to 1992, when the USA Environmental Protection Agency (EPA) started with the labelling of energy efficient computers. It expanded quickly towards labelling of other office equipment and started with labelling residential dwellings in 1995. Four years later, in 1999, the programme also introduced a label for commercial buildings in the form of an online benchmarking programme. ENERGY STAR offers a strategy for energy management in commercial buildings (new and existing); it includes a wide range of building types e.g. schools, offices, hotels, supermarkets, and hospitals. Up to date 21 000 buildings are evaluated and 2 500 buildings are labelled with the energy star. Obtaining an ENERGY STAR indicates that the building belongs to the countries' 25% most efficient buildings.

Energy Performance Advice for Non-residential Buildings (The Netherlands)

The Energy Performance Advice for Non-residential Buildings (EPA-U) was initiated by the Ministry of Housing, Spatial Planning and the Environment (VROM). SenterNovem, which is the implementing agency of VROM, is responsible for the operation and implementation of the EPA-U programme. The programme was developed based on experiences with a similar programme for the residential building stock (EPA-W). The EPA-U is a voluntary energy audit programme, focussed on existing commercial and public buildings. It is linked to a subsidy and tax scheme to support investments in energy efficiency by owners. Although the programme was fully developed in 2004, the implementation was delayed due to the uncertainties regarding the implementation of the mandatory EPBD. Experts estimate that 1 200 - 2 000 buildings have been labelled under EPA-U.

2.10.4 Method of data collection

During the first stages of the research, a thorough exploratory study was carried in order to obtain more knowledge on the concept of labelling and existing labelling programmes. Because it is a relatively new topic, there are a limited number of books written about building labelling. Therefore, most of the relevant literature consisted of conference papers.

The second part of the research consisted of collecting data regarding the case studies, which was mainly through the internet and email. Programme managers of the case studies were approached by email. In addition, several interviews were conducted with relevant people; appendix A provides a summary of these interviews. The initial programme managers of the Green Buildings for Africa, Mr V. Singh and Prof. LG. Grobler were interviewed regarding the start-up and development of the GBfA programme and their experiences with the programme. In addition, Dr E. du Toit, director of the Energy Efficiency and Environment department within DME was interviewed regarding current developments and activities in relation to the national energy policy framework in South Africa.

During a short visit to the Netherlands, two interviews were conducted. The first one was with Mr. E.Blankestijn, working for Senter Novem, which is the organisation tasked with the national administration and implementation of the EPA-U programme. The interview was about the start and development of the EPA-U, the role of supporting policy instruments and the effects of the implementation of the EPDB. Secondly, an interview was conducted with two consultants, Mr E. Bouten and Mrs. G. van Chruchten, of EBM. EBM is a consultancy involved in carrying out EPA-U s, developing EPA-U software and offering courses regarding the EPA-U methodology. The interview covered implementation issues and the role of the EPDB on future development of the EPA-U.

Email contact was established with the programme manager of the ABGR, in which an appointment for telephone interview was proposed and agreed upon from both sides. Unfortunately, this never took place since the manager was extremely busy and did not respond to any subsequent messages.

Close cooperation with the CSIR was established, which provided the available relevant documents regarding the GBfA programme. Furthermore, a broad research survey was carried out to obtain an understanding regarding the current energy consumption in commercial buildings in South Africa. A questionnaire covering questions regarding energy consumption and maximum demand of a range of buildings in different climate zones, were sent to 200 consultant engineers. Additionally, six large property owners have been contacted to provide energy consumption data regarding their buildings. Response to the email survey was poor; only ten questionnaires were completed and submitted.

2.11 Case Study Categorisation

Table 2-7 shows general information regarding the case studies; it outlines the hosting country, year of introduction, implementation rate (when data available) and the implementation as a percentage of the total potential buildings.

Table 2-7: Overview of general case study information

	GBfA	ABGR	ENERGY STAR	EPA-U	ELO
Country	South Africa	Australia	United States of America	Netherlands	Denmark
Year of introduction	1997	1999	1999	2005	1997
Implementation rate (no. of buildings)	6	263 buildings. of which 76% score good	26 000 evaluated 2 500 labelled	~1 200-2 000	15 000
Implementation percentage (no. buildings/total no. buildings)	0%	36% NSW 23% Nation	38% hospitals, 25% offices, 24% supermarkets, 15% schools, 14% hotels evaluated	~10-15% by 2010	42% of total potential bld and 52% of total bld area

The table shows that ABGR, ENERGY STAR and ELO are well-established programmes, running for 7 to 9 years respectively. The Dutch Energy Performance Advice for non-residential buildings is quite a new scheme and has not been implemented fully; however, the case study is selected due to its well-designed programme structure and availability of information. The reason for the delay in implementation is that the European Union simultaneously introduced the EPBD and therefore the Dutch government was reluctant to implement the programme until it complied with the European requirements.

Table 2-8 provides an overview of the characteristics of the case studies regarding the factors to which the case studies can be categorised. All the case studies have a specific labelling scheme for commercial buildings, except for the ELO scheme. The Danish labelling scheme offers two types of labels, one for buildings smaller than 1 500 m^2, the so-called EM-scheme and a scheme for buildings larger than 1 500 m^2, the ELO -scheme. It is decided to include only the ELO -scheme because most commercial buildings are larger than 1 500 m^2. The ABGR is solely applicable for offices and does not facilitate other types of buildings.

Table 2-8: Overview of categorising factors

	GBfA	ABGR	ENERGY STAR	EPA-U	ELO
Building type	Commercial	Offices	Commercial	Commercial	> 1 500 m^2
Building stage	Existing	New/Existing	New/Existing	Existing	Existing
Nature of hosting organisation	Semi-government	Government	Semi-Government	Semi-Government	Semi-Government
Scope of assessment	Energy Audit	Benchmarking	Benchmarking	Energy Audit	Energy Audit
Implementation approach	Voluntary	Voluntary	Voluntary	Voluntary	Mandatory
Supporting instruments	No	Yes	Yes	Yes	No
Financial support from government	No	Yes	Yes	Yes	Yes

The ABGR and ENERGY STAR make provision for rating new buildings, while GBfA, EPA-U and ELO focus on existing buildings. Except for the ABGR, all the case studies are hosted by semi-government organisations. The initiative for the development of labelling schemes came from the government.

Figure 2-6 gives the possible categorisation of the case studies based on the implementation approach, scope of assessment and availability of supporting instruments.

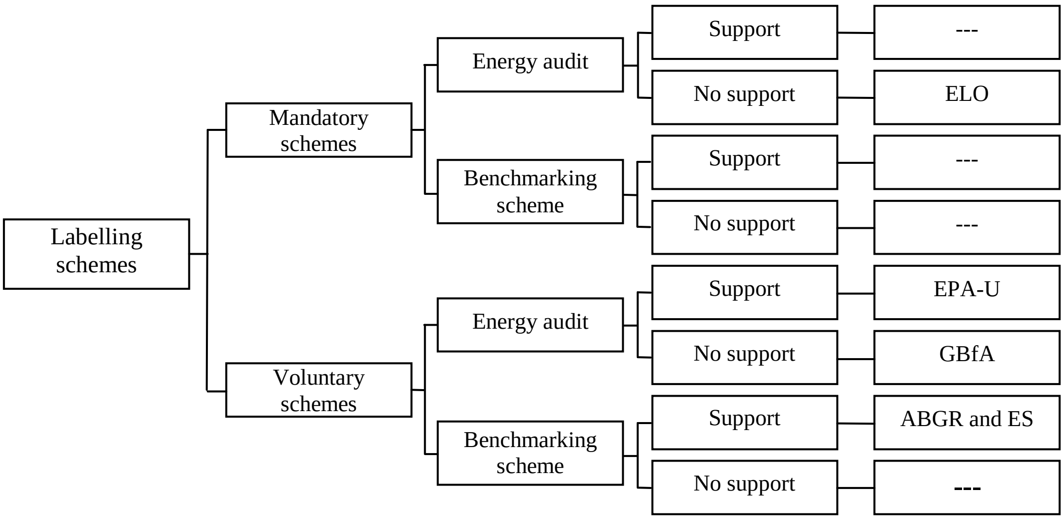

Figure 2-6: Possible categorisation of the case studies

2.12 Readers Guideline

Figure 2-7 presents the research approach and the way the chapters relate to each other. Chapters 3 to 6 discuss the assessment of the case studies according to the assessment frameworks given in section 2.9. From the analyses, section 7.2 brings together the results of the assessment and concludes the threats and opportunities, and the strengths and weaknesses for a future labelling scheme for South Africa. Section 7.3 covers the final conclusion regarding the most appropriate labelling approach for South Africa. The chapter ends with recommendations for the development of labelling programme in South Africa (section 7.4) and recommendations for further research (section 7.5).

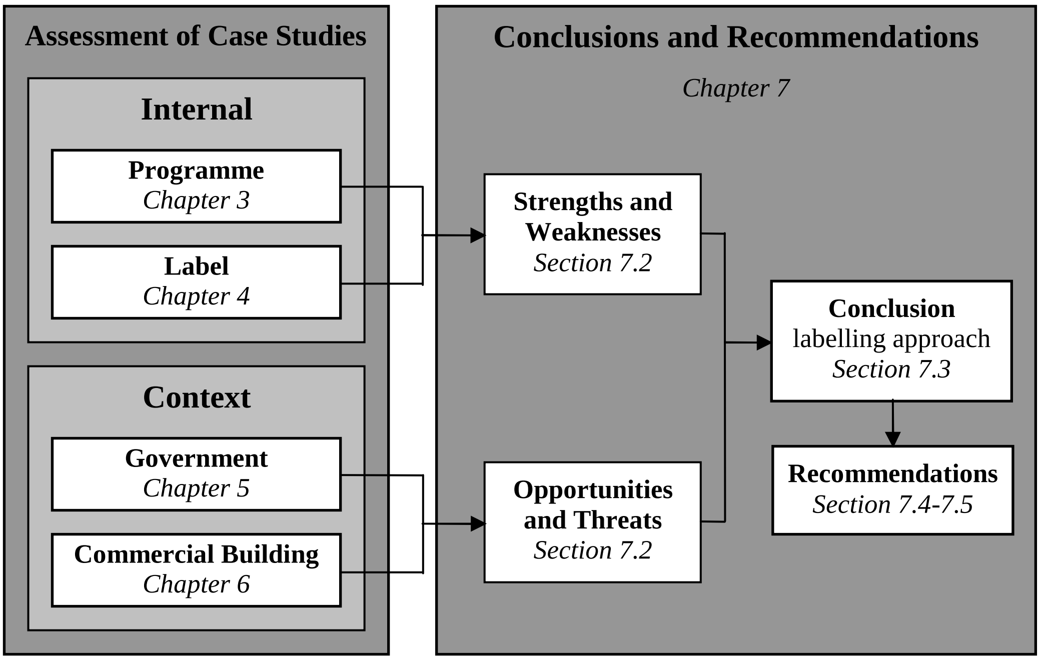

Figure 2-7: Readers guideline

The report also includes several appendices. The first appendix is a summary of the interviews carried out during the research and the other five appendices provide supplementary information regarding each case study. The appendices were compiled to consolidate and structure the large amounts of discrete and segmented information available on each case study, but also to provide the reader with a reference guide to obtain in-depth information regarding a specific case study. The appendices and their bibliographies can furthermore be used as a starting point for further research on the topic of energy labelling.

3 Programme Design

3.1 Introduction

This chapter looks at different aspects of the design of a labelling programme. It looks at programme objectives and development (section 3.2), organisational structure (section 3.3), implementation costs (section 3.4), promotion and marketing strategies (section 3.5), quality assurance and control (section 3.7) and monitoring and evaluation (section 3.7). The main objective of the chapter is to identify the strengths and weaknesses of the different labelling designs of the case studies.

3.2 Programme Objectives and Development

Well-defined programme goals are the key to successful implementation (UNEP and EPA 1997). The programme goals formulated by the Green Buildings for Africa programme were very ambitious. The main objective of the programme was as follows; 'The Green Buildings for Africa programme seeks to develop the infrastructure and resources to overcome the informational, financial and institutional barriers that are inhibiting the application of cost-effective energy-efficiency measures in the commercial sector' (Grobler and Singh 1999). The overall objective of the GBfA is divided into four sub-objectives. The programme aimed (Grobler and Singh 1998):

- To build local capacity to promote and deliver energy savings to the commercial building sector;
- To demonstrate the cost savings and emissions-reduction potential through improved energy-efficiency in the commercial sector;

- To stimulate the creation of energy service companies and other private sector mechanisms to foster and replicate energy-efficiency investment;
- To initiate the development of the institutional mechanisms that will establish a sustainable national programme.

These objectives propose to realise additional matters beyond the scope of developing and implementing a labelling programme. Table 3-1 illustrates where the objectives originate from and how they relate to the formulated outcomes and statement of work. The need for energy efficiency in buildings was identified by several prominent South African organisations (first column in Table 3-1). Furthermore, four types of barriers were identified as important, namely informational, financial, capacity and institutional barriers (second column in Table 3-1).

The main objective of the GBfA relates to these barriers because it aims to develop the infrastructure and resources to overcome *all* four barriers. This would suggest that the sub-objectives, expected outcomes and the statement of work are also in line with and directly address the identified barriers. However, Table 3-1 shows that the sub-objectives address all the barriers except for the financial barrier. Furthermore, it shows that the expected outcomes only address the informational and financial barrier. The statement of work includes all the barriers and adds some additional tasks to be executed to develop the programme. To illustrate the inconsistency between the barriers, objectives, and outcomes, the ‘capacity barrier’ is elaborated on in the section below.

The GBfA programme developers indicated that there is a lack of professional capacity to incorporate green building technologies into practice. Two sub-objectives address this barrier directly. Firstly, the GBfA programme aimed to build local capacity to promote and deliver energy savings to the commercial building sector. Secondly, the GBfA programme aimed to stimulate creation of Energy Service Companies (ESCOs) and other private sector mechanisms to foster and replicate energy efficiency investments (fourth column in Table 3-1).

Table 3-1: Needs, barriers, objectives and outcomes of the GBfA programme

Need	Barriers	Main Objective	Sub-objective	Expected Outcomes	Statement of Work
Ratification of the UN Framework on Climate Change 1997 Draft White paper on Energy Eskom demand-side programme DPW improvement of government buildings SABS promoting ISO 140001	**Informational:** Awareness by building owners, occupants, engineers and other stakeholders on green building issues and opportunities; about building technologies and options available to reduce energy usage and related costs	To develop the infrastructure and resources to overcome the existing barriers to the implementation of cost-effective energy-efficiency measures in the commercial sector	Demonstrate the cost savings and emissions reduction potential through improved energy efficiency in the commercial sector	Creation of a marketing and information package to promote market acceptance and implementation of profitable energy-efficiency and environmental assessment and upgrades. Documentation of the showcase projects and the potential for cost-effective greenhouse gas emissions reductions. High profile demonstrations and documentation of the cost-savings potential of energy efficiency measures through ten showcase commercial buildings	1) Showcase programme to demonstrate the applicability of the GBfA environmental improvement achieved through profitable building upgrades 2) Setting up training and education: introduction of the programme to the commercial building sector by training and educating building owners and the public 3) Establishment of technical network and database of role players in the energy conservation industry 4) Public Relations: to give GBfA a recognisable and popular identity 5) Development of a marketing strategy 6) Stimulate the formation of Energy Service Companies 7) Investigating the feasibility of a revolving loan facility 8) Development of a national programme 9) Documentation of emissions reduction potential and related cost-effectiveness 10) Development of new modules 11) Development of funding sources to sustain the national programme
	Financial: Lack of financial and capital resources to incorporate green building technologies and practices			Development of a private sector financial mechanism to implement and replicate building audits and upgrades	
	Capacity: Lack of professional capacity to incorporate green building technologies and practices.		To build local capacity to promote and deliver energy savings to the commercial building sector Stimulate the creation of ESCOs and other private sector mechanisms to foster and replicate energy-efficiency investment		
	Institutional: No institutional mechanisms and structures that are responsible for and promote green building		To initiate the development of the institutional mechanisms that will establish a national Green Buildings for Africa programme ***that is sustainable***		

Besides the fact that these two sub-objectives could facilitate two *separate* programmes, it can be questioned if the sub-objectives do not fall outside the scope of a labelling programme. The implementation of labelling programmes could trigger the creation of ESCOs and local capacity development, but this should be seen as positive spill-over effects, not as an objective of the programme. On the other hand, it can be argued that these barriers needed to be addressed in order for the GBfA to operate efficiently.

Looking at the expected outcomes (fifth column in Table 3-1) note that there are no expected outcomes related to the capacity building issue, which is confusing since the issue represents two of the four sub-objectives. The statement of work on the other hand (sixth column in Table 3-1) does include development of training and education modules for stakeholders and public. The GBfA work plan document (Grobler and Singh 1998) works this out in more detail:

- To develop programme and implementation guidelines for the customer;
- To develop practical training modules on improving energy efficiency to educate building managers, maintenance personnel and contractors;
- To develop professional training modules on energy efficiency in buildings to educate and train professionals, consulting engineers and potential ESCOs;
- To develop software modules to assist in energy savings predictions and cost analysis and;
- To create forums and workshops to promote awareness within the industry.

Besides the fact that there is a need for these training, education initiatives and awareness creation of the public, it can be questioned if it should form part of the scope of a labelling programme. It is therefore not surprising that this task of the statement of work has never been realised by the GBfA programme. Regarding other tasks of the statement of work, the majority of the tasks were never carried out, with the exception of the initiation of the showcase programme. The showcase programme aimed to attract ten buildings owners of prominent organisations and guide their buildings through an energy efficiency retrofitting and upgrading process. However, even regarding this task the programme manager mentioned that they underestimated the timeframe that is required to implement the showcase programme and time required to guide the buildings through the full GBfA implementation cycle. Eventually six organisations participated in the GBfA showcase programme (Singh 1999a).

When the programme was transferred to a different business unit within the CSIR and changed programme managers in 2000, the GBFA programme redirected its focus. Instead of auditing buildings and encouraging energy efficient upgrading, the focus changed to an information function. The intention of the programme was to influence decision-making by raising awareness levels through training and education. From this point, the programme mainly facilitated workshops regarding energy, water and waste efficiency. Although this can be seen as very necessary, it is not a financially viable activity.

Comparing GBfA programme design with the reference case studies, large differences can be observed. Although the ENERGY STAR programme acknowledges all the barriers towards energy efficiency, however its main focus is on addressing the information gap, through a straightforward, market-based approach. The goal of the ENERGY STAR label is to motivate building owners and property managers to improve the energy performance, occupant comfort and cost effectiveness of commercial buildings while minimizing their deleterious impact on our energy resources and natural impact (Hicks and Neida 2000). The programme offers an energy management strategy with a corresponding benchmarking system to enable building owners to measure, improve and compare the energy performance of the buildings. The ABGR programme is also focused on filling the information gap by giving building owners and tenants the opportunity to benchmark their performance and encouraging best practice.

Labelling programmes clearly have to focus on one aspect, and that is filling the information gap, by providing information and benchmarking systems. Their goals and objectives are expressed in the number of buildings aimed to be benchmarked and labelled.

Regarding programme development, both programmes gradually extended the programme. The programmes started with a small focussed scope, but systematically added building types, information tools, additional activities, etc. The GBfA started ambitiously, but finally ended up not being able to carry out all the tasks.

What can be concluded from the table and the discussion is that the barriers, objectives, outcomes and statement of work did not follow each other logically. Furthermore, the objectives of the programme were too broad and ambitious and were not feasible within the time, finances and human resource capacity available to the programme. What can be learnt from the international reference case studies is that labelling programmes need to have a clear focus, namely filling the information gap by providing means to measure, improve and monitor the energy performance of buildings. The reference case studies also showed that the programmes started small and developed gradually over time.

3.3 Organisational Structure

As outlined in section 2.5.2 four key players can be identified in a labelling programme, namely the administrator, implementing agent, energy consultant and the client. This section analyses how the administrative structure of the GBfA compares with international experience.

In case of the GBfA programme, only two actors could be identified, namely the CSIR and the client. Figure 3-1 visualises the organisational structure of the GBfA programme. The CSIR initiated and developed the GBfA programme. Initially, it acted as the administrator, implementing agent, and the energy consultant. Daily administration, promotion, marketing, and even the energy audits were carried out by the programme staff. Some of the energy audits were executed by Cybernetics, which is an energy consultancy company directed by one of the programme developers. The other energy audits were done by XENERGY, which was an American energy consultancy under contract of the USA Environmental Protection Agency (EPA). EPA was involved in the first years of the GBfA programme development providing technical advice and financial assistance. Because the CSIR acted as the administrator, implementing agent and the energy consultant, the client was in direct contact with the GBfA programme in a comprehensive sense.

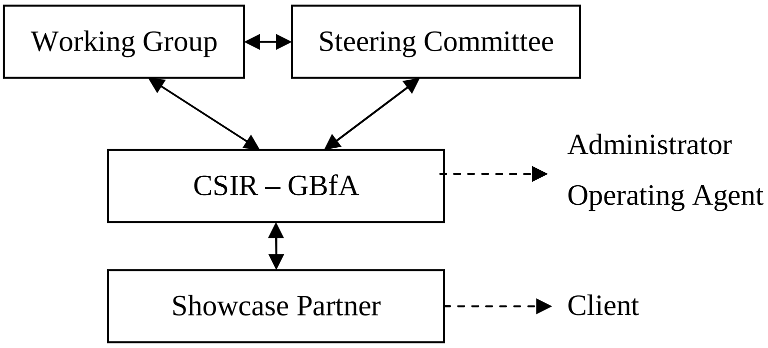

Figure 3-1: Organisational structure of the GBfA programme

The fact that the government did not initiate the programme does not mean the government was not supportive. Due to capacity and financial constraints, the government was not in a position to initiate an energy labelling programme for commercial buildings then. The relevant government departments did support the programmes ideas and participate actively in the Steering Committee and Working Group.

The Steering Committee consisted of national stakeholders representing a wide range of organisations e.g. DME, DEAT, DPW, IIEC, Eskom, SABS, and SAPOA. This committee had bi-annual meetings. The aim of the steering committee was to represent national ownership, provide national support, mandate, serving national interests, coordination, and a forum for interaction (Singh 1998).

The working group was established to attend to operational matters of the GBfA programme. The members of the working group were selected from the steering committee, and held meetings on a monthly basis. The working group consisted of people from government and industry who were committed to the success of the programme. The working group facilitated exchange of ideas and collaboration; were expected to think pro-actively with the programme managers and to provide new ideas and initiatives. The GBfA status report indicates that the purpose and role of the steering committee was not well understood and seemed to have served the greater need of external donors, EPA and IIEC (Singh 1999a). However, the steering committee reflected endorsement of national stakeholders and was therefore maintained.

The organisational structures of the reference case studies provide a different picture. The case studies, irrespective of whether voluntary or mandatory, have a clear organizational structure in comparison to the GBfA programme. Figure 3-2 shows the organisational structure of the ABGR programme. The other organisation structures can be found in section 2.2 of each case study Appendix. The structure of the reference case studies is very similar. It consists of the national administrator, implementing agent, energy consultant and the client. Roles and responsibilities of each key player differ slightly among the case studies, but the overall structure is similar. The national administrator is the initiator of the scheme and in *all cases* this is the governmental institution dealing with energy efficiency. The administrator sets guidelines, supervises the process, and provides funding. Additionally, the implementing agent is also represented by a governmental institution.

In case of the ABGR and ENERGY STAR programmes, the roles of the national administrator and implementing agent are carried out by the same organisation. However, after the ABGR programme was launched nationwide in 2001, the programme established an implementing agent in each of the states. The implementing agents of the ELO and EPA-U programme are governmental implementation agencies commissioned by the administrator. Energy consultants are commercially operating engineers, running their own business or working through an energy consultancy agency. Clients only have contact with the energy consultant, not with the operating agent or national administrator.

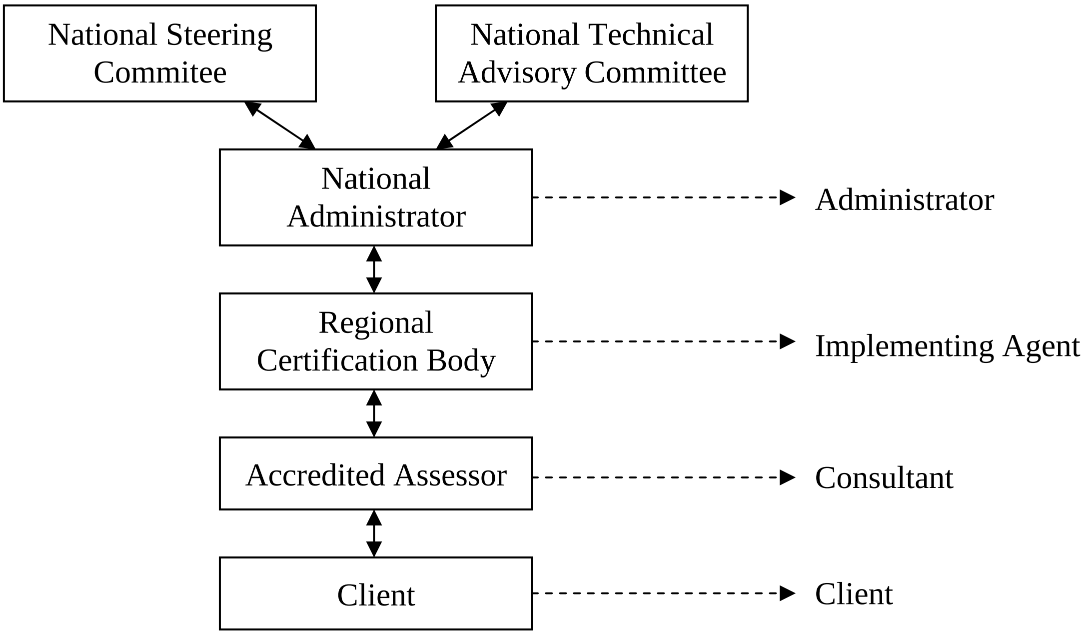

Figure 3-2: Organisational structure ABGR programme

The ABGR has some strong features regarding the organisational structure, which are similar to the GBfA and therefore worth mentioning. Besides the basic actors in the administration, the programme established two committees that play an important role. These committees are the National Steering Committee and the National Technical Advisory Committee (see Figure 3-2). The National Steering Committee is a group of actors, consisting of state and territory representatives, federal government representatives, and industry organisations. The committee reflects endorsement and more importantly, brings forward financial support for the programme. The official role of the committee is to advise on direction, guidance and strategic development of the scheme.

The National Technical Advisory Committee on the other hand, is established from a consumer perspective and consists of only industry representatives. Their role is to act as a link between the ABGR programme and the target group, furthermore to provide advice on the trends in the industry and the impact of the ABGR on the industry.

The ELO-scheme established a similar committee, representing industry representatives, to emphasise the importance of the link with the target group. These committees are seen by the reference case studies as an important link with the government and industry stakeholders. The steering committee and the working committee of the GBfA programme were also established for these reasons. The GBfA programme manager indicated that the role of the committees was not well understood and therefore the committees were not exploited to their full potential. Therefore, to be effective and useful, roles and responsibilities of the committees should be clarified.

It is clear that the organisational structure of the GBfA programme was not effective. The major difference with the reference case studies is the origin of the national administrator and implementing agent. In all the reference case studies, these are government institutions, while in case of the GBfA it was the CSIR, which is the national research council. Furthermore, energy audits were carried out by energy consultants connected to the GBfA programme, which might have been because of a lack of capacity in South Africa at that time. However, currently there are sufficient energy consultants, trained by Eskom, who can carry out the energy audits. By using commercial certified energy consultants, instead of in-house capacity, it will reduce the workload and responsibilities of the GBfA programme.

3.4 Implementation Costs

This section deals with implementation costs of labelling schemes. It evaluates the GBfA regarding its finances and discusses the financial structures and funding streams of the reference case studies. Costs are divided in two groups, the administration costs of a labelling programme and the labelling costs itself. Table 3-2 provides an overview of the administration costs and labelling costs of all the case studies.

Administration and operating costs

The GBfA programme started with funding from the CSIR and the International Institute of Energy Conservation (IIEC) through DME. The United States Environmental Protection Agency (EPA) made US$95 000 (R 456 000) available through the IIEC. This funding was sufficient to start up and implement the showcase programme. The CSIR added an additional R840 000 spread over two years for the development and implementation of the programme. The funding made it possible to carry out the energy audits on showcase buildings free of charge for the clients. After two years, the CSIR became fully responsible for financial support. Little additional income came from GBfA activities and annual fees of the participants, and the funding was not sufficient to sustain the programme (Singh 1999a).

Analysing the financial structures of the reference case studies, it can be concluded that ongoing contribution of the government is vital. The administration and operating costs of the EPA-U and the ENERGY STAR are fully covered by the government. The ABGR administration and operating costs are largely financed by government, but the programme receives additional funding from consultants through labelling fees and annual registration fees. The ELO-scheme is self-sustainable regarding its daily administration and operation costs, due to the mandatory nature of the scheme, which guarantees a certain income. However, the Danish Department of Energy is responsible for the funding of marketing and promotion activities and quality control processes.

Table 3-2: Overview of the labelling costs of the case studies

Case Study	Administrative costs are covered by:	Labelling Costs			
		Client costs to obtain label	Cost Formula	Label Renewal	Financial incentives
ABGR	• Contribution Steering committee (government) • Fee Regional Certification Body (annually) • Consultant registration and training fee (annually) • Administration fee for each label verified	R4 420 to R13 260	Market Based	Annually	None
EPA-U	• National government: VROM	R13 500 (building 1 500m^2)	Market Based	N/A	Linked to subsidies and tax incentive
ELO	• National government • Consultant registration fee (annually) • Company registration fee (annually) • Administration fee for each label issued	Maximum price: R4 150 (building 1 500m^2)	Market based, however max prices: R3 000 + R0.68 per square metre	Annually	None
ENERGY STAR	• Federal government: DOE (US$ 50 million) and EPA	R500 to R1 010 (building 1 500 m^2)	Market based, estimate of R0.35 - 0.68 per square metre	Annually	None
GBfA	• CSIR • US EPA funding trough IIEC • Annual fees from participants	R15 000 to R25 000 annually + R50 000 for energy audit	Fixed price	Annually	None

Labelling costs

As can be derived from Table 3-2 the GBfA programme charged on average R50 000 for carrying out an energy audit and annual fees for being a GBfA partner were between R15 000 and R25 000. These prices are very high compared with the costs charged by the reference labelling programmes. In general, prices are obviously dependent on the size of the building and the comprehensiveness of the labelling. The reference case studies showed that prices for labelling are market-based, which means that the energy consultant determines its own prices for its services. Only the price to obtain an ELO-label is bound by price limits set by the Danish government through the Executive Order on Fees and Liability Insurance (DEA 1999).

As can be derived from the table, labelling costs for ABGR, ELO and ENERGY STAR are relatively low, compared with the EPA-U and GBfA. Because ABGR and ENERGY STAR are voluntary programmes, they have to keep the prices low to avoid discouragement of potential participants. In addition, the programmes can make their prices lower because their product is less comprehensive than the product of EPA-U, GBfA and ELO. The costs to obtain an ENERGY STAR label are the lowest, because the price only represents the costs of a professional energy consultant. No additional costs are charged for obtaining the label from ENERGY STAR. The costs for an ABGR label are a bit higher because it consists of the costs of the energy consultant and a certain amount that needs to be paid to the implementing agent for issuing the label. The ELO prices are relatively low because the government does not want to add a cost burden on the building owners and therefore set maximum prices for issuing ELO-labels.

Although the EPA-U is a voluntary scheme and therefore expected to have low prices, their prices are relatively high compared with the other voluntary schemes. This is feasible because the scheme is linked to subsidies and tax incentives, which reduces the price for the building owner but leaves the consultant revenue unchanged. Furthermore, the costs for an EPA-U are a once-off fee, while the other programmes require the clients to renew their labels annually. Financial sustainability is obviously more difficult for a voluntary scheme than for a mandatory scheme. A mandatory labelling programme can be designed so that it is self- sustainable, while this is more difficult for a voluntary labelling scheme. Experts interviewed during the research also agreed that a voluntary labelling programme would struggle to sustain itself without continuous financial support (E Bouten and G van Chruchten 2006, pers.comm., 11 January). Additionally, voluntary *energy audit* programmes (EPA-U and GBfA) are more expensive and more difficult to sustain than voluntary *benchmarking* schemes (ABGR and ENERGY STAR) due to its comprehensiveness

In conclusion

The analysis of the case studies shows that a labelling programme should ideally be operated and financially supported by government. The South African government supports the idea of a labelling programme, but is not in a position to initiate and operate such a programme due to budget and capacity constraints. Therefore, to develop a labelling programme in South Africa the programme managers have to be extremely creative to establish secured financial support. Recently, the DME has worked together with other governmental institutions and the industry stakeholders to establish the National Energy Efficiency Agency (NEEA). Through this agency, all types of projects and programmes can apply for funding. The budget for the NEEA is provided by Eskom and national government. The disadvantage for a labelling programme being dependent on external funding is that the donor of the finances wants to have its share in the operation of the programme. Furthermore, a donor can stop the financial support at any time.

Because of its mandatory nature, a programme such as the ELO-scheme is able to sustain itself, with little government funding. Voluntary schemes seem to be more dependent on government funding. Programmes such as ABGR, ENERGY STAR and EPA-U are to a large extent financially supported by their governments. A market-based labelling programme, which does not receive government support, will struggle to implement its programme without secured funding. Moreover, an energy audit programme is more expensive to sustain than a benchmarking programme, due to the level of comprehensiveness.

Because the GBfA programme was operating without the financial security from government, finances were constantly uncertain. It would have been more cost effective when the GBfA considered the market-based benchmarking approach undertaken by the ABGR or ENERGY STAR, whereby the labelling process is less comprehensive and therefore less expensive.

3.5 Promotion and Marketing Strategy

Whether a programme is voluntary or mandatory, it would need an implementation strategy to be successful. The target group will not participate in an energy audit programme when it is not informed about the benefits. There are several instruments available for a labelling programme to include in the implementation strategy, which are the following[5]:

- Financial incentives from government. These instruments provide financial incentives to the target group to obtain a label for their buildings. Examples are subsidies or tax rebates to compensate for the assessment costs or upgrading costs
- Regulation requires labelling.
- Government programmes, policies or acts, which require a building label. These instruments, when applied, include labelling as part of their programme. Examples are long-term agreements, accommodation policies.
- Non-government programmes, which require a building label. An example is environmental-labelling schemes requiring a label for their energy component.
- Promotion and marketing instruments. Promotion activities are to create awareness and good publicity and are often the responsibility of the national administrator or implementing agent. Marketing activities are to

[5] This list is not comprehensive; it is compiled based on the implementation activities of the case studies.

sell the product and attract owners to participate in the programme, which is often executed by the energy consultants.

Because the GBfA was still in its early stages, little effort was put into developing an implementation strategy. The programme started with the showcase programme, which was set up to demonstrate the cost effectiveness of energy efficiency to the commercial sector. The GBfA approached several large, well-known property owners to convince them to participate. The aim was to include ten buildings in the programme, however only six organisations were willing to commit themselves to the GBfA showcase programme. The showcase programme consisted of the following organisations and buildings:

- Old Mutual Properties, Old Mutual Centre in Pretoria
- Eskom, Megawatt Park in Johannesburg
- Sanlam Properties, Sancardia in Pretoria
- CSIR, Conference Centre in Pretoria
- Sasol, Headquaters in Rosebank

During the showcase programme, a marketing brochure was developed and several articles were written regarding the energy efficiency potential of the buildings.

Once the showcase programme was finalised, a good marketing strategy would have been necessary to disseminate the results of the showcase programme and to attract other property owners to join the programme. Although the showcase programme demonstrated the cost effectiveness, the GBfA programme never came to the stage of finalisation and dissemination of results. The GBfA programme did develop a recognisable identity, in the form of the name and logo, but a dynamic marketing campaign never took place. By 2000, a new programme manager took over and the GBfA took a different direction, it became a more information provision programme instead of a labelling programme. The main marketing approach of the GBfA was through networking and approaching potential participants by the programme managers and the steering committees. During the first two years, the GBfA built a notable network of organisations supporting the programme.

Looking at the reference case studies, we can observe differences between the marketing approach of voluntary and mandatory programmes, as well as between the energy audits and benchmarking programmes. Although the ELO scheme is a *mandatory energy audit programme* it still needs promotion activities to create awareness among the target group. An evaluation of the ELO -scheme in 2001 (Lausten and Lorenzen 2003) pointed out that the programme should put more effort in promoting the scheme, seeing that only 50% of the buildings were labelled after four years of implementation. Although the Act, which mandates the ELO-scheme, allows the Department of Environment and Energy to impose a fine in case of non-compliance, this has not been put into practice (Poulsen 2001). The scheme is not supported by other policy instruments or support programmes.

The implementation of the *voluntary energy audit scheme*, EPA-U, enjoys government support through a regulatory instrument, namely the Environmental Act. This act requires building owners to implement all cost-effective measures with a pay-back period of five years when the buildings uses more than 25 000 m^3 gas and/or 50 000 kWh electricity. The EPA-U is utilised to identify these cost-effective measures. Furthermore, the programme is promoted through voluntary Long Term Agreements between government and businesses to improve energy efficiency of business processes and buildings. Finally, a tax rebate that compensates investment costs, stimulates organisations to undertake an EPA-U and improve the building. Promotion activities are the responsibility of the implementing agent, who currently only maintains the website. Marketing activities are left to the energy consultants, who offer the EPA-U as part of their total package of services.

The *voluntary benchmarking programmes,* ABGR and ENERGY STAR, require more effort in their marketing and promotion activities to implement the scheme, because the programmes are not supported by subsidies, tax incentives or supporting regulatory instruments. However, **close operation with other governmental institutions** resulted in the inclusion of the label programmes in governmental voluntary programmes promoting energy efficiency. Additionally, both governments established policies regarding government accommodation. These accommodation policies require a label for all buildings occupied by governmental institutions and agencies. For example, the Australian NSW accommodation policy requires a 4.5 ABGR tenancy star rating for all accommodation occupied by governmental agencies.

Because ENERGY STAR and ABGR have established proven methods of measuring and benchmarking energy performance of buildings, the schemes are included in voluntary **environmental rating schemes**. An ENERGY STAR rating is required to obtain the USA Green Buildings Council's LEED certification. The ABGR rating is required for the environmental rating scheme of the federal government, NABERS and for the Australian Green Building Council's Green Star certification.

To encourage building owners and tenants to participate in the programme, **challenges** are initiated to trigger the competitiveness of the businesses. ENERGY STAR challenged businesses and government agencies to improve their energy performance with 10, 20, 30 percent and receive **market recognition** for this achievement. Furthermore, seminars and conferences are organised to hand out awards for best performing companies.

Websites are playing a major role in disseminating information to building owners. The **websites** of ENERGY STAR and ABGR are an important means of communication. Both programmes make use of web-based rating tools, which means that the energy performance of the building can be calculated and monitored online. Information and tools on how to improve the energy performance of buildings can also be found on the website. Furthermore, the websites contain databases of all labelled buildings and best practices are highlighted to serve as examples.

The marketing approach of ENERGY STAR and ABGR includes **networking** with prominent stakeholders in the field for support. For example, ABGR is marketing the scheme through the Property Council of Australia, Master Builders Association, Australian Conservation Foundation, Facility Managers Organisation, etc. Obtaining support from the industry is seen as one of the most important aspects of the marketing strategies.

Finally, the energy consultants are also encouraged to market the labelling programme. The ABGR equips each energy consultant with a marketing package, which contains marketing brochures and ideas for marketing strategies.

In conclusion

Table 3-3 gives an overview of the main promotion and marketing strategies of each of the case studies. Implementing a labelling programme, whether it is mandatory or voluntary, requires a well-developed implementation strategy. This is especially valid for the voluntary benchmarking programmes, which are not supported by financial incentives or regulatory instruments. The GBfA started with the showcase programme to demonstrate the cost-effectiveness of energy efficiency and the benefits of participating in the programme. Establishing the showcase programme indicated how difficult it was to convince building owners about the benefits of the programme. This indicated the necessity of a good marketing and promotion strategy to make the programme successful. The GBfA managed to establish a network and create support from a range of important stakeholders.

Implementation strategies of the ELO and EPA-U are not realistic in the current South African context. For the ELO-scheme, legislation and a monitoring system to keep track of implementation need to be in place to become successful. The EPA-U scheme is implemented and sustained due to all the government support and supporting instruments. The marketing approach and implementation strategy of the ABGR and ENERGY STAR is more business oriented and therefore more applicable to the South African context. These strategies focus more on the (economic) benefits the programme can offer the target group.

Table 3-3: Implementation strategies for labelling schemes

Linked to:	EPA-U	ELO	GBfA	ABGR	ENERGY STAR
Subsidies	X				
Tax incentives	X				
Regulation	X	X			
Government accommodation policy requiring rating				X	X
Governmental voluntary energy programmes requiring rating	X			X	X
Environmental rating systems				X	X
Regulation instruments requiring rating	X				
Networking			X	X	X
Market recognition			X	X	X
Website	X	X		X	X
Award events				X	X

Although the South African government is not in the position to provide significant financial support, current government activities could provide opportunities for a potential implementation strategy. The South African government is currently carrying out energy audits for their own buildings to show leadership. The labelling programme could link to this initiative by providing the benchmarking and labels so the government can display and receive market recognition for their achievements. Furthermore, the South African government, (through DME) signed an energy efficiency accord with 30 large industrial organisations. The organisations committed themselves to improve their energy performance of all business activities, which also includes the energy efficiency of their buildings.

3.6 Quality Assurance and Control

This section looks at quality assurance and control processes of labelling schemes. The GBfA did not have a quality assurance or control processes in place. This was also not necessary at the time, since the programme was doing all the energy audits in-house. Quality control would then mean they would assess themselves. However, for the development of a potential labelling programme in South Africa this section looks at the experiences of the reference case studies.

Quality assurance and control is divided into three main aspects, which are discussed in three separate sections, namely

- Quality assurance of people and organisation (section 3.6.1)
- Quality assurance of the process (section 3.6.2)
- Quality control of the end product (section 3.6.3)

3.6.1 Quality assurance of consultants and organisations

The main question here is how to ensure that people are competent to execute the work that needs to be done. Table 3-4 indicates how this has been done by all the reference case studies. As can be seen, pre-qualification of the energy consultant is a requirement in all the cases. For the ENERGY STAR programme, this is also the only requirement for the energy consultant. The programme requires a Professional Engineer to carry out the work. To become a Professional Engineer in the USA, the person has to have certain degrees and experience, which is seen as sufficient by ENERGY STAR. When a person has the Professional Engineer title, some guarantee can be given regarding the quality of skills. A database is available on the website containing professional engineers who have performed an ENERGY STAR verification before.

ELO, EPA and ABGR require the energy consultant to undertake a basic training course and, in case of the ELO and ABGR, an examination. ABGR and ELO develop and carry out their own training programme. EPA-U leaves it to the market; there are several private education/training institutes that offer an EPA-U course. ELO, EPA-U and ABGR require the energy consultant to obtain authorisation and certification. In the case of the ABGR the certification needs to be renewed annually, which has assumingly more to do with financial revenues than with quality assurance.

Table 3-4: Quality assurance of people and organisation

Quality assurance of consultants and organisation	**ELO**	**EPA-U**	**ABGR**	**ENERGY STAR**
Training	Mandatory	Mandatory	Mandatory	-
Prequalification	Degree + experience	Degree + experience	Degree + experience	Degree + experience
Examination	Test at the end of the training	-	Test at the end of the training course	-
Who will be authorised	Consultant	Organisation	Consultant	N/A
Renewal of certification	Certification for life	Certification for life	Annually	N/A
Authorisation done by	Independent committee	Independent institute	Implementing Agent	N/A

ELO and EPA-U require their energy consultants to execute an energy audit as part of the labelling process. This requires knowledge regarding energy audits. Energy audits vary in scope and detail, and therefore it is necessary to conduct a training programme to create an understanding of the scope of work. ABGR and ENERGY STAR only require their energy consultants to verify data collected by the client and to verify the indoor air quality of the building. The ABGR provides a four-day training programme to become an ABGR accredited assessor. During the course, the participants are familiarised with the validation protocol and the code of conduct. The first two official ratings are done under supervision of an experienced accredited assessor.

These following systems can be used for ensuring the quality of the energy consultant in a potential labelling programme in South Africa. Firstly, South Africa has a similar qualification system as the USA. A graduate engineer can become a Professional Engineer after several years of practice. The Engineering

Council of South Africa (ECSA) accredits professional engineers. Secondly, the Southern African Association for Energy Efficiency (SAEE) provides a Building Energy Audit Training course and a Certified Energy Manager course. The courses are supported by the Department of Minerals and Energy and are executed by the Energy Training Foundation in conjunction with North-West University. The course is registered with Energy Sector Educational and Training Authority (ESETA).

3.6.2 Quality assurance of the process

There is a major distinction between the energy audit programmes (ELO and EPA-U) and the benchmarking programmes (ABGR and ENERGY STAR) regarding the quality assurance of the process. The process including an energy audit is more comprehensive, and therefore the quality assurance is also more comprehensive.

The GBfA programme compiled a 'guide to implement energy efficiency', which provides a five-step strategy to improve and upgrade the energy performance of the building. The original purpose of this guide was to provide a roadmap to guide participants through each of the five stages. However, the content of this four-page guide suggests it is only an introduction to energy efficiency in buildings. It would provide insufficient support should the client decide to upgrade its building according to the steps outlined in the guideline.

Table 3-5 shows the systems in place to ensure quality of the process. The quality of the EPA-U process is established by National Certification Agreements (BRL) developed by independent institutions. These agreements describe the process systematically and outline the requirements during the process. This is a comprehensive way to ensure the quality of the process, but would certainly be unnecessary in the case of a benchmarking programme. On the other hand, the validation guidelines of the ABRG and ENERGY STAR would not be adequate in the case of an energy audit.

Each of the case studies has mandatory software in place to standardise the calculation methodology. Calculation methodologies usually use either primary or delivered energy for the energy consumption calculations (see Conceptual definitions in section 1.4.4). ABGR, ENERGY STAR and the ELO-scheme use delivered energy in their calculations, while EPA-U uses primary energy for the energy consumption calculation. The use of primary energy for the calculations is useful for and related to national energy policy considerations. Using delivered energy for the calculations approximates the quality of the building and is more appropriate for building owners and tenants, since it directly relates to the energy expenditure.

Table 3-5: Quality assurance of the process to obtain the label

Quality assurance of process				
	ELO	**EPA-U**	**ABGR**	**ENERGY STAR**
Procedures	Standardised forms and checklists	BRL 9503 + manual	Validation protocol	Validation guidelines
Software	Mandatory software	BRL 9501 + software	Mandatory software	Mandatory software

3.6.3 Quality control of the end product

The GBfA programme labelled six buildings, so random quality control of the end product is not applicable. Regular quality checks of the end product (ratings or reports) become more important when the number of buildings participating in the programme grows significantly. The ELO-scheme, which has the largest number of buildings covered by their label, randomly checks the quality of the energy labels and energy plans generated by the energy consultant (0.5% of the reports). A team, consisting of 5-6 auditors, is appointed to execute this task. The task includes contacting the client and the energy consultant, visiting the building and reading the report. In case the report is not up to standard, the energy consultant receives feedback from the team and gets an opportunity to rectify the report. If this is not done properly, the registration committee may deprive the registration of the energy consultant.

3.6.4 Concluding remarks

The GBfA programme did not have a system to ensure the quality of process and the product. It was also not necessary to develop such a system since only six buildings were included in the programme and most of the work was executed by the programme itself. Nevertheless, overall development plans of the GBfA did not mention a quality assurance and control system either.

Quality assurance and control is a means to obtain credibility from potential clients and therefore a necessity. This is illustrated by the reference case studies. It appears that the level of quality control is not related to the implementation approach of the programme (mandatory or voluntary), but to the scope of the programme (energy audit or benchmarking system). Quality control systems become more important and wide-ranging when an energy audit is included in the scope of work, and additionally, when the number of labelled buildings grows. The EPA-U and ELO include an energy audit in their processes and consequently the quality control in those programmes is much more extensive than in either of the benchmarking programmes.

3.7 Monitoring and Evaluation

Part of the work plan to introduce the GBfA programme into the commercial sector (Grobler and Singh 1998) was to determine the emission reduction potential and cost effectiveness of the showcase programme. However, this was not realised within the timeframe. From the reference case studies, it is clear that monitoring and evaluation is important in order to determine the impact of the programme and the actual effectiveness of the programme in terms of energy savings and emission reduction. Measurement and verification of the effects of the programme and individual buildings become more and more important, especially in terms of carbon credits and carbon trade[6]. Furthermore, when the impact of individual

[6] Carbon trading involves the trading of permits to emit carbon dioxide. CDM is a Kyoto Protocol mechanism, which allows Annex I parties to implement projects activities that reduce emission in non-Annex I parties, in return for certified emission reductions (CERs). These CERs can be used

projects is known, the labelling programme can monitor and evaluate the performance and progress of the programme. Ideally, a measurement and verification procedure should be able to quantify the impact of the labelling programme on project, regional and national level.

Due to technology development, it is very easy these days to obtain information via internet, etc. A web-based database is therefore a viable option for a labelling programme. An additional advantage of the ABGR, ENERGY STAR, and ELO schemes is that the labels have to be renewed annually, which means that the programmes can easily monitor the energy performance of the buildings included in the programme. In the case of the EPA-U, there is no renewal of the label required. This makes monitoring of energy savings more difficult. The labelling process should not be finished when the energy audit or labelling is complete. It is an added advantage to monitor building upgrades and their impact on the energy consumption.

by an Annex I party to achieve their emissions targets under the Kyoto Protocol (UNFCCC 2006). In order to become eligible for CDM projects, a project needs to be able to indicate the emission reduction due to the activities of the programme. It is therefore crucial that measurement and verification is integrated in the design of the programme (see also footnote on page 2).

4 Labelling Characteristics

4.1 Introduction

This chapter evaluates the GBfA according to Rogers' attributes of an innovation. An innovation is explained as 'an idea, practice, or object that is perceived as new by an individual or other unit of adoption' (Rogers 1995, p.11). Labelling can therefore be recognised as an innovation, since it is new and it has not been introduced to the market before. Rogers' attributes are frequently used to explain implementation difficulties or delays and to forecast implementation success. Rogers' attributes of innovation (section 2.6), consist of relative advantage (section 4.2), compatibility (section 4.3), complexity (section 4.4), triability (section 4.5) and observability (section 4.6). The chapter ends with a discussion about the relation between the adoption of the label and the actual energy efficiency improvements (section 4.7).

4.2 Relative Advantage of Labelling

Relative advantage is the degree to which an innovation is perceived better than the idea it supersedes (Rogers 1995). Relative advantages point out the benefits resulting from adopting the label. The degree of relative advantage can be expressed in economic terms (e.g. economic profitability, initial costs), but social prestige, convenience and the immediacy of the reward are also important. What matters is whether an individual perceives the innovation as advantageous. The more a building owner perceives a relative advantage the easier and faster the implementation of the labelling programme.

The relative advantages as promoted by the GBfA programme are that participation in the programme conserves the environment, saves money, and the client would gain positive public image through market recognition for its achievements.

Saving the environment

The primary goal of the GBfA is to make buildings more energy efficient, to achieve CO_2 reductions and contribute to stabilising climate change. However, energy efficient behaviour involves a conflict in what is best for the whole system (reducing CO_2) and what the individual would prefer to do (using electricity). Therefore, this concept is difficult to disseminate among individual building owners. Building owners do not see the relationship between their electricity use and the degradation of the earth. The majority of the building owners do not see conserving the environment as a relative advantage.

Money savings

GBfA emphasised the cost benefits of the programme. Economic profitability of energy efficiency is proven. The energy audits of the showcase buildings did show that on average 20-30% could be saved with low to medium investments costs. While the profitability of energy efficiency was proven, building owners were still hesitant to join the GBfA programme. Firstly, building owners had to commit themselves to a *three-year* programme, which could not indicate upfront what the exact financial profitability would be. Profitability only becomes clear after an energy audit is carried out, in other words after the building owner has committed to the programme. Secondly, the results and corresponding revenues are in the long term, not in the short term. The building owner has to invest money first, before he can experience the returns of energy efficiency. Additionally, the annual costs of being a GBfA partner were relatively high, compared with the reference case studies (section 5.3).

Market recognition and positive public image

The GBfA also put forward market recognition as a relative advantage to participating in the programme. Building owners could use the GBfA logo to promote their commitment and achievements regarding energy efficiency. Furthermore, the GBfA would recognise the Green Building Partner's achievements by publishing articles regarding the pollution prevented by participants and organising media events. Receiving recognition would therefore increase the social status of the Green Building Partner.

Displaying the GBfA label indicates that the building owner is committed to the improvement of energy efficiency of its facilities. It indicates that the owner committed to upgrade 80% of the floor area with cost-effective improvements within three years after entering the programme. An important weakness of the GBfA is that they did not have benchmarks for typical buildings, which meant that it was not possible to compare the building performance with other buildings. This is essential when the programme aims to support excellent performance; it should be known what excellent performance and common practice entails.

International experience regarding relative advantages

It appears that the benchmarking programmes (ABGR and ENERGY STAR) follow the same relative advantages as the GBfA. Energy saving is the most important advantage, promoted in combination with the market recognition for the achievements. Although reduction of CO_2 is the overall goal of the programmes, this is not emphasised as a relative advantage. The energy audit programmes (ELO and EPA-U) do not share the same relative advantages of the GBfA. These programmes do not rely on the market forces, and therefore indicate government incentives as most important. According to SenterNovem (2005), the main benefit for the building owner to participate in the EPA-U programme is the tax incentive.

Market recognition is put forward as a relative advantage by GBfA, ABGR, and ENERGY STAR . The three programmes put emphasis on the market recognition and competitive advantage a building owner gains when participating in the programme. The labels function as a trademark and provide market recognition. The labels are relatively simple, and do not give much information, but indicate that this company is committed to the energy efficiency of the building. Figure 4-1 shows the labels of GBfA, ABGR and ENERGY STAR.

The EPA-U and ELO programmes provide a label as well, but the function of the label is to provide information in a compact format, not to be used for display or marketing purposes.

Figure 4-1: Trademarks of GBfA, ABGR and ENERGY STAR

The meaning of the labels of each programme differs to some extent. The meaning of the GBfA is described earlier in this section; it indicates commitment of the building owner to energy efficiency and upgrading the buildings.

When a building displays an ENERGY STAR label, it indicates that the building belongs to the 25% best performing building in the USA. In the ENERGY STAR programme energy performance is expressed in consumption per square metre, yet this is coupled to a certain number of points on a scale from 1-100, calculated by the software program Portfolio Manager. The performance is compared with similar buildings. The programme provides benchmarks for offices, schools, hotels, hospitals, residence, and warehouses. When a building rates 75 points or higher, it means that the building ranks among the top 25% energy efficiency buildings and is eligible for an ENERGY STAR label.

Display of the ABGR rating indicates that a building owner or tenant obtained an official certified rating for the building. It does not necessarily mean the building is energy efficient. A simple counting exercise was carried out, using the online accredited-building database of the ABGR, to determine the percentage of buildings that obtained a certified rating while being energy inefficient. The database contains all building ratings; also those buildings that obtained a low rating. The results showed that 24% of the ratings scored lower than a 3-star rating (a 3-star rating represents good building performance; Table 4-1), 76% of the ratings were a 3-star rating or higher, and 40% of the ratings 4-star or higher (section 3.2 in Appendix B). It is possible that those buildings scoring lower than a 3-star rating are part of an energy efficiency programme that obliges building owners to rate their buildings upfront, upgrade their buildings, monitor the improvements and rate the building again. All performance ratings are disclosed on the internet.

Table 4-1: Rating and benchmarks of the ABGR for Sydney (ABGR 2005)

No of stars awarded	Rating	Description	Energy Performance (kg CO_2 per m^2)		
			Tenant	Base Building	Whole Building
★	Poor	Poor energy management or outdated systems	145 - 172	168 - 199	313 -372
★★	Good	Average building performance	118 - 144	136 – 167	253 – 313
★★★	Very Good	Current Market Practice	90 - 117	104 – 135	193–253
★★★★	Excellent	Strong Performance	63 – 89	72 – 103	134–193
★★★★★	Exceptional	Best building performance	0 – 62	0 – 71	0–134

Financial incentives

The ELO-scheme and EPA-U do not put forward market recognition as an important relative advantage of participating in the programme. The hosting governments provide incentives to building owners to increase the rate of adoption. The Dutch government provided incentives, such as subsidies and tax rebates, to start up the programme assuming that it triggers a self-generating process. The programme sees the tax rebates as the most important relative advantage for participating in the programme. The Danish government mandated the ELO scheme to ensure adoption of the programme.

Concluding remarks

It appears to be difficult to convince building owners on the benefits of the programme. The most important relative advantage of the labelling programme is the potential costs savings for the building owner. However, this relative advantage turns into a disadvantage when the building owner realises that he/she has to invest in energy efficiency upgrading first before he/she will experience the economic profitability. The reference case studies show same experiences concerning this problem. The Dutch and Danish governments realised that the relative advantage of a labelling programme is low and therefore introduced financial incentives (EPA-U) and induced labelling (ELO).

4.3 Compatibility of the Labelling

Compatability is ‘the degree to which the innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters’ (Rogers 1995). The relationship between compatibility and effectiveness of the labelling scheme is positive. A labelling scheme can be compatible or incompatible with socio-cultural values and beliefs; previously introduced ideas and clients need for the innovation. The adoption of an incompatible innovation, however, requires adoption of a new value system, which is a relatively slow process.

Existing values and beliefs

The GBfA introduced energy efficiency in commercial buildings. Sustainable use of electricity is not part of the values and beliefs of the building owners. GBfA promotes a desired behaviour, which is absent in the values and beliefs of most building owners because they do not see the direct benefit. GBfA requires the creation of a new value system to make energy efficiency a concern in business.

Compatibility with previously introduced ideas

There were no previously introduced ideas, which would have benefited the GBfA programme regarding the implementation. However, DME started recently with the implementation of appliance labelling. In Europe, USA and Australia appliance labelling probably contributed to the acceptance of building energy labels. In Europe, appliance labelling became mandatory from 1995. The ENERGY STAR programme established its first labels in 1992 for energy efficient computers, after that the label expanded to more than forty products. Labels for energy efficient buildings became eligible for residential dwellings in 1995 and commercial buildings in 1999. ENERGY STAR has established a brand name, which certainly contributes positively to the implementation of the building label.

Needs of the Building Owner

The programme identified the following needs for GBfA (Grobler and Singh 1998). Firstly, the ratification of the UNFCCC, which implied that efficient energy use should become a national priority. Secondly, Eskom launched a demand-side management (DSM) programme, whereby energy savings in commercial buildings would play a key role. Thirdly, several government departments indicated the importance of environmental friendly buildings. The CSIR identified the need for a programme that incorporated the various initiatives. These needs are all perceived needs of the GBfA programme managers and government, while building owners do not necessarily recognise these as needs and therefore do not act accordingly.

4.4 Complexity of the Labelling

Complexity is 'the degree to which an innovation is perceived as difficult to understand and use' (Rogers 1995). The level of complexity of a product is negatively related to its rate of adoption. New ideas that are easier to understand are adopted more rapidly than innovations that require development of new skills and understandings.

Complexity of the label is expressed as the level of detail of the aim of the programme, evaluation of the energy performance, identification of energy savings measures, reporting and market recognition. Table 4-2 gives a summary of the complexity of the labelling process. Furthermore, the involvement of an energy consultant also indicates the level of complexity of the process.

The GBfA was a complex and comprehensive programme. The energy performance evaluation is based on a detailed energy audit of the specific building. The audit creates a thorough energy consumption profile of the building and its service systems. The audit evaluates the local electricity tariff structure and the impact of the local climate conditions. Identification of possible energy savings plays an important role. With the help of simulation software, potential measures to improve energy efficiency are explored. It identifies potential upgrades, expected savings, investment costs, and recommendations for each of the following implementation stages:

Stage 1: Lighting upgrade
Stage 2: Building tune-up
Stage 3: Load reductions
Stage 4: Air distribution systems
Stage 5: HVAC plant upgrade

The results of the energy audit are compiled into an energy report, which is a detailed technical report. It covers an energy consumption profile, energy savings measures, professional advice on performance improvement, expected savings and the investment costs.

Table 4-2 shows that the energy audit programmes are more extensive in all aspects. Firstly, the evaluation of the energy performance is done by means of an energy audit, which provides a detailed and facility-specific energy profile of the building. Secondly, improvement suggestions are facility-specific and accompanied with potential savings, investment costs, rate of returns and payback time. The suggestions relate to improvements regarding architectural characteristics, building services and building management. Thirdly, the results are compiled in a detailed technical report. The role of the energy consultant is crucial in the process to obtain an EPA-U, ELO and GBfA label. The energy consultant is responsible for the actual work, building inspection, calculation of the energy performance, energy savings, recommended building improvements and the final report. The energy audit programme tools and software are attuned to the tasks of the energy consultant. The software is more complex and technically sophisticated than the tools provided by the benchmarking systems, aligned to the technical knowledge level of the energy consultant.

Table 4-2: Summary of comprehensiveness of the label

Evaluation of energy performance	**EPA**	**ELO**	**GBfA**	**ABGR**	**ES**
Statement of Energy Performance	X	X	X	X	X
Brief energy consumption profile		X			
Comprehensive energy profile	X		X		
Identification of improvements	**EPA**	**ELO**	**GBfA**	**ABGR**	**ES**
Improvement suggestions provided by general software program				X	X
Improvement suggestions facility-specific by professional consultant	X	X	X		
Indication of the potential savings of the measures	X	X	X		
Indication of investment costs and pay-back time	X	X	X		
Reporting of the results	**EPA**	**ELO**	**GBfA**	**ABGR**	**ES**
Brief summary of the results				X	X
Summary plus covering of energy savings recommendations		X			
Detailed technical report	X		X		
Recognition of achievements	**EPA**	**ELO**	**GBfA**	**ABGR**	**ES**
Label is used as trademark			X	X	X
No recognition of achievements	X	X			

The benchmarking programmes are simpler and less complicated. Evaluation of the energy performance consists solely of rating the energy performance by means of a software tool. Since the benchmarking programmes do not include a physical visit to the facility by an energy consultant, suggestions for improvement are also not part of the labelling process. However, both programmes provide extensive information and support tools to guide the property owner on how to improve the energy efficiency of the facilities. The Diagnostic Tool of the ABGR provides suggestions regarding lighting, equipment, miscellaneous easy savings, air-conditioning savings, and building envelope. Although many assumptions and generalisations are made in the creation of potential improvements, it helps the building owner or tenant to identify the most obvious improvements.

The ABGR and ENERGY STAR provide a range of tools to make it less complicated for the building owner. Because the energy consultant only gets involved in the latter stages of the process to obtain a label, the tools are attuned to the level of knowledge of the client, who in most cases is a non-technical. The tools are freely available from the website. The ABGR provides a Star Rating Calculator (see Figure 4-2) which calculates the energy performance and the Diagnostic Tool, which provides the energy saving opportunities. The Star Rating Calculator is a static software tool, meaning that it calculates the energy performance at a certain point in time. Both tools are uncomplicated and user friendly.

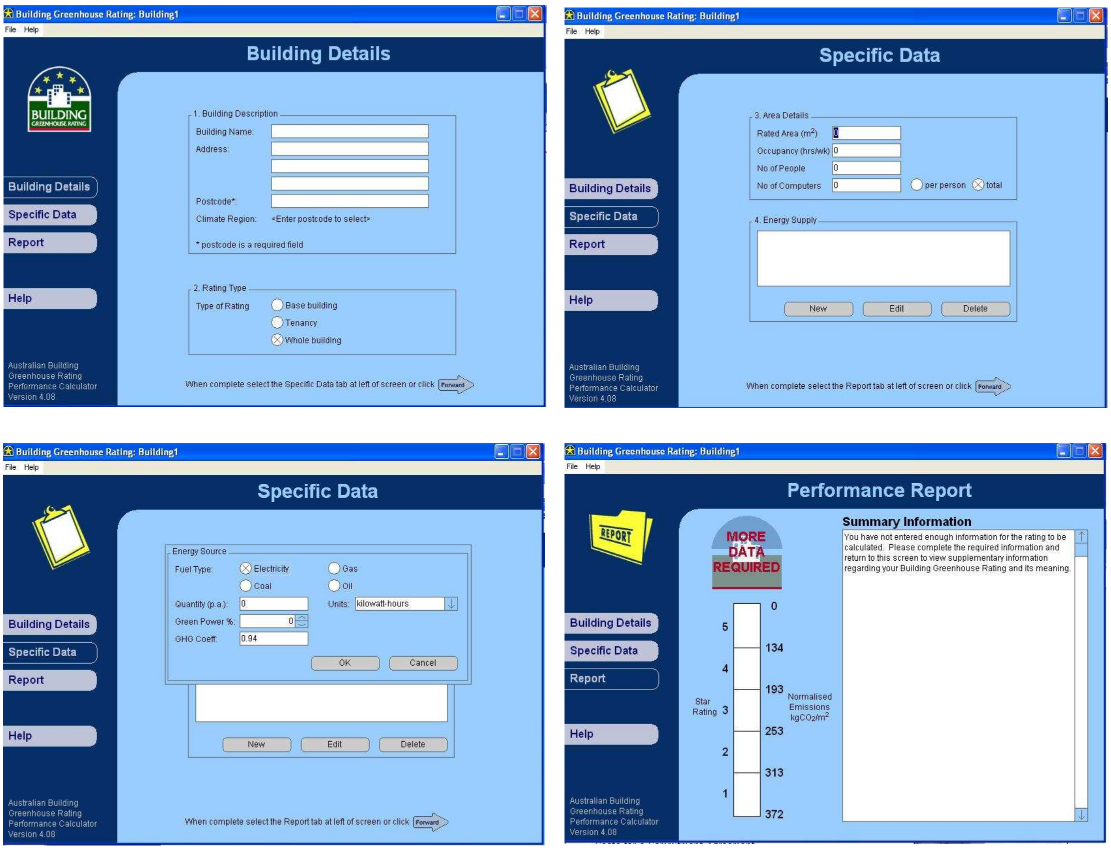

Figure 4-2: Preview of the ABGR rating tool (ABGR 2005)

The rating tool of ENERGY STAR is more complex than ABGR's performance rating tool and works as a facility management tool; it can assist the facility manager in monitoring energy consumption. The tool is a dynamic tool, meaning that it monitors the energy performance over time and multiple meter readings can be used as input. The user can adapt the format according to the needs and preferences. The tool is web-based and is not downloadable to the local computer. The building owner can use an excel format off-line and this can be uploaded when he/she is on-line. ENERGY STAR furthermore provides extensive information on their website. For all the steps in the process, there is a document which guides the client through the phase.

The table and the analysis show that the level of complexity is directly related to the scope of assessment. Case studies including an energy audit (EPA-U, ELO and GBfA) are more complex and comprehensive than the benchmarking programmes, which only rate energy performance of buildings (ABGR and ENERGY STAR).

Concluding remarks

The GBfA appears to be the most extensive programme. The complexity of the programme has most likely contributed to the failure of adoption by building owners. EPA-U and ELO are also complex programmes, but their government heavily supports them. It is unlikely that this approach is feasible on a voluntary basis without any government support or other continuous financial resources. The voluntary and market-based programmes, ABGR and ENERGY STAR, are less complex, which most likely contributed to their implementation success.

As can be derived from the table the labelling process of GBfA shows more resemblance with EPA-U and ELO than with ABGR and ENERGY STAR. EPA-U and ELO are government controlled and supported in the implementation process; their programme design is not based on market-based principles. ABGR and ENERGY STAR on the contrary, as well as GBfA, follow a more commercial approach. It was therefore assumed that GBfA would show similarities regarding complexity with the ABGR and ENERGY STAR.

4.5 Triability of Labelling Process

Triability is 'the degree to which an innovation may be experimented with on a limited basis' (Rogers 1995). An innovation that is triable, represents less uncertainty to the individual who is considering it for adoption. To explore the possibilities for triability, the section focuses on the process which needs to be undertaken to obtain a label. This section explains the different stages in the process and the roles and responsibilities of the building owner and the energy consultant.

The GBfA does not give the building owner an opportunity to experiment with energy efficiency before committing to the programme. Signing the MOU implies that the building becomes a member of the GBfA programme, and the building owner commits to the programme for at least *three years*. In the MOU, participants commit to execute an energy audit of the entire building and conduct an analysis on the potential cost-effective upgrades within the first six months by a professional energy consultant. In addition, the client commits to upgrade 80% of the floor area with cost-effective measures, without compromising on the indoor comfort and safety, within three years. Monitoring and evaluation is therefore also part of the process. Such a commitment is extensive and has rigorous consequences for the organisation. The difficulties faced in bringing together a representative showcase programme illustrate the hesitance of building owners to participate. Triability appears to be more important for early adopters as they have no precedent to follow. To lower the barrier, GBfA carried out the programme with no costs involved for the showcase partners. This was done to create the opportunity to demonstrate the cost-effectiveness of energy efficiency and transforming the showcase partners into peers to trigger other companies to join.

Figure 4-3 schematically represents the process of obtaining a label for benchmarking programmes and energy audit programmes. The critical issue here is up to what point the building owner can explore and try-out the labelling programme before having to make a commitment to the programme, thus adopting the label. Figure 4-3 attempts to illustrate the level of triability by indicating the point of commitment. As can be seen, the point of commitment regarding the energy audit programmes is right at the beginning of the process. There is no opportunity to obtain an indication of the performance of the buildings first, before entering the programme. The building owner commits to the programme, the energy consultant carries out the energy audit and provides the building owner with the label. From here, the building owner can decide to either upgrade the building or leave it as it is.

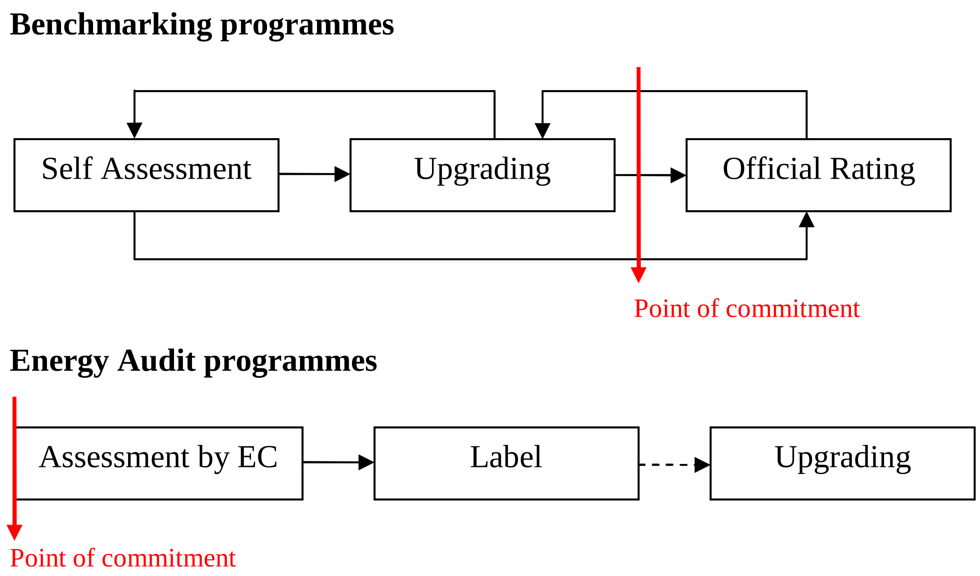

Figure 4-3: Process scheme of labelling

In the case of the benchmarking programme, the point of commitment to the programme is not in the beginning of the process. The ABGR and ENERGY STAR provide measuring tools on their websites, which allows the building owner to carry out self-assessments to determine the performance of the buildings. In case of the ABGR programme, the building owner can obtain an official rating after the self-assessment, also when the building is not performing well. More likely, the building owner explores the opportunities for upgrading the building, in case the building is not performing well. This can be done with the help of another tool, which indicates what steps can be taken to achieve energy efficiency. The building owner may involve an external energy consultant, for example if there are no in-house engineers. The building owner improves the performance of the building and monitors progress during the year. At the point where the building owner is satisfied with his/her performance, he/she can apply for an official label. Only at this point does he/she have to make a commitment and pay for the privileges offered by the programme.

However, benchmarking programmes and energy audit programmes can supplement each other. Benchmarking programmes can be used by a building owner to self-assess the performance of the buildings. In the case that the building is performing badly, the building owner can decide to figure out what interventions needs to be undertaken to improve the performance of the building. However, most of the times the building owner does not have the technical knowledge and skills, and therefore an energy consultant can be recruited to do this for the building owner. After upgrading, the building owner can submit the building to the benchmarking programme for the label.

In the case of the ENERGY STAR programme, the building owner is able to make use of the tools and resources without committing to the programme. However, when the building owner decides to implement energy efficiency in his/her buildings, some level of commitment to energy efficiency is expected from the building owner to bring the project to a success. This can be done by becoming an ENERGY STAR partner. To become a partner, the CEO, CFO or top administrator must sign the partnership letter. The partnership represents commitment to monitoring and benchmarking energy performance, develop and implement an action plan to improve the energy performance, and to educate staff about the partnership. The building owner will not be able to apply for a label until the building is compliant with the minimum energy efficiency requirements (75 points out of 100).

The websites of the ABGR and the ENERGY STAR play an important role in increasing the level of triability of the labelling programmes. The websites provide information, tools and case studies to illustrate the benefits and results of the programme.

Concluding remarks

The triability of the energy audit programmes is much lower than the benchmarking programmes. Costs and commitment are required from the beginning of the process, whilst the financial profitability remains uncertain until after the energy audit. Moreover, in the case of the GBfA the building owner has to commit himself/herself to a three-year programme and to cost-effective upgrading of 80% of the facilities floor area, without knowing what the financial profitability will be. Building owners were not provided with the opportunity to self-assess their performance before involving an energy consultant.

4.6 Observability of Labelling

Observability is the degree to which the results are visible to others (Rogers 1995). Regarding a labelling programme for commercial buildings, it is important that the results will be visible for their (future) clients and competitors. However, the difficulty is that energy efficiency is not visible in a building.

The GBfA programme developed the label and trademark to make energy efficiency visible to others. Furthermore, the GBfA programme responsibility was to publish articles regarding the achievements of the participants and organising media events to give the participant the opportunity to present their achievements. The energy audit programmes, EPA-U and ELO, have no activities in place to provide for observability of the achievements of the building owner. Figure 4-3 shows a dotted line between label and upgrading in the case of the energy audit programmes. The energy audit programmes provide detailed advice on how to improve the energy performance of the building, but this does not necessarily mean that the building owner actually upgrades the building. Because the upgrading is not part of the process, the programmes do not include monitoring of the improvements and the corresponding energy savings. In the case of the EPA-U, the building owner has to go through the process again to demonstrate the achievements. This process makes it impossible to visualise achievements of the building owner to the public. The ELO-scheme requires annual labelling; it is therefore possible for the programme to monitor improvements in energy efficiency. However, the programme does not use this information to disseminate excellent achievements to the public. GBfA incorporated upgrading into the process, which made monitoring and dissemination of achievements possible. However, this increased the level of complexity of the programme significantly.

The ABGR and ENERGY STAR developed the labels to increase the observability of the programme to the public. The programmes award best practice, displaying the ENERGY STAR label means that the building belongs to the 25% top performing buildings regarding energy efficiency.

4.7 Impact of Adopting Labelling

The main goal of labelling programmes is to reduce CO_2 emissions. To achieve this goal the programme stimulates improvement of energy efficiency in buildings. By adopting the labelling programme, it is assumed that the participants shall upgrade the building. However, does labelling by definition imply implementation of energy efficient measures?

Energy audit programmes provide the building owner with a very detailed, facility-specific report on what the energy performance is of the building and what the building owner must do to improve it. Investments costs, rates of return, payback times are all specified in the report. However, there are no commitments to actually implement the improvements suggested. Is this information provision sufficient to stimulate the building owner to actually implement the proposed energy efficient measures?

Benchmarking programmes provide a tool which measures and rates the energy performance of the building. This allows the building owner to compare his/her buildings with other buildings. Will a building owner be triggered to explore possibilities of improving the energy performance of the buildings and implement them, when he/she measures a 1-star rating (ABGR) or when he/she does not belong to the 25% best performing buildings (ENERGY STAR)?

The GBfA programme carried out six detailed energy audits for the showcase partners. These six showcase partners only implemented those suggestions provided by the report, which involved little or no investment costs. Because GBfA made energy efficient upgrading part of the GBfA process, participating in the GBfA can therefore be linked to actual upgrading of the building.

An evaluation of the mandatory ELO-scheme, estimated that 36-55% of the building owners who receive an energy label and energy plan, carry out one or more of the suggested improvements (Reinikainen 2002). Issuing an ELO label does therefore not guarantee upgrading of the building. The Danish government could improve this percentage by e.g. obliging the building owners to implement all cost-effective measures with a payback period of less than three to five years.

According to a feasibility study carried out in commission for SenterNovem, it was estimated that only 10% of the commercial building market would voluntarily carry out an EPA-U (Corpelijn et al. 2004). However, a high percentage of these participating building owners will most likely upgrade their buildings, because why carry out an expensive energy audit without being willing to upgrade the building? The people who carry out an EPA-U programme are already interested in upgrading their buildings, and they use the EPA-U as a tool to identify the most effective measures. Barriers to participate in the programme are quite high, due to the comprehensiveness and costs of the programme. It can therefore be argued that issuing an EPA-U label does not guarantee upgrading, but due to high barriers to participation, it is argued that once a building owner has overcome these barriers he/she is also more willing to upgrade the building.

The ENERGY STAR programme proudly announced that 21 000 buildings have been evaluated with the energy star rating system, Portfolio Manager. Up to January 2006, only 2 500 of these buildings received the ENERGY STAR label, meaning that these buildings belong to the 25% best performing buildings of the country. This implies that only 12% of the buildings evaluated have improved their energy performance to such a level that they are eligible for an ENERGY STAR label. However, the fact that 21 000 buildings have been evaluated and rated with the Portfolio Manager indicates that entry barriers to participate in the programme are low. Participation in the ENERGY STAR programme therefore does not guarantee that the building owner will upgrade the building. Obtaining an ENERGY STAR label indicates that the building has reached a certain energy performance.

As said earlier, 40% of the labels issued by the ABGR programme achieved an excellent or exceptional energy performance. No evidence is available to suggest that the labelling programme is responsible for this achievement or that the rating triggered the building owner to upgrade the building.

It can be argued that the building owners who participate in a voluntary labelling programme are already interested in energy efficiency and are likely to improve the energy performance of the building. The labelling programme then functions as a facilitation programme. It facilitates those building owners who are already interested in energy efficiency with the right equipment and tools to upgrade the energy performance of the building.

It cannot be stated that an energy audit programme is more successful in triggering building upgrading than a benchmarking programme, or visa versa. Energy audits are expected to be more effective due to the complexity and comprehensiveness of the approach. However, comprehensiveness and complexity goes hand in hand with increased costs and time. The choice for either an energy audit programme or benchmarking programme depends on the context in which the labelling programme takes place. Energy audit programmes require government support in order to be successful.

5 National Context

5.1 Introduction

It is important to understand how the labelling programme fits into the government approach towards energy efficiency and CO_2 reduction. This chapter analyses the current situation in South Africa and refers to the countries which are linked to the case studies included in the research. Table 5-1 briefly reiterates which countries correspond with the international labelling schemes:

Table 5-1: Overview of labelling scheme and corresponding country

Labelling Scheme	Country
Australian Building Greenhouse Rating (ABGR)	Australia
Energie Prestatie Advies (EPA-U)	The Netherlands
EnergiLedelsesOrdeningen (ELO)	Denmark
ENERGY STAR	United States of America
Green Buildings for Africa (GBfA)	South Africa

Section 5.2 outlines the international frameworks the countries are involved in, followed by section 5.3, which discusses the different national approaches of the countries. Section 5.4 goes through the implementation instruments regarding energy efficiency and energy savings in the built environment with special focus on the commercial building sector. Finally, section 5.5 summarises the opportunities and threats arising form the international and national context.

5.1.1 Some energy statistics

This section starts with some quantitative facts to get an understanding of the energy consumption and intensity of South Africa and the countries included in the study. The dark grey boxes in Table 5-2 present the worst performance and the light grey second worst performance. This shows South Africa is not performing well. The energy and emission intensities of South Africa are the highest, due to the very energy intensive nature of the economy[7]. Interestingly, South Africa consumes 48% of Africa's total energy consumption and is responsible for 42% of Africa's CO_2 emissions (IEA 2005).

Table 5-2: Energy facts (IEA 2005, p48-57)

	World	Australia	Denmark	Nether-lands	South Africa	United States
Population (Million)	6 268	21.01	5.39	16.22	45.83	291.09
GDP (PPP) (Billion 2000$)	49 315	566.18	156.75	439.95	447.91	10 330
TPES[8] (Mtoe)	10 579	112.65	20.76	80.83	118.57	2280.79
CO_2 emission (Mt of CO_2)	24 983	347.13	56.21	184.69	317.97	5728.63
$CO_{2\ country}$/$CO_{2\ world}$ (%)	100	1.3	0.22	0.74	1.27	22
Electricity price	--	0.0357	0.0950		0.0122	0.0490
TPES/Pop (toe/capita)	1.69	**5.63**	3.85	4.98	2.59	**7.84**
TPES/GDP (PPP) (toe/000)	0.21	0.20	0.13	0.18	**0.26**	**0.22**
Elec. cons./pop (kWh/capita)	2 429	**10 642**	6 599	6 748	4 504	**13 066**
CO_2/pop (tCO_2/capita)	3.99	**17.35**	10.43	11.38	6.94	**19.68**
CO_2/GDP (PPP)	0.51	**0.61**	0.36	0.42	**0.71**	0.55

At the same time, South Africa has the lowest energy prices worldwide, which is not an incentive for energy savings and energy efficiency. However, South Africa is facing rapid growth in energy demand without an increase in energy generation capacity. Therefore, peak demands will outstrip energy supply around 2006-2007 and will have its effects on energy prices. Eskom has already announced price increases of 6% annually.

[7] Energy intensity is the amount of energy used for every Rand, measured in TPES/GDP (PPP); Emission intensity is the amount of CO_2 emitted for every Rand, measured in CO_2/GDP (PPP)

[8] Total Primary Energy Supply (TPES), which is energy production + imports – exports – international marine bunkers ± stock changes (IEA 2005).

Furthermore the table shows that the USA has 4% of the world population, but produces 22% of the total CO_2 emissions in the world. Australia has 0.34% of world's population, but is responsible for 1.37% of the total CO_2 emissions. In addition, Australia and the USA have extremely high electricity consumptions, total energy and emissions per capita, which are almost double the figures for Denmark and the Netherlands.

The energy statistics and indicators show that Australia and the USA are not performing well, and of concern is that South Africa has very high energy and emission intensities. In the next 50 years, South Africa's energy demand is likely to grow considerably, simply because of economic growth and improved distribution of electricity to households[9]. According to Douglas et al. (2005), total energy demand and electricity requirements will double by 2040 if no interventions are taken.

5.2 International Framework for Climate Change

There are three international agreements which are worthwhile mentioning and discussing. The UNFCCC, including the Kyoto Protocol, is the most important since it is a global agreement affecting all countries. The Asia Pacific Partnership on Clean Development and Climate and the European Union are regional agreements.

5.2.1 UNFCCC and Kyoto Protocol

The UNFCCC was initiated in 1990 and came into force in 1994. Almost worldwide membership indicates the importance of the climate change issue. However, requirements of the UNFCCC were not sufficient to tackle climate change. The Kyoto Protocol was developed to introduce more stringent commitments for industrialised countries. Unlike the UNFCCC, the Kyoto Protocol outlines legally binding obligations for countries. The goal of the

[9] Currently, ~30% of the households in South Africa do not have access to grid-electricity

protocol is to reduce emissions of greenhouse gases with an average of 5.2% in the period 2008-2012 with base year 1990. The protocol came into force on February 16, 2005.

South Africa ratified the convention on August 29, 1997 and the protocol on July 31, 2002. South Africa is categorised as a Non-Annex I, or developing country, which means that they are not compelled to actively reduce the greenhouse gas emissions. However, South Africa is required to report on national emissions and is encouraged to consider climate change issues in their national policies (EIA 2004). It is unknown what the responsibilities for South Africa will be after the first compliance period of the Kyoto Protocol, which ends in 2012. The first discussions regarding the post 2012 period started in May 2005, but no agreements have yet been made. South Africa suggested at this meeting that more countries should be included in the Annex I list after 2012 (BNA 2005).

The USA and Australia both signed and ratified the UNFCCC, but only *signed* the Kyoto Protocol. Because they did not *ratify* the protocol, they are not obligated to achieve the targets set in the Kyoto Protocol. The targets set for Australia and the USA are respectively an 8% increase and a 7% reduction of the GHG emissions with regard to emission levels of 1990. Both countries state that ratifying the protocol is going to harm their economy significantly. Furthermore, they disagree about the fact that there are no legal binding implications for the Non-Annex I countries. According to Australia and the USA, climate change is a global problem, which should involve *all* countries. Hereby they refer to China and India, who are large emitters of greenhouse gases in absolute terms, but are not legally bound to reduce their GHG emissions.

Denmark as well as the Netherlands signed and ratified the convention and the protocol as members of the European Union (EU). All members of the EU submitted their ratification on the May 31, 2002. The EU agreed to the largest reduction commitments compared to all the other countries that ratified the Kyoto Protocol. The EU agreed to reduce its emissions by 8% with regard to emissions levels in 1990. The EU Burden Sharing Agreement outlines the distribution of the targets among the member states. Denmark agreed to a very ambitious reduction target of 12%, while the Netherlands committed themselves to a reduction of 6%.

The UNFCCC and the Kyoto Protocol are not addressing emission reduction in the built environment directly. This is because the Kyoto Protocol uses a calculation methodology, which assigns emissions to the converters of fossil fuels to an energy carrier (heat or electricity). In other words, electricity generators (e.g. Eskom) are held responsible for the GHG emissions they generate, even though the built environment is the end-user of the electricity.

The Kyoto Protocol sets targets for emission reductions, but also provides certain mechanisms to assist countries to achieve their targets. The Clean Development Mechanism (CDM) provides for Annex I countries to initiate projects in Non-Annex I countries to reduce emissions. However, to date there are two South African CDM projects officially registered, which are ‘Kuyasa low-cost urban housing energy upgrade project, Western Cape’ and ‘Lawley Fuel Switch Project’. The UNIDO (2003) identified several energy efficiency measures in the residential, public and commercial building sector as eligible for CDM projects. This could create an opportunity for the Green Buildings for Africa Programme.

5.2.2 Asia Pacific Partnership on Clean Development and Climate

Australia and the USA joined forces in the Asian Pacific Partnership on Clean Development and Climate. The partnership is between USA, China, India, Japan, Korea and Australia to respond to the challenge of climate change, energy security and air pollution. These countries together are responsible for approximately 50% of the total greenhouse gas emissions. The partnership is an international non-treaty, which means that there are no legal binding agreements, and was only launched on January 12, 2006 in Sydney. Critics say that the partnership is ineffective due to lack of mandatory agreements and is nothing more than a public relation exercise (Wikipedia 2006).

5.2.3 European Union

Denmark and the Netherlands are both members of the EU, and are therefore subject to the rules and regulations of the EU. In 1991, the European Commission launched the first strategy to limit CO_2 emissions and improve energy efficiency. In 1997, the European Union Treaty was revised to accommodate an environmental dimension in order to achieve sustainable development. Every five years the European Union launches an Environmental Action Plan. Developing a common energy policy is complicated due to major differences in country policies and their reliance on different energy generation methods. As a result, the EU mainly focuses on promotion of energy efficiency and the development of renewable energy sources. They have committed themselves to double the amount of renewable energy resources from 6% in 1995 to 12 % in 2010. In 2000, a policy document called ‘EU policies and measures to reduce greenhouse gas emissions’ was presented to break new ground regarding possible future enforcement of the Kyoto Protocol (EC 2000). This also resulted in the establishment of the European Climate Change Programme (ECCP). The goal of the ECCP is to identify and develop all the necessary elements of an EU strategy to implement the Kyoto Protocol and achieve the targets.

The European Union recognises the importance of energy efficiency in the built environment, residential as well as non-residential, to achieve Kyoto targets. The built environment is the largest energy user in absolute terms, adding up to 40% of the final energy demand. Therefore, the EU developed a very important legislative instrument, the Energy Performance for Buildings Directive (EPBD). The directive was adopted in December 2002 with overwhelming support from the Member States and the European Parliament. Consequently, the EPBD came into force in January 2003. Research (Mure 1998) estimated that the potential cost-effective savings within the building sector could have added up to 22% by 2010 if it was fully implemented in 2003. Member states were required to implement the Directive from January 2006. The majority of the member countries, except for Denmark and Germany, do not have all the mechanisms in place to comply with the directive.

The main goal of the directive is to stimulate energy efficiency improvements in the built environment throughout the whole building lifecycle, and therefore affects a large number of stakeholders in the built environment; e.g. designers, housing associations, architects, property owners, contractors, installation companies. The EPDB consists of five requirements (EC 2002):

- A methodology to calculate the integrated energy performance of buildings
- Minimum energy standards for new buildings
- Minimum energy standards for large existing buildings when large renovations are undertaken
- Energy certification for buildings
- Inspection and assessment of heating and cooling installations

The energy certification of buildings is required when buildings are constructed (new buildings), sold or rented out (existing buildings), whereby the owner is responsible to provide the label to the potential buyer or tenant. The certification states the energy performance of the building, with an additional advice on how to improve the energy performance of the building. For public buildings, certification is used for disclosure and display of the energy performance. Certificates are valid for a period of 10 years.

Concluding remarks

International commitments are an important incentive for countries to be actively involved in the reduction of greenhouse gases. The Netherlands and Denmark have legal responsibilities towards the Kyoto Protocol and the European Union. Moreover, the European Union directly addresses the built environment with the EPBD, which requires the member states to have mandatory labelling in place. This means that the labelling programmes in the Netherlands and Denmark are driven and forced upon by a regional framework.

The USA and Australia do not have any legal responsibilities regarding an international framework. Although both countries state that they are committed to play a leading role internationally and to achieve their internationally agreed emissions, they did not ratify the protocol.

South Africa signed and ratified the Kyoto Protocol, but does not have any obligations towards emission reduction. It is therefore unlikely that energy efficiency and emission reduction will become high priority on the agenda of the South African government. There are currently no legal penalties for South Africa regarding the Kyoto protocol, but this is likely to change in 2012 when the first term is finalised and targets will be evaluated and re-allocated among the countries that ratified the protocol.

5.3 National Framework for Climate Change and Energy Efficiency in the Built Environment

The GBfA programme started in 1997. At that time, there was little attention and no incentives for energy efficiency. The programme was very novel for that period, which is one of the major reasons why implementation was difficult. South Africa was not yet ready for a labelling programme as energy efficiency was a very new issue. Awareness levels were very low and there was no policy in place to address energy efficiency.

Only in 1998 did South Africa start to develop policies towards climate change. The White Paper on Energy (DME 1998a), was the first policy document dealing with energy efficiency. The White Paper addresses demand sectors, supply sectors and crosscutting issues. Energy efficiency is identified as one of the crosscutting issues. The White Paper acknowledges that the government has paid little attention to the promotion of energy efficiency, and confirms the significant potential and opportunities for energy efficiency improvements in South Africa. Estimations of potential energy savings vary between ten and twenty percent for current energy consumption.

The White Paper states that '*the government will promote energy efficiency awareness amongst industrial and commercial energy consumers, and will* *encourage the use of energy-efficient practices by this sector'* (DME 1998a). The paper raises concerns that South Africa does not have any energy efficiency standards, norms or regulations for the commercial building sector. It points out that 20% of the total municipality electricity consumption is utilised by commercial buildings. Cost effective improvements as well as improved design and management practices can realise energy savings of 30%. The government is therefore determined to establish energy efficiency standards and energy audit schemes for commercial buildings. However, the major barriers to energy efficiency are the lack of expertise in industry and lack of capacity within government. The paper suggests the establishment of a National Energy Efficiency Agency to work around the capacity problems.

September 2004, DME released the Draft National Energy Bill for public comment. The bill provides DME with a legal mandate for a budget and structure to establish a national energy efficiency programme. To date the bill is still in draft form.

In March 2005, the DME published the Energy Efficiency Strategy of the Republic of South Africa (DME 2005). The strategy presents a plan of action to implement the goals of the white paper on energy. The strategy outlines the importance of energy efficiency and presents the goals and targets of DME in terms of sustainable development of the energy sector and energy consumption.

The overall energy efficiency target for South Africa is determined to be a reduction in energy consumption of 12% by 2015. This is a 12% reduction with regard to the projected energy consumption in 2015. The target for the commercial and public building sector reflects a 15% energy consumption reduction by 2015. Yet, the strategy does not quantify what this means for the commercial building sector in terms of actual consumption. A simple calculation estimates that this target implies that the consumption *growth* of the commercial building sector needs to be halved[10]. The strategy is a step in the right direction, but it lacks detail on the implementation programmes. Outcomes, targets and budgets are vague and the output activities and measures are not clearly described and defined.

Looking at the implementation of the labelling programmes in the other countries, it is noticed that they were implemented at a time when energy efficiency was already integrated in national policy and action plans. Denmark, the Netherlands and the USA have a long history of policy stimulating energy savings and energy efficiency. Due to the oil crisis in the seventies and the dependence on imports to secure the energy supply, the countries developed their first energy plans in the late seventies. The Dutch have facilitated energy efficiency in the built environment since the seventies. Awareness campaigns were launched and pilot projects started. However, it took the Netherlands until 1995, to implement the first significant measure to improve energy efficiency in the built environment. In this year, energy performance norms were integrated into the building regulations. The Danish also revised their building regulations in 1995 to include energy standards. The USA have developed national energy codes from 1989. However, jurisdictions are not compelled to implement the energy codes. Currently, 35 states have mandatory energy standards for commercial buildings.

In conclusion, these countries were promoting energy efficiency in commercial building and integrated energy norms in the building regulations years before they started with the labelling programmes. The GBfA programme was ahead of time when it started in 1997. There was absolutely no attention shown for energy efficiency in commercial buildings and there was no national policy framework in place. Although energy efficiency is not yet on the national political agenda due to

[10] Current consumption commercial building sector is 4% of 2400 PJ, which is 96 PJ. In 2015, the projected consumption is at least 4% of 3200 PJ, which is 128 PJ. The targeted consumption in 2015 is a 15% reduction of the projected consumption, which is 109 PJ. This implies that the consumption can grow over 10 years by 13,5% (target) instead of the projected 33%. The figures used in this calculation are derived from the Energy Efficiency Strategy (DME 2005).

other pressing needs, things are changing; energy efficiency is becoming increasingly important. The DME has developed a national policy framework and strategy to stimulate energy efficiency in South Africa. It would therefore be an appropriate time to start developing a labelling programme such as the GBfA programme.

5.4 Labelling Schemes and the Overall Strategy to Stimulate Energy Efficiency in Commercial Buildings

The case studies recognise the building sector as important in the national frameworks to stimulate energy efficiency. This section discusses the strategy and corresponding implementation instruments to stimulate energy efficiency in commercial buildings.

Table 5-3 gives a summary of the implementation instruments of each country regarding the commercial building sector. The table shows that Australia (federal government and NSW state government combined) and the Netherlands have developed a comprehensive approach to target the commercial building sector. The approach consists of a mix of regulatory, economic and self-regulating instruments.

The Danish government relies completely on a mandatory approach, while the USA promotes energy efficiency through voluntary programmes. The USA federal government promotes energy requirements in the building regulations, but does not make it compulsory for the jurisdictions to integrate these requirements in the regulations. The ENERGY STAR programme is the highlight of the USA strategy for energy efficiency in commercial buildings.

Table 5-3: Implementation instruments for energy efficiency in commercial buildings

Type of Instrument	Australian Instruments	Dutch Instruments	Danish Instruments	USA Instruments	South African Instruments
Regulatory instruments	Mandatory energy disclosure at sale or change of lease ***(in dev)***	Building regulations: energy performance norm	Building regulations		Energy Efficiency Standard for Buildings (SANS 204) ***(in dev)***
		Environmental management act	Energy audit programme: Scheme (ELO)		Mandatory energy audits for commercial buildings ***(in dev)***
		EPBD	EPBD		
Economic instruments	Energy savings fund (NSW)	Fiscal incentives/ subsidies			
Self regulating instruments	Voluntary office rating scheme: ABGR	Energy audit programme: EPA-U		Building rating scheme: ENERGY STAR	SAEDES guidelines
	Building regulations: Minimum standards in Australian Building Code ***(in dev)***	Long term agreements		Executive Order 13123: Greening the government through energy efficient management	Energy efficiency accord
	Memorandum government buildings (NSW)			Building regulations	

5.4.1 South African strategy for the commercial building sector

The South African Energy Efficiency Strategy (DME 2005) outlines interventions towards energy efficiency in the South African commercial building sector. The strategy proposes a combination of regulation and voluntary activities.

DME has mandated the SABS to develop energy-efficiency standards for buildings. There are currently two projects running, the South African National Standards (SANS) 283 and SANS 204. The SANS 283 covers naturally ventilated buildings and falls under the Department of Housing. The other energy efficiency standard, SANS 0204 *'Energy standard for buildings excluding those with passive environmental control'* will be applicable to commercial buildings. The standard is still in development process, but according to the Energy Efficiency Strategy, it needs to be finalised and integrated into the National Building Regulations by 2008. Additionally, DME wants, in combination with the energy standard, to introduce energy labels to assist in compliance monitoring (DME 2005).

The SANS 204 is being developed based on the South African Energy and Demand Efficiency Standards (SAEDES) for new and existing buildings, published by the DME in January 1998. The SAEDES guideline was developed to reduce building energy consumption and/or demand, thereby improving energy and cost effectiveness within the commercial building sector (DME 1998b). The guideline was tested and evaluated during 2000-2004 and this evaluation showed that the application of the guideline indeed results in energy efficiency and cost savings. However, the pilot study also indicated that the guideline is not user-friendly and empowering legislation is needed to make the guideline effective (Parsons 2004).

The Energy Efficiency Strategy also introduces mandatory energy audits to encourage energy efficiency in the commercial building sector. The idea is to make energy audit compulsory when buildings change ownership, thus when they are sold (E Du Toit 2006, pers. comm., 3 February). This will then only be applicable to a very small percentage of the total commercial building stock, because buildings do not change ownership regularly. The Energy Efficiency Strategy points out that implementation of mandatory energy audits will only take place in 2015. However, the topic needs further investigation and research regarding its effectiveness before implementation.

The DME signed an ‘Energy Efficiency Accord’ with 30 large industrial organisations. The purpose of the accord is to establish a mutually beneficial framework for voluntary energy efficiency initiatives. Although, the accord is a step in the right direction, the commitments of this accord are weak. The organisations have to recognise that energy efficiency improvement needs to be considered and they need to pursue national energy efficiency targets on a voluntary basis. The targets as outlined by the accord are that the organisations have to acknowledge the national targets, as stated in the Energy Efficiency Strategy. Because no specific clear-cut targets were proposed, the accord becomes rather symbolic instead of an actual implementation instrument.

5.4.2 Regulatory instruments and labelling schemes

Energy requirements included in building regulations have played a major role in reducing energy consumption of new buildings in Denmark and the Netherlands. Energy requirements have been part of the Dutch building regulations since 1995. The energy requirements have been modified three times towards requirements that are more stringent. Due to these energy requirements in the building regulations, energy performance of new buildings increased with 15% (1995) and after tightening the requirements by 27% (2003) (Ecofys 2004).

The Danish government implemented a mandatory approach for both new buildings and existing buildings. Energy performance requirements have been incorporated in the building regulations since 1995, mainly to set minimum standards for new buildings. The mandatory labelling schemes have to ensure energy savings and energy efficiency in the existing building stock. The labelling schemes find their mandate in the ’Act to promote energy and water savings in buildings’ (DEA 1996).

The USA and Australia on the other hand, do not have energy requirements integrated in their building regulations. The USA has energy performance standards for buildings since 1989, but these are voluntary. Australia’s federal government only developed an energy code for commercial buildings in 2005, which will be integrated into the National Building Code in May 2006. This, however, does not imply that all jurisdictions will include these requirements in their own building code. In both countries, it is completely dependent on the political will of the jurisdictions to integrate energy efficiency standards in their building regulations.

Because energy codes are not widely implemented in Australia and the USA, both labelling programmes decided to add a labelling arrangement for new buildings. ABGR offers a Commitment Agreement, which states the dedication of the building owner to design, construct and commission new building to a four or five star rating. This allows the building owner to promote and market excellent performance of the new building. After twelve months of operation of the building, an official ABGR rating needs to be executed to prove the performance, based on the operational consumption figures. If the building does not comply, the building owner has another twelve months to upgrade the building.

Discussion

The South African government is preparing an energy standard for new and refurbished buildings. The government anticipates that this standard will be included in the building regulations in 2008. Although regulations only set minimum standards and are restricted to new buildings and/or large refurbishments, they are a necessary component of a strategy to stimulate energy efficiency. Energy requirements in building regulations eliminate worst practice, but also increase awareness among professionals in the built environment. It seems pointless to develop a labelling system for compliance with the building regulations, as proposed by DME in the energy strategy, when you have a good monitoring system in place. Labelling should not be linked to building regulations. The purpose of labelling new buildings is to stimulate excellent design behaviour and not to provide for compliance with minimum standards.

5.4.3 Economic instruments and labelling schemes

Economic incentives can encourage building owners to participate in labelling programmes. Because labelling programmes do not finance the energy upgrading, subsidies or tax incentives can play a major role in the effectiveness of the labelling scheme. The investment costs of upgrades are often high, and the payback periods long. Government subsidies can reduce the investment costs by providing a subsidy that pays for the investment costs (in part or in full).

The Australian state government NSW provides the Energy Saving Fund, a $40 million (~168 million Rand) annual fund, which encourages energy savings and stimulates investment in innovative energy savings measures. The Dutch government provides a tax incentive for commercial building owners who implement measures to increase the energy performance of the building.

On the other hand, the subsidy or tax incentive can become the main reason for participating in a labelling programme, as in the case of ‘EPA for housing’. The subsidy, which financed the costs of the EPA and 50% of the investment costs in energy efficient technology, appeared to be the main reason for participating in the programme. Discontinuation of the subsidy resulted in a dramatic drop in the number of EPAs carried out (Beerepoot 2005).

Discussion

Energy efficiency is not yet a priority for the South African government and therefore DME has not received a sufficient budget for implementation of economic instruments to stimulate energy efficiency (E Du Toit 2006, pers. comm., 3 February). Nevertheless, CDM funding is available as well as tax allowances for the implementation of renewable energy and energy efficiency projects which would otherwise not have been considered.

Furthermore, a collaboration between DME, Eskom, NER and CEF established the National Energy Efficiency Agency, which will be managing and allocating 50% of Eskom's DSM budget. Although this fund is not meant to provide a continuous subsidy to support a potential labelling programme, it will be used to finance energy efficiency projects. To date, Eskom finances 100% of capital investments concerned with load management projects and 50% of the capital investments of energy efficiency projects.

5.4.4 Self-regulating instruments and labelling schemes

Building regulations affect only new buildings, while the savings potential of the existing building stock is much larger. Self-regulating instruments and labelling schemes are therefore important in a strategy to improve the energy performance of existing buildings.

Labelling schemes are self-regulating instruments in the Netherlands, Australia and the USA. They are implemented based on a voluntary approach. The Dutch government attempts to encourage certain sectors to implement energy efficiency by concluding Long Term Agreements. These sectors represent approximately 15% of the total energy consumption in the non-residential sector. These agreements force the companies to reduce the CO_2 emissions of the companies with 20-25%. These agreements are usually made with large corporations, where the energy efficiency potential is substantial. The results are mixed; some companies are doing well and even exceeding the targets, while in other companies there is a decline in the energy efficiency (Ecofys 2004). Effectiveness is difficult to determine due to lack of proper monitoring procedures.

Both the Australian and the USA government demonstrate leadership by entering their own buildings (public sector) in the benchmarking programmes. The premier of the Australian state of NSW signed a memorandum of understanding to show government's commitment to energy efficiency in buildings. The buildings need to achieve a minimum of 3 stars and commit to 4 stars when undertaking major upgrades. The federal government of the USA took a similar approach and developed an Executive Order to green the government through energy efficiency.

Discussion

The South African government signed an Energy Efficiency Accord with thirty companies. The idea is similar to the Long Term Agreements in the Netherlands. However, the accord did not set targets or mechanisms to force the companies to reduce their energy consumption and increase the energy efficiency. The South African government, especially DME, is committed to show leadership by making their own buildings energy efficient.

6 Commercial Building Market

6.1 Introduction

The title of the thesis states that it is concentrating on a labelling scheme for the commercial building sector. Commercial buildings consist of public buildings, office buildings, financial institutions, shops, recreation and education. Clearly, commercial buildings comprise a range of different building types which cannot be treated alike. This chapter discusses the advantages and disadvantages of the target group chosen by the GBfA and the reference case studies. It furthermore focuses on the characteristics of the commercial building sector and outlines the opportunities and threats for a labelling programme.

6.2 Target Group

The GBfA identified the commercial building market as the initial target group of the programme. As explained in the introduction, commercial buildings are a very heterogeneous target group. It comprises e.g. offices, hospitals, hotels, prisons, educational, retail and airports. These buildings have different energy consumption patterns and requirements. However, commercial buildings in general offer a large saving potential in terms of energy savings as well as cost savings, which creates an opportunity for a labelling programme.

The GBfA focussed on *existing* buildings since they represent the largest part of the building stock. The showcase partners consisted of prominent companies, namely Eskom, Old Mutual, Sanlam, Sasol, and the CSIR Conference Centre. They were furthermore selected due to the size of their portfolios.

International experience

The target group of ABGR is relatively homogeneous; it is restricted solely to office buildings. The ABGR offers a label for existing buildings, but also a commitment agreement for new buildings, to incorporate energy efficiency during the design phases. ENERGY STAR started with a label solely for office buildings, but gradually developed the programme for a wider range of commercial building types. ENERGY STAR also offers architects a rating system to evaluate buildings, which are in the design stage. To be able to rate the energy performance of buildings, availability of benchmarks is a prerequisite.

The EPA-U and ELO schemes are not restricted to a particular building type. The ELO-scheme is applicable to all buildings larger than 1 500m^2 and the EPA-U can be applied to all types of commercial buildings. The EPA-U does not compare the performance of the building with other buildings; each building is addressed in isolation. This is similar to the GBfA approach. With the implementation of the EPDB, the programmes have to provide a label for existing as well as new buildings.

In all programmes, the government is an important target group. The federal governments of Australia and USA have committed their buildings to the labelling programmes. In addition, the EPA-U is to date mainly applied to government buildings and corporate buildings, which are part of a Long Term Agreement with the government (B Bouten and G van Chruchten 2006, pers.comm., 11 January).

A major opportunity for a proposed labelling scheme in South Africa is the Energy Efficiency Accord that the government signed with thirty large companies in South Africa. The accord is an agreement between DME and industry to establish a mutually beneficial framework for voluntary energy efficiency initiatives. Labelling of buildings can be part of this framework.

Furthermore, the South African government wants to lead by example and subjects their buildings to an energy audit. The goal is to audit 500 buildings annually up to 2015. The South African government has a building portfolio of 112 000 buildings nationwide, which represents a floor area of 25 000 000 m^2. The government is therefore an important target group of a potential labelling programme in South Africa.

A labelling scheme in South Africa should also consider a label for new buildings. Although new buildings only represent a small part of the total building stock (new buildings younger than 2 years represent approximately 2-5% of building stock), it is expected that the number of new commercial buildings will grow significantly, due to the economic growth in South Africa.

6.3 Energy Efficiency in Commercial Buildings

The GBfA programme was the first of its kind in South Africa. When the programme started, there was no data available regarding electricity consumption and demand of commercial buildings. The GBfA programme undertook several projects to obtain a better understanding of the electricity consumption of the commercial building sector. Energy audits were executed as part of the showcase programme, which showed the energy savings potential of building upgrades.

Electricity consumption

The commercial building sector consumed 17 164 GWh of electricity in 2000 (DME 2002), which represents ~83% of the total energy used in commercial buildings (StatsSA 2005)[11]. Table 6-1 specifies the environmental impact of using one kWh of electricity and the total environmental impact of the commercial sector. Electricity is the most greenhouse gas intensive energy source and the commercial building sector is responsible for 15.45 million metric tons of CO_2

[11] The remaining 17% is energy supplied by means of coal (8,2%); fuel oil (4,0%), LPG (3,2%), hydrogen gas (1,1%), paraffin (0,3%) and town gas (0,4%) (StatsSA, 2005).

emission annually. Energy is mainly used for lighting (26%), HVAC (48%) and for equipment (e.g. faxes, computers, printers).

Table 6-1: Environmental impact of electricity in South Africa (adapted from Eskom 2003)

Impact of using 1 kWh of electricity in South Africa		Total impact of the commercial building sector
0.90	CO_2 emissions (kg)	15 447 600 metric tons of CO_2
3.62	NO_x emissions (g)	62 134 metric tons of NOx
8.22	SO_2 emissions (g)	141 088 metric tons of SO_2

To be able to compare buildings with each other and to establish benchmarks, a database of energy consumption figures is required. This information was not available at the time the GBfA started. Later, the programme used the SAEDES guidelines as a reference and benchmark. SAEDES does not provide general benchmarks for commercial buildings, but creates a building-specific benchmark based on prescriptive deemed-to-satisfy rules. However, SAEDES was developed to become part of the National Building Regulations, which implies that SAEDES only sets minimum requirements.

To obtain a better understanding of the energy consumption in commercial buildings in South Africa, an email survey was carried out among consultant engineers and property owners in collaboration with the CSIR. The questionnaire covered questions regarding energy consumption and maximum demand of a range of buildings in different climate zones in South Africa. Over 200 questionnaires were sent to consultant engineers and six large property owners have been contacted. The response to the questionnaire was poor. However, the responses received contained valuable data for the research. The figures were combined with the dataset generated during the SAEDES pilot study (CSIR 2005). The final data set contains information regarding 52 office buildings in different regions of South Africa. A database has been developed to analyse the data. Table 6-2 and Table 6-3 summarises initial results. Major gaps in the data set are identified and communication with property owners is ongoing to fill these gaps in the near future.

The sample size is too small, and the buildings are too heterogeneous to be able to generalise the results for the total commercial building sector. There are many variables which have an impact on the energy consumption in a building, e.g. building age, size, number of occupants, climate. Therefore, the results presented in this section only give an *indication* of the energy consumption in commercial buildings.

Table 6-2: Electricity consumption by region (CSIR 2006)

Electricity consumption of office buildings in different regions	Average kWh/m^2	Max kWh/m^2	Min kWh/m^2
Gauteng (n=32)	271.07	566.82	98.70
Durban region (n=8)	223.98	300.00	113.79
Cape Town region (n=5)	321.95	366.00	264.79
Bloemfontein region (n=2)	295.38	383.90	206.87
Total (n=47)	278.10	566.82	98.70

Table 6-2 shows that buildings in Cape Town consume relatively large amounts of electricity, while Durban seems to consume the lowest amounts of electricity. The average electricity consumption of all the buildings is 278.10 kWh/m^2, but it must be noted that there are enormous differences in performance (the standard deviation of the different samples varies between 60 and 110 kWh/m^2). Remarkable are the extreme high energy consumption of 566.82 kWh/m^2 and the low energy consumption of 98.70 kWh/m^2, both in buildings in Johannesburg.

Table 6-3 consists of the same sample used in the previous analysis plus an additional five buildings, which could not be categorised in one of the selected regions. The table shows that smaller buildings (<5 000 m^2), which are likely to be low-rise office blocks, consume relatively large amounts of electricity. The energy consumption seems to grow with the building size, which is illustrated in Figure 6-1.

Table 6-3: Electricity consumption by building size (CSIR 2006)

Electricity consumption of office buildings for different building sizes	Average kWh/m^2	Max kWh/m^2	Min kWh/m^2
Commercial Buildings < 5 000 m^2 (n=9)	272.35	486,74	136.18
Commercial Buildings 5 000-10 000 m^2 (n=10)	231.29	305.41	98.70
Commercial Buildings 10 000 – 25 000 m^2 (n=16)	264.27	566.80	113.8
Commercial Buildings 25 000 - 60 000 m^2 (n=12)	279.98	395.38	154.00
Commercial Buildings >100 000 m^2 (n=5)	397.65	486.53	306.88
Total (n=52)	289.11	566.82	98.70

It was assumed that larger buildings use less electricity, due to economies of scale. However, as shown in Figure 6-1, the size of the building is positively related to the electricity per square metre. This could also imply that larger buildings use their floor space more intensively, but that does not necessarily mean that the building is less energy efficient.

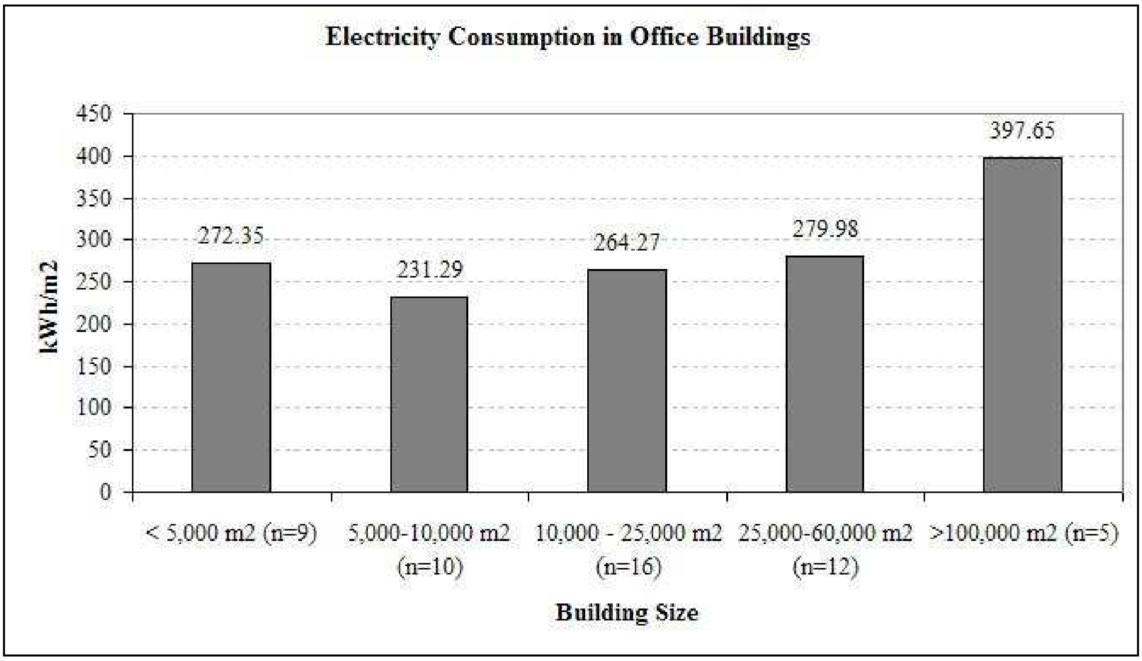

Figure 6-1: Electricity consumption related to the building size (CSIR 2006)

To develop and establish realistic benchmarks, it is important for a labelling programme to create a database, which takes into account a number of variables. The reference labelling programmes developed extensive databases over the years. The tool provided by ENERGY STAR to evaluate and benchmark the performance of the building, is a facility management tool. The tool, named Portfolio Manager, which can be integrated into the work of the facility manager, helps to monitor and to analyse energy consumption. Portfolio Manager requires monthly consumption input. This helped ENERGY STAR considerably to establish a better understanding of energy consumption in buildings and establish appropriate benchmarks.

It is very difficult, if not impossible, to compare the energy consumption data with the reference case studies, and to determine the status of the average commercial building in South Africa. While in Europe and the USA energy is predominantly used for *heating*, energy in South African buildings is needed for *cooling*. Furthermore, different energy sources are used for the operation of a building. For example, an average office building in the Netherlands uses 80 kWh electricity per square metre, but also an additional 679 MJ natural gas per square metre (SenterNovem 2004). Energy is predominantly used for space heating (65%), secondly lighting (27%) and the remaining 8% for equipment and warm water (SenterNovem 2004).

The Australian climate is more similar to the South African climate. A commercial building in Australia uses 63% of the total energy for HVAC, 21% for lighting and 15% for others. Australian commercial buildings also use electricity as their predominant energy source (85%) (AGO 1999). Average energy consumption in a commercial building in Sydney is 253 – 313 kWh per m^2 annually (ABGR 2005). This is comparable with the average performance of a South African commercial building as found in the survey.

Energy savings

As demonstrated by the GBfA showcase buildings energy savings of 10-30% can be achieved with low cost or medium cost investments (pay back period is less than 2 years). Table 6-4 shows the results of the energy audits executed under the GBfA programme. The GBfA showcase programme demonstrated that savings in energy consumption ranged from 13% to 36.8%, while the costs savings ranged from 10% up to 28%. Energy savings and cost savings are not necessarily identical to each other, due to load management issues and tariff structures.

Table 6-4: Energy and cost savings of the GBfA showcase buildings

Building Type	Size (m^2)	Energy Savings		Cost Savings (R)	
		kWh	%	R	%
Conference	5 492	637 000	27%	R 107 000	26%
Offices	12 313	2 376 775	36.8%	R 306 263	20.46%
Offices	100 000	18 727	30%	--	--
Offices	22 424	476 960	13%	R 87 738	10%
Office/Retail	24 000	--	--	R 370 000	28%
Office/Retail	65 000	1 991 040	17%	R 609 929	28%

6.4 Impact of Labelling on Energy Savings and Emission Reduction

To create an idea of the impact of the different labelling approaches, this section attempts to quantify the impact of each of the labelling schemes. Table 6-5 shows the calculation for the total energy savings per scenario. The percentages in this model are estimates derived through an analysis of each of the case study programmes.

Labelling approaches

Table 6-5 compares four different labelling approaches regarding their effectiveness, while throughout the research only three approaches are compared. In this exercise, the mandatory approach as implemented by the European

Commission, according to the EPBD, is also taken into account to show the differences in effectiveness compared with the Danish mandatory approach. The main differences between the approaches are the time when labelling takes place and the renewal interval. *All* building owners in Denmark are required to obtain an ELO label and renew it annually. The EPDB is only applicable when the building changes ownership (reduces the size of the target group significantly) and the label is valid for 10 years.

Table 6-5: Comparison of the savings per labelling approach

	Mandatory (ELO)	Mandatory (EPDB)	Voluntary (Energy audit)	Voluntary (Benchmarking)
Office Surface (m^2) (A)	12 000 000	12 000 000	12 000 000	12 000 000
Kg CO_2 /kWh coal fired electricity (B)	0.9	0.9	0.9	0.9
Average energy consumption (kWh/m^2)(C)	280	280	280	280
Estimated participants (D)	80%	5%	10%	20%
Estimated upgrading (E)	40%	40%	60%	70%
Estimated savings potential (F)	20%	20%	20%	10%
Potential energy savings (kWh/m^2) (F*C)	56	56	56	28
After upgrading (kWh/m^2) (F*C*E)	22.4	22.4	33.6	19.6
Potential office surface m^2 (A*D)	9 600 000	600 000	1 200 00	2 400 000
Total savings (GWh)	215.04	13.44	40.32	47.04
Total savings (metric tons CO_2)	193 536	12 096	36 288	42 336

Office surface

Rentable office surface in South Africa’s major cities (Johannesburg, Pretoria, Durban, Cape Town) is estimated to be 9 000 0000 m^2, which is based on SAPOA’s office vacancy survey of September 2005 (SAPOA 2006). Assuming that this is 75% of the total office area, the other 25% is owner occupied office area, which makes total office surface in South Africa’s major cities 12 000 000 m^2. This number is a rough estimation and should not be used in further research.

The purpose of this calculation is not to determine the exact office surface available in South Africa; the purpose is to create an idea of the effect of the labelling approaches. The amount of office surface in South Africa is expected to be substantially more than 12 000 000, because it does not take into account public buildings and other cities in South Africa.

CO_2 emissions using electricity

According to Eskom's annual report 2003 (Eskom 2003) the kg CO_2 emissions generated when using 1 kWh of electricity in South Africa are 0.90 kg CO_2/kWh.

Average energy consumption kWh/m^2

The average energy consumption is based on the results of the survey as explained in section 6.2. Average annual energy consumption is 280 kWh/m^2, although this figure is based on a limited sample, it is sufficient to serve its purpose in this calculation.

Estimated participants

Based on figures of the ELO-scheme and a study in the Netherlands (Corpelijn et al. 2004) it is expected that implementation of a mandatory energy audit programme will result in participation of 80% of the building owners after 5 years. In the case of the voluntary energy audit programme, this number is significantly lower, 10% after 5 years, due to complexity and costs. For the energy benchmarking programme it is expected that this is 20%, since the programme is simpler, cheaper and more easily accessible.

Estimated upgrading

This number indicates the percentage of the participants who actually implement the suggested upgrades. The percentage is higher for the voluntary programmes, because the building owners who participate in a voluntary programme are already interested in energy efficiency and are more likely to invest in energy efficiency. The mandatory approach targets all building owners, also those who are not interested in energy efficiency. Estimations from an evaluation of the ELO-scheme (Reinikainen 2002) are that 35-55% of the building owners will implement the suggestions.

Estimated savings potential

It is assumed that an energy audit programme, because of its comprehensiveness and technical detail, can identify more potential energy savings than a benchmarking programme. A benchmarking programme only provides the building owner with generic energy savings opportunities, while the energy audit approach goes into more detail and is facility specific.

Discussion

Table 6-5 shows that the mandatory ELO approach, as expected, generates the largest energy and CO_2 emission savings. The energy savings of the voluntary energy audit and benchmarking scheme are similar to each other. However, as discussed in section 3.4, the implementation costs of an energy audit approach are higher than a voluntary benchmarking approach. Therefore, the voluntary benchmarking approach is preferred to the energy audit approach.

The impact of the mandatory EPBD approach is significantly less than the ELO approach and even less than the voluntary approaches. This is because the label is only required when the building changes ownership. When the South African government is considering implementing the mandatory energy audit programme, as proposed in the energy efficiency strategy, it should take into account that this approach might not be satisfactory in terms of its effectiveness.

6.5 Drivers for Labelling in the Commercial Building Sector

This section describes the drivers for a labelling programme in the commercial building sector. Opportunities are divided in four categories, namely institutional, economical, socio-cultural and technological. This section mainly draws on data and experience of the GBfA programme, due to a lack of data about the case studies. The available case study data are used where applicable.

6.5.1 Institutional drivers

As described in the previous chapter, attention for energy efficiency in the built environment is growing slowly. The Energy Draft Bill calls for the establishment of an energy efficiency programme. The bill provides DME with a legal mandate for a proper budget and structure to undertake an energy efficiency programme.

However, these policies and bills are not adequate incentives for the commercial building sector to participate in a labelling programme. The Energy Efficiency Accord on the other hand, might be an incentive for corporations to participate in a labelling programme to show commitment and quantify achievements.

Treasury also announced government's intention to review the tax structures, and to look at possibilities to formulate new structures to stimulate environmental friendly activities (National Treasury 2006). For example, municipalities are authorised under the Municipal Property Rates Act to charge property owners for owning property. These property rates can be reduced when the property owner can prove that the buildings are energy efficient. Such a tax structure in favour of a labelling programme could be an incentive for commercial buildings to participate in a labelling programme.

The SANS 0204 '*Energy Standard for Buildings excluding those with passive environmental control'* is currently under development. This standard will be mainly applicable to new buildings and large refurbishments, and therefore does not create an incentive for building owners to participate in a labelling programme. However, the standard raises awareness and forces architects to design energy efficient buildings. The labelling programme can contribute to this by offering information on the design of energy efficient buildings and provide benchmarks to define the consumption of an energy efficient building, which should encourage architects to go beyond standard practice.

6.5.2 Economic drivers

Economic drivers are financial incentives for building owners, which will encourage them to participate in a labelling programme.

Electricity price

Eskom is running out of capacity, and soon there will not be enough generating capacity to supply electricity at peak demand times. This leads to power cuts during peak demand periods, which is currently happening on a regular basis in Cape Town. Eskom has to build new generating capacity and it is highly likely that these costs will be reflected in future energy prices. Higher energy prices increase the energy efficiency awareness among building owners, and at the same time increases the cost savings potential of energy efficiency measures in commercial buildings.

Financial support by Eskom

Eskom DSM programme offers a financing arrangement for building owners who are committed to energy efficiency and load reduction. Eskom funds 100% of the costs of a project dealing with load management. In the case of energy efficiency projects, Eskom contributes 50% towards the implementation costs. Projects are eligible when installed capacity savings are larger than 500kW per project. A labelling programme can supplement this process by offering a GBfA label after implementation and verification of the savings.

Economic growth

Growth in construction activities is linked positively to economic growth. Construction activities are therefore likely to grow in the coming years. Construction of new commercial buildings will increase significantly in the near future (Rode 2006). If this is implemented within the new SANS 0204 regulation it can provide an opportunity for a labelling programme. A labelling programme can play a role by providing information and encouraging designers to include energy efficiency as a component or priority in the building design.

6.5.3 Socio-cultural drivers

Socio-cultural opportunities are knowledge and attitude issues that could trigger the building owner to act in a more environmentally friendly manner.

Educational programmes

DME developed a training manual which is circulated among the South African universities to include energy efficiency in the curriculum (E Du Toit 2006, pers. comm., 3 February).

The University of Witwatersrand (WITS) is currently in the first stages of the development of an educational programme regarding energy efficiency in buildings. This is in collaboration with several international universities. The programme is meant to be multi disciplinary and accessible for students from different backgrounds (e.g. mechanical, electrical, and architectural). Problems faced in this regard include limited capacity to train and weak financial support for scholarships/bursaries.

Positive public image

The creation of a positive public image is what a labelling programme offers. However, this must be valued by the client; otherwise the public image is not worth much. The motivation for Sasol to include their headquarters in the GBfA showcase programme ranged from pride in the accommodation owned by the Sasol Pension fund, but also from the corporate governance value for an organization active in a less than environmentally benign industry (Singh 1999b).

6.5.4 Technological drivers

Although the economic isolation during the apartheid era has effected the diffusion of advanced energy efficient technologies and practices, most of these technologies are currently available on the South African market (Grobler 2002). Energy efficient technologies are in general more expensive than the conventional technologies. For example, a normal light bulb is half the price of an energy efficient light bulb. Although the costs are easily recovered, the initial investment costs of energy efficient technologies are higher. However, it should be noted that technologies are not driving energy efficiency but facilitating it.

6.6 Barriers for Labelling in the Commercial Building Sector

This section describes the barriers for a labelling programme in the commercial building sector. The barriers are categorised in four categories; institutional, economic, socio-cultural and technological. This section mainly draws on data and experience of the GBfA programme, due to a lack of data about the case studies. The available case study data is used where applicable.

6.6.1 Institutional barriers

According to Singh (1999b), securing commitment of the companies was time consuming since GBfA introduced new thinking in terms of the performance of the buildings. Furthermore, perceptions were that commitment would negatively affect costs and comfort implications. When the programme was accepted as being useful, the fee payment was a major hurdle to seal commitment.

Facility manager is not the decision maker

In most cases, the facility manager is the person who will understand and appreciate energy efficiency, but the facility manager is not the decision maker. This appeared to be a problem when the CSIR conference centre wanted to enter the GBfA showcase programme. The manager of the conference centre was enthusiastic about participation, however he had no authority over technical and capital expenditure. Decision-makers in internal services were reluctant to participate, but the participation of one of CSIR's buildings was stressed by GBfA and the conference centre eventually entered the programme.

Additionally, outsourcing of property operations becomes more and more attractive to property owners. In such a case, the facility manager is no longer an internal technician but becomes an external service provider (Singh 1999b)

These barriers were found not to be unique to South Africa. The reference case studies experienced similar problems. As an example, ENERGY STAR identifies this issue as one of the major barriers to implementation of the labelling programme. They point out that although facility managers are keen, many high-level financial decision makers do not see electricity as a controllable cost category (EPA 2003). Also E Blankestijn (2006, pers. Comm., 12 January) argues that the facility managers should not be the target group, instead the programme should aim at the executive managers. The Dutch government attempts to avoid this problem by making labelling part of Long Term Agreements and the Environmental Act.

Tenant – property owner relationship

A substantial part of the building stock is not occupied by the building owner, but rented out to tenants. Meaning that there is a tenant – property owner relationship and one of the two has to pay the electricity bill. In the case where the tenant pays the electricity bill, the tenant has an incentive to use energy efficiently. However, the building owner has little incentive to engage in energy efficiency efforts because the tenants benefit directly from the savings, not the owner. The tenant is therefore bound to energy efficiency measures related to the operation and management of the building, which can still result in significant savings. In the case where the property owner pays the electricity bill, he/she would have an incentive to invest in energy efficiency. However, the tenant does not pay for energy and therefore has no incentive to use the energy efficiently. A study in the USA (Hines 1990) showed that there is a large difference between owner-occupied and tenant-occupied buildings regarding the implementation of energy efficient technologies. It showed that in 80% of the owner-occupied buildings high efficiency lamps were implemented, whereas this was only 20% in tenant-occupied buildings. This was not only limited to energy efficient lighting, the same difference was found for other building services such as high efficiency motors, glazing and chillers.

According to the programme manager of the GBfA programme, Singh (1999b), owners of owner-occupied properties responded more positively to the GBfA programme than owners who are renting out their property. Suggestions for energy efficiency upgrading were also better received because the benefits were not distributed to tenants. Furthermore, market recognition and corporate image was directly linked to the building owner.

The ABGR addresses this barrier by offering a separate label for tenants (to stimulate energy efficient consumption) and for property owners (to stimulate energy efficient investments). In addition, a third label combines both approaches and besides improved operational activities includes improvements in building services and architectural characteristics. In February 2006, 21% of the labels issued by ABGR were tenant ratings; 43% were base building ratings; and 36% were whole-building ratings (section 3.2 in Appendix B).

Corporate performance

From the experience of the GBfA programme it became clear that some building owners are concerned about publication openly in the case where the buildings were performing badly. This discouraged them from participating in the programme (Singh 1999b). This also indicates that building owners are indeed sensitive to public opinion.

6.6.2 Economic barrier

Electricity Price

Electricity prices in South Africa do not incorporate environmental costs. South Africa's energy prices are the lowest in the world (IEA 2005), which is not an incentive for property owners to consider energy efficiency. Energy costs are not a significant part of the operating costs of a building. A study (CSIR 2005) done among 38 building in South Africa showed average energy costs of R5,27 m^2/month in 2000. Compared to average rental prices of R40-50 m^2/month, plus the operational costs of the space, energy costs are minimal. Additionally, costs for human capital are many times higher than the electricity bill, which does not give a strong financial drive for energy savings.

Electricity and energy efficiency is far from the top of the agenda of most property owners and other participants in the commercial building sector. It is therefore important to highlight productive and healthy workplaces and public relation benefits of energy efficiency.

Capital costs

Besides the fact that the facility manager is not the person who is making the capital expenditure decisions, securing funding for upgrading is often a long process. In the case of one of the showcase partners, the process to secure funding for upgrading the building took nearly two years (Singh 1999b). This is due to the *high initial* investment costs to improve the energy performance of the facility and the absence of proper maintenance planning and budget.

6.6.3 Socio-cultural barrier

Lack of awareness

Probably the largest barrier in this area is the lack of awareness among the commercial building owners. Due to socio-economic pressures, environmental issues are not a priority in most people’s lives. In Europe and USA, consumer attitudes and practices towards energy usage have been shaped by the energy crisis in the 1970’s and are considered a matter of national strategic importance. Furthermore, the European construction industry is highly regulated with policing and enforcement of regulations. In general, the society is more aware and places greater priority on environmental issues. To illustrate this, the UK environmental building labeling scheme, BREEAM, was initiated at the request of *industry* to address the mounting pressures to improve environmental management.

Although there is more attention and awareness for environmental issues in the Western countries, lack of awareness and interest are still experienced as major barriers. EPA (2003) points out that although information is available on how to approach and undertake effective energy efficiency improvements in commercial buildings, this information is not widespread.

Related to lack of awareness is lack of willingness. From the experience with the GBfA programme and pilot studies around SAEDES, it became clear that although the cost-effectiveness of energy efficiency was proven for many buildings, participants in the GBfA programme were reluctant to actually implement the improvements and monitor the savings (Singh 1999b; CSIR 2005).

Lack of technical expertise

Technical expertise is required to carry out an energy audit, identify energy efficiency opportunities and implement the measures to upgrade the energy performance of a building. In general, there is a lack of awareness regarding environmental issues amongst professionals in the built environment and a lack of professional capacity to introduce and implement energy efficient practices and technologies (Grobler 2002). The number of engineers, who are specialised and have experience in the field of energy in buildings, is slowly growing. DME is supporting the development of energy service companies (ESCOs). An ESCO is a company that sells energy services, such as energy management, energy audits of buildings. Currently, there are not many ESCOs (110 ESCO's are registered at Eskom) and many of them have limited experience (DME 2005).

The ENERGY STAR programme identified a lack of available technical expertise *within* organisations as a barrier to implementation (EPA 2003). This is also applicable to South Africa; many facility managers do not have an engineering background and do not have an understanding of energy saving and energy efficiency.

6.6.4 Technological barriers

The building sector is a very conservative economic sector and is not responsive to change and adoption of innovations. Therefore, energy efficient technologies are often experienced as foreign and expensive.

Energy management systems are rather an exception than normal practice within commercial buildings. It is difficult to manage something that is not measured.

Building management systems increase the understanding of where and how much energy is consumed in the building. This will also make it easier to identify opportunities for energy savings and energy efficiency.

Many energy efficient replacements only become economically feasible when the old technology fails. For example, replacing a motor with a more energy efficient motor will not provide enough cost savings to justify the procurement of the new motor. However, when the old motor breaks down, the cost difference between a conventional motor and an energy efficient motor can be justified by the energy savings that will be made.

6.7 Summary of the Drivers and Barriers

Table 6-6 provides a summary of the opportunities and barriers for building owners to participate in a labelling scheme and for the implementation of a labelling scheme. The most important opportunities in the short term are the financial support of Eskom for energy efficiency and the load management project as well as the energy efficiency accord between DME and thirty large organisations. The major barriers to the labelling programme are the lack of awareness and interest among building owners, the tenant – property owner relationship, and the low energy prices.

Table 6-6: Summary of opportunities and barriers

Type	Opportunity	Barrier
Institutional: government and policy	Energy efficiency standard	Lack of funds and capacity in government departments
	Energy efficiency accord	Incentives are insufficient
	Tax review	Policy framework lacks implementation plan
		Facility manager is not the decision maker
		Tenant – property owner relationship
Economic: market and financial	Economic growth	Low electricity price
	Electricity price	High capital costs
	Financial support from Eskom	Minimal competition
	Power cuts in Western Cape	Low demand for energy efficient buildings
		Focus on high investment cost and not on savings in long term
Socio-cultural: Knowledge and Attitude	Study programmes 'Energy in buildings'	Lack of technical expertise
	Positive public image	Lack of awareness and interest
		Lack of study programmes
Technological: technology and process	Technologies are available	Property owners do not have regular contact with suppliers of new technologies
		Lack of measuring tools and benchmarking

7 Conclusions and Recommendations

7.1 Introduction

The research objective, as formulated in section 1.5.1, was to obtain a better understanding of labelling schemes and their potential application in South Africa, as part of a strategy for improvement of energy efficiency in commercial buildings. The research drew on experiences internationally in order to identify strengths and weakness of the GBfA programme and the opportunities and threats of the context. The research identified factors that need consideration in the development of an effective energy labelling programme in order to arrive at recommendations for potential development and implementation of a labelling programme in South Africa.

This chapter presents the conclusions and recommendations that can be drawn from the analyses and discussions in the previous chapters. This chapter starts with answers to the sub questions, and ends with an answer to the main research question:

> *Which energy labelling approach would be the most appropriate for implementation in the commercial building sector in South Africa’s current context, and how could this explain the discontinuation of the Green Buildings for Africa programme?*

The conclusions are followed by the recommendations in section 7.4, which outline the suggested path for a labelling programme in South Africa. As well as recommendations for further research (section 7.5)

7.2 Conclusions

7.2.1 The concept of energy labelling of buildings

Labelling programmes appear to be more complex than expected at the beginning of the research. The theory behind labelling stems from appliance labelling. Energy labelling of buildings can be applied when a building is changing owner or just to disclose energy performance of buildings.

Energy labels directly address information problems in purchasing decisions. The label provides the building owner with information regarding the energy performance of building. The information can facilitate the building owner during acquisition of buildings. However currently, energy efficiency is not a decisive factor in building procurement: location, security, amenities and building prestige are often more important.

The label can also be used to disclose energy performance of buildings which could in turn trigger competitiveness between building owners. Labelling programmes can classify the building performance on a scale, e.g. from 0 to 100 (ENERGY STAR) or from one star to five stars (ABGR). This enables property owners to compare their building performance among each other, which could trigger competitiveness. Competitiveness can act as an incentive to improve the building performance and increase the rating.

It is essential to understand that labelling is a communication tool to encourage energy efficiency in buildings. It is not a measure, since labelling does not necessarily guarantee energy efficiency upgrading. It provides information regarding the energy performance of the building to the building owner, which should encourage the building owner to improve the performance in case the building is performing poorly.

7.2.2 Types of energy labelling of buildings

Labelling programmes can be categorised according to their labelling characteristics and eight theoretically possible categories are identified and presented in Figure 2-2 (section 2.3). The selected case studies are classified according to these categories (section 2.11). The GBfA programme is categorised as a voluntary energy audit programme without additional support. The EPA-U is classified as a voluntary energy audit programme, but with additional support. ELO-scheme is a mandatory energy audit programme with no additional support. ABGR and ENERGY STAR are both voluntary benchmarking schemes with little additional support. The categorisation is useful, because it defines the main difference between the approaches.

7.2.3 Programme design

The goals and objectives of the GBfA were broad and ambitious for the available human resources, time and finances (section 3.2). Furthermore, the goals and objectives were not elaborated logically into a statement of work. International experience shows clear focus on one aspect, and that is filling the information gap, by providing information and benchmarking systems. Their goals and objectives are expressed in the number of buildings aimed to be benchmarked and labelled.

Regarding programme development, ENERGY STAR started small and gradually extended the scope. The programme started with rating office buildings, and systematically added building types, information tools, additional activities, etc. The GBfA was ambitious from the start, but finally ended up not being able to carry out all the tasks.

The organisational structure (section 3.3) shows that the GBfA programme differs significantly from the reference labelling programmes. Firstly, the South African government did not play a dominant role in the programme, whereas the governments of the reference labelling programmes fulfil the role of the national administrator and implementing agent. Even though the South African government supported the programme by being part of the steering committee, it did not have the human resources or the financial capacity to initiate and implement the programme. Secondly, the GBfA programme used in-house capacity to carry out the energy audits. All the reference case studies outsource this task to commercial energy engineers.

The financial situation of the GBfA programme arises from this organisational structure (section 3.4). The programme was funded mainly by the CSIR's normal budget with additional funding from the IIEC through DME. Since this was insufficient, it resulted in relatively high annual fees for the participants, in order for the programme to finance the remaining costs. The reference case studies are all funded by their relative government and their sustainability is not dependent on external funding. The ELO-scheme shows that a mandatory scheme can be self-sustainable regarding daily administration and operating costs.

The research showed that the implementation strategy (marketing and promotion) is most intensive for the voluntary energy audit programmes and least intensive for the mandatory energy audit programmes (section 3.5). Experience with implementation of the EPA-U showed that it is difficult to successfully implement and operate a voluntary energy audit programme, even though it had intensive government support and additional incentives for building owners to participate in the programme, such as subsidies or tax rebates. The benchmarking programmes, ABGR and ENERGY STAR, are more business-oriented and less supported by additional instruments.

The programme designs of the case studies show that quality assurance and control is a means to obtain credibility from potential clients and therefore a necessity (section 3.6). It appears that the level of quality control is not related to the implementation approach of the programme (mandatory or voluntary), but it is related to the scope of the programme (energy audit or benchmarking system). Quality control systems become more important and wide-ranging when an energy audit is included in the scope of work, and particularly, when the number of labelled buildings grows. The EPA-U and ELO include an energy audit in their processes and consequently the quality control in those programmes is much more extensive than in either of the benchmarking programmes.

7.2.4 Label characteristics

Chapter 4 analyses the strengths and weaknesses of the label characteristics according to Rogers' attributes of an innovation. These attributes are often used to forecast implementation success of an innovation. The analysis of the GBfA showed that the characteristics of labelling were not in favour of adoption by building owners and that an energy label is not easy to sell.
The research showed that labelling programmes are experiencing difficulties convincing building owners of the relative advantage of labelling (section 4.2). Relative advantages of labelling buildings as put forward by the labelling programmes are saving the environment, cost savings, financial incentives, market recognition and positive public image. The most important relative advantage is the potential cost savings, but this becomes a disadvantage when the building owner realises that relatively high initial investments are required to obtain those cost savings. ABGR and ENERGY STAR emphasise cost savings and the market recognition as the most important relative advantage. EPA-U on the other hand indicates the tax incentive as the major relative advantage of participating in the labelling programme. ELO does not have to convince building owners of the relative advantage since the programme is mandatory.

Compatibility of labelling with existing values and beliefs is very low (section 4.3). Sustainable energy use is not part of the values and beliefs of building owners. The compatibility of labelling with previously introduced ideas is low. However, in Europe, USA and Australia, appliance labelling probably contributed to the acceptance of building energy labels. The ENERGY STAR programme established its first labels in 1992 for energy efficient computers, after which the label expanded to more than forty products. ENERGY STAR has established a brand name, which certainly contributes positively to the implementation of the building label. Implementation of appliance labelling could create awareness among building owners and a better understanding of what labelling of building entails.

DME is currently in the process of implementing appliance labelling in South Africa. The compatibility of labelling with the needs of the building owner is low. Although the programmes are aware of the need of the programme, building owners do not share this conviction.

The complexity of labelling programmes is high (section 4.4). Complexity is expressed as the level of detail of the evaluation of the energy performance and identification of energy savings measures. The complexity is higher when the labelling programme includes an energy audit. Energy audit programmes are more extensive and detailed than benchmarking programmes and therefore more complex. The GBFA programme appeared to be the most extensive programme. EPA-U and ELO are also complex programmes, but they are heavily supported by government. This complexity of GBfA contributed significantly to the failure of adoption by South African building owners. The complexity and comprehensiveness of the energy audit approach makes implementation on a voluntary basis difficult. The voluntary and market-based programmes, ABGR and ENERGY STAR, are less complex, which probably contributed to their implementation success.

The triability of the energy audit programmes is lower than the benchmarking programmes (section 4.5). Costs and commitment are required from the beginning of the process, whilst the financial profitability remains uncertain until after completing the energy audit. Moreover, in the case of the GBfA the building owner has to commit to a three-year programme and to implement cost-effective upgrading of 80% of the facilities floor area. The triability of the ABGR and ENERGY STAR is significantly higher because the programme offers tools on the web site to allow self-assessment of the energy performance. In case the building is performing badly, the building owner can decide what interventions are needed to improve the performance. However, if the building owner does not have the in-house technical knowledge and skills, an energy consultant can be recruited to carry out an energy audit for the building owner. After upgrading, the building owner can submit the building to the benchmarking programme to obtain the label.

7.2.5 National context

The reference case studies show that international commitments can create an important incentive for countries to be actively involved in the reduction of greenhouse gases (section 5.2). This applies especially to The Netherlands and Denmark: they have legal responsibilities towards the Kyoto Protocol and the European Union to reduce their greenhouse gases. Moreover, the European Union directly addresses the built environment with the EPBD, which requires the member states to have mandatory labelling in place. This means that the labelling programmes in the Netherlands and Denmark are driven and forced upon by a regional framework.

The USA and Australia do not have any legal responsibilities regarding an international framework. Although both countries state that they are committed to play a leading role internationally and to achieve their internationally agreed emissions, they did not ratify the Protocol. South Africa signed and ratified the Kyoto Protocol, but does not have any obligations towards emissions reduction. It is therefore unlikely that energy efficiency and emission reduction will become a high priority on the agenda of the South African government. There are currently no legal penalties for South Africa regarding the Kyoto protocol, but this is likely to change in 2012 when the first term is finalised and targets evaluated and re-allocated among the countries that ratified the protocol.

The reference case studies, especially The Netherlands and Denmark, had a mature national framework to stimulate energy efficiency in the built environment in place, before they started with the labelling programmes (section 5.3). The USA and Australia have also been encouraging energy efficiency since the eighties, although with less stringent measures. The GBfA programme was ahead of time when it started in 1997, as there was nothing like a national framework or action plan for energy efficiency in place. Although energy efficiency is still not a priority on the national political agenda due to other pressing needs, things are changing. Energy efficiency is currently becoming increasingly important. The DME has now developed a policy framework and strategy to stimulate energy efficiency in South Africa. Although energy efficiency is not yet fully integrated into policies and acts, it would be a more appropriate time to start developing a labelling programme such as the GBfA in South Africa.

Table 5-3 shows that the respective countries have the labelling programme integrated in their national strategy to stimulate energy efficiency (section 5.4). The labelling programmes are all initiated and operated by a government institution. Furthermore, in the case of the ABGR and ENERGY STAR the governments support the schemes by encouraging governmental institutions to participate in the scheme. The Dutch government supports the labelling programme by making it part of other measures to encourage energy efficiency, such as Long Term Agreements and the Environmental Act. It furthermore supports the programme by providing a tax rebate for building owners when participating in the programme. However, it was noted that labelling should not be linked to building regulations, since the purpose of labelling is to encourage excellent design and not to provide for compliance with minimum standards. Energy requirements in the building regulation do increase awareness among professionals in the built environment.

Building regulations are mainly applicable to *new* buildings, while the largest energy saving potential is within in the existing building stock. Labelling programmes can therefore play a significant role in a national strategy, since they address energy efficiency issues in the *existing* building stock. The GBfA was not part of a national strategy and therefore did not have policy support from the government. Furthermore, due to lack of financial capacity at that time, the South African government was unable to support the programme financially.

7.2.6 Commercial building market

Commercial buildings are a very heterogeneous target group (section 6.2). The ABGR reduced this heterogeneity by focussing solely on office buildings. ENERGY STAR also started with a label for office buildings, but developed benchmarks for other types of buildings over the years. ABGR and ENERGY STAR also provide a rating or target scheme for new buildings. ELO and EPA-U are not restricted to building type, but are limited to existing buildings. In all the case studies, the government is an important target group to participate in the labelling programmes.

The research attempted to determine the energy consumption in commercial buildings in South Africa (section 6.3). The annual average energy consumption of the buildings in the sample is between 278-289 KWh/m^2. However, the sample size was too small to generalise this figure for the total commercial building sector. More consumption data is required to enable a labelling programme to establish benchmarks for different building types and climate zones. The GBfA demonstrated, by means of the showcase buildings, that savings in energy consumption ranged from 13% to 36%, while the cost savings ranged from 10% to 28%.

A calculation exercise, outlined in Table 6-5, estimated that a mandatory energy audit (ELO-design) has the largest impact on potential energy savings and emission reduction. The benchmarking schemes are rated second but there is not much difference with the voluntary energy audit programmes. The mandatory approach that is currently implemented by the European Commission is expected to have the lowest impact.

The most important drivers of a labelling scheme are the current activities of DME such as the energy efficiency accord, and the integration of energy requirements in the building regulations. Drivers for building owners to participate in a labelling programme are the increasing energy costs due to increasing energy prices, financial support of Eskom and the energy efficiency accord.

The most important barriers to implement a labelling programme are the lack of awareness among the building owners and lack of technical expertise. Barriers towards participation in a labelling scheme are the tenant-property owner relationship; facility managers without effective decision making roles, and high initial investment costs.

7.3 Final Conclusion

This section provides the answer to the main research question, which now can be answered based on the conclusions in the previous sections. Figure 7-1 shows four main labelling approaches, however only three are discussed in this section, namely:

- Mandatory energy audit scheme;
- Voluntary energy audit scheme;
- Voluntary benchmarking scheme.

The fourth scheme, mandatory benchmarking scheme, is not considered as an option. Firstly, no such a scheme was found being implemented in a country. Secondly, in general, an energy audit is preferred over benchmarking, because of its comprehensiveness. Therefore, where a government is able to mandate a labelling scheme, an energy audit would be more appropriate than a benchmarking scheme.

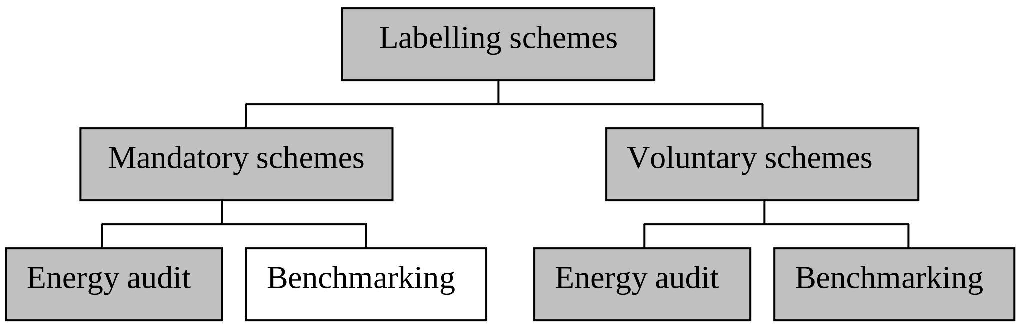

Figure 7-1: Different labelling approaches

The following sections, discusses the application of each of the approaches in the South African context. Section 7.3.4 consolidates these discussions and states the conclusion.

7.3.1 Mandatory energy audit scheme

The case study that represented the mandatory energy audit approach is the ELO-scheme. The EPDB also proposes a mandatory energy audit approach for implementation in the European Union. The main differences between the approaches are the time when labelling takes place and the renewal interval. *All* building owners in Denmark are required to obtain an ELO label and renew it annually. The EPDB is only applicable when the building changes ownership (reduces the size of the target group significantly) and the label is valid for 10 years.

A mandatory approach (ELO-scheme) is the most effective approach to achieve the highest CO_2 reductions, because the labelling scheme affects all the building owners in the country (section 6.4). The approach proposed by the EPDB will be less effective because it is only applicable when buildings change ownership and the label is valid for ten years.

A mandatory scheme can only be initiated and implemented by the government. This is the only authority in a country that can make labelling mandatory. The South African government is not yet ready to implement a mandatory labelling scheme. The planning of the DME is to implement mandatory labelling in 2015. The DME indicated that this mandatory scheme would be applicable when buildings change owner, which indicates the EPBD approach (E Du Toit 2006, pers. comm., 3 February). Table 6-5 shows that this type of labelling will not make a significant impact on energy savings and emission reduction.

The mandatory labelling approach as implemented by Denmark, will have a significant impact on the energy savings and emission reduction. However, it should be kept in mind that the ELO-scheme has been implemented in an already highly regulated construction industry, something that is not comparable to the South African building regulations. This approach requires an extensive operation; it requires hundreds of qualified engineers, skilled to carry out energy audits. In The Netherlands and Denmark, the qualification for energy consultants is a BSc degree in electrical, mechanical or building engineering. In South Africa, there is currently a shortage of engineers. The government should ensure that this shortage does not lead to minimising the qualification requirements of the energy consultant, since this will then also reduce the quality of the energy audit.

It furthermore requires a well-established and functional monitoring system to ensure that every building owner has the label in place. It also requires a well-developed quality control system to guarantee the quality of the energy audit reports. Moreover, penalties for non-compliance should be mandated by legislation and applied by the relevant government bodies.

The fact that many buildings are labelled does not mean that these labelled buildings will also be upgraded. The labelling scheme only provides the building owner with information regarding the energy performance of the building. Additional regulations or economic incentives need to be introduced to ensure upgrading. For example, an act that forces building owners to implement all cost-effective measures with a payback period of less than two years. Alternatively, a subsidy that bears part of the investment costs could be considered.

The strength of a mandatory energy audit programme is that it can be financially sustainable, without extensive funds from the government. Because it is mandatory, the programme can rely on guaranteed income from the labelling. However, this is only applicable when every building owner needs to apply for a label and label renewal is required annually or bi-annually (the ELO-design).

Although the South African government is moving towards a situation in which energy issues become more important, currently energy efficiency is not a priority on the national political agenda. The draft energy bill, which will provide DME with a legal mandate for a budget and structure to establish a national energy efficiency programme, has not been enacted. The political support for a mandatory labelling scheme from the government will therefore be limited.

7.3.2 Voluntary energy audit scheme

Case studies that represented the voluntary energy audit approach are the EPA-U and GBfA. A voluntary energy audit programme is not necessarily initiated or operated by government, although government policy support does benefit the programme. Experiences with the GBfA showed the difficulty maintaining an energy audit programme on purely market driven approach. Experts regarding the EPA-U label (E Bouten and G van Chruchten 2006, pers.comm., 11 January), say that the EPA-U will not be sustainable without the support of the Dutch government (e.g. programme support, subsidies, tax incentives). Therefore, government support is a critical factor in case of a voluntary energy audit programme.

Table 6-5 shows that a voluntary energy audit scheme is not the most effective labelling scheme. Although the estimates do not differ much from the voluntary energy benchmarking scheme, international experience shows that an energy audit programme entails significant administrative costs. Energy audit programmes require well-developed quality control and monitoring systems in place. Moreover, energy consultants need to be educated and trained.

The strength of the voluntary energy audit approach is that it gives a detailed and specific energy profile of the building. Furthermore, the suggestions for improvement are custom-made for the facility and include investment costs and the potential cost savings. However, the process is therefore comprehensive, costly and time consuming, and it requires the involvement of specialised energy consultants. Although these issues contribute to the quality of the label, the comprehensiveness and cost could inhibit building owners from participating.

In the case of a voluntary approach, the programme has to put much effort into promotion and marketing of the label to convince building owners of the benefits of the programme. The GBfA showed that it is difficult to convince building owners of the benefits of the programme. The strength of a voluntary energy audit scheme is that when building owners are participating, they are doing that voluntarily. This implies that they are interested in energy efficiency and the corresponding cost savings. Therefore, it is more likely that they will implement the recommended interventions to improve energy performance of their buildings.

A major opportunity for a voluntary energy audit programme is the Eskom's DSM programme, which finances capital investments for load management (100%) and energy efficiency projects (50%). Another opportunity is the Energy Efficiency Accord, whereby thirty industrial organisations have agreed with the DME to treat energy efficiency as important within their organisation. All these companies have headquarters, which can enter a labelling programme to show their commitment and achievements. This creates an opportunity to start up the labelling programme.

The major threat to a voluntary programme is the lack of awareness and the lack of interest of property owners. This remains a problem until the energy price increases significantly or an oil crisis hits South Africa. Furthermore, the tenant-property owner relationship is causing a barrier to the implementation of energy efficiency upgrades.

7.3.3 Voluntary benchmarking scheme

This section is based on implementation of the ABGR and ENERGY STAR. A voluntary benchmarking scheme is not necessarily initiated and operated by the government, although government support would benefit the programme. The strengths of a benchmarking scheme are that the approach is simple, quick and relatively cheap. The way to determine the energy performance of the building is significantly simpler than the energy audit programme. No energy consultant is required to obtain the energy performance of the buildings. The energy consultant is there solely to verify the data collection for the building owner.

Additionally, a voluntary energy benchmarking programme is easily accessible. Both the case studies are web-based programmes. They provide a calculation tool on the web to calculate the energy performance of the building and an accompanying tool gives the building owner suggestions on how to improve the building. Additional information and guidebooks are provided through the website.

A weakness of the benchmarking programme is that it does not generate a facility specific energy profile of the building and the suggested improvements are less technical. Operational management issues and a change in people's behaviour are more important (e.g. switching off lights, heating hours).

The triability of the benchmarking is high, in contrast with the energy audit programmes; the building owner can test the building on the internet with the help of the tools, before making a commitment to the programme. Observability of the benchmarking schemes is relatively low, since energy efficiency is not visible. However, labels and promotion material are developed to increase the observability of the achievements of the building owner.

Because of the voluntary nature of the programme, promotion and marketing activities are crucial during the implementation of the labelling programme to succeed. The approach is more business-oriented and less dependent on government support. The building owner needs to be convinced of the benefits of the programme.

A weakness of a voluntary benchmarking programme is that the target group consists of companies already interested in energy efficiency. This could be an advantage, since the companies are more likely to aim for excellent performance, upgrading the building to the maximum. However, the programme is less likely to convince ignorant building owners to participate.

Major opportunities are also Eskom's DSM programme and the Energy Efficiency Accord. The major barrier to the implementation of the programme is the tenant – property owner relationship. However, the benchmarking programmes showed that this can be overcome by providing separate rating schemes for tenants and property owners (ABGR). The lack of demand for a labelling programme from building owners is a serious threat. Environmentally responsible business activities do not yet offer a competitive edge in South Africa.

7.3.4 Conclusion

The failure of the GBfA can be attributed to several factors. However, the main reason is that the selected type of labelling programme did not match the context in which it was implemented. The GBfA was a voluntary energy audit programme with no policy or financial support from the government. This type of labelling programme is difficult to maintain even *with* government support, as shown by the Dutch labelling scheme, let alone without government support. Furthermore, in terms of national context, the GBfA was ahead of its time, as at the time of its launch there was no sustained interest or policy in energy efficiency at all. At the time, there was no established national policy framework present. This is now slowly changing

Although the programme design of the GBfA is similar to the programme design of EPA-U and ELO, it is very different when one looks at the context. The context of South Africa is similar to the USA and Australia, where the government leaves energy efficiency to the market and relies on voluntary activities. Energy audits are only sustainable in combination with strong government support. GBfA did not have that, and therefore the programme was not sustainable with that programme design. In view of the context, then, a voluntary benchmarking programme would have been more suitable.

Whereas the mandatory approach would be the most effective approach in terms of reducing CO_2 emissions; it requires implementation by government. The impact of a voluntary energy audit programme and benchmarking do not differ much. However, implementation of an energy audit programme entails more administrative and professional support costs. It requires government intervention in the form of financial support and additional implementation instruments, such as subsidies or tax incentives. In a context where resources are limited and developmental priorities out-compete environmental focus, preference goes to a voluntary benchmarking programme.

Throughout the document, it is argued that an energy audit is a better approach than a benchmarking approach because of the facility specific approach and the technical thoroughness. However, a benchmarking programme does not exclude energy audits. The building owner can carry out a self-assessment and find ways to improve performance, or alternatively an energy consultant would be enlisted to do this for the building owner. After upgrading, the building owner can apply for an accredited rating of the benchmarking programme.

Taking the current situation of the South African government into account, as well as the strengths and weaknesses of each of the approaches, the voluntary benchmarking programme would currently be the best labelling approach in South Africa. In the long term, a mandatory approach is more desirable; however, a study regarding the effectiveness of the different mandatory labelling programmes would be required.

7.4 Recommendations

It is recommended that in the short term, development of a labelling programme should be based on an energy-benchmarking programme. EPA-U and GBfA showed that a voluntary energy audit programme is very difficult to sustain, even if government support is at hand. Due to the national context of South Africa (development priorities, financial constraints and institutional capacity), a mandatory approach is currently not feasible. However, in the long term the government should aim for a mandatory scheme. In the short term, the best option for a successful labelling programme is a voluntary benchmarking programme with complementary government support especially in awareness promotion and market based incentives.

Ideally, the government should initiate and operate the labelling scheme. However, a non-profit or semi-government organisation would also be able to act as the implementing agent. It is imperative to secure funding for the first few years. Furthermore, it is important to focus on one type of building initially and gradually extend the labelling to different building types. Detailed data collection is required to be able to establish realistic benchmarks. The programme should develop objectives for the short term, and simultaneously develop the ultimate goal for the long term (be ambitious within reality).

The recommended labelling programme should aim at existing buildings, but also make provisions for new buildings. Although existing buildings form the largest part of the total building stock, new buildings should not be neglected (especially when the new energy efficiency standard will be integrated in the national building regulations). The labelling programme can provide information to the design team to encourage best practice. Energy efficiency is relatively easy to implement in the early stages of design without significant cost implications. Prevention is above all cheaper than retrofitting. In addition, to minimise the barrier of tenant-property owner, the labelling programme should develop separate ratings for the tenant and the property owner (section 6.6.1).

To ensure adoption of the labelling programme by building owners, the attributes of an innovation should be taken into account when developing an implementation strategy. Relative advantages should be defined and emphasised, e.g. the use of the label as a trademark to increase the value of market recognition for the benefit of labelled properties.

The process of obtaining a label and the calculation of the energy performance should be transparent and simple enough for building owners to understand. However, a certain level of complexity is required to obtain credibility and to cover technical building systems in the building.

To increase observability, the labelling programme should establish the label as a trademark. This increases the visibility of the achievements of the building owner. It also triggers competitiveness among building owners, because the competitor has something they do not have. The programme should allow the building owners to use the trademark for promotion and marketing purposes to increase observability and visibility.

The ultimate goal of a labelling scheme is to create energy efficient buildings. Therefore, it is preferable that labels be awarded to buildings that perform better than average. The ENERGY STAR is such an example where only the top 25% performing buildings are awarded with a label.

Calculation of the energy performance should ideally consider the asset calculation of a building and the operational calculation. Performance of a building is determined by the efficiency of the assets available in a building (e.g. air-conditioning, vans, equipment) and the operational side of the building (e.g. settings of the air-conditioning, light switches). Furthermore, to be able to compare and rate the energy performance of a building the programme needs to establish benchmarks for different climate areas and different building types.

Appropriate calculation software should be developed in order to establish benchmarks. The calculation software should take into account different building and fuel types, as well as climate data and basic building characteristics.

An opportunity for the future GBfA is to develop a web-based energy management tool for building owners or facility managers, which will allow building owners to manage and monitor the energy performance of their buildings. Building owners should be able to use the tool off-line to enter consumption data and on-line to upload the data to the GBfA. This will provide the GBfA with consumption data of buildings to enable constant review and update benchmarks and energy efficiency trends in the property market.

It is recommended that the training of energy consultants be left to the market. The SAEE provides courses such as the Building Energy Audit Course and the Certified Energy Managers Course. However, the programme can decide to insist on professional registration at Engineering Council of South Africa (ECSA), plus several years of practical experience as additional requirements to ensure quality.

With regard to the potential role of CDM projects, monitoring and evaluation should be taken into account when designing the labelling programme. A verification methodology should be developed to measure achievements and consequently measure the effectiveness of the labelling programme.

An opportunity for the proposed GBfA is the energy efficiency accord. The programme should become involved with the organisations that signed the accord and convince them of the benefits of labelling their buildings (as tenants or owners).

7.5 Recommendations for Further Research

The initial objective of this research was to determine the effectiveness of several energy labelling programmes. However, it appeared too ambitious within the scope of a masters thesis. Effectiveness of labelling programmes is dependent on several factors, such as number of participants, percentage of participants that actually improve the energy performance, and the potential energy savings achievable in a building. It would be very interesting and useful to develop and apply a methodology to determine the effectiveness of labelling schemes for commercial buildings in terms of energy savings and greenhouse gas emissions reductions. Ability of such a methodology to benchmark cost effectiveness (kWh/R of investments) would be invaluable.

A voluntary energy benchmarking programme requires a database to create an understanding of current (baseline) energy consumption in commercial buildings in South Africa. This would not only obtain information on the total energy consumption of buildings, but also create an understanding where this energy is used and what the major energy saving opportunities are at a national scale.

Further research is also necessary on the technical aspects of energy efficiency in buildings to obtain an understanding of the latest technologies available on the market, and their impact on the energy consumption of the building. In addition, there is a need to create an understanding of the impact of changing people's behaviour on energy consumption of a building.

The assessment of drivers and barriers towards energy efficiency and labelling programmes is based on experience of the case studies. It would be useful to carry out a market survey in order to obtain more precise understanding of what type of information is available among building owners regarding energy efficiency in their buildings and furthermore what would drive building owners to upgrade and label their buildings.

References

Australian Building Greenhouse Rating (ABGR) 2005, *ABGR calculator 4.08.* Available from: www.abgr.com.au [cited 25 November 2005]

Africon 2005, *Energy efficiency: Energy and demand efficiency for commercial buildings – Interim report*.
Available from: http://www.dme.gov.za [cited 4 April 2006]

Aho, I 1999, 'Market transformation: Building certification', *Proceedings SAVE conference for an energy efficient millennium*, Session I, Lecture 3, Graz, Austria.

Australian Greenhouse Office (AGO) 1999, *Australian commercial Building Sector: Greenhouse Gas Emissions 1990-2010*, Commonwealth of Australia, Canberra. Available from: www.greenhouse.gov.au/energyefficiency/building [cited 15 November 2005)

Beerepoot, M 2005, 'The effectiveness of energy labels in improving sustainability in the Building Stock', *Proceedings Sustainable Building Conference 2005*, Paper 18-017, Tokyo, Japan.

Boonstra, C, Cohen, R, Bordass, B, Field, J, Clocquet 2005, 'Europrosper: Experiences in energy labelling of existing buildings', *Proceedings Sustainable Building Conference 2005*, Paper 11-033, Tokyo, Japan.

Bordass, B, Cohen, R, Field, J 2004, 'Energy performance of non-domestic buildings: Closing the credibility gap', *Proceedings International Conference on Improving Energy Efficiency in Commercial Buildings IEECB'04,* Frankfurt, Germany.
Available from http://europrosper.energyprojects.net/ [cited 29 November 2005]

Bordass, B 2005, *How energy performance certification and benchmarking might work for buildings in operation, using actual energy consumption*, Discussion paper.

Available from http://europrosper.energyprojects.net/ [cited 20 November 2005]

Bureau of National Affairs (BNA) 2005, 'Experts meeting: Begins discussion of post-2012 period', *BNA International Environmental Reporter*, vol. 28, no 10, p 357, 18 May.
Available from: http://unfccc.int/press/news_room/unfccc_in_the_press/items/2781.php or http://www.bna.com/products/ens/iner.htm [cited 25 April 2006]

Corpelijn, M, Graaf de, R, Jullens, J 2004, *Ex ante evaluatie EIA and EPA-U of Quickscan: Mogelijkheden, kosten en opbrengsten in kantoren, detialhandel, onderwijs, gezondheidszorg,* In commission of SenterNovem, Rotterdam/Arnhem.

Council for Scientific and Industrial Research (CSIR) 2005, *Final Report Evaluation: SAEDES Pilot Study*, Prepared for Department of Minerals and Energy (DME), Unpublished document, Pretoria.

Council for Scientific and Industrial Research (CSIR) 2006 *The completion of SANS 0204: Energy standard for buildings excluding those with passive environmental control,* Unpublished document, CSIR, Pretoria.

Danish Energy Authority (DEA) 1996, *Act to Promote Energy and Water Savings in Buildings*, no. 485 of 12 June 1996, Legislative document.

Danish Energy Authority (DEA) 1999, *Executive order on fees and liability insurance for energy rating of buildings*, no. 1170 of 16 December 1996, Legislative document.

Department of Minerals and Energy (DME) 1998a, *White paper on the energy policy of the Republic of South Africa*, Pretoria.
Available from: http://www.dme.gov.za [26 April 2006]

Department of Minerals and Energy (DME) 1998b, SAEDES guideline: *Energy and demand efficiency standard for existing and new commercial buildings*, Pretoria.

Department of Minerals and Energy (DME) 2002, *Digest of South African energy statistics,* Pretoria.

Department of Minerals and Energy (DME) 2005, *Energy efficiency strategy of the Republic of South Africa*, Pretoria.
Available from: http://www.dme.gov.za [25 November 2005]

Douglas, B, Schäffler, J 2005, 'A sustainable energy Future for South Africa? Results from a scenario exercise to 2050', *Proceedings fourth conference sustainable built environments: Enabling frameworks for sustainability – Working towards triple-bottom-line outcomes*, p.10-19, University of Pretoria, Pretoria

Eberhard, A 2004, Electricity reform in SA is at a critical juncture, *Business Day South Africa*, 29 July 2004.
Available from: http://cesp.stanford.edu/news/321/ [cited 2 September 2005]

Ecofys (2004), *Evaluatie van het klimaatbeleid in the gebouwde omgeving 1995-2002*, prepared for Department of Housing, Spatial Planning and Environment.
Available from: www.ecofys.nl/nl/publicaties/documents/Samenvattingrapport_20040623.pdf [cited 2 December 2005]

Energy Information Administration (EIA) 2004, *South African Country Analysis.*
Available from: http://www.eia.doe.gov/emeu/cabs/safrica.html [cited 20 July 2006]

Environmental Protection Agency United States (EPA) 2003, *Energy Star – The power to protect the environment through energy efficiency*.
Available from: http://www.energystar.com [cited 13 March 2006]

Eskom 2003, *Annual report 2003*.
Available from: http://www.eskom.co.za/about/Annual%20Report%202003/index.html

European Commission (EC) 2000, *EU policies and measures to reduce greenhouse gas emissions: Towards a European Climate Change Programme (ECCP)*, COM (2000) 88.
Available from: http://ec.europa.eu/environment/docum/index.htm [cited 30 March 2006]

European Commission (EC) 2002, ‘Council directive 2002/91/EC of 16 December 2002 on the energy performance of buildings’, *Official journal of the European Communities*, no. L1, 4 January 2003 pp. 65-71. [cited 14 May 2006]

Grobler, LJ, Singh, V 1998, *Green Buildings for Africa Programme: Work plan for introducing the Green Buildings for Africa Programme into the commercial building sector*, CSIR, Pretoria.

Grobler, LJ and Singh, V 1999, ‘The Green Buildings for Africa programme’, *Building Research & Information*, vol. 27, no. 3, pp.183-193.

Grobler, LJ 2002, ‘Energy use in buildings: A strategy to reduce their usage’, *Proceedings Sustainable Building and Integrated Design (SBID) Solar Academy*, Johannesburg.

Hattingh, J 2002, ‘On the imperative of sustainable development: A philosophical and ethical appraisal’ in J van Rensburg (ed.) *Environmental Education, Ethics and Action*, EEASA & HSRC, Pretoria, pp 5-16.

Henderson, G, Tillerson, K, Blaustein, E 2001, ‘Building Energy Labelling in existing buildings’ *Proceedings Summer Study 2001 European Council for Energy Efficiency Economy (ECEEE)*. Mandelieu, France.
Available from: www.eceee.org [cited 30 September 2005]

Hicks, TW, von Neida, B 2000, ‘An evaluation of America’s first ENERGY STAR® buildings: The class of 1999’ *Proceedings American Council for an Energy Efficient Economy (ACEEE) 2000*, Pacific Grove, California.

Hines, V 1990, *Possible effects of electric-utility DSM programs, 1990-2010*, Oak Ridge National Laboratory, Oak Ridge.

Howard, N 2005, ‘Building Environmental Assessment Methods: In Practice’, *Proceedings Sustainable Building Conference 2005*, Paper 04-059, Tokyo, Japan.

International Energy Agency (IEA) 2004, *Key world energy statistics.*
Available from: http://www.iea.org [cited 5 September 2005]

International Energy Agency (IEA) 2005, *Key world energy statistics.* Available from: http://www.iea.org [cited 4 March 2006]

Kaatz, E, Barker, G, Hill, R, Bowen, P 2002, 'A comparative evaluation of building environmental assessment methods: Suitability for the South African context', *Proceedings Sustainable Building Conference 2002*, Oslo, Norway.

Kuijsters, A 2004, 'Environmental response of the Chilean building Sector: Efforts and constraints towards environmental building practices in the Santiago Metropolitan Region', MSc Thesis, Eindhoven University of Technology. Available from: http://www.tue.nl/bib [cited 25 January 2005]

Lausten, J, Lorenzen, K 2003, *Danish Experience in Energy Labelling of Buildings*, Danish Energy Authority. Available from: www.eva.ac.at/publ/pdf/forum_experience_dk.pdf [cited 16 August 2005]

Lytras, K and Gaspar, C 2003, *Topic report: Energy audit models*, SAVE project AUDIT II, European Union.w Available from: http://www.eva.ac.at [cited 20 January 2006]

Mesures d'Utilisation Rationelle de l'Energie (Mure) 1998, *Database*, European Commission. Available from: http://www.mure2.com [cited 2 February 2006]

National Treasury 2006, *Draft policy paper: A framework for considering market-based instruments to support environmental fiscal reform in South Africa*, Tax Policy Chief Director, Pretoria. Available from: http://www.treasury.gov.za/ [cited 16 May 2006]

Nortje, T 2005, *South Africa's Demand Side Management Program: A savings opportunity*, Johannesburg. Available from: http://www.eskomdms.co.za [cited 2 September 2005]

Organisation for Economic Co-operation and Development (OECD) 2003, *Environmentally sustainable buildings: Challenges and policies*, Paris. Available from: http://www.oecd.org/publications/Pol_brief [cited 6 July 2005]

Parsons, SA 2004, *International building energy standards (codes): Their relevance for the proposed SA National Energy Efficiency Standard SANS 0204*, Unpublished document, CSIR, Pretoria.

Poulsen, H 2001, *Energy Labelling of Existing Buildings: Case study Denmark*, Belas SAVE project contract No. XVII/4.1031/Z/99-261.
Available from: http://belas.jrc.it/final_report.pdf [15 February 2006

Reinikainen, E 2002, *AUDIT II: Country Report Denmark*, SAVE Project AUDIT. Available from: http://www.motiva.fi/en/projects/saveiiprogramme/auditiiproject/countryreportsgroup1.html [cited 15 February 2006]

Rode, E 2006, 'Commercial and industrial property boom', *Property News*, January 2006 Vol 1, No 10, pp 4-5, Malnor (pty) Limited, Aucknd Park, Johannesburg.

Rogers, EM 1995, *Diffusion of Innovations*, Fourth Edition, The Free Press, New York.

SenterNovem (2004) *Energiebesparings monitor gebouwde omgeving 2003*, Utrecht.
Available from: http://www.senternovem.nl/kompas/aanpak/monitoring/energiebesparingsmonitor_gebouwde_omgeving_2003.asp [cited 25 December 2005]

SenterNovem 2005, *Voordelen EPA-U: Waarom EPA-U?*
Available from: http://www.senternovem.nl/kompas/utiliteitsbouw/EPA-Utiliteitsbouw/index.asp [cited 20 August 2005]

Singh, V 1998, *Green Buildings for Africa: Interim steering committee meeting. Unpublished*, Presentation 15 May 1998, CSIR, Pretoria.

Singh, V 1999a, *Green Buildings for Africa Status Report*, Unpublished report, CSIR, Pretoria.

Singh, V 1999b, *Green Buildings for Africa discussion document*: *Boutek strategic planning session*, unpublished document, CSIR, Pretoria.

South African Property Owners Association (SAPOA) 2006, 'SAPOA office vacancy survey', *Property Review*, Jan-Feb 2006, Auckland Park, Johannesburg.

Statistics South Africa (StatsSA) 2005, *Natural resource accounts: Energy accounts for South Africa: 1995-2001*, Statistics South Africa, Pretoria.

Sunikka, M 2001, *Policies and regulations for sustainable building: A comparative study of five European countries*, Housing and urban policy studies no 19, DUP Science Delft University Press, Delft.

Sunikka, M 2005, 'Energy certificate in the energy performance of buildings directive: Effectiveness of the application on the existing housing stock in the UK', *Proceedings Sustainable Building Conference 2005*, Paper 11-001, Tokyo, Japan.

United Nations Environmental Programme (UNEP) and United States Environmental Protection Agency (EPA) 1997, *Reducing greenhouse gas emissions: The role of voluntary programmes*, United Nations Environmental Programme Publication.

United Nations Framework Convention on Climate Change (UNFCCC) 2006, *The mechanisms under the Kyoto Protocol: The Clean Development Mechanism, Joint Implementation and Emissions Trading.*
Available from: http://unfccc.int/kyoto_mechanisms/items/1673.php [cited 8 August 2006]

United Nations Framework Convention on Climate Change (UNFCCC) 2005a, *Caring for climate: a guide to the Climate Change Convention and the Kyoto Protocol*, Climate Change Secretariat, Bonn.
Available from: http://unfccc.int/essential_background/items/2877.php [cited 5 December 2006]

United Nations Framework Convention on Climate Change (UNFCCC) 2005b, *The first ten years*, Climate Change Secretariat, Bonn.
Available from: http://unfccc.int/essential_background/items/2877.php [cited 5 December 2006]

United Nations Industrial Development Organisation (UNIDO) 2003, *CDM investor guide: South Africa*.
Available from: http://www.unido.org/file-storage/download/?file_id=12074 [cited 24 April 2006]

United States Green Building Council (USGBC) 2006, Certified project list.
Available from: http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx?CMSPageID=247& [cited March 2006]

Van Egmond – de Wilde de Ligny, ELC 2001, *Technology Policies in Developing Countries. Lecture Notes course 0N470,* Eindhoven University of Technology, Eindhoven.

Väisänen, H, Chirstensen, W, Despretz, H, Espegren, KA, Gaspar, C, Lytras, K, Meyer, B, Reinikainen, E, Sattler, M, Starzer, O 2003, *Guidebook for Energy Audit Programme Developers,* SAVE project AUDIT II, European Union.
Available from: http://www.eva.ac.at [cited 20 January 2006]

Waide, P 1999, 'Market analysis and effect of EU labeling and standards: The example of cold appliances', *Proceedings SAVE conference for an energy efficient millennium*, Session IV, Lecture 2, Graz, Austria.

Wikipedia contributors 2006, *Asia-Pacific Partnership on Clean Development and Climate.* Wikipedia, The Free Encyclopedia.
Available from: http://en.wikipedia.org/w/index.php?title=Asia-Pacific_Partnership_on_Clean_Development_and_Climate&oldid=70961792 [cited 4 March 2006]

Yin, RK 1989, *Case study research: Design and methods*, Newbury Park, Sage.

Zimmerman, A, Aho, I, Bordass, W, Geissler, S, Jaaniste, R 2002 'Proposed framework for environmental assessment of existing buildings' *Proceedings Sustainable Building Conference 2002*, Oslo, Norway.

APPENDICES

Introduction to Appendices

The appendices are created to provide supplementary information regarding the research. The following five appendices are included in the report:

Appendix A is a summary of the interviews carried out during the research;
Appendix B contains information regarding ABGR programme;
Appendix C contains information regarding EPA-U programme;
Appendix D contains information regarding ELO programme;
Appendix E contains information regarding ENERGY STAR programme;
Appendix F contains information regarding GBfA programme.

Appendix A is a summary of the interviews with relevant people carried out during the research (section 2.10.4). The initial programme managers of the Green Buildings for Africa, Mr V. Singh and Prof. LG. Grobler were interviewed regarding the start-up and development of the GBfA programme and their experiences with the programme (section A.1-A.2). During a visit to the Netherlands, two interviews were carried out. Firstly, Mr. E.Blankestijn, of Senter Novem (the organisation tasked with the national administration and implementation of the EPA-U programme) was interviewed (section A.3). Secondly, an interview was conducted with two consultants of EBM, Mr E. Bouten and Mrs. G. van Chruchten. EBM is a consultancy firm involved in carrying out EPA-U s, developing EPA-U software and offering courses regarding the EPA-U methodology (section A.4). Dr E. du Toit, director of the Energy Efficiency and Environment directorate within DME was interviewed regarding current developments and activities in relation to the national energy policy framework in South Africa (section A.5).

Appendices B - F provide additional information about the case studies. The appendices are compiled based on a range of secondary and primary data sources, such as interviews, journal articles, presentations, evaluation reports, research reports, and website content. This information is collected, structured and synthesised according to the assessment framework (section 2.9), which is also reflected in the structure of the main report.

The reasons for inclusion of these comprehensive appendices are twofold. Firstly, the appendices were created to consolidate and structure the large amounts of discrete and segmented information available on each case study. Each appendix is therefore structured according to the four main chapters of the thesis, namely programme design, labelling characteristics, national context and commercial building sector. The sub-sections also correspond with the structure used in the main body of the thesis.

Secondly, the appendices can be used as a reference guide to provide the reader with in-depth information regarding a specific case study. Furthermore, in case the reader wants to execute further research on energy labelling of buildings the appendices can act as a starting point. Each appendix therefore ends with a bibliography, which also includes references not directly cited to in the report, but considered to be relevant for the corresponding case study (references which are already listed in the reference-list of the main report are not repeated in the bibliography).

Appendix A Interviews

During the research five interviews took place and one email conversation. This appendix provides a summary of these interviews.

A.1 Interview with Vinod Singh

Vinod Singh was the project leader of the GBfA programme at the CSIR from 1998 to 1999. He is currently working for the City of Johannesburg. The interview took place on 31st of August at the Metro Centre in Johannesburg.

Vinod Singh joined the GBfA programme when it was running for one year and he became a full-time project manager of the programme. The programme started within Fire Investigations but moved to the division 'Facilities Planning and Management' in 1999. The programme was funded out of allocations from regular Parliamentary Grant to the CSIR and IIEC provided technical support (time of their staff).

The focus of the programme was mainly on energy issues, while 'green buildings' comprises more than only energy. The focus of the GBfA on energy issues was mainly to create a profitable win-win situation; the largest tangible cost savings could be made by energy savings. The objective of the programme was to transform the market perception of commercial building sector and to reward those companies which strive to improve the environmental performance, indoor air quality and energy efficiency of their buildings.

The major barriers to the programme were the fund raising and financial sustainability of the programme. Furthermore, it was very difficult to convince building owners of the benefits to participate in the showcase programme. The commercial building market is very reluctant to change regarding environmental issues. Property owners do not want to assess their indoor air quality, because the results can be used against them when the building has a poor indoor air quality.

On the question if the BEARS tool was a sufficient tool to determine the environmental impact of the building, Mr Singh answered that the BEARS assessment tool was never indented to be a scientific high standing tool; the GBfA programme was experimenting to improve it over time. The idea was to create separate tools for hotel, housing etc over time.

With the change of project leader in 2000 the objectives of the programme changed to a more educational role. The change of strategy when Mr Singh left the programme was mainly due to the change of strategy of Facility Planning and Management. It did not have to do with the capacities and background of the succeeding programme manager.

To revive the GBfA programme, Mr Singh advises to do a market research to identify the needs of the property owners and make a proper business plan. Access to continuous funding is the most critical issue.

A.2 Interview with Prof Grobler

Prof Grobler was closely involved with the initiation and development of the GBfA programme. He is a full-time lecturer at the School for Mechanical and Materials Engineering at the Potchefstroom University. The interview took place on the 2nd of November, 2005 at the University of Potchefstroom

Prof Grobler was involved from the start of GBfA. He was involved, together with Richard Truter and Theuns Knoetze, in the development of the BEARS (Building Environment Assessment and Rating System) that was derived from BREEAM. From the start, the property owners were not very receptive to the system since they were afraid of negative results and publication. Therefore they decided to bring it in a different form, namely the Green Buildings for Africa programme. The GBfA programme started off well, however some organisational changes within the CSIR did not benefit further implementation of the programme.

Prof Grobler confirmed that GBfA was mainly focussed on energy, with the intention of expanding the programme in the future. The energy focus was also due to the development of the SAEDES documents, which was done under the umbrella of GBfA for DME.

With the development of an assessment scheme there should be a difference between the design and the management. The building can be designed as highly energy efficient, but when effective management at the operational stage is lacking the design is useless. This indicates that the management of a building is as important, if not, more important than the design.

Prof Grobler is member/President of Southern Africa Association for Energy Efficiency (www.SAEE.org.za) and also member/(President-elect for 2007) of Association of Energy Engineers (www.aeecenter.org). The two associations are linked and SAEE is part of AEE. These organisations offer courses to become a Certified Energy Engineer and offer a Building Energy Audit Training. According to Prof Grobler ***credibility*** of the programme and programme organisation is very important in the implementation of the GBfA. Credibility can be obtained by doing one of the courses provided by SAEE and AEE.

Currently there are more drivers towards energy efficiency than when the GBfA was initiated. Four important trends and documents indicate that energy efficiency will be very important in the near future:

1. SANS 204 (regulation)
2. Energy Efficiency Strategy
3. DSM Eskom. Eskom has the funding which government cannot provide; Eskom provides subsidies to building owners for refurbishing and upgrading their offices. They support energy efficiency initiatives and subsidise 50% of the capital costs up to 100% (50% has to be paid back over a few years). Their budget is R500 million a year.
4. Energy Efficiency Accord. This is signed by the DME and approximately thirty industrial and mining companies. The companies indicated that they will be committed to energy efficiency by signing the accord. This means that those companies will have to come up with energy efficiency initiatives.

These drivers indicate that energy efficiency in commercial buildings is becoming more and more important. Prof Grobler acknowledged that it is good to start with energy efficiency and extend from there with waste, air quality, water etc. To restart the GBfA again, the first thing to do is a needs assessment of the industry which can consist of analysing the drivers for energy efficiency, which indicate what the industry has to comply with in the coming years (STEP 1). From there the CSIR should decide on whether there is a niche to be filled, a business opportunity. But keep in mind that credibility and professionalism is most important (STEP 2).

Regarding the question if the CSIR would be the right organisation to host the programme, Prof Grobler could not confirm. However, the programme needs to be developed and researched, which is step 1. After that, it might be taken over by for example Agrement. Though, a small team of building experts should be working on it to maintain the system.

A.3 Interview with energy consultancy agency EBM

Consultant agency EBM is located in Arnhem in The Netherlands. They focus on energy, building physics and environmental issues in the new and existing building stock. The interview took place with two consultants, Eric Bouten and Gerelle van Cruchten, on the 11th of January 2006.

EBM has been closely involved with the development of the EPA-U. EBM carries out EPA-Us, developed the EPA-U software and offers courses regarding the EPA-Umethodology. Furthermore EBM participates in several research projects, in cooperation with other European consultancies and research institutes, regarding the implementation of the EPBD, e.g.:

- ENPER-EXIST (January 2005 - July 2007): http://www.enper-exist.com
- EPA-NR (January 2005 - January 2007): http://www.epa-nr.org
- EPA-ED (October 2002 - October 2004): http://www.epa-ed.org/
- Build-On-RES (January 2002 - July 2004): http://www.buildonres.org.

Energy consumption

Usage of gas is decreasing, but the consumption of electricity is increasing. Energy is the main component when talking about environmental issues. The chapter ‘environmental issues’ in the Building Decree (building regulations) is still empty and the chapter ‘energy’ is only two pages, while the total document is hundreds of pages. Energy is still not a high priority.

Voluntary or mandatory labelling programme

After years of experience with the voluntary EPA-W and EPA-U, the consultants are convinced that a voluntary system will only work when the energy prices rise in the near future. Market driven systems will not work, since there are not many measures that will provide the energy improvement without a long PayBackPeriod (PBP) in the Netherlands. There are not many financial attractive measures with a PBP less than five years. Furthermore, the consultants estimate that 10-20% of the companies are environmentally aware, and they will take the necessary measures to increase their energy performance. The other 80% of the companies are not interested, which makes the voluntary market very small, and you are aiming at people who are already environmentally aware. Both consultants do not have faith in a voluntary system; it needs to be mandatory to attract the attention of the property owners. Drivers for companies to voluntarily execute an EPA are financial advantage (tax rebates, subsidies), positive public image, and obligation (Environmental Act)

Implementation of the EPDB

The implementation of the EPDB in the Netherlands is very slow. The government was supposed to have all mechanisms in place by January 2006; however they requested to postpone this deadline. The official reason is the lack of qualified experts that have to carry out the labelling, but more important is that the Dutch government does not want to put a cost-burden on the population. The administrative costs for the population is a valid reason according to the consultants, but the government also knew since 2002 that they have to implement the EPBD directive, so they could have prepared better and not just wait till the latest moment. The Department of Housing, Spatial Planning and Environment (VROM) is currently doing a study to find out what alternatives are available to cut the costs for the Dutch citizen. The EPDB is a mandatory system, but according to the government will turn out too expensive for people. There will be a staged implementation of the EPDB starting in 2007, meaning that first the governmental buildings and residential sector has to comply, and then the non-residential, etc.

Energy Performance Advice for Non-Residential Buildings (EPA-U)

The EPA calculation is determined based on the characteristics of the building; it does not take into account user behaviour. The score can be corrected for standard user-behaviour, based on several behaviour characteristics. The EPA has been implemented in commercial property sector, banks, department of defence (> 1 000 buildings) and municipal buildings. EMB developed a software programme, the EP-ACT, to calculate the energy performance of buildings. There are several similar instruments available on the Dutch market.

Implementation effectiveness of EPA-U

At the moment the supply of offices is larger than the demand for offices. This means that people can choose. Energy efficiency can then play a decision-factor. For the owners of offices it can be an incentive to make the building more energy efficient to be able to sell/rent the property sooner. Furthermore the energy prices can be a substantial part of the rent of the property, which can be an incentive for the owner. The development of the methodology and calculation method is not a problem, but the implementation and the monitoring will continue to be a problem, no matter which country. Regarding finances; there should be a continuous money stream. It is only possible to implement a labeling scheme through the government. There are not many opportunities for a commercial company to host the labelling scheme.

Auditors

Companies and organisations are certified to issue certificates, not individuals. The auditors should apply the 'Manual for the EPA (ISSO, nr 27)'. The companies decide if a person is competent to execute an EPA.

A.4 Interview with SenterNovem

SenterNovem is the implementing agency of VROM and Department of Economical Affairs (EZ). SenterNovem is a consultancy agency, which forms a bridge between the government and commercial companies. Their aim is to encourage environmental sustainability and innovation. They provide local government, individuals, and companies with advise, network, information and subsidies. SenterNovem is responsible for the operation, implementation and promotion of the EPA-U programme, maintaining the EPA-U website and the helpdesk. The interview took place with Mr. Ed Blankestijn on the 12th of January, 2006. SenterNovem also works on international level and executes projects for European Union, International Energy Agency and the World Bank.

Existing Buildings

In 2000, the Dutch government had money available for home owners to increase the level of energy performance of their building. The government had a subsidy, Energy

Performance Refund (EPR) to encourage energy efficiency in dwellings. To assist the home owners to decide how to improve the energy efficiency of their dwelling, the government developed the EPA (Energy Performance Advise). The EPA was developed to give information regarding the energy performance of the dwelling. When homeowners executed an EPA they received an extra bonus of 25% on top of the EPR subsidy submitted. Till 2004 there were 600 000 applicants for the EPR, of which 10% made use of the EPA

Parallel to the EPA for residential buildings, the EPA-U was developed for non residential buildings by the stakeholder groups. The EPA for Hospitals was developed by stakeholders involved in hospitals. The EPA for Offices was developed by the stakeholders involved in the development of offices. In April 2002 there were several versions of the EPA-U.

In 2002, SenterNovem executed an evaluation of the climate policies (tussenevaluatie Klimaatbeleid) for the built environment. Two major issues were highlighted: firstly, the CO_2 emission reduction had to be reduced and the built environment was identified as a high potential sector. Secondly, the European Union introduced the EPDB, which required a certification system for the built environment. The EPA needed to serve as a generic basis to comply with the EPDB. This led to the development of the EPA-U.

Halfway 2003, a programme manual was developed, and April 2004 the EPA-U should have been finished to serve as a proper instrument to comply with the EPDB. To guarantee the quality, a BRL (BeoordelingsRichtLijn) was developed, which sets requirements for consultants (education level, knowledge, experience), monitoring and the certification system.

The software programme was developed by VABI (ICT company specialised in software applications for the built environment), which made different versions available for a range of building types, namely

- A generic excel version;
- A standard calculation module which can be used by other programmers for software development;
- A comprehensive version (including different building types, but also additional norms and standards set by the government).

The EPA-U has never been adopted/implemented very well, which is mainly due to the uncertainty of the implementation of the EPDB. They did not want to put too much effort in the implementation and promotion of the EPA-U, before there was more clarity on the development and implementation of the EPDB. Eventually, VROM decided that they did not want to implement the EPA-U. When companies want advice on the energy performance of the buildings, they should do it the way it was always done, namely go to a consultancy agency that will do an energy audit of the building.

The EPDB system was ready around July-August 2005 and was presented to the board of ministers, but they concluded that it will be too expensive. The government does not want to put an extra cost burden on the people and companies. They wanted an investigation into more economical and profitable options. VROM will go to Brussels to apply for a postponement for the deadline of the implementation (4 January 2006). Further research should include costs-quality relation, effectiveness of certification and possible integration with ‘white certificates’ system.

The cost of certification is ~ €35-300, whereby €35 is for apartment block where there is some repetition, to €300 for a large single house. For non residential buildings, this amount is approximately €1 400-1 500 for an average office, but this will largely depend on the size of the building.

Purpose of the certificate

The EPDB certificate only measures and expresses the energy performance of the building not the user. The EPA-calculation also does not take user-behaviour into account, but it will be considered when making the advice. The certificate gives insight, but does not mean that owners will upgrade their buildings. The certificate provides information regarding the energy use of the building. This can be linked to a subsidy that provides funds to actually implement the measures to make the buildings more energy efficient.

SenterNovem carried out a study to compare three different certification systems:

1. Voluntary (only workable when there are additional measures that stimulate companies to execute an EPA, such as EPR)
2. Mandatory but simple and less costly (most cost effective)
3. Mandatory comprehensive

Mr Blankestijn does not believe in a voluntary scheme, as it should only work when labelling becomes mandatory. Keep in mind that:

1. The certificate gives information regarding energy efficiency of a building, but is not a guarantee that the measures will be implemented
2. Certification does not take into account user-behaviour, since the new tenant can be completely different (certification takes place when the dwelling is being sold, refurbished, etc)
3. The Environmental Management Act (Wm) can play a major role, since approximately 70% of the offices should already execute an energy audit and implement measures.

Environmental Management Act (Wet Milieubeheer = Wm)

Enforcement of the act is a problem as it depends on the priorities of municipalities. For example Amsterdam is very upfront with these issues and therefore the Act is implemented and monitored well. The act requires that each company/organisation which uses more than 50 000 kWh of energy should undertake an energy audit and implement measures with a pay back period less than five years. Approximately 70% of the number of offices use more than 50 000 kWh, which is equal to more or less 50% of the total office surface area.

Consultants

There are 150 certified consultants/bureaus/organisations who are allowed to issue certificates (residential sector) and 300 consultancies specialised in energy efficiency for U-buildings.

Facility Management

There is a gap between the Management (decision makers) and the Facility Managers. The problem is universal. They try to overcome the problem through:

1. MJA: Long Term Agreement. This agreement is concluded between the government and large companies, whereby they try to reduce the CO_2 emissions by 25%. There are many companies doing this, since it is good for their image and attitude in view of Department of Economic Affairs. Small companies are not a target group, since the major changes can be made among the big companies.

2. MJA is an agreement between EZ and large companies to achieve 25% reduction in CO_2 emission. SenterNovem support the company with technical advice and subsidies. The incentive for the companies is the good relationship between the two.
3. Environmental Management Act

A.5 Interview with Department of Minerals and Energy

Interview with Department of Minerals and Energy

Dr. Elsa du Toit is the Director of Energy Efficiency and Environment within the Department of Minerals and Energy of South Africa. She was the initiator of the Steering and Working Committee of the Green Buildings for Africa programme. The interview took place on the 3rd of February 2006 at Mineralia Centre in Pretoria. The goal of the interview was to obtain an understanding of the current activities of the DME regarding the commercial building sector.

International agreements

South Africa signed and ratified the Kyoto Protocol in 2002 and is categorised as a Non-Annex I country. This means that there are currently no legally binding CO_2 reduction targets South Africa needs to achieve. However, this situation could change with the start of the second phase of the Protocol in 2012/2013.

There are other international agreements which influence South Africa’s energy policies, such as the Basil agreement, but these do not have implications for the built environment. DME is currently working closely with several European governments, such as the Danish, Norwegian, and Dutch governments.

National policy documents regarding energy

National policy documents regarding energy consist of the White paper on Energy 1998, Energy Efficiency Strategy 2005, and the Draft Energy Bill. Energy efficiency plays a significant role in the Draft Energy Bill.

Current activities targeting commercial and public sector buildings

The DME is working in close cooperation with SABS to guide the development process of **SANS 204** ‘Energy Standard for Buildings excluding those with Passive Environmental Control’. The SANS 204 draft document was received by the SABS in

February 2006, but they concluded that the document is not yet in the correct standard format and needs to be redrafted.

The DME sent a **training manual** to all the **universities** to get Energy Efficiency implemented into the curriculum. Furthermore, a letter went out to all **State Owned Enterprises,** which included a request to integrate energy efficiency goals into the shareholders compacts of the companies.

The current focus of DME is mainly on the existing public-sector buildings. DME is working closely with the Department of Public Works to make **public buildings** more energy efficient. There are approximately 106 000 public-sector buildings in South Africa. The number of new commercial buildings will develop hand-in-hand with economic growth. DME does not have statistical data regarding commercial buildings.

The budget for the implementation of the Energy Efficiency Strategy 2005 is currently not sufficient; the energy efficiency and environment programme is relying heavily on donor funding. Fortunately energy efficiency pays for itself by savings accrued. The energy strategy for the built environment mainly consists of regulatory measures (standards & mandatory energy audits) and communication measures (energy management systems). There is no budget allocated from government to provide economic incentives systems, nevertheless CDM funding is available as well as tax allowances for the implementation of renewable energy and energy efficiency projects which would otherwise not have been considered.

Furthermore, DME is developing a **National Energy Efficiency Agency (NEEA)** in close cooperation with Eskom**,** NERSA and the Central Energy Fund. This agency has 50% of the DSM funds of Eskom available to spend on energy efficiency projects, which indicates that there are opportunities for project funding.

Labelling programme

One implementation measure from the Energy Efficiency Strategy is ‘Mandatory Energy Audits for Commercial Buildings’. The idea is to label/audit existing buildings when they change ownership. However, DME thinks there will be more buildings newly built than buildings changing ownership. DME would like to see an organisation/programme which develops the training, implementation and monitoring of the energy audits. Funding might be available through the NEEA.

ESCOs

At the moment there are at least 80 ESCOs (the ones trained by ESKOM), some of which are BEE companies, some fully trained and others not well trained yet.

Drivers for the commercial building market

Drivers for property owners/commercial building market to become more energy efficient are the Energy Efficiency Strategy 2005, SANS 204, Eskom's DSM programme, increasing energy prices due to the need for new generating capacity and the voluntary Energy Efficiency Accord (this is the agreement with the government to improve the energy efficiency of 37 industrial companies).

Barriers for the commercial building market

Barriers for property owners/commercial building market to become more energy efficient are low energy prices, energy efficiency not being a priority, lack of awareness, energy costs not being a substantial amount compared to the human capital costs, and lack of capacity within government.

A.6 Email contact with ABGR

In January 2006, email contact was established with Matthew Clark, programme manager of the ABGR programme. In the first instance of contact, it looked promising, and arrangements were initiated for a telephone interview. In spite of several following-up emails, he only responded once.

Market transformation

ABGR's main ongoing market penetration tracking is fairly straightforward and they do it in- house. They know how big the office market is from an annual survey of office space around Australia undertaken by the private sector Property Council of Australia. The "market penetration" measure is the proportion of that space that has obtained an official ABGR rating. Every official rating is lodged on the website by an ABGR Accredited Assessor, so they have a database of every rated building.

The market penetration is calculated simply by the ‘Area of rated buildings/Total market area’. The current figures show us that 23% of the national office market has been rated using ABGR. 36% of the NSW office market has been rated; NSW has the largest office market in Australia, and was the first to adopt ABGR.

Appendix B Australian Building Greenhouse Rating

B.1 Introduction

This appendix gives more information regarding the ABGR. It describes the programme in sections B.2 and B.3 and the context in which it is implemented in sections B.4 and B.5. A summary of the programme can be found in section 2.10.3 (page 45).

B.2 Programme Design

B.2.1 Programme goals

The ABGR programme sets its goals in terms of numbers. The programme needed to deliver 50 ratings and 5 commitment agreements in State of New South Wales during 2003/2004 (SEDA 2004). The programme delivered 49 accredited ratings compared with 41 in 2002/2003, and an additional 18 ratings on national level, mainly in Queensland and Australian Capital Territory. Furthermore, six organisations entered commitment agreements. This indicates that the ABGR sets realistic goals and reviews them in order to see if they are on track.

B.2.2 Organisational structure

Figure 3.2 (page 60) shows the organisational structure of the ABGR programme. The *administrator* of the scheme is DEUS. The national administrator ensures national consistency in procedures and processes and is responsible for the overall quality assurance procedures. Additional responsibilities are development of training programs and information packages, maintaining technical resources, national database of rated buildings, register of ABGR auditors and the website.

The *operating agent* is responsible for the overall implementation of the scheme and executes the marketing and promotion of the scheme at state level. It furthermore selects and authorises consultants and issues ABGR certificates. If the capacity is available, the operating agent also provides training to the energy consultant. Three state agencies, Sustainable Energy Authority (Victoria), Environmental Protection Agency (Queensland) and Sustainable Energy Development Office (Western Australia) act as the operating agents, or as called by the ABGR, the Regional Certification Body. DEUS acts as the operating agent in the other states where there is no operating agent identified.

The *energy consultant* is the professional authorised to issue an official ABGR rating to the client. The energy consultant, or the company he/she is working for, offers the ABGR rating to the market and is the only person that deals with the client. The *client* needs to have an understanding of the ABGR certification and that it needs to be renewed annually.

The role of the National Steering Committee and the National Technical Advisory Committee are explained in section 3.3 (page 57). Further information regarding the organisational structure can be found in 'Accredited assessor process outline' (ABGR 2002a)

B.2.3 Implementation costs

The ABGR programme is financed by rating fees and the financial support of the steering committee. Additionally, the Regional Certification Body pays a regular fee to the National Administration to cover administration support.

The energy consultant sets its own prices for an ABGR rating, which is left to market competition. The energy consultant has to pay an administration fee to the Regional Certification Body for each rating. The amount is determined by the National Administrator and the Steering Committee. The energy consultant also has to renew its certification annually and attend training courses, whereby the fees go to the relevant body.

The cost for the client to obtain an accredited rating is estimated to be between AUS $1 000 and AUS $3 000, which is 4 420 to 13 260 Rand[1], depending on the type of rating, size of the rated area and availability of required data. The label has to be renewed every year, so these are annual costs.

B.2.4 Promotion and marketing strategy

Although the ABGR programme is supported by federal government and state governments it takes a highly commercial approach towards the implementation of the programme. The most important benefit of the programme is that it offers competitive advantage and market recognition; the building owner can use the ABGR logo for promotion and marketing purposes.

[1] Exchange rate: 1 AUS $ = 4.42 SA Rand (30/03/2006)

The ABGR is not linked to any mandatory instruments, which require an ABGR rating. It is also not supported by financial incentives, such as subsidies or tax advantages. Nevertheless, the ABGR is adopted by several institutions and organisations, which have made the ABGR part of their voluntary programmes. Examples are:

- Australian Green Building Council's Environmental Rating Scheme: **Green Star**. The ABGR is required for the energy performance.
- Federal Government's National Australian Building Environmental Rating System: **NABERS**. The ABGR is required for the energy performance.
- **Accommodation policy** for government buildings. DEUS wants to set an example by committing public buildings to the ABGR scheme.
- **Energy Smart Programme for Businesses and Government (NSW).** The programme provides technical advice and assistance to business and government organisations. The organisations are encouraged to obtain an ABGR rating.
- **Sydney's 3 CBDs Greenhouse initiative**. This initiative stimulates commercial tenants to improve energy efficiency in offices in Sydney's three largest CBDs. Participants are required to obtain an ABGR rating for their office buildings.

The national administrator and the regional certification body promote the programme among government through involvement of as many agencies as possible. The energy consultant is responsible for promotion and marketing of the scheme among commercial clients. Additional promotion activities of the programme are website, monthly bulletin, marketing packages for the consultants, seminars, DEUS' Green Globe awards, ABGRs national case study conference.

B.2.5 Quality assurance

Quality assurance of the *consultants* is based on a combination of training, pre-qualification and an examination. The training is developed by the national administrator, executed by the regional bodies and mandatory for each consultant. Examination is part of the training; those who achieve acceptable results and agree with the aim of the scheme are accepted as certified consultants. There is limited information available regarding pre-qualification of the consultant. However, the website mentions that the consultant should be 'proficient with the technical aspects of operating commercial buildings and also have hands-on building management experience' (ABGR 2006). National procedures are put in place by the national administrator for the selection of the consultants.

Authorisation of the consultant is the responsibility of the Regional Certification Body, or National Administrator in case of absence of the Regional Certification Body. Accreditation is granted for twelve months (annual renewal) and the consultant needs to attend any training course that is required by ABGR for renewal of certification.

The ABGR certification process consists of verifying the data collected by the client and is therefore less complicated than a full energy audit procedure. Consequently, the quality assurance of the *process* is also less complex. The ABGR assures quality of the process by providing a Validation Protocol. This validation protocol is developed by the National Administrator in cooperation with the National Steering Committee and the National Technical Advisory Committee. The validation protocol covers detailed information regarding the steps required for the consultant during the verification.

The regional bodies are responsible for maintaining high quality standards and they regularly check work of the consultants. Quality control of the *end product* includes customer's service, accuracy of the star rating and the level of consultants' commitment to the scheme.

B.2.6 Monitoring and evaluation

Monitoring

The national administrator maintains a national database of rated buildings, which is available from the ABGR website. The energy consultant has to up-load every accredited building to the website. Because building owners have to renew their ratings annually, it is possible to monitor improvements in energy performance of the buildings. However, it is expected that the starting energy consumption remains unknown to the ABGR, since the building owner is likely to obtain an official ABGR rating after the building rates 3,5 stars or higher.

Evaluation

In 2003, DEUS initiated a survey to understand how the ABGR rating is used by the property market. The survey was carried out to create a baseline for further development of the programme and consisted of a comprehensive web-based questionnaire with questions regarding; usage of energy efficiency tools prior to ABGR, knowledge of the ABGR scheme, involvement of the ABGR scheme in work environment, promotion of ABGR to staff, and industry associations.

B.3 Label Characteristics

B.3.1 Process to obtain a label

To obtain a rating the building owner or tenant has to evaluate the energy performance online through the ABGR Performance Rating Tool. This tool gives a rough estimate of the building energy performance. Additionally, with the ABGR Diagnostic Tool the building owner or tenant can identify possible improvements to the building. However, the results of the tools do not give the building owner or tenant permission to use the logo of the ABGR. To obtain an official accredited rating it is required to contact an accredited assessor. Building owners or users are encouraged to collect all the information needed upfront to cut down on the time and costs for the accredited assessor. The assessor needs evidence of completeness and accuracy of the data and verifies the data in strict accordance with a validation protocol. After data verification, the assessor provides the client with the Accredited Performance Rating Certificate and a marketing package. The assessor notifies the client for certificate renewal before certification expires. The client is allowed to use the ABGR trademark (see Figure A-2) for publication and advertising material for a year.

B.3.2 Calculation of the energy performance

The ABGR programme provides the following three different types of ratings (ABGR 2002b). Table B-2 gives an overview of the number of accredited ratings per category.

- **Tenancy rating:** for leased office space within a building, covering the tenant's use of light and power (e.g. equipment, self controlled air-conditioning)
- **Base Building rating:** covering central services and common areas of a building (e.g. lighting, lifts, HVAC installations)
- **Whole Building rating:** a combination of the above

The performance calculation is based on an operational calculation. Very basic information such as floor area, occupation hours, number of people, number of computers and energy consumption (energy bills of the preceding 12 months) is required to perform the calculation. The calculation is based on operational consumption figures and therefore takes user behaviour into account.

The ABGR programme has a complementary rating for new buildings. Property developers have to sign a Commitment Agreement, which indicates the commitment to design, build and commission the building to a 4-5 star level. An approved third party contractor is involved to guarantee achievement of the ABGR star rating, based on an asset calculation. After twelve months of operation of the building, an ABGR rating needs to be executed to prove the performance of the buildings, based on the operational consumption figures. If the building does not comply, the building owner has another twelve months to upgrade its building.

Table B-1 Number of buildings rated in the different categories (ABGR 2006b)

ABGR rating	Tenancy rating	Base building rating	Whole building rating	Totals
0	-	-	2	**2**
1	-	1	1	**2**
1.5	2	6	2	**10**
2	2	5	2	**9**
2.5	2	7	5	**15**
3	4	10	10	**24 (76.1%)**
3.5	4	19	8	**31 (60.6%)**
4	2	12	5	**19 (40.6%)**
4.5	7	5	2	**14 (28, 4)%**
5	10	2	18	**30 (19.4%)**
Totals	**33 (21%)**	**67 (43%)**	**53 (36%)**	**155 (100%)**

The ABGR calculated performance is expressed in 'normalised emissions, kg CO_2 per m^2' and is ranked on a scale of 0 kg CO_2 per m^2 to 372 kg CO_2 per m^2, divided in five categories as can be seen in Table 4-1 (page 82).

B.3.3 Availability of tools

The ABGR provides a range of tools for the client as well as for the accredited assessor. Because the role of the client is more important in the process, the programme developed tools that are uncomplicated and user friendly. The 'Guideline for Collecting Data' (ABGR 2002b) helps the client to collect the right data, based on which the client can calculate the building performance. The building performance rating can be calculated with the help of the 'Star Rating Calculator', which can be downloaded from the webpage. The design of the tool is very simple, no complicated information is asked, and the tool can be used based on very basic information (Figure 4-2, page 87)

To obtain ideas on how to upgrade the building, the client can make use of the 'Diagnostic Tool'. The tool gives, based on the type of rating, suggestions for lighting power density, lighting hours, and office equipment (tenancy rating); miscellaneous easy savings, air-conditioning savings, and building envelope savings e.g. insulation, shading and glazing (base building rating). The tool is well-developed and very user friendly. Suggestions regarding a tenancy rating are within the knowledge range of the building owner. However, it is recommended to involve a building engineer when it becomes more technical and involves air-conditioning improvements.

A 'Validation Protocol' has been developed to guide the energy consultant through the verification process. The protocol ensures that the rating allocated to the specific premises is accurate, and consistent with other ratings in Australia. After the client has received a rating, the programme provides the client with an 'ABGR Style Guide', which explains how the label can and must be used.

B.4 National Context

Australia is one of the largest greenhouse gas emitters per capita in the world. The federal government has a budget of AUS $1.8 billion[2] to invest in initiatives regarding climate change for 2008-2012. The goal of the government is to continue economic growth, but limit the greenhouse gas emissions and reduce energy consumption. Estimates project an annual reduction of 85 million tons of greenhouse gas emissions based on a mix of mandatory and voluntary actions for all sectors (AGO 2005a).

B.4.1 International framework

Kyoto Protocol

Although Australia signed and ratified the UNFCCC in 1992, it has signed but not ratified the Kyoto Protocol. Australia states that the protocol does not provide a long-term response to climate change, meaning that they do not agree with the fact that there are no legally binding targets for the developing countries. Furthermore the Australian government is concerned it will cost jobs and additionally they are convinced that they are already doing enough to reduce greenhouse gas emissions. The Kyoto protocol outlines that Australia need to limit its greenhouse gas emissions to 108% of 1990 levels by 2008-2012. Although it did not ratify the protocol, the Australian government states it is committed to achieve this target (AGO 2005a).

[2] This is approximately RSA R 8.22 billion

Asia-Pacific Partnership on Clean Development and Climate

Australia joined the Asia-Pacific Partnership on Clean Development and Climate (see section 5.2.2, page 100).

B.4.2 National framework

Australia is divided into eight jurisdictions, whereby each has its own policies and regulations regarding energy efficiency within the federal government framework[3]. Due to this set-up, *federal frameworks* are more developed towards voluntary programmes and the *state frameworks* are responsible for the mandatory implementation measures. It is outside the scope of this study to examine policies regarding climate change mitigation strategies of all the jurisdictions. However, the study looks more closely at the policy framework of the State of New South Wales, because this state initiated and developed the ABGR scheme.

During 2002/03, the Ministerial Council on Energy developed a National Framework for Energy Efficiency (NFEE). The NFEE's purpose is 'to unlock the significant but un-tapped economic potential associated with the increased implementation of energy efficient technologies and processes across the Australian economy to achieve a major enhancement of Australia's energy efficiency performance' (MCE 2004). The framework covers residential, industrial, commercial, government and finance sectors[4].

The NFEE covers implementation of energy efficiency measures over two stages, whereby stage one 'Foundation Measures' covers 2004-2007 and stage two 'Forward measures' will be based on the outcomes of stage one and starts in 2008. In August 2004, the MCE made a commitment to the implementation of nine integrated and inter-linked energy-efficiency policy packages, comprising stage one. The estimated energy savings are 50 PJ by the year 2015. The budget available for the implementation of stage one is AUS $33 million (~ R140 million).

B.4.3 Stakeholders

This section describes the institutional bodies regarding the federal government and the State of New South Wales.

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[3] The eight states and territories are West Australia, Victoria, New South Wales (Sydney, Melbourne), South Australia, Queensland, Capital Territory, Northern Territory and Tasmania

[4] More information regarding the NFEE can be found on http://www.nfee.gov.au.

Federal government

The Australian Greenhouse Office (AGO), (part of the Department of the Environment and Heritage), is responsible for the majority of implementation programmes on a national level and manages the $1.8 billion budget allocated for the implementation.

The Ministerial Council on Energy (MCE) is the national policy and governance body for the Australian energy market and was established in 2001 by the Council of Australian Governments (COAG). The council consists of ministers who are responsible for energy from federal government as well as from the states and territories. The MCE is responsible for providing leadership and coordination of the development of national energy policy.

State government New South Wales

Within the state of New South Wales, the Department of Energy, Utilities and Sustainability (DEUS) is responsible for any issue regarding energy and emission reduction. Their mission is to ‘achieve sustainable, safe, reliable and affordable supply and use of energy and water through innovative planning, delivery and management’ (DEUS 2004)

B.4.4 Policies and instruments for the built environment

Federal government

The NFEE package for commercial buildings aims at improving the energy performance of the commercial building stock and at the same time improve the information provision to owner and tenant. The owner and tenant need to have access to credible and readily available information to be able to make a balanced decision. The areas of focus are (EEGWG 2003):

- Minimum energy efficiency standards with the Australian Building Codes Board
- Commercial Building Energy Rating Methodology
- Mandatory disclosure of building energy performance

<u>Minimum energy standards</u>

In Australia, each jurisdiction has its own building regulations which are referenced to the national Building Code of Australia. Up to now, only the Australian Capital Territory (ACT) and Victoria have integrated energy requirements in their building code, but these are only applicable to residential buildings.

Australian Building Codes Board (ABCB) reviewed the Building Codes of Australia (BCA) to include nationally consistent minimum energy performance requirements. The BCA is a performance-based code, which outlines minimum standards with the aim of eliminating worst practice. In the previous two years, the ABCB worked on a revision of the BCA to incorporate minimum energy performance standards; the new BCA was to be introduced in May 2006.

Energy rating systems

The ABCB is also currently developing a protocol that allows rating tools for commercial buildings to be used for regulatory purposes. This topic is closely related to the mandatory disclosure.

Mandatory disclosure

Although a study has been commissioned on international energy rating schemes (AGO 2005), no decision has been taken regarding implementation of the mandatory disclosure scheme.

State government New South Wales

The state of New South Wales has a mixed packet of instruments to stimulate energy savings and energy efficiency. Table B-2 gives an overview of the instruments, which are applicable to the commercial building sector.

Discussion

The Australian government is relatively late with the development of a framework for energy savings and efficiency. Additionally, the targets are rather weak. The difficulty in Australia is that it is divided to eight jurisdictions, which means that each of those jurisdictions can implement their own policies and regulations. This implies that the actual monitoring and implementation responsibilities are with the individual jurisdictions and is therefore dependent on the political will of the government to prioritise energy efficiency. The federal government mainly focuses on voluntary approaches, research, and development. A step in the right direction is that minimum energy standards will be integrated in the national building code (Note: this was already done in the Netherlands and Denmark in 1995).

Table B-2: Overview of instruments to stimulate energy savings and efficiency (Productivity Commission 2005)

Name	Type of instrument	Short description
Australian Building Greenhouse Rating Scheme (ABGR)	Energy Efficiency rating scheme	Enables commercial office building owner and tenants to rate the energy performance of their buildings
Energy Savings Action Plan	Mandatory reporting	Large energy users are required to submit an energy savings action plan every 4 years
Energy Savings Fund	Financial Incentive	Provides a financial incentive to encourage energy savings and investments
Energy Smart Business	Voluntary agreement, technical assistance	Assists businesses with energy bills larger than $300 000 annually to implement cost effective measures
Memorandum of Understanding	Voluntary agreement of government	The NSW government wants to set an example by committing their building to the ABGR scheme (see section 5.4.4, page 112)

B.5 Commercial Building Sector

The built environment is responsible for over 20% of the national greenhouse gas emissions (Clark 2002). Total energy consumption in the commercial sector during 2000-2001 was 218 PJ, with an average annual growth rate of 3.8% since 1974. Projections indicate that the emissions from the commercial buildings are more than 35 million tonnes of CO_2 (Pears 1998) and likely to increase with 94% compared to 1990 levels. This growth is due to a structural change in the economy from industrial activities to a more service oriented market economy (ABARE 2003a). This results in an increased number of buildings, including air-conditioning and increased use of electrical and electronic appliances (ABARE 2003b).

Pears (1998) says that it is widely recognised that there is a substantial scope for cost effective energy efficiency improvement, especially in the commercial sector. Approximately 60% of the population of Australia lives in the five capital cities, 40% live in Melbourne and Sydney. Office densities are typically one person for every $20m^2$ compared to one person per $15m^2$ in European cities (Clark 2002).

The benefits of the ABGR scheme are market recognition for good performance. Furthermore, it presents a competitive advantage when selling or renting out the building. The ABGR promotes best practices in design, operation and management of office buildings regarding the energy performance. An accredited rating can be used for promotion material to promote a greenhouse friendly workplace and morale. The ABGR provides cost savings through energy efficiency. ABGR also states that energy efficiency can improve staff productivity and morale. The major barrier towards energy efficiency in this sector is slow change of attitudes and culture (EEGWG 2003). Specific challenges for the Australian commercial sector are (EEGWG 2003):

- Encouraging innovation in traditional design and construction
- Supplying high-performing energy efficient buildings
- Stimulating energy efficient upgrades and refurbishment of existing buildings
- Ensuring building tenants are aware of building energy costs and the options for reducing these costs
- Improving the energy management skills of building management
- Demonstrating the operational effectiveness and non-energy benefits of low-energy design buildings
- Effectively demonstrating government commitment and leadership.

B.6 Bibliography ABGR Case Study

Australian Bureau of Agricultural and Resource Economics (ABARE) 2003a, *Trends in Australian energy intensity 1973–1974 to 2000–2001*, Report 03.9

Australian Bureau of Agricultural and Resource Economics (ABARE) 2003b, *Australian energy—national and state projection to 2019–2020*, Report 02.10.

Australian Building Greenhouse Rating (ABGR) 2002a, *Accredited assessor process outline.* Available from: http://www.abgr.com.au [cited 8 November 2005]

Australian Building Greenhouse Rating (ABGR) 2002b, *Guidelines for collecting data.* Available from: http://www.abgr.com.au [cited 8 November 2005]

Australian Building Greenhouse Rating (ABGR) 2002c, *What the stars mean…* Available from: http://www.abgr.com.au [cited 8 November 2005]

Australian Building Greenhouse Rating (ABGR) 2002d, *Style Guide: Guidelines for the use of the ABGR trademark and specifications for promotional material.* Available from: http://www.abgr.com.au [cited 8 November 2005]

Australian Building Greenhouse Rating (ABGR) 2004, *ABGR market transformation survey,* Sustainable Energy Development Agency, New South Wales

Australian Building Greenhouse Rating (ABGR) 2006a, *Becoming an accredited assessor*. Available from: http://www.abgr.com.au [cited 19 February 2006]

Australian Building Greenhouse Rating (ABGR) 2006b, *Database ABGR rated buildings.* Available from: http://www.abgr.com.au/main.asp?section=1&page=1 [cited 18 February 2006]

Australian Government 2004 *Energy Efficiency BCA Volume 1: Regulation Document, Proposal for class 5-9 buildings.* Department of the Environment and Heritage, Australian Greenhouse Office, Canberra. Available from: http://www.abcb.gov.au [cited 04 February 2006]

Australian Greenhouse Office (AGO) 1998, *Strategic framework for advancing Australia's greenhouse response,* Commonwealth of Australia, Canberra. Available from: http://www.greenhouse.gov.au/energyefficiency/building [cited 04 February 2006]

Australian Greenhouse Office (AGO) 1999, *Australian Commercial Building Sector Greenhouse Gas Emissions 1990-2010,* Commonwealth of Australia, Canberra. Available from: http://www.greenhouse.gov.au/energyefficiency/building [cited 04 February 2006]

Australian Greenhouse Office (AGO) 2000, *International survey of building energy codes*, Commonwealth of Australia, Canberra. Available from: http://www.greenhouse.gov.au/energyefficiency/building [cited 16 March 2006]

Australian Greenhouse Office (AGO) 2005a, *Australia's response to climate change. Australian Greenhouse Office,* Department of the Environment and Heritage, Commonwealth of Australia. Available from: http:// www.greenhouse.gov.za [cited 4 March 2006]

Australian Greenhouse Office (AGO) 2005b, *A study into international directions for the mandatory disclosure of the energy performance of buildings,* Department of the Environment and Heritage, Commonwealth of Australia, Canberra. Available from: http: www.greenhouse.gov.za [cited 15 November 2005]

Carr, B 2004, *Memorandum No.2004-4 Greenhouse performance of government office buildings and rental properties*, Department of Energy, Utilities and Sustainability (DEUS). Available from http://www.deus.nsw.gov.au

Clark, D 2002, ‘Sustainable buildings in Australia: Challenges, incentives and successes’, *Proceedings Sustainable Building Conference 2002*, Oslo, Norway.

Department of Energy, Utilities and Sustainability (DEUS) 2004, *Annual report 2003-2004,* New South Wales Government, Sydney. Available from: http://www.deus.nsw.gov.au [cited 3 December 2005]

Energy Efficiency and Greenhouse Working Group (EEGWG) 2003, *Towards a national framework for energy efficiency – Issues and challenges*, Discussion Paper, Finsbury. Available from: http://www.nfee.gov.au [cited 15 November 2005]

Government of Western Australia 2004, *Office accommodation policies: A guide to the procurement and management of Western Australia government office accommodation*, Department of Housing and Works.

Harris, J, Anderson, J, Shafron, W 1998, *Energy efficiency investment in Australie,* ABARE research Report 98.2, Canberra. Available from: http://www.abare.gov.au

Ministerial Council on Energy (MCE) 2004, *Statement on national framework for energy efficiency: Overview plan of state one measures 2005-2007*. Available from: http://www.nfee.gov.au [cited 24 November 2005]

National Framework for Energy Efficiency (NFEE) 2005. Available from: http://www.nfee.gov.au [cited December 2005]

Pears, A 1998, *Rating energy efficiency of non-residential buildings: a path forward for New South Wales: Report for the Sustainable Energy Development Authority (SEDA)*. Available from: http://www.abgr.com.au [8 November 2005]

Productivity Commission 2005, *The private cost effectiveness of improving energy efficiency*, Commonwealth of Australia, report no 36, Canberra

Sustainable Energy Development Authority (SEDA) 2004, *Annual report 2003-2004*. State of New South Wales. Available from: http://www.deus.nsw.gov.au [cited 3 December 2005]

Appendix C Energie Prestatie Advies

C.1 Introduction

This appendix gives more information regarding the EPA-U. It describes the programme in sections C.2 and C.3 and the context in which it is implemented in sections C.4 and C.5. A summary of the programme can be found in section 2.10.3 (page 46).

C.2 Programme Design

C.2.1 Organisational structure

Figure C-1 presents the organisational structure of the EPA-U programme. There is a clear distinction between the basic actors within the programme.

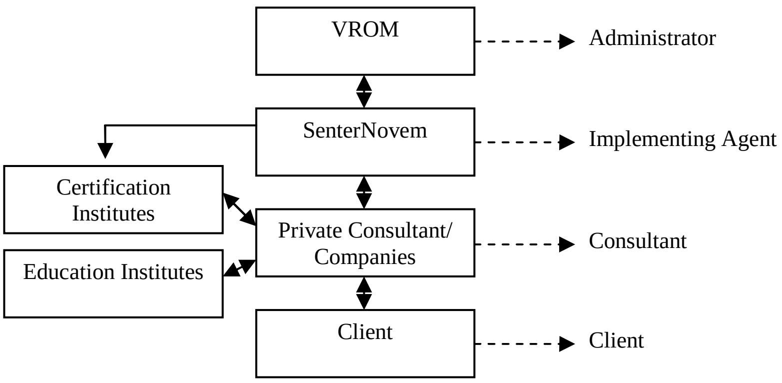


Figure C-1: Organisational structure of the EPA-U programme

The national administrator, who initiated and has overall responsibility for the scheme is the Department of Housing, Physical Planning and Environment (VROM). VROM develops policies and implementation plans to improve energy efficiency in the built environment. They decided that the EPA-U is a suitable instrument to reduce CO_2 emissions in commercial buildings. For the operation and implementation of the scheme VROM appointed SenterNovem, which is the implementing agency of VROM and Department of Economic Affairs (EZ). SenterNovem is a consultancy agency, which forms a bridge between the government and commercial companies. Their aim is to stimulate environmental sustainability and innovation. They provide local government, individuals, and companies with advise, network, information and subsidies. SenterNovem is responsible for the promotion of the programme, maintaining the EPA-U website and the helpdesk.

Section C.2.4 (page 196) describes the role of certification institutes and educational institutes in detail. The implementation of the EPA-U is left to the market. Private energy consultants can offer an EPA-U as part of their business activities. They are responsible for the marketing of the EPA-U and they are the only link with the client.

C.2.2 Implementation costs

The programme administration by the SenterNovem is financially covered by the Dutch government. Prices for the EPA-U set by energy consultants or companies are determined by the companies themselves. Cost estimates[5] for an EPA-U for a general office block (1 000 m^2) starts at €1 500 (11 280 Rand[6]). The costs are dependent on the time needed by the energy consultant to perform the required activities and the size of the area under consideration. The label is valid for life; labels do not have to be renewed.

C.2.3 Promotion and marketing strategy

Because the EPA-U was developed just before the EPDB was adopted, it was decided not to actively promote the EPA-U, in order to decide on the implementation of the EPDB and the role of the EPA-U in this process. Besides that, the design of the EPA-U was not to commercially market energy performance of the building. Competitive advantage and market recognition are not identified as drivers of the programme; instead the fiscal advantage is mentioned as the first reason for executing the EPA-U and secondly a good negotiating position regarding the Environmental Act and Long Term Agreements. There is no marketing benefit from for the EPA-U; a commercial implementation strategy is lacking.

The EPA-U is however supported by other government implementation instruments, such as the Environmental Act, Long Term Agreements, and tax incentives/subsidies. These instruments will be explained in section C.4.5 (page 203). In conclusion, other policy instruments are driving the implementation of the EPA-U. The EPA-U would not be able to sustain itself without these additional government instruments.

C.2.4 Quality assurance

The overall quality assurance of the EPA-U programme is guaranteed by the National Certification Agreement (BRL); BRL 9503 'Energy Performance Advice for Non-residential Buildings'. This agreement is developed and agreed upon by a wide range of

[5] Cost estimations are based on estimations of experts from EBM consultancy and SenterNovem

[6] Currency Rate: 1 € = 7.52 SA Rand (30/03/2006)

stakeholders and outlines requirements for the EPA-U consultants and organisations; the EPA-U methodology, process and calculation methods; and quality evaluation of the product. Figure C-2 visualises how the BRL is implemented and is explained in the paragraphs below.

Quality assurance of the people and the organisation

Quality assurance of the *people and the organisation* is based on a combination of training and pre-qualification. Training is partly mandatory and partly recommended. The general EPA-U course is mandatory for a consultant to become a certified EPA-U consultant. However additional courses are offered, which go into more technical detail and depending on the background of the consultant an additional training course is recommended. For example, a building engineer can do a course to obtain more knowledge regarding building services and a mechanical engineer can go for an architectural course. The development of the training courses are left to the market. There are several private training institutes which developed and provide courses for EPA-U consultants. Duration, costs and content of the training varies among the institutes and it is the consultants' responsibility to find the most adequate training programme for his/her situation.

The BRL also specifies pre-qualification requirements for the consultant. The auditor needs to have at least a BSc in the field of building or mechanical engineering, plus four years of relevant audit experience.

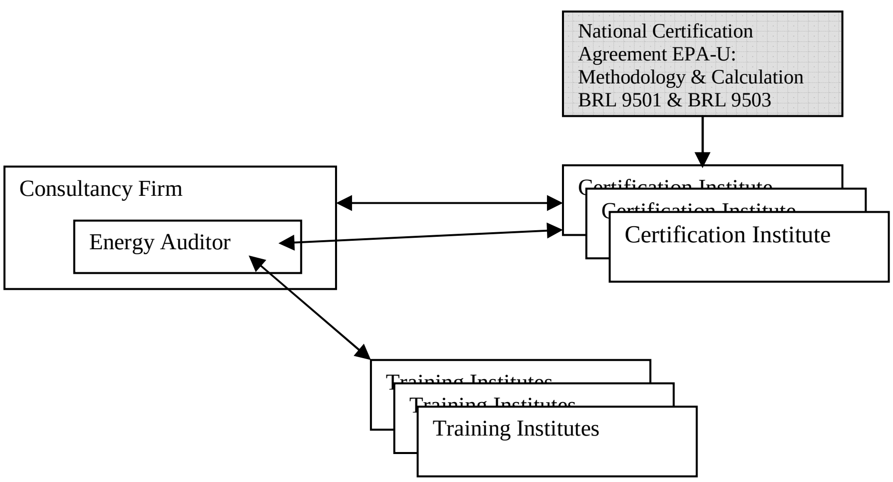


Figure C-2: Quality assurance system EPA-U

To obtain authorisation to perform EPA-U labelling the BRL has more requirements. The consultancy *firm* also needs a certification. Requirements for certification of the company are:

- The company is registered at the Chamber of Commerce
- It agrees to work according to the National Certification Agreement, which basically means the company works according to the EPA-U manual and software
- At least one of the employees is a certified EPA-U consultant.
- The firm has established competence and experience in the field building engineering, as well as mechanical engineering

There are currently approximately 300 consultant companies authorised to offer EPA-U (E Bouten and G van Chruchten 2006, pers.comm., 11 January).

Quality assurance of the process

The BRL 9503 describes requirements for the EPA-U methodology and instruments, the certification process and certificate. The BRL requires that companies work according to the 'EPA-U manual', which provides the consultant with detailed process procedures standardised forms, checklists, and report formats. A company can develop their own procedures and methodology, but it must be based on the EPA-U manual. The BRL requires the consultancy firm to develop a policy document that indicates how the consultancy firm assures the quality of the advice process.

Quality control of the end product

The certification institute is responsible for ongoing investigation of the consultancy company compliance with the BRL. This investigation takes place six months subsequent to certification and annually after that. This investigation includes random project checks within the consultancy firm and interviews with staff members. The quantities of projects and staff employees that need to be evaluated are dependent on the size of the consultancy firm and the numbers are specified in the BRL.

C.2.5 Monitoring and evaluation

Monitoring

The National Certification Procedure (BRL) of the EPA-U requires monitoring as part of the procedure to execute an EPA-U by the energy consultant. A standard format is developed for monitoring data and the energy consultant is required to send this document within six weeks after issuing the EPA-U to the client. The document is sent to VROM through SenterNovem. The monitoring data is required to obtain an understanding of the aspect of energy performance of existing buildings on a national level. Monitoring of the EPA-U scheme captures three levels of monitoring information, namely expenditure, energy audit volumes, theoretically possible energy savings.

Evaluation

An evaluation has not taken place, due to the fact that the programme has not been implemented for more than three years. Evaluation is regarded as important by SenterNovem, the EPA-W (EPA for residential buildings) was extensively evaluated after 3 years of implementation to create an understanding of the level of awareness, usage of the scheme by the different stakeholders and the reasons for using the scheme.

C.3 Label Characteristics

C.3.1 Process to obtain a label

To obtain an EPA-U the building owner contacts an energy consultant. The first meeting consists of an intake interview whereby the companies' objectives and working conditions are discussed. Subsequently, the energy advisor inspects the building and collects the necessary information. The energy consultant analyses the data and based on that information determines the energy performance of the building. The EPA-U aims to provide knowledge regarding the energy consumption profile of the building and to provide an integrated advice aimed at improvement of technical and mechanical installations in a building. The energy performance is evaluated based on a detailed energy audit of the building.

The next step is that the advisor makes a cost-benefit analysis and indicates which measures are cost-effective to implement. The EPA-U identifies potential building technical energy savings measures, such as insulation, double glazing and it identifies energy saving measures for the service systems and production processes, such as HVAC and air handling systems.

The results of the energy audit are presented to the client in the form of a report. This EPA-U report is a detailed report including the issues discussed above. It covers energy consumption profile, energy savings measures, professional advice on performance improvement, investment costs and potential subsidies and tax deductions. The EPA-U does not supply a label in the form of a trademark for the company to obtain public recognition.

The role of the energy consultant is extensive; he/she is the one who does all the work to come to an energy advice. The average time spent by the energy advisor from acquisition to the final advice is 18 to 36 hours, whereby building inspection, potential energy saving calculations and the report writing consume most of the time. This is evidently dependent on the experience and knowledge of both the energy advisor and the client, the complexity of the building, availability of standardised forms, and the quality of the report (Corpelijn et al. 2004). Since the role of the client is minimal, he/she is only involved in the beginning and in the end when the report is handed over; the time spent by the client is negligible.

C.3.2 Calculation of the energy performance

To calculate the energy performance of existing buildings an asset calculation method is used, which is based on the Energy Performance Coefficient (EPC) calculation method (section C.4.5, page 203). The calculation is quite comprehensive and includes the architectural characteristics and the service systems in the building. The calculation covers energy consumption for heating, cooling, preparation of hot water, humidifying, mechanical ventilation, lighting gains of solar energy and cogeneration. All types of energy sources are taken into account, electricity and gas are calculated to primary energy (DuboCentrum 2005).

The energy performance indicator is the Energy Index (EI).The calculation methodology of the EPC and the EI are similar, however there are several variables in the EI, which are fixed in the EPC calculation. In the EPA-U calculation methodology several user behaviour factors such as opening hours, number of occupants and internal load of the computers can be further specified if desired (EC 2005). It is also possible to compare the calculated energy-use with the actual energy-use. There are no benchmarks set for the EI of existing buildings, because the objective of the label is not to rate the buildings according to a certain scale but to provide the building owners with information regarding the building consumption profile and possible energy saving measures.

C.3.3 Availability of tools

The EPA-U methodology consists basically of two tools; an EPA-U manual and a calculation programme. The manual provides background information and explains the procedure from A to Z to arrive at an energy performance advice. The manual is in conformity with the ‘process certification directive BRL 9503’. The manual contains standard forms for intake interview, building inspection and the report writing.

The software to calculate the Energy Index (EI) was developed in cooperation with Vabi, which is an organisation specialised in development of software for the construction industry. The company developed three versions:

- Generic Windows Excel version
- A standard calculation module, which can be used by other programmers to develop their version of EPA-U software
- A comprehensive version, which includes several calculation models for different building types, it calculates not only the EPA, but also other norms required by the government.

Any software developer can buy the calculation core from Vabi to develop its own EPA-U software for €1 500 annually or buy it for €3 500. For example, EBM-consultancy developed their version of the EPA-U software, called the EP-ACT[7]. EBM further detailed the EP-ACT tool specifically for offices, hospitals and hotels. Large property owners can even request an individual EP-ACT fully tuned to their property portfolio. EBM sells the EP-ACT to energy auditors for an annual licence fee of €1 500. The software is very comprehensive and assists the energy auditor in all his/her tasks towards the final advice. The software contains a complete library with energy savings possibilities and can calculate all the necessary information required.

C.4 National Context

C.4.1 International framework

The Dutch climate policy is largely based on the Kyoto agreements and additional European Union agreements which are discussed in the following sections.

UNFCCC & Kyoto Protocol

The Netherlands accepted the Kyoto protocol in 1997 and thus committed to reduce its GHG emissions by 6% during 2008 and 2012 relative to emissions in 1990. This corresponds to a reduction of 200 Megaton annually. Furthermore, they set a goal to obtain 10% of its energy from renewable energy sources by 2012 (SenterNovem 2005a).

[7] A demo version can be downloaded from http://www.ep-act.nl [cited 15 January 2006]

European Union

As a member of the European Union (EU) the Netherlands have to follow regulations and directives developed by the EU. The most important regulation developed by the European Union is the Energy Performance for Building Directive (EPBD) (section 5.2.3, page 101). The Netherlands endorses the intent and goal of the directive and current energy savings policies for the built environment are in line with the directive. However to date they only comply with the first three requirements of the EPBD and partly with requirement 5. Regarding the first requirement, the Dutch developed a calculation method for the energy performance of building; it has mandatory minimum energy performance standards for new buildings and large renovations, which are revised periodically. Additional heating installations with a power of 100 kW are periodically inspected, however this needs to be extended to periodical inspection of all heating and cooling installations for full compliance with requirement number 5. The Netherlands do not comply yet with requirement number 4; however voluntary certification programmes have been developed by SenterNovem in the last decade, which need to be adapted in order to be compatible with EPBD requirement.

The Dutch government states that implementation of requirements 4 and 5 will result in high administrative costs for the residents. This is in contradiction with the aim to reduce the administrative costs for the residents with 25%. This delay in the implementation will allow for the exploration of possibilities to reach both objectives; reduce costs and reduce CO_2. The expectation is that the implementation takes place and is embedded in regulation from beginning of 2007.

C.4.2 National framework

The National ‘Action Plan Climate Policy’ was finalised in 1999 (part I) and 2000 (part II). This plan outlines how the Netherlands attempts to achieve the goals set in the Kyoto Protocol. Progress is monitored by periodical evaluations, the first evaluation took place in 2002 and the latest monitoring resulted in the ‘Evaluation Climate Policy 2005’. Targets are developed for the national emissions and for the international emission trade through Joint Implementation (JI) and Clean Development Mechanisms (CDM). According to the climate policy evaluation the Netherlands will achieve the Kyoto targets in time; however expert opinions are more critical and question this statement (E Bouten and G van Chruchten 2006, pers.comm., 11 January).

The evaluation showed that the total greenhouse gas emissions slightly dropped, nevertheless CO_2 emissions increased. Most sectors are heading in the right direction. However, the built environment is still lagging behind the targets. Total emission would have been 5% higher if there was no policy in place. According to VROM, the CO_2 emissions would have been 16% higher without policy intervention in the built environment, which means that policy intervention is successful, but not yet successful enough. Furthermore there is a reduction in CO_2 emissions in the residential sector with 1%, but the effect is annulled by the increase by the non-residential CO_2 emissions of 3% (VROM 2005). The evaluation furthermore reports that significant reductions are necessary to achieve the targets set for the built environment. Total budget spent by the government on climate change between 1999 and 2003 is approximately €1 500-3 200 million[8] (VROM 2005).

C.4.3 Stakeholders

In the Netherlands the Department of Housing, Spatial Planning and the Environment (VROM) is responsible for developing policies and implementation plans regarding energy efficiency in the built environment. The main aim of the Department is creating a healthy living environment and the creation of a sustainable future. VROM is primarily a policy making organisation and is not an executive organ. The department employs SenterNovem for the actual implementation of their policy plans. SenterNovem is the implementation agency for policies on innovation, energy & climate, and environment & spatial planning (section A.4, page 172).

C.4.4 Policies for the built environment

From the seventies the Dutch government promoted energy efficiency in the built environment. However, energy savings and efficiency became integrated in policy frameworks only in the nineties. With the introduction of the Energy Performance Norm in 1995 a first significant measure was taken to improve energy efficiency in the built environment. Currently the energy policy for the built environment is based on several documents produced by Department of VROM. The policies are of course based on the Kyoto agreements and the European Union agreements. In 2004, SenterNovem developed the National Strategic Framework for the Built Environment. This document outlines potential intervention strategies to achieve the necessary CO_2 reduction. The built environment need to reduce its emissions to 28 Mton in 2010, this is a CO_2 reduction of 3

[8] This is approximately RSA R11,250 – 24,000 million (1 Euro = 7.5 Rand)

Mton annually till 2010, which is a yearly reduction of CO_2 emissions of 1.0%. Note: these are targets for the reduction of direct emissions[9].

C.4.5 Policy implementation instruments

The Dutch government has a wide range of implementation instruments to promote and enforce energy efficiency in the non-residential building sector. The Dutch framework consists of an integrated mix of policy instruments to stimulate energy efficiency in the built environment. An overview of the instruments is given in Table C-1. The government recognises that there is not much CO_2 reduction potential in the new building stock. The focus of policy intervention in the built environment will therefore be on emission reduction in the existing building stock.

Table C-1: Overview of implementation instruments to stimulate energy efficiency

Instrument	New Buildings	Existing Buildings
Energy Performance Norm (EPN/EPC)	X	-
Environmental Management Act (Wb)	X	X
Regulating Energy Tax (REB)	X	X
Fiscal advantages/subsidies (EIA/VAMIL/EINP)	½	½
Long Term Agreements (MJA)	½	½
Energy Performance Advice (EPA-U)	X	X

X = applicable to the sector ½ = applicable to part of the sector

Energy Performance Norm (EPN)/ Energy Performance Coefficient (EPC)

Since 1995 the energy performance of the building has to be calculated in order to obtain 'construction permit' from the municipality. Before 1995 there were only requirements for insulation and air tightness of the building. The energy performance is calculated by means of the Energy Performance Norm (EPN) enacted by NEN 2916 and NEN 2917. This is a calculation method whereby the energy consumption is expressed by the Energy Performance Coefficient (EPC). It calculates the theoretical energy consumption in a building for heating, cooling, humidification, ventilation, warm water, and electric

[9] The difference between direct and indirect emissions has to do with who is producing the actual emissions. Direct emissions are produced by the end-user; the indirect emissions are produced for the end-user. For example the use of electricity by buildings; electricity is generated by the electricity company, who is responsible for the emissions, but the electricity is used by the building (indirect emissions). Especially for the built environment it is important to take the indirect emissions also into account since they are even more than the direct emissions.

lighting corrected for user-behaviour and weather (DuboCentrum 2005). The lower the EPC the more energy efficient it is. The Building Degree provides an EPC for each of the building types. The EPC is tightened regularly.

Environmental Management Act (Wet Milieubeheer)

The Environmental Management Act (Wm) has been implemented since 1993. For new buildings or large renovation project it requires an ‘environmental permit’ jointly with the ‘construction permit’, which can lead to extra energy-reducing measures. The act requires companies and organizations, where the energy consumption is more than 25 000 m^3 gas and/or more 50 000 kWh electricity, to implement energy efficiency measures related to the operation of the building with a pay-back time less than five years. This basically means that existing (office) buildings larger than 1 000 m^2 need to execute an energy audit and implement all energy efficiency measures with a pay back time less than 5 years. This covers approximately 85% of the energy consumption in the sector. Effectiveness of the act is limited, due to lack of monitoring (Ecofys 2004).

REB (Regulerende Energie Belasting = Regulating Energy Tax)

In 1996, the government introduced the REB, which is a levy on the consumption of gas and electricity. Due to the tax the energy price increases, which should be an incentive to minimise the energy consumption. Part of the revenues is used for subsidies for motivating energy efficiency. The effect of the REB on the energy prices in the non-residential sector has been limited due to the fact that the tax becomes less when more energy is used, and the non-residential are mainly large consumers. Furthermore the reaction time to changes in energy consumption is slower than in the residential sector.

Energy Investment Tax Reduction (EIA, VAMIL and EINP)[10]

Investments in energy savings in the profit sector are stimulated by the EIA and VAMIL (VAMIL was cancelled in 2002). For the Non-profit sector there was the EINP. The Energy Investment Deduction (EIA), introduced in 1997, is a fiscal arrangement to incentivise entrepreneurs to invest in energy efficiency and renewable energy in the profit-sector. The arrangement offers the company a tax benefit besides the reduced energy costs. This arrangement is funded by the revenues of the REB. In 2004 there were 1 400 applications, which represent investments in energy efficiency of €1.38 billion by

[10] EIA = Energie Investerings Aftrek, VAMIL = Regeling Willekeurige Afschrijving Milieu Investeringen, EINP = Energie Investeringsaftrek voor non-profit Organisaties

6 431 companies (SenterNovem 2005b). Approximately 60% of the investments were used for installation upgrading (lighting, heating and cooling systems) and approximately 40% to insulation measures (double glass etc.). According to Ecofys (2004) these arrangements were very effective, considering the amount of money spent.

MJA (Long Term Agreements)

Since 1995 the government attempts to motivate certain sub-sectors to implement energy efficiency by concluding Long Term Agreements. The sub-sectors represent approximately 15% of the energy consumption in the non-residential sector. The agreements commit the companies to reduce respective CO_2 emissions with 20-25% and are usually targeted at large corporations, where the energy efficiency potential is large. The results are mixed; some companies are doing well and even better than the targets, while in other companies there is a worsening in the energy efficiency (Ecofys 2004). Effectiveness is difficult to determine due to lack of proper monitoring procedures.

Energy Performance Advice (EPA-U)

The Energy Performance Advice (EPA) is an advice aimed at improvement of building technical and mechanical installations. The instrument is relatively new and not fully implemented. It has been successfully implemented in the residential sector. It gives insight regarding the energy performance of the building coupled with an advice on how to improve the energy performance. It is applicable to existing commercial buildings, of which the building approval was given before 1st of January 1998.

The EPA-U is linked to several of the other implementation measures mentioned earlier. For example, it can be used as an instrument to partly comply with the Environmental Act. Furthermore the EPA-U can be used as an instrument in the Long Term Agreements. Financial incentives to implement recommended EPA-U measures are provided by the EIA tax advantage arrangement.

C.5 Commercial Building Sector

The built environment is responsible for approximately 30% of the CO_2 emissions in the Netherlands. Table C-2 and Table C-3 give a brief overview of the energy consumption and the CO_2 emissions of the built environment in the Netherlands. As can be seen a distinction is made between the direct CO_2 emissions and the indirect CO_2 emissions. National climate policy only takes into account the direct emissions, however in policies directly related to the built environment both types of emissions are used.

Table C-2: Energy consumption and CO_2 emissions of the Dutch built environment (Ecofys 2004)

	Energy consumption (PJ prim)		Total CO2 emissions (Mton)		Direct CO2 emission (Mton)		Indirect CO2 emission (Mton)	
	1995	2001	1995	2001	1995	2001	1995	2001
Residential	573	568	34	33	22	21	12	12
Non-residential	369	441	24	26	12	11	12	15
Total	942	1008	58	59	33	31	24	28
% total NL	32%	32%	33%	33%				

Table C-3: Energy consumption and CO_2 emissions of non-residential buildings (SenterNovem 2004a)

Segment	Size	Total primary energy consumption	CO_2 production		
			Direct (gas and heat)	Indirect (electrical)	Total
	[m^2 BVO * million]	[PJ]	[Mton]	[Mton]	[Mton]
Offices	84.5	111.3	2.0	4.3	6.2
Shops	51.8	62.6	0.9	2.6	3.5
Manufacturing halls	31.4	50.1	1.3	1.5	2.8
Catering	24.9	36.2	0.9	1.1	2.0
Hospitals	13.8	20.1	0.6	0.6	0.1
Nursing	20.2	18.2	0.7	0.3	1.0
Education	30.2	16.9	0.6	0.3	0.9
Sport complex	0.0	8.0	0.3	0.2	0.4
Swimming pools	0.0	8.0	0.3	0.2	0.4
Community buildings	2.0	5.5	0.1	0.2	0.3
Rest	2.0	4.0	0.1	0.1	0.2
Prison	0.0	0.0	0.0	0.0	0.0
Stations	0.0	0.0	0.0	0.0	0.0
Total	**260.8**	**340.9**	**7.6**	**11.5**	**19.1**

The drivers for commercial building owners to execute an EPA-U currently are (SenterNovem 2005c):

- Fiscal advantage; through the tax system the company saves 50% of the EPA-U costs and the investment costs for energy efficiency improvements
- An EPA-U gives a benefit in the negotiations with the municipality regarding the implementation of the Environmental Act and the Long Term Agreements with the national government.

- The EPA-U is a professional and practical energy advice specifically executed for a particular facility and therefore provides excellent insight into the energy performance, savings and investments for the facility.
- Energy costs savings due to lower energy consumption
- The quality is guaranteed by a national certification procedure.

C.6 Bibliography EPA-U Case Study

Haren, R, Langeveld, M, Weevers, B 2004, *Eerste ervatingen met EPA-U: bevindingen van de eerste pilotprojecten*,CEA Bureau voor communicatie en advies over energie en milieu, Rotterdam. Available from: http://www.senternovem.nl/kompas/utiliteitsbouw/EPA-Utiliteitsbouw/index.asp [cited 25 November 2006]

DuboCentrum 2005, *Energiebesparing in woningen en utiliteitsbouw*. Available from: http://www.dubocentrum.nl [cited 1 July 2005]

European Commission (EC) 2005, *Energy certification of Berlaymont: Summary report on project results*. Available from: http://europa.eu.int/pressReleasesAction.do [cited 29 September 2005]

Klein Goldewijk, K, Olivier, J.G.J, Peters, J.A.H.W, Coenen, P.W.H.G, Vreuls, H.H.J 2005, *Greenhouse gas emissions in the Netherlands 1990-2003: National inventory report 2005*.RIVM/MNP, Bilthoven.

Novem 1999a, *Lange-termijn visie energie efficiency kantoorgebouwen*, Utrecht. Available from: http://www.senternovem.nl/mmfiles/Lange-termijn%20visie%20energieefficiency_tcm24-153895.pdf#search=%22Lange-termijn%20visie%20energie%20efficiency%20kantoorgebouwen%22 [cited 15 January 2006]

Novem 1999b, *Plan van aanpak LTGO bestaande U-bouw: Deel 2 PvA kantoorgebouwen, Eindrapport*, Utrecht.

SenterNovem 2004a, *Strategisch Kader Gebouwde Omgeving 2004.* Available from: http://www.senternovem.nl/mmfiles/2004%20SKGO%20def_tcm24-107335.pdf#search=%22strategisch%20kader%20gebouwde%20omgeving%202004%22 [cited 15 January 2006]

SenterNovem 2004b, *Energiebesparings monitor gebouwde omgeving 2003*, Rapportage van SenterNovem in opdracht van VROM/DGW, Utrecht.

SenterNovem 2005a, *Wegwijzer naar kwaliteitssprong.* Available from: *http://*www.epadesk.nl [cited 15 August 2005]

SenterNovem 2005b, *Stand van Zaken EIA budget.* Available from: *http://*www.senternovem.nl [cited 28 August 2005]

Stichting KBO 2004, *Nationale beoordelingsrichtlijn voor het KOMO-procescertificaat voor 'Energieprestatie advisering voor utiliteitsgebouwen'*, Rotterdam.

Volkshuisvesting, Ruimtelijke Ordening and Milieu (VROM) 2001, *Een wereld en een wil: Werken aan duurzaamheid*, Den Haag. Available from: http://www.vrom.nl [cited 26 December 2006]

Volkshuisvesting, Ruimtelijke Ordening and Milieu (VROM) 2004, *Voortgang klimaatbeleid gebouwde omgeving 2003: Intstrumentmonitor,* Rapportage van SenterNovem in opdracht van VROM/DGW in het kader van Kompas, Utrecht.

Volkshuisvesting, Ruimtelijke Ordening and Milieu (VROM) 2005, *Evaluatienota klimaatbeleid 2005 onderweg naar Kyoto: Een evaluatie van het Nederlandse klimaatbeleid gericht op realisering van de verplichtingen in the Protocol van Kyoto, Den Haag.* Available from: http://www.vrom.nl [cited 6 January 2006]

Weevers, B, Langeveld, M, Ryckebosch, D 2004, *EPA-U in de markt: Evaluatie tweede tranche pilotprojecten, eindrapport,* EBM-consult and CEA, Bureau voor communicatie en advies over energy en milieu, Arnhem. Available from: http://www.senternovem.nl/kompas/utiliteitsbouw/EPA-Utiliteitsbouw/index.asp [cited 25 November 2006]

Appendix D EnergiLedelsesOrdeningen

D.1 Introduction

This appendix gives more information regarding the ELO-scheme. It describes the programme in sections D.2 and D.3 and the context in which it is implemented in sections D.4 and D.5. A summary of the programme can be found in section 2.10.3 (page 45).

D.2 Programme Design

D.2.1 Programme goals

The aim of the programme is to raise awareness of energy consumption and savings in daily building management as well as in future planning regarding maintenance and procurement of new buildings. The goal of the programme was to contribute to national goals and international goals in emission reduction. It became mandatory when the Act to Promote Energy and Water Savings in Buildings was put into force in January 1997. The law prescribed that each building should be energy-rated and provided with an energy plan. There was no specific target set for the coverage of the ELO-scheme and after four years only 50% of the buildings were included in the scheme. Since it is a mandatory scheme this number is not satisfactory (Reinikainen 2002)

D.2.2 Organisational structure

Figure C-3 shows the organisational structure of the ELO-scheme. There is a clear distinction between the basic actors within the programme.

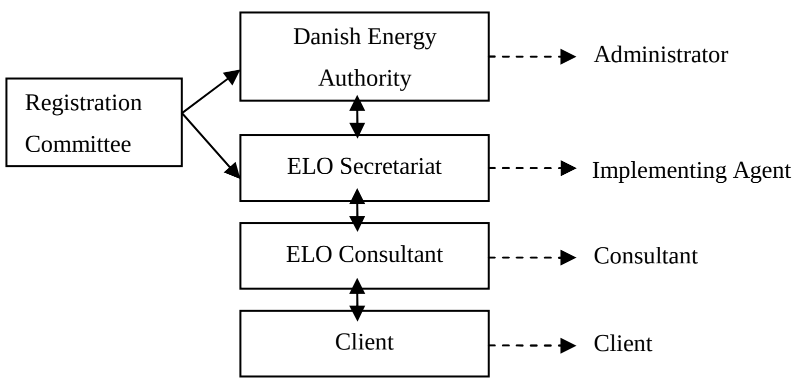


Figure C-3: Organisational structure of the ELO programme

The national administrator, Danish Energy Authority (DEA), initiated and has overall responsibility for the programme. The DEA is an administrative authority under the Danish Ministry of Economic and Business Affairs and is responsible for all issues related to energy savings, energy policy, and energy efficiency. Regarding the ELO programme the DEA gives guidance and provides process procedures; they are responsible for the administration, and promotion of the programme as well as monitoring of the results.

The ELO -scheme has its own secretariat, which can be seen as the operating agent of the scheme, and consists of three people who do the daily administration of the programme. They are responsible for quality control of the reports, monitoring of results and organisation of training courses for the energy consultants. Other tasks include maintenance of the handbook and the software, statistical analyses of the results for tools and evaluation.

ELO consultants offer an ELO assessment as part of their business activities. They are responsible for the marketing of the EPA-U and they are the only link with the client.

Besides the basic actors in the administration of a labelling programme, the ELO scheme also has a Registration Committee. This committee brings together representatives from twelve Danish industry organisations, such as the Building Owner Association, energy suppliers, Danish municipalities etc. The committee is established to create the link between the programme and the target group. Responsibilities of the committee include quality assurance, authorisation of consultants and registration of companies, determine the prices of labels for consultants, and feedback to DEA concerning the design and implementation of the scheme (Lausten and Lorenzen 2003).

D.2.3 Implementation costs

The Danish scheme is a non-profit but fully self-financed programme. This is possible due to the mandatory nature of the scheme. The costs for operation are fully financed by the labelling fees, and registration fees of the companies and the consultant. The operation costs consist of costs of the secretariat and quality assurance of the reports and results. Training is also part of the duties of the secretariat; however the costs are covered by the participation fees of the consultants and the companies.

The costs for the consultant and the company (paid to the secretariat) are a yearly registration fee for each company of 3 000 DKK (R2 900); yearly registration fee for the consultant of 1 000 DKK (R966); and the costs for a pre-printed label for the client which is 120 DKK (R116). The fee rules and structure are outlined in the Executive Order on Fees and Liability Insurance for Energy Rating of Buildings of Danish Energy Agency (Poulsen 2001).

The building owner pays the energy consultants a fee to organise the energy label and energy plan. To control the costs of the labelling, the scheme sets maximum amounts for the costs of labelling, which consists of a fixed fee plus a fee per square metre. The scheme makes a difference between ordinary buildings (e.g. offices, hotels, libraries etc) and buildings that consume large amounts of energy (e.g. hospitals, shopping centres etc). There are no price limits for buildings larger than 5 000 m^2. Maximum fee structure is shown in Table C-4.

Table C-4: Maximum fee structure ELO –scheme (Poulsen 2001)

Building type	< 5000 m^2 (excl VAT)	> 5000 m^2 (excl VAT)
Ordinary Buildings	3 100 + 0.70 DKK per m^2	No price limits
Large consumers	4 900 + 0.70 DKK per m^2	No price limits

For an average 1 500 m^2 office building, the maximum costs are DKK 4 150, which is R4 011[11]; and approximately R 4 612 including tax (assumption of tax rate at 15%). Furthermore, the label should be renewed every year, which basically means that these are annual costs. However, the government wants to extend this to three-years.

D.2.4 Promotion and marketing strategy

Research (Lausten and Lorenzen 2003) has shown that after four years of implementation only 52% of eligible building area and 42% of the eligible buildings are labelled. This indicates that even a mandatory scheme needs some additional support to be successful. The promotion of the ELO -scheme is the responsibility of the Danish Energy Agency. The DEA uses mainly brochures, campaigns and websites; however additional promotion activities are necessary. Additionally, financial instruments might be provided in such a case to stimulate the actual energy efficiency improvements, since the improvements are not mandatory.

[11] Currency Rate: 1 DKK = 0.967 SA Rand (30/03/2006)

D.2.5 Quality assurance

Overall, it is the Registration Committee that is responsible for quality control of the programme.

Quality assurance of people and organisation

Quality assurance regarding the energy consultant takes place through a combination of training, pre-qualifications and examination before obtaining a certificate which allows the energy consultant to perform an ELO audit. Training is mandatory and a training course can take up to nine days. The training covers a wide range of topics: such as legislation, labelling procedure, principles of energy losses, building envelope, heating systems, lighting, cooling systems, ELO procedures, responsibilities, advice or suggestions in energy planning. Annual training sessions are required to maintain the certification.

Prequalification of the energy consultant is seen as very important and is strictly followed. The energy consultant is required to have a BSc Eng or MSc Eng or MArch or similar degrees, plus up to five years of practical experience.

Accreditation of consultants is done by the Registration Committee. The secretariat is responsible for the registration of the energy consultant in an ELO database after the consultant obtains its certification. The certification is valid for life, provided the consultant follows the rules set out in the Executive Order, which include attendance of training sessions, yearly fees payment, using official labels etc.

The company of the consultant needs to be registered with the Registration Committee and needs to comply with the following requirements;

- At least one employee is an authorised ELO consultant;
- The company is registered for VAT;
- The company has professional responsibility insurance.

Both the company as well as the consultant have to pay a yearly registration fee; €461 and €197 respectively. In 2002 there were 350 registered companies with about 640 energy consultants (Reinikainen 2001).

Quality assurance of the process

The process is controlled by providing the energy consultants with the necessary standardised forms and checklists. Furthermore mandatory software is provided by the programme to do the calculations of the energy performance. The software ensures that data is handled consistently and errors or missing data are indicated during the calculation.

Quality control of the end product

The ELO -programme strives towards high levels of consistency and standardization of the energy labels and energy plans. Random checking of energy labels and plans is initiated by the registration committee and covers 0.5% of the annual labels and plans (target is 2%). A team of 5-6 experienced impartial auditors from Danish Technology Institute are responsible for this quality check. Random selection of reports is done by secretariat. The impartial auditor contacts the client as well as the consultant, visits the site and reads the report. The auditor checks the suggestions for energy savings and the quality of the energy plan. The findings of the random quality checks are communicated back to the energy consultants. Appropriate steps are undertaken in the case the consultant and the report are not complying with the required quality level.

D.2.6 Monitoring and evaluation

Monitoring

The responsibility for monitoring of the ELO scheme lies with the secretariat. Energy labels and energy plans are handed in by the consultant at the secretariat in digital versions since the energy consultant has to use a mandatory software programme and can upload the information on the internet. The data is automatically uploaded in the main database. Because the rating needs to be done annually it is possible to monitor the improvements of the energy efficiency of the buildings. A survey should be used to obtain data about what techniques and technical improvements have been implemented to achieve the energy efficiency. This information is publicly available (in Danish) from the internet www.energiledelseordingen.dk. Monitoring of the ELO scheme captures five levels of monitoring information, namely expenditure, energy audit volumes, saving potential, theoretical savings of implemented measures and the measured savings at site level.

Evaluation

The ELO -scheme has undergone two evaluations: one in 1998/1999 regarding barriers towards energy management and an evaluation in 2000, three years after the programme was started. The second evaluation was done by an independent engineering consulting company (COWI) and the reports are publicly available from the internet (in Danish). Key conclusions of the evaluation were that the implementation rate was not satisfactory and that many building owners did not have any knowledge regarding the scheme. Additional effort towards promotion and marketing was therefore recommended.

D.3 Label Characteristics

D.3.1 Process to obtain a label

The ELO -scheme is a mandatory scheme, whereby it is the responsibility of the building owner to engage with an energy consultant to assess the energy performance of the building on a regular basis. The building owner needs to appoint an energy manager for the building, who will be in contact with the energy consultant. The energy consultant inspects the building, installations and appliances. The site visit usually takes up to 3-4 hours and the whole process can be completed within one day. The time spent by the energy consultant and client is 3-4 hours.

Based on this information, together with the energy bills, the energy consultant calculates the energy rating and develops an energy plan with suggestions for future upgrading. The energy label can be used for display purposes, but it is not specifically designed for market recognition; it should rather be seen as a progress label and report. The energy consultant discusses the findings with the energy manager of the building. The energy consultant provides information about possible energy saving measures for the building itself, operational issues and general maintenance.

Reporting is done in the form of an energy plan, which is drawn up by the energy consultant. The energy plan contains the consumption patterns of the building over the preceding three years. It identifies the implemented and potential energy saving measures. Energy-saving suggestions vary from improvement in general management and maintenance to investments in insulation, heating system etc. The energy plan gives further information on the investment amount, and the annual saving due to the investment. Saving suggestions are prioritised according to several aspects, such as payback period, investment costs and lifetime.

D.3.2 Calculation of the energy performance

Calculation is based on operational calculation, in other words it is based on measured energy consumption. The energy labelling consists of a standardised energy rating, presenting the information about the heating consumption (heat is mainly generated with gas) and electricity consumption. This is expressed in consumption per m^2 and CO_2/m^2 and rated on a scale A to M, whereby A is the ultimate goal and M is the poor practice.

D.3.3 Availability of tools

The ELO -secretariat and Danish Energy Agency provide a range of tools for the ELO -consultant (Lytras and Gaspar 2003), these include:

- Handbook
- Catalogue of typical savings
- Checklists during building inspection for energy saving in building
- ELO -PC, which is a software calculation programme
- Key figures for energy consumption in different building types

The ELO-PC programme is a mandatory tool. The tool is freely available for a licensed auditor. It is used for data collection, calculation of energy performance, developing energy plans and energy labels. The tool is connected to a central ELO monitoring database, whereby auditors can upload their assessments. Support for the tool can be obtained through email.

D.4 National Context

D.4.1 International framework

Denmark has a long history on energy policies, which is a logical result stemming from the lack of natural energy sources, effects of the World Wars and the oil crisis in the seventies[12]. Denmark became aware of its reliance on energy imports during the First and Second World War, and was further emphasised during the oil crisis of 1970s. Denmark's reliance on foreign countries for their energy sources resulted in interest in renewable energy opportunities. It is for this reason that the Danish are world leaders when it comes to utilisation of wind power. At present Denmark is no longer dependent on foreign countries for its oil and gas supplies.

[12] http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/RE_info/denmark.htm (23/03/2006)

UNFCCC & Kyoto Protocol

The European Union agreed to the largest overall reduction commitments compared to all the other countries which signed and ratified the Kyoto Protocol. The EU agreed to reduce its emissions by 8% relative to the emissions in 1990. For reference; Japan and Canada committed to 6%, Russia and New Zealand to 0%. The US accepted a reduction of 7%; but has not ratified the protocol. The distribution of the target among the European member countries is outlined in the so-called Burden Sharing Agreement of 1998.

As a member of the European Union, Denmark ratified the Kyoto protocol in 1997, which means that they are obliged to reduce GHG emissions during 2008-2012 with 21% relative to emissions in 1990. Denmark realises that the reductions they committed to are very ambitious, especially since Denmark is already in forefront with efficient energy use and therefore further initiatives to reduce emissions will be relatively expensive.

European Union

The European Union developed the Energy Performance of Buildings Directive, which came into force in January 2003 (section 5.2.3, page 101). The Directive originates to a certain extent from the Danish labelling schemes, which were already being implemented since 1997. However there are certain areas where the Danish schemes do not yet comply with the European Directive and areas where the Danish go beyond the Directive (Lausten and Lorenzen 2003).

The most important distinctions between the Danish Schemes and the European Directive are (Lausten and Lorenzen 2003):

- Area categories; Danish schemes differentiate between building smaller and larger than 1 500 m^2 , whereas the EU uses 1 000m^2
- Duration of a label; Danish schemes use labels which need to be renewed annually after three years; the EU labels are valid for 10 years.
- Assessment scope; Danish schemes include heating, electricity and water; the EU only requires energy consumption to be included.
- Types of buildings; the Danish schemes include more types of buildings than the EU directive. However the EU requires energy certification for flats or buildings rented out, which was not included in the Danish scheme.
- Regular inspection of gas boilers and air-conditioning; and inspection of boilers and heating installations after 15 years had not yet been included in Danish policy.

Denmark adjusted their policy to accommodate the above shortcoming and expects this to be finalised early 2006. However to implement the EU directive, the Danish parliament needed to pass new legislation on energy performance in buildings, which was done on 16th of June 2005. The modifications made to the existing schemes are covered in the new legislation as well as the inspection of boilers and air-conditioning. New energy regulations have been prepared to facilitate the implementation of the EPDB and will be enforced from April 2006 (Baleras 2005).

D.4.2 National framework

Due to the oil crisis 1973 and the dependence on imports to secure the supply of energy, Denmark adopted its first National Energy Plan in 1976, which was further developed during the eighties. The plan resulted in a restructuring of the energy system and led to stabilised energy consumption while the economy was growing. Already in 1990 the policy 'Energy 2000' was introduced, which set the target to reduce CO_2 emissions with 20% in 2005 compared with 1998 levels. The subsequent policy 'Energy 21' states that renewable energy share should become 12-14% of total energy supply in 2005. The policy also introduced a ban on construction of new coal fired power stations. Wind power was seen as an important opportunity and Energy 21 stated that offshore wind power needed to be 1 500 MW in 2005. The Danish government introduced Climate 2012 in 2000, the fourth action plan in the field of energy. The plan included new initiatives to secure the goal of reducing CO_2 emissions.

Figure C-4 shows changes in final energy consumption in Denmark; it shows that the GDP keeps on growing, while the energy consumption remains constant over the years, which results in a reduction in the energy intensity. This indicates that the Danish energy policy has been successful in promoting energy efficiency.

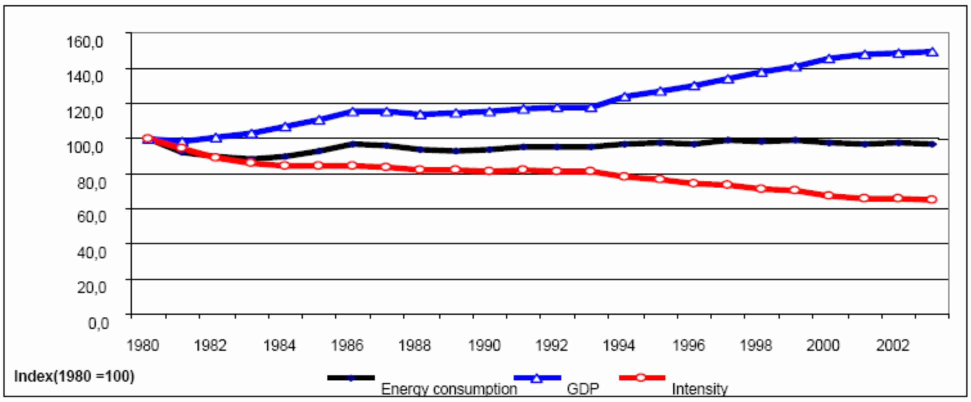


Figure C-4: Energy consumption, intensity and GDP (DEA 2006)

Denmark has designed several schemes to support energy savings regarding buildings, industry and appliances. The current initiatives include (DEA 2006):

- Energy and CO_2 levies on domestic and public sector energy consumption;
- CO_2 levies on industrial consumption and CO_2 quotas;
- Voluntary agreements for industry;
- Energy labelling for large and small buildings;
- Energy labelling of appliances and lighting;
- Norms for energy efficiency and voluntary agreements;
- Reduction of standby consumption.

D.4.3 Policies for the built environment

The first legislation regarding energy in the built environment was enacted in 1981, which was a law on Heat Inspection for residential building (EK-scheme) and for large buildings (VKO-scheme). These laws tried to limit the energy consumption used for space heating and hot water heating in building constructed before 1979. The procedure was similar to the EPBD procedures. When a building was sold the seller had to present a certificate to inform the buyer about the energy performance of the heating installations. The legislation went through some major changes and review after which it was stopped in 1996. The current energy labelling schemes for buildings are based on this energy saving legislation. Energy labelling is seen as an important measure to improve energy efficiency and achieve energy savings in existing buildings. Since 1997, Denmark has implemented two mandatory energy labelling schemes for existing buildings (Energy Management Scheme for Large Buildings (ELO-scheme) and Energy Labelling for Small Buildings (EM-scheme)). The application of the labelling schemes is recorded in the Act to Promote Energy and Water Savings in Buildings (1996).

D.4.4 Policy implementation instruments

As already introduced in the previous section, Denmark sees the labelling schemes as the most important implementation instrument in existing buildings. The schemes rate electricity as well as energy used for heating and the corresponding CO_2 emissions, and water consumption.

Act to promote energy and water savings in buildings

This Act (No 485 of 12th of June 1996) provides the legal basis for the EM and ELO scheme. It is accompanied by several executive orders; such as Executive Order on Energy Rating in Buildings and Executive Order on Fees and Liability Insurance for energy rating in buildings. The Act provides the overall guidelines for labelling and the executive orders specify these guidelines for practical implementation issues. The Act states that labelling should be executed annually, which makes labelling mandatory.

D.4.5 Discussion

The Danish implementation approach towards energy savings and efficiency in buildings is a very straight forward approach. The approach solely make use of mandatory instruments to achieve the goal. The labelling schemes are self-regulating instruments, but because they are connected to legislation the schemes become mandatory.

The Danish approach seems to be cost-effective, due to the fact that the labelling schemes are financed by the fees paid by the consultants and no other economic incentives are provided. However, although the scheme is compulsory the implementation rate is not 100%, but only 52% which indicates that the implementation is not completely effective. Furthermore, it was estimated by an evaluation of the schemes that only 35-55% of the savings potential of the scheme is actually realised.

D.5 Bibliography ELO-scheme Case Study

Balaras, CA 2005, *Survey: National context and need for instruments.* Energy Performance Assessment for Existing Non Residential Buildings (EPA-NR). European Commission Intelligent Energy –Europe Programme. Available from: http://www.epa-nr.org [cited 29 January 2006]

Danish Government 2003, *Proposal for a climate strategy for Denmark.* Available from: htpp://www.ens.dk [cited 16 January 2006]

Danish Energy Authority (DEA) 2006, *Energy savings.* Available from: http://www.ens.dk [cited 16 November 2005]

Energy Systems Research Unit (ESRU) Policy Denmark. *Danish energy policy.* PowerPoint Presentation. Available from: http://www.esru.strath.ac.uk/EandE/Web_sites/01-02/RE_info/denmark.htm [cited 12 December 2005]

Lautsen, J 2005, *Energy performance in buildings: Implementation of directive on energy performance in buildings in Denmark*, ENERCERTE workshop, Frankfurt, 15-16 March [PowerPoint Presentation].

Mesures d'Utilisation Rationelle de l'Energie (Mure) 1998, *Energy efficiency profile: Denmark*, European Commission. Available from: http://www.mure2.com [cited 2 February 2006]

Thomsen, KE 2003, *Implementation of the new energy performance directive in Denmark*, ENPER Workshop, Brussels, 19 May 2003 [PowerPoint Presentation]. Available from: http://dbur.dk [cited 16 August 2005]

Appendix E ENERGY STAR

E.1 Introduction

This appendix gives more information regarding the ENERGY STAR. It describes the programme in sections E.2 and E.3 and the context in which it is implemented in sections E.4 and E.5. A summary of the programme can be found in section 2.10.3 (page 46).

E.2 Programme Design

E.2.1 Programme goals

The main goal of the ENERGY STAR programme is to achieve emissions reduction. Annual reports clearly state what the goals were and report the results and achievements (Table E-1). The programme sets targets in terms of number of buildings to be rated and provides goals on how to develop the programme to the next level. The aim of the ENERGY STAR programme is to fill the information gap and to enable businesses, organisations and consumers to realise cost savings and environmental benefits of energy efficiency investments. The programme also provides recognition for top performing buildings.

The main goals for 2001 (EPA 2001) were:

- Develop building energy performance ratings for two additional building types: hospitals and supermarkets
- Rate 5 000 additional buildings in 2001 and label 1 250 with an ENERGY STAR

The main goals for 2002 (EPA 2002) were:

- Develop building energy performance ratings for four additional building types: hotels, discount stores, home centres, and central offices (ENERGY STAR will be applicable to 40% of the total commercial building market)

The main goals for 2003 (EPA 2003) were:

- Develop building energy performance ratings for retail spaces, residence halls, post offices, etc (ENERGY STAR will be applicable to more than 50% of the total commercial building market)

Main goals for 2004 (EPA 2004):

- Set up an award system whereby companies will be awarded when their energy performance rises with 10, 20, 30 points.
- Develop a system for the design of new buildings; 'Design to earn the ENERGY STAR'

The main goals for 2005 (EPA 2005b) were:

- Launch a new ENERGY STAR initiative 'Building a Better World 10% at a Time'
- Recognise the countries improving their performance with 10, 20, 30 points
- Update and expand the energy performance rating system

Table E-1: Key achievement figures to evaluate the goals of the programme (EPA 2002, 2003, 2004, 2005b)

	2000	2001	2002	2003	2004	2005
Buildings evaluated	4 200	10 000	15 000	19 000	21 000	26 000
Billion square feet (% of total comm. bld. market)	-	-	-	3.2 (15%)	-	-
Buildings labelled	545	720	1 104	1 400	2 000	2 500
Million square feet (% of total comm. bld. market)	-	-	-	325 (1.5%)	-	480 (2.25%)
Building types	3	5	9	-	11	-
Billion kWh saved	-	-	47.5	55.7	-	-

Although the labelled buildings only represent approximately 2.25% of the total building market and only 10% of the evaluated buildings earn an ENERGY STAR label, the programme is steadily and consistently growing.

E.2.2 Organisational structure

Figure E-1 shows the organisational structure of the ENERGY STAR programme. There is a clear distinction between the basic actors within the programme. In this case the Environmental Protection Agency (EPA) is the administrator *and* the operating agent[13]. The EPA initiated the programme in 1992 for computer labelling. The programme has grown over the years to include more than 35 product categories.

[13] EPA was established in 1970 by the White House and the Congress in response to growing public demand for a better quality environment. Since 1996, EPA worked in partnership with the Department of Energy (DOE) to incorporate ENERGY STAR into overall policy of the government.

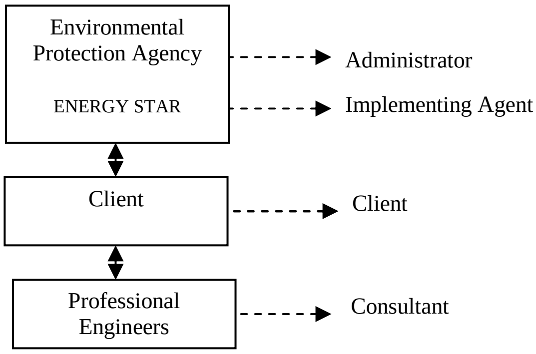


Figure E-1: Organisational structure of the ENERGY STAR programme

Another remarkable difference with the other case studies is that the energy consultant is not in contact with the labelling programme but the client is directly involved with ENERGY STAR. The professional consultant does not have to be registered with the ENERGY STAR programme in order to verify the statement of energy performance.

E.2.3 Implementation costs

It seems that the administration costs for the ENERGY STAR programme is fully covered by the US government. There are no costs to client in applying for an ENERGY STAR label. The only costs for the client are the costs for a professional engineer who verifies the Statement of Energy Performance and the indoor air quality. This must be done by a licensed professional engineer, who can be an in-house engineer or a consultant. The costs for the verification are between \$0.054 to \$0.108 per gross square metre (EPA 2005a). For an average 1 500 m^2 office building this comes to US \$80 up to US \$161, which is 500 to 1 010 Rand[14]. The label has to be renewed every year, which means that these costs can be seen as annual costs.

The administrative costs for the ENERGY STAR 'buildings' programme are estimated to be US\$ 12 million annually, including 25 permanent staff members for the programme (OECD 2001, p.34). Figure F-2 indicates the total funding amount EPA receives from DOE to sustain the ENERGY STAR programme (ASE 2006).

[14] Currency Rate: 1US \$ = 6.2580 SA Rand (30/03/2006)

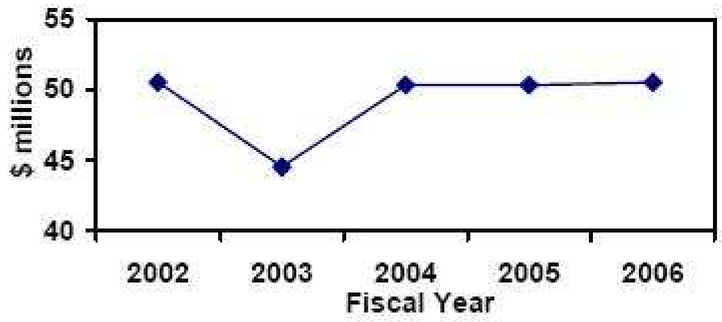


Figure E-2: ENERGY STAR funding from DOE (ASE 2006)

E.2.4 Promotion and marketing strategy

The implementation strategy of the ENERGY STAR for commercial buildings has a similar marketing strategy as the ABGR programme. Emphasis on the competitive advantage and the market recognition of earning an ENERGY STAR building label is necessary to attract the building owners to participate in the programme. Incentivising them to become market leaders in energy efficiency is viewed as one of the drivers.

Although the programme is a Federal programme, it is supported by many of the states who partner with the programme. The programme is supported by Federal government as expressed in the **Executive Order 13123** 'Greening the Government through Efficient Energy Management' (White House 1999). This order states that the government, as the largest energy consumer in the country, will improve energy efficiency wherever possible. The federal government maintains 500 000 buildings and can become a front-runner in energy efficient building design, construction and operation. The goals are to reduce energy consumption by 30% in 2005 and 35% by 2010. For promotion of federal leadership in energy management governmental agencies are encouraged to participate in several voluntary programmes such as ENERGY STAR Buildings. The Order recommends government agencies to utilise the Portfolio Manager tool to monitor the energy performance of the buildings they occupy. Funding for energy efficiency improvements can be applied for. Taking a closer look at the database of buildings included in the ENERGY STAR programme, *only* 20 Federal government buildings, 39 state government buildings (5 were award winners) and 145 local government buildings (6 were award winners) participated (EPA 2006b).

Although, the ENERGY STAR programme chose a voluntary approach towards labelling of buildings with no supporting instruments, the government is making an attempt to participate and upgrade its buildings and promote the schemes towards the states. The advantage of the programme is that it is already a well-known trademark in labelling of energy efficient appliances and equipment. There are no subsidies, tax advantages, or other financial incentives used to support the programme.

E.2.5 Quality Assurance

Unfortunately, there is very little information available regarding quality assurance and control within the ENERGY STAR programme, especially regarding quality assurance of the process and control of the end-product. It must be kept in mind that the work required for ENERGY STAR is less intensive and complex compared to an EPA-U or ELO process. The work required of the consultant is to verify the work done by the client.

Authorisation is based only on pre-qualification of the consultant. The consultant needs to be registered as a Professional Engineer in a discipline related to commercial building systems, such as mechanical or electrical engineering. Furthermore the consultant needs to have a working experience with ASHRAE standard 55-1992 'Thermal environmental conditions for human occupancy', ASHRAE standard 62-2001 'Ventilation for Acceptable Indoor Air Quality' and IESNA Lighting Handbook (comprehensive guide about lighting; explanations of concepts, techniques, applications, procedures and systems, as well as detailed definitions, tasks, charts and diagrams).

E.2.6 Monitoring and Evaluation

Monitoring

The programme makes use of a web-based portfolio manager which can be used by building owners as a daily management and monitoring tool regarding energy consumption of the portfolio. Consequently, this is the ultimate monitoring tool for the programme to keep track of the energy consumption of thousands of buildings.

Evaluation

No information could be obtained regarding the evaluation of the scheme, but given the growing success of the programme and the well organised monitoring system, EPA might perceive frequent evaluation as secondary priority.

E.3 Label Characteristics

E.3.1 Process to obtain a label

The programme offers a process to improve the energy efficiency of a building. It offers an energy management strategy that facilitates measuring of current energy performance, setting goals, tracking savings and rewarding improvements. This strategy is outlined in Figure E-3. The role and involvement of the building owner and its staff is extensive; the programme is very time consuming since they have to benchmark their buildings, identify opportunities, upgrade the building, and educate staff. Time needed by the energy consultant is negligible as he/she only comes into the process to verify data collected by the owner when the building owner wants recognition.

Figure E-3: Process of energy management (EPA 2005c)

The evaluation of the initial energy performance is expected to be done by the client. The programme facilitates calculation of the performance with the software programme, 'Portfolio Manager'. The software does not provide identification of energy savings opportunities. The Guidelines for Energy Management (EPA 2005c) suggest that the owner/client should either consult energy consultants to execute an energy audit, or evaluate past projects and best practices to obtain an idea of improvement opportunities. The programme's website provides a wide range of specific technical documents and sources or references for owner and consultants as well as the general public.

The Portfolio Manager generates a report (Statement of Energy Performance), which summarises basic information about energy information, building characteristics and occupational use. A building can apply for an ENERGY STAR label when the building scores 75 or higher. The Statement of Energy Performance needs to be verified by a professional engineer. The building owner can then use the ENERGY STAR logo for promotion and marketing purposes. Additionally the building owner receives a plaque with the ENERGY STAR award for display in the building (see figure 4-1, page 81).

E.3.2 Availability of tools

The programme makes a large number of tools and resources available for the client. Just like the ABGR, the ENERGY STAR programme relies on the active involvement of the client, and therefore the tools need to be simple and easy to use. The programme provides tools and resources to:

- Commit to continuous improvement
- Evaluate performance and set goals
- Improve building efficiency: specific technical resources
- Create and implement an action plan
- Train and motivate staff
- Communicate and get recognised
- Manufacturing plant efficiency: specific technical resources

Although there is an enormous amount of resources available from the website of the programme, it cannot be expected from a building owner to have detailed knowledge regarding service systems in a building. Therefore it is recommended to include help from an external energy consultant.

To calculate performance, ENERGY STAR developed the Portfolio Manager. This software helps the building owner to benchmark the energy performance of the building on a scale from 1-100, the performance is corrected for weather conditions. Portfolio Manager facilitates energy management for individual buildings but also for large groups of buildings. It provides information about the energy consumption, average energy intensity and average rating of the entire portfolio. It is a management programme which allows the building owner to continuously monitor and evaluate the energy performance (EPA 2006c). The tool is a bit complex, and difficult to understand initially. But the programme provides a guide on how to use the tool.

E.4 National Context

The USA is the world's largest producer and consumer of electricity, and therefore also the largest emitter of greenhouse gases. On the other hand the USA has large potential for renewable energy. The USA, like Australia, consists of Federal Government and individual State Governments, which make energy policy making and implementation more complicated. States are pulled together under various federal energy policies to achieve the aims of the country as a whole. The USA aims to maximise use of renewable energy where this is most economically feasible.

E.4.1 International framework

The oil-crisis in 1973 caused the USA to review their energy sector and adjust it for more diversity and versatility in an environmentally friendly way. The Gulf War (1991) emphasised the reliance of the USA on imported oil. This resulted in the launch of the first 'Energy Policy Act', which goal was to realise diversity of electricity generation by means of encouraging competition within the sector.

UNFCCC & Kyoto Protocol

The USA signed and ratified the UNFCCC but only signed the Kyoto Protocol without ratifying it. Its main concern against the Protocol is that it does not include legally binding measures for developing countries (non-Annex I), which according to the USA 'would result in serious harm to the economy of the United States' (Wikipedia 2006). The wide range of measures to achieve the targets are viewed as very expensive and the financial penalty for the country in case the target is not attained could be enormous. Additionally, the USA considers the climate change challenge, as one that requires participation of all countries in the world, and not only from the industrialised countries. As an example, the USA singles out China and India which are completely exempted from any requirements of the Protocol while they belong to the category of the largest emitters of greenhouse gases.

Asia-Pacific Partnership on Clean Development and Climate

USA joined the Asia-Pacific Partnership on Clean Development and Climate (see section 5.2.2, page 101).

E.4.2 National framework

The USA has developed a comprehensive approach to reduce greenhouse gas emissions which consists of a range of strategies aimed at different economic sectors, namely electricity sector, transport sector, industry, buildings, agriculture and forestry. The approach consists of strategies such as support of research and development programmes, promotion of cleaner technologies for electricity generation, partnerships, and conservation programmes. Furthermore, the federal government wants to show good practice by taking steps to reduce greenhouse gas emissions in federal buildings and the transportation fleet. The federal national framework to promote and support climate change is heavily reliant on voluntary agreements and measures.

E.4.3 Policies for the built environment

Commercial and residential buildings are responsible for approximately 35% of the US CO_2 emissions. According to the US government many commercial buildings could effectively operate with 30% less energy consumption if owners made cost-effective investments in energy efficiency. The National Energy Policy applies a balanced mix of market transformation, standards, education, and assistance in order to promote energy efficiency in the built environment (IEA 2002).

Because the USA, like Australia, consists of a Federal Government and individual State governments, the situation is more complex. Regarding the built environment the federal government mainly promotes voluntary partnership programmes to support energy efficiency in buildings. Partnerships consist of technical assistance programmes, labelling of efficient products, homes and office buildings. Federal support programmes use a market-based approach, which mainly consists of labelling energy efficiency products and buildings. The ENERGY STAR is the most widely used instrument as it promotes energy efficiency in appliances, homes and commercial buildings.

E.4.4 Policy implementation instruments

The main implementation instruments in the built environment sector are:

- ENERGY STAR ® Programme
- Building codes
- LEED

ENERGY STAR ® Programme

The ENERGY STAR for Commercial Buildings was introduced in 1999 and allows benchmarking of energy performance of buildings such as hospitals, schools, supermarkets, hotels. The programme promotes energy efficiency within homes and commercial buildings. The ENERGY STAR contributed to a reduction of 35 million metric tons of GHG emissions in 2005 alone (equivalent to annual emissions from 23 million vehicles) and saved an amount of 150 billion kWh (equivalent to 4% of total electricity demand in 2005). The results and benefits of ENERGY STAR have been doubled since 2000 (EPA 2006a). Table E-2 shows the goals and achievements of the programme and shows that the commercial building improvements are responsible for 50% of the total energy saved (in billion kWh), which confirms the energy saving potential of this sector.

Table E-2: Annual goals and achievements of the ENERGY STAR programme (EPA 2005a, p11)

ENERGY STAR Program: Annual Goals and Achievements

	2004				2005	
	Energy Saved (Billion kWh)		Emissions Prevented (MMTCE)		Energy Saved (Billion kWh)	Emissions Prevented (MMTCE)
	Goal	Achieved	Goal	Achieved	Goal	Goal
PROGRAM TOTAL FOR ENERGY STAR	99.5	125.8[1]	24.8	30.3	116.8	27.3
Qualified Products and Homes[2]	—	61.2	11.9	12.8	—	13.3
Residential Products	—	24.9	—	5.6	—	—
Consumer Electronics[3]	—	7.5	—	1.5	—	—
Residential Appliances[4]	—	0.2	—	0.0	—	—
Residential Office Equipment	—	9.4	—	1.9	—	—
Lighting	—	5.3	—	1.1	—	—
Heating and Cooling	—	2.6	—	1.1	—	—
Commercial Products	—	35.6	—	7.2	—	—
Commercial Appliances	—	0.6	—	0.1	—	—
Office Equipment	—	33.7	—	6.8	—	—
Commercial Lighting	—	1.2	—	0.2	—	—
Other	—	0.1	—	0.0	—	—
New Homes	—	0.7	—	0.2	—	—
Commercial Building Improvements[5]	—	64.6	9.5	13.2	—	10.5
Industrial Improvements[6]	—	—	3.4	4.1	—	3.5

1 *The kWh savings imply peak demand savings of more than 25 gigawatts (GW), based on conservation load factors developed by LBNL (Koomey et al., 1990).*
2 *Results for qualified products from Webber et al., 2005.*
3 *A small portion of consumer electronics may be used in commercial buildings such as hotels. For reporting purposes, all consumer electronics results are included under Residential Products.*
4 *EPA results only, does not include products under the responsibility of DOE.*
5 *Results from building improvements based on methodology presented in Horowitz, 2004.*
6 *Results from industrial improvements from ICF Consulting, 2005.*

Totals may not equal sum of components due to independent rounding.
___ : Not applicable

Building codes and standards

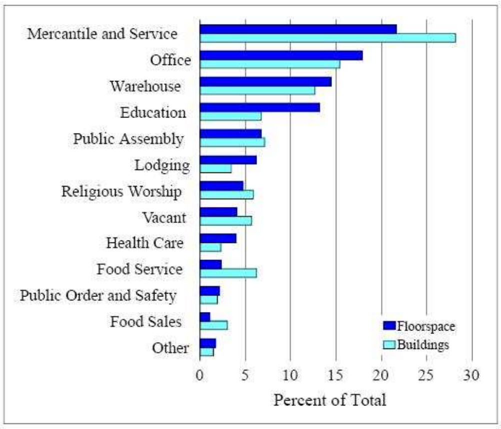
Building codes and appliance standards are important instruments for setting minimum required performance levels regarding their energy performance. In general, codes and standards regarding energy performance are developed at a national level, implemented at state and local levels and enforced by local governments. Some states increase the requirements for energy performance to strengthen the effectiveness of the code. In other states the political will to enforce a mandatory energy code is hard to find, and these states rely on voluntary programmes to achieve the energy efficiency goals. Surveys indicated that mandatory energy codes are often ignored due to the complexity and difficulty to understand them. Only 26% of the commercial building construction is covered by some sort of building energy code. The energy codes and standards for commercial buildings adopted by states are usually based on standards developed by ASHRAE and IES.

Voluntary rating systems

Voluntary rating systems are developed in almost all the states, and are seen as a supplement to mandatory energy codes. Voluntary rating systems stimulate best practice and innovation, while mandatory energy codes only set minimum requirements. ENERGY STAR is an example of such a programme, but many states have developed their own home energy rating system. The Leadership in Energy and Environmental Design (LEED) programme, hosted by the Green Building Council also voluntarily promotes energy efficiency in design of new buildings. Over the years LEED has been expanded towards many types of buildings and also developed an assessment frame for existing buildings. However, the method to rate energy performance in the LEED assessment frame is by requiring an ENERGY STAR rating. A major advantage of voluntary rating systems is that they go beyond minimum requirement, thus promoting best practice.

E.5 Commercial Building Sector

Commercial buildings in the USA used 3 106 TWh of primary energy (including electricity) in 1995, which is approximately 11% of USA's total energy use (EIA 1998). Natural gas dominates in space heating and electricity in lighting. In total the commercial building owners spent $70 billion for electricity, natural gas, fuel oil and district heating. Figure E-4 and Figure E-5 show some basic information regarding the commercial buildings.



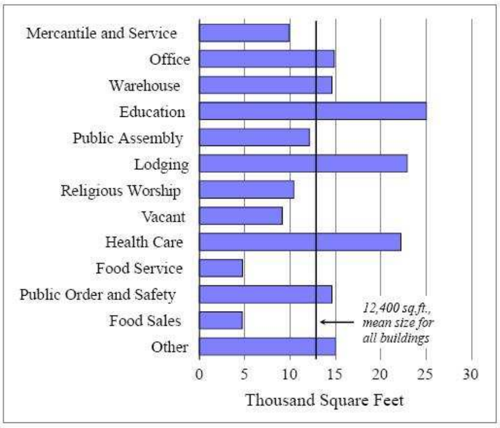


Figure E-4: Distribution of floor space (left) and mean building size (right) related to principal building activity (EIA 1998)

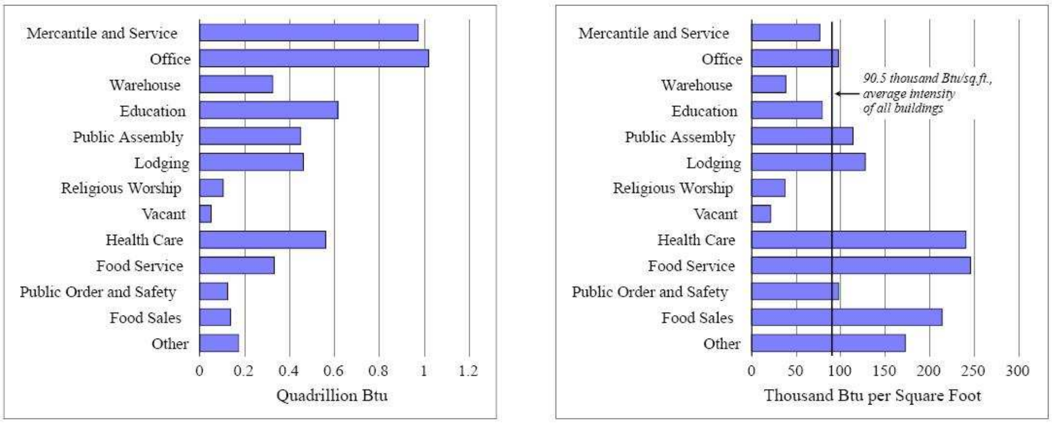


Figure E-5: Site energy consumption (left) and site energy intensity (right) in relation to principal building activity (EIA 1998)

The incentive for owner-participation in the ENERGY STAR programme is its proven energy management strategy that helps monitoring energy performance, setting goals, tracking savings and most importantly, rewards improvements made in the form of an energy label.

E.6 Bibliography ENERGY STAR Case Study

Alliance to Save Energy (ASE) 2006, *Energy star fact sheet*, Federal Energy Efficiency Programme Funding. Available from: http://www.ase.org/section/_audience/policymakers/policyfacts [cited 04 April 2006]

Department of Energy (DOE) 2005a, *Energy efficiency strategy for buildings*, Energy Efficiency and Renewable Energy. Available from: http://www.eere.energy.gov/EE/buildings.html [cited 29 March 2006]

Department of Energy (DOE) 2005b *EPA's and DOE's ENERGY STAR programme.* Available from: http://www.ase.org/section/_audience/policymakers/fedbudget [cited 4 April 2006] – p.84

Energy Information Administration (EIA) 1998, *A look at commercial buildings in 1995: Characteristics*, *energy consumption and energy expenditures.* US Department of Energy. Washington. Available from: http://www.eia.doe.gov [cited 03 June 2006]

Environmental Protection Agency (EPA) 2001, *Protecting the environment – Together: Energy Star annual report 2000*, EPA, Washington. Available from: http://www.energystar.gov [cited 20 August 2005]

Environmental Protection Agency (EPA) 2002, *Protecting the environment – Together: Energy Star annual report 2001*, EPA, Washington. Available from: http://www.energystar.gov [cited 20 August 2005]

Environmental Protection Agency (EPA) 2003, *Protecting the environment – Together: Energy Star annual report 2002*, EPA, Washington. Available from: http://www.energystar.gov [cited 20 August 2005]

Environmental Protection Agency (EPA) 2004, *Protecting the environment – Together: Energy Star annual report 2003*, EPA, Washington. Available from: http://www.energystar.gov [cited 20 August 2005]

Environmental Protection Agency (EPA) 2005a, *Protecting the environment – Together: Energy Star annual report 2004*, EPA, Washington. Available from: http://www.energystar.gov [cited 20 August 2005]

Environmental Protection Agency (EPA) 2005b, *Portfolio manager frequently asked questions (FAQs).* Available from: http://www.energystar.gov [cited 12 December 2005]

Environmental Protection Agency (EPA) 2005c, *Guidelines for energy management..* Available from: http://www.energystar.gov/index.cfm?c=guidelines.download_guidelines [cited 08 July 2005]

Environmental Protection Agency (EPA) 2006a, *ENERGY STAR® overview of 2005 achievements.* Available from: http://www.energystar.gov/index.cfm?c=business.bus_index [cited 16 March 2006]

Environmental Protection Agency (EPA) 2006b, *Labelled buildings.* Available from: http://www.energystar.gov/index.cfm?fuseaction=PARTNER_LIST [cited 4 April 2006]

Environmental Protection Agency (EPA) 2006c, *Portfolio Manager.* Available from: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager [cited 18 February 2006]

International Energy Agency (IEA) 2002, *Energy Policies of IEA Countries -- the United States of America- 2002 Review*, Paris. Available from: http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1179 [cited 23 March 2006]

Organisation for Economic Co-operation and Development (OECD) 2001, *Case studies on policy instruments for environmentally sustainable buildings*, Paris. Available from: http://www.oecd.org/publications/Pol_brief [cited 6 July 2005]

White House 1999, *Executive order 13123: Greening the Government through Efficient Energy Management*, Washington.

Wikipedia contributors 2006, *Kyoto Protocol.* Wikipedia, The Free Encyclopaedia. Available from: http://en.wikipedia.org/wiki/Kyoto_protocol [cited 4 March 2006]

Internet

For additional information regarding energy building codes, refer to *http://www.energycodes.gov/implement/state_codes/index.stm* [cited 08 February 2006] and *http://www.ase.org/content/article/detail/2603* [cited 04 April 2006]

For additional information regarding policy options for buildings, refer to http://www.eere.energy.gov/states/alternatives/policy_buildings.cfm [cited 04 April 2006]

For additional information regarding commercial buildings and their energy consumption, refer to http://www.eia.doe.gov/emeu/consumption/index.html [cited 05 June 2006]

Appendix F Green Buildings for Africa

F.1 Introduction

This appendix gives more information regarding the GBfA programme. It describes the programme in sections F.2 and F.3 and the context in which it is implemented in sections F.4 and F.5. A summary of the programme can be found in section 2.10.3 (page 44).

F.2 Programme Design

F.2.1 Programme goals

'The Green Buildings for Africa (GBfA) programme seeks to develop the infrastructure and resources to overcome the informational, financial and institutional barriers that are inhibiting the application of cost-effective energy-efficiency measures in the commercial sector' (Grobler and Singh 1997, 1999). More specific, the goals of the programme are:

- To build local capacity to promote and deliver energy savings to the commercial building sector;
- To demonstrate the cost savings and emissions-reduction potential through improved energy-efficiency in the commercial sector;
- To stimulate the creation of energy service companies and other private sector mechanisms to foster and replicate energy-efficiency investment;
- To initiate the development of the institutional mechanisms that will establish a sustainable national programme.

For a detailed discussion of the programme goals and objectives of the GBfA refer to section 3.2 (page 52).

F.2.2 Organisational structure

Figure 3-1 (page 58) presents the organisational structure of the GBfA programme. The structure of the programme is not very clear, and the role and responsibilities of each of the stakeholders is missing.

The initiator of the scheme is the CSIR, Building Technologies Department. This indicates that the initiative for the programme was not government driven. The CSIR acted as the administrator, operating agent, and the auditor. Daily administration, promotion, marketing, and even the energy audits were carried out by the programme managers. Ideally the programme wanted to outsource the auditing of the buildings;

however according to the programme managers those capabilities were not available in South Africa at that time. It was therefore also part of the programme goals to ensure capacity building within the country. The programme had not yet developed to a point where the client would contact an auditor for a GBfA label; the client remained in direct contact with the programme managers of GBfA.

The steering committee met twice a year, and their assumed role was to give advice and support to the programme. The committee consists of a wide range of organisations including government (i.e. DME, DEAT, DPW), IIEC, Eskom, SABS, and SAPOA. The aim of the steering committee was to represent national ownership; provide national support; mandate; serving national interests; coordination; and a forum for interaction (CSIR 1997). Meetings were held on 15th of May 1998; 3rd December 1998, 10th of June 1999. The 'November 1999 programme status report' indicated that the purpose and role of the steering committee is not well understood and seems to have served a greater need of the external donors (US EPA and IIEC) (Singh 1999a). However it was concluded that the steering committee reflected endorsement by national stakeholders and was therefore to be maintained.

The working group was established to attend to operational matters of the GBfA programme. The members of the working group were derived from the steering committee, and they met on a monthly basis. The working group facilitated exchange of ideas and collaboration; they were expected to think pro-actively with the programme managers and to come up with new ideas and initiatives. The working group seemed to fulfil a useful role; the participants were enthusiastic and wanted to see the programme succeed.

F.2.3 Implementation costs

The financial situation of the Green Buildings for Africa was not systematic. No budget documents could be found regarding the programme design and implementation. Also no budget indication was found in the programme design documents. The GBfA status report (Singh 1999a) mentions that the in 1999 the project overhead costs were exceeded due to the high degree of interaction with foreign potential donor organisations, stakeholder institutions and industry to build awareness and support for the programme. The programme was funded out of allocations from regular Parliamentary Grant funds to the CSIR, whereby the CSIR allocated the funds among its various research departments. The steering committee and the working group were not financially contributing to the programme. The starting-up phase was partly funded by the US EPA through the IIEC (CSIR 2000a). Furthermore the programme was running on the income paid by the showcase partners: a Green Buildings for Africa Partnership cost R25 000 annually. The energy audit and SAEDES assessment would cost an additional R50 000 (CSIR 2000b). It should be noted here that the GBfA was mainly aiming at large property owners or large industrial companies (Eskom, RandWater etc).

F.2.4 Promotion and marketing strategy

The marketing approach of the GBfA was focussed on the benefits for the target group. It aimed to demonstrate cost savings and emission reduction potential through improved energy efficiency. However, the GBfA was still in its pilot stages, and the promotion and marketing of the programme was not fully developed. The showcase partners were personally approached by the programme managers. The Green Buildings for Africa aimed at the well established organisations to participate in the show case programme. The buildings which initially participated in the GBfA are:

- Old Mutual Properties (Old Mutual Centre in Pretoria)
- Eskom (Megawatt Park in Johannesburg)
- Sanlam Properties (Sancardia in Pretoria)
- CSIR (Conference Centre in Pretoria) see 'Green Building Profile' on next page.
- Sasol (Headquarters in Rosebank)

The programme started with the large and well-known organisations to stimulate other companies and trigger their participation. The major promotion factor was that GBfA guarantees energy savings and therefore cost savings. The programme managers however underestimated the time required to guide the building owners through the full GBfA implementation cycle. By 2000 the programme management changed and the programme took a different direction. It became more of an information provision programme instead of a labelling programme. From that point workshops were offered to large property owners to create awareness regarding energy efficiency in buildings.

F.2.5 Quality assurance

In general there were no provisions made regarding quality control. The GBfA was not mature enough. However, quality control should have been part of the programme design and that was not the case. Quality control assessment is therefore not applicable to the programme. Future opportunities regarding quality assurance for a labelling programme is discussed in section 3.6 (page 72).

GREEN BUILDINGS FOR AFRICA

CSIR CONFERENCE CENTRE: A GREEN BUILDING PROFILE

Getting peak performance (comfort and efficiency) from the building management system is critical for this conference centre's ability to attract customers.

"Comfort levels have increased markedly since the control changes were made in 1998; temperatures are much more stable."

— ***Raymond Gourley***
Building Operations

CSIR Your Technology Partner

The CSIR Conference Centre plays a crucial role on the CSIR campus in serving as the primary conference facility of Africa's leading technology organization. The Centre is also a highly lettable asset and strategic meeting venue for other leading organizations, both from South Africa and abroad. With the capacity to accommodate 450 people, the facility hosts over 800 national and international events per annum and also displays numerous CSIR products, services, and accomplishments.

BULDING AT A GLANCE

Building Type:	**Conference Centre with lecture halls, banquet hall, main lobby offices, and waiting rooms**
Location:	**CSIR Campus, Pretoria**
Size:	**5 492 m²**
Year Built:	**1977**
Owner:	**CSIR**
Architect:	**Burg, Doherty, Bryant & Partners**
Construction:	**Concrete frame. Two floors with one basement. Curtain walls and structural glass walls. Single glazed, bronze-tinted windows. Mechanical rooms in basement.**
Building Systems:	**Constant volume air supply HVAC system. Electric resistance heat. Two reciprocating chillers. Mostly incandescent lighting. 100 kw geyser for domestic hot water.**

As the agency managing the *Green Buildings for Africa* programme and a recognized leader in building and energy technologies for the African environment, the CSIR has committed itself to optimizing energy efficiency/pollution prevention in its own buildings throughout its campus. After a thorough energy audit of the Conference Centre in 1997, it was determined that the building could potentially decrease its total energy bill by approximately 44% with energy efficiency upgrades. The CSIR is now well on the way to realizing the full savings potential of upgrades to this high-profile facility. In addition, CSIR is improving building comfort for its customers and the overall marketability of this asset.

Original Design and Systems

When built over 20 years ago, the Conference Centre incorporated a number of traditional technologies that make it a ripe candidate for energy and cost savings today.

The heating, ventilation and air-conditioning (HVAC) system is constant volume. Perimeter heating is provided by electric resistance coils, and hot water heating coils serve the central zones from an electric boiler. Two reciprocating chillers supply the air handlers. The heating and cooling systems both operate during the winter and summer, inefficiently cooling and heating each zone simultaneously.

Interior lighting in the building is almost exclusively incandescent, with 500, 250, 60 and 40 Watt incandescent bulbs, which are replaced individually upon burnout. A 100 kW geyser heats the domestic hot water.

Initial Upgrades

A Building Management System (BMS) was installed and commissioned at the Conference Centre in October 1995. The system, however, never worked properly and did not produce any savings. In 1996, the system was recommended for re-commissioning.

In 1998, preliminary changes were made to the BMS, which reduced the amount of simultaneous heating and cooling and stabilized room temperatures throughout the Conference Centre.

Significant Energy Savings Already Being Achieved:

- R80 000/year lower energy costs
- 700 000/year kWh savings
- R5 000 investment, yielding a simple payback of less than 0.1 years

New Paths to Profits

CSIR continues to implement further recommended energy efficiency measures as part of the Green Buildings for Africa Programme. These measures include:

Additional Controls Upgrades. This includes: eliminating unnecessary reheat of cool air; adding demand-shedding capability; preventing undesired operation of extractors; adding temperature resets for chilled and hot water; turning off pumps when not needed; and optimizing fan operations.

Occupancy Sensors. Because the majority of the rooms are only occupied 50% of the time, occupancy sensors can reduce the operating hours of lighting and cooling systems.

In-Line Geysers. The installation of new in-line geysers can eliminate the use of (and energy losses associated with) the existing 100 KW central geyser.

Recommended Upgrades

Energy Efficiency Measure	Demand Savings (kW)	Energy Savings (kWh)	Annual Cost Savings	Estimated Project Cost
New Controls Upgrades	105	320 000	R51 000	R44 000
Occupancy Sensors	50	225 000	R36 000	R76 000
In-Line Geysers	15	57 000	R10 000	R11 000
Operable Dampers	20	35 000	R10 000	R14 000
All Measures Combined	190	637 000	R107 000	R145 000

Operable Outside Air Dampers. Current dampers allow only a fixed quantity of air into the building. Adding controls to the dampers could allow more air to be brought in for cooling when outside conditions are right.

CSIR management considers its Conference Centre a strategic, revenue-generating asset where the customer comes first. Stabilizing room temperatures, through optimization of its BMS, is only one measure implemented in a series of planned upgrades. Through its leadership in and commitment to the Green Buildings for Africa programme, the CSIR has recognized that the profitability of a building can be significantly improved by reducing utility costs and increasing customer comfort.

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CSIR Your Technology Partner

F.2.6 Monitoring and evaluation

Monitoring and evaluation was not part of the programme design. Due to the fact that the programme was relatively new and there were not yet many buildings involved in the programme, the programme managers might have thought monitoring and evaluation to be unnecessary at that stage. However, to evaluate the programme in retrospect, it is difficult to locate certain documents which seem to be essential when developing a labelling scheme such as a database, or design for a database, a register of activities, etc.

When the first programme manager of the Green Buildings for Africa left the CSIR a *brief* evaluation was done regarding the programme. The programme launched the showcase programme in the 1998/1999 financial year. They underestimated the timeframe that was required to commit to the programme and the full-implementation cycle. The status report also suggested reviewing the BEARS tool to make it more user-friendly, and revising the MoU to make it more accessible. Furthermore, a need was identified for development of a guide to participation for the programme implementers, a green buildings communication and marketing guide and an environmental fact sheet to educate on the impact of the building on the environment. (Singh 1999a).

F.3 Label Characteristics

F.3.1 Process to obtain a label

To start the GBfA process a Memorandum of Understanding (MoU) would be signed between the property owner or senior management and the CSIR. By signing the MoU the property owner made energy reduction and efficiency one of the priorities of the organisation. The client also committed to survey the energy performance of its building(s) and explore potential cost-effective upgrades within six-months after signing the MoU. In addition, the client committed himself to improve the energy-efficiency of at least 80% of the floor area within three years. An implementation manager needed to be appointed and he/she would report annually on the progress. The client also agreed to assess its building(s) informally according to BEARS within one month after signing the MoU, this only allowed five months for improvements as the first *official* assessment was performed six months after signing the MoU. An assessor accredited by the CSIR assessed the facility as stipulated in BEARS. On signing the MoU the client became a member of the Green Buildings for Africa Programme and had the right to use the Green Buildings for Africa Logo for marketing purposes. This meant that the client entered the programme and committed itself for at least three years. The programme then supported and provided guidance during the upgrading (Grobler and Singh 1997).

The energy performance evaluation was based on a detailed energy audit of the specific building. The audit created a thorough energy consumption profile of the building and its service systems. It also evaluated the local electricity tariff structure and the impact of the local climate conditions. The energy performance was expressed according to several indicators, such as total kWh, kWh per m^2, maximum demand, and load factor. Identification of possible energy savings played an important role. With the help of a simulation programme, potential measures to improve energy efficiency were explored. It identified potential upgrades, expected savings, investment costs, and recommendations for each of the following implementation stages:

Stage 1: Lighting upgrade
Stage 2: Building tune-up
Stage 3: Load reductions
Stage 4: Air distribution systems
Stage 4: HVAC plant upgrade

The results of the energy audit were compiled into a GBfA energy report, which was an extensive but easily readable report. The report was comprehensive and provided general as well as technical information regarding the energy performance of the building. It covered energy consumption profile, energy savings measures, professional advice on performance improvement, expected savings and the investment costs.

The programme developed a label, which would be used as a trade mark to give the owner/client opportunity to obtain market recognition. The GBfA label (figure 4-1, page 81) itself does not contain any information regarding the energy performance of the building. The display of the label was simply an indication that the building owner had committed itself to energy efficiency.

F.3.2 Calculation of the energy performance

The Green Buildings for Africa process implied a detailed energy audit of the building based on the actual energy consumption (operational calculation). GBfA did not provide a rating based on energy consumption per square meter mainly due to lack of available data regarding energy use in non-residential buildings. The programme also developed an environmental assessment scheme, BEARS (based on BREEAM), but the implementation was lacking, and the focus of the programme was mainly on energy issues. The rating system in the environmental assessment scheme was significant and therefore explained in a bit more detail here. The building assessment rates ‘lighting’ as follows:

- One credit for implementing energy-efficiency upgrades since the MoU
- One credit for implementing 80% energy-efficiency upgrades with an IRR < 50%
- One credit for implementing 80% energy-efficiency upgrades with an IRR < 30%
- One credit for implementing 80% energy-efficiency upgrades with an IRR < 20%
- One credit for implementing 80% energy-efficiency upgrades with an IRR < 10%

The other criteria; energy efficiency, building tune-up, load reductions, HVAC distribution system, HVAC plant, were rated in the same way. Rating the different aspects in this manner allowed buildings which are already energy efficient to join the programme and obtain public recognition, as well as buildings which are energy *in*efficient, since they can obtain the same rating as the energy efficient building after improvements are made. The rating is based on how the building’s energy efficiency is improved over the three years and not on energy consumption per m^2. The disadvantage of ratings based on consumption per m^2 is that owners of older buildings are not triggered to join since it is not very likely that they achieve best practice figures. The BEARS rating awarded building owners for the achievements regarding upgrading of a building and not on the actual consumption performance of the building.

F.3.3 Availability of tools

The programme was still in the process of developing the Guide for Implementation. Because the programme failed in its early years, the implementation guide was never completed. The guide was intended to contain eight modules, namely:

Module 1: Memorandum of Understanding
Module 2: Guide to Implement Energy Efficiency
Module 3: Guide for the Green Building Environmental Assessment System
Module 4: Technical Assistance
Module 5: Financing Assistance
Module 6: Information Resources
Module 7: Public Recognition and Marketing
Module 8: Ally Members

Module four to eight were still in development. No software was developed.

F.4 National Context

South Africa has a very energy intensive economy; it was responsible for 301.48 million metric tons of Carbon Dioxide (CO_2) in 2002, which is 40.6% of Africa's total CO_2 emissions, and 0.1% of the total world emissions (DME 2002; IEA 2004). South Africa's CO_2 emissions per capita (6.65 ton per capita) are relatively high compared to other African countries, but lower than most developed countries, due to lower levels of automobile and home appliances per capita and higher consumption of non-commercial energy such as wood. South Africa's CO_2 *intensity* was 0.75 kg CO_2 per US$95, which is not only one of the highest in Africa, but also worldwide. According to Department of Minerals and Energy (DME) there are two reasons for this inefficient energy consumption. Firstly, South Africa has an energy-intensive economy, which relies on coal reserves for primary energy supply. Secondly, low energy prices results in a lack of awareness and does not give an incentive for energy efficiency measures (DME 2005). South Africa is one of the four cheapest electricity producers and has the lowest energy prices in the world (IEA 2004).

F.4.1 International framework

UNFCCC & Kyoto Protocol

South Africa ratified the UNFCCC convention on August 29, 1997 and the Kyoto Protocol on July 31, 2002, and is categorised as a Non-Annex I, or developing country. This means that it is not compelled to actively reduce its greenhouse gas emissions. Legal interventions are only applicable to Annex I countries. However, Non-Annex I countries are required to report on national emissions and is encouraged to consider climate change issues in their national policies (EIA 2004).

F.4.2 National framework

The South African government, through the Department of Minerals and Energy (DME) recognises that South Africa should work towards energy efficiency in all economic sectors. As pointed out by the Minister of DME (DME 2005), people in South Africa take energy for granted, resulting in a larger consumption than necessary. The low energy prices provide no incentive to save electricity.

The DME developed and published the South African Energy Efficiency Strategy in 2005, which takes its mandate from the White Paper on Energy Policy (DME 1998). The strategy sets energy efficiency targets for defined economic sectors, namely industrial &

mining sector programme; commercial and public buildings sector programme; residential sector programme; and transport sector programme

The Department of Minerals and Energy (DME) recognises that commercial and public buildings can significantly contribute to the reduction of GHG emissions and securing ecologically sustainable development. A large amount of energy is consumed during the operation of buildings. In South Africa the built environment is responsible for 21% of the total energy consumption. Although the commercial sector buildings[15] are responsible for only 4% of the total energy consumption in South Africa, significant energy savings can be made (DME 2005). The Energy Efficiency Strategy identifies commercial and public buildings sector as one of the core sectors to save energy and improve energy efficiency. The strategy outlines the key facts, core objectives and the approach to achieve the energy efficiency in buildings. However, it is all very straightforward and brief. The strategy furthermore sets the target for commercial and public buildings at 15% reduction against the projected energy consumption in 2015.

F.4.3 Policies for the built environment

The key facts are that commercial buildings account for only 4% of the final energy demand, and that most of the energy is used in the form of electricity. HVAC systems, lighting and office equipment are the major users of energy.

The core objectives of the strategy regarding the commercial and public buildings sector are that the government is committed to energy efficiency within its own buildings, wants to progressively upgrade the energy performance in the existing building stock and achieve best practice in the new building stock (DME 2005).

To achieve the objectives the government will lead by example and implement energy efficient measures in its own buildings. Furthermore the government intends to make use of mandatory instruments; it will develop and implement energy efficiency standards for buildings (new and existing) and incorporate it in the National Buildings Regulations: this will include an energy audit programme, energy efficient technologies, and energy labels for compliance rating.

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[15] According to DME's building classification, commercial buildings cover public buildings, office buildings, financial institutions, shops, recreation, and education

This approach is mainly based on direct regulation and ignores the indirect and self-regulatory instruments. Direct regulation is a very effective strategy to make buildings more efficient, though regulation always set minimum standards and does not stimulate excellent design. This basically means that regulation is good instrument to set a minimum target, but it will not act as an incentive for owners and designers to go beyond the minimum. Therefore, there is still a need for additional instruments to create such an incentive. This can be done by means of economic instruments (subsidies, taxes, loan programmes) and labelling schemes (OECD 2003). Indirect regulation in the form of financial incentives to support implementation of energy efficient measures is limited. The energy strategy indicates that it is difficult to justify financial support from the government for energy efficiency when there are so many other pressing socio-economic development needs (DME 2005).

F.4.4 Policy implementation instruments

The Energy Efficiency Strategy outlines a range of implementation instruments for the commercial and public building sector, which comprises the following:

- Energy Efficiency Standards for Commercial and Public Buildings
- Mandatory Energy Audits for Commercial Buildings
- Energy Management Systems

None of the above mentioned implementation instruments have been finalised or implemented yet.

Energy efficiency standards for commercial and public buildings

DME started in 1997 with the development of the ‘South Africa Energy and Demand Efficiency Guidelines (SAEDES)’. However, a SAEDES pilot study indicated that the guideline was not user-friendly and empowering legislation was needed to make the guideline effective (Parson 2004). DME is currently developing a South African National Standard ‘SANS 0204: Energy Standard for Buildings with mechanically assisted ventilation systems’. This standard aims to ensure that energy efficiency is incorporated into new buildings, and will be incorporated in the National Buildings Regulations as proposed in the energy strategy.

Mandatory energy audits for commercial buildings

The South African government is determined to implement mandatory energy audits for commercial buildings. The government is leading by example by currently auditing the public buildings. Preparation and development of the mandatory energy audits for commercial buildings will be spread over three phases. In Phase 1 (2005-2008) the framework for energy audits will be developed as well as the protocol for monitoring and evaluation. Phase 2 (2008-2011) involves the identification of target groups, developing auditor training programme and certification framework for auditors. The final phase (2011-2015) deals with the possible financial mechanisms, commissioning audit schemes and developing the quality assurance and monitoring frames. After 2015 the programme should be ready for implementation (DME 2005).

F.4.5 Conclusion

The South African approach towards a more energy efficient economy is relatively new and not yet well-established. Furthermore, there are no legal commitments regarding the Kyoto Protocol yet. The Energy Efficiency Strategy 2005 is a step in the right direction, although the targets set in the documents are not very ambitious. A 15% reduction of energy demand seems very ambitious but it is 15% reduction regarding estimated consumption in 2015, which means that energy demand in absolute terms can still grow.

Table F-1 summarises the proposed implementation instruments to support and stimulate energy efficiency in the built environment. Most of the instruments are still under development and the first real changes will only take place in 2008. The problem is that energy efficiency does not have priority on the national political agenda due to socio-economic development priorities. The budget for implementation of the energy efficiency strategy is therefore very limited.

Table F-1: Summary of South African implementation instruments for commercial buildings

Type of Instrument	South African Instrument	
Regulatory Instruments	Energy Efficiency Standard for Office Buildings (SANS 204) (in development)+ Energy Labels conform to SANS 204	2005-2008
	Mandatory Energy Audits for Commercial Buildings (in development)	2008-2015
Economic Instruments		
Self Regulating Instruments	SAEDES	
	Energy Management Systems	2008-2015

F.5 Commercial Building Sector

The target group of GBfA consisted of commercial building owners. The programme aimed to improve energy efficiency of existing buildings. It was promoted as a programme that assists commercial and industrial building owners in implementing profitable, energy efficient improvements through partnerships with those interested in enhancing energy and environmental practices in their building, using proven technologies. The benefits of participating in the programme were highlighted as follows:

- Have access to the best technologies available
- Receive assistance in making important upgrades to existing property
- Gain national recognition for pioneering efforts

Drivers for joining the programme, as outlined by the programme on a marketing brochure (CSIR 1999), are

- To save money
    - Save money over the long term
    - Increase property value in a highly competitive market place
    - Improve productivity in organisation
- To meet new standards

  Standards that address energy management currently are being drafted and finalised by the DME and SABS. These standards will soon be introduced to property owners. The GBfA programme provides the ideal vehicle for advancing these standards.
- Protect the environment

  South Africa ratified the UNFCCC in 1997. Improving energy efficiency is now a national priority. Energy conservation can help protect people's health and the environment by:
    - Conserving precious, non-renewable resources
    - Reducing pollution and greenhouse gas emissions
    - Enhancing indoor air quality

These drivers were formulated by the programme. The second driver 'to meet new standards' was not entirely valid since at that time the government was busy developing the SAEDES guideline, but the guideline has to date not be actively promoted among property owners. Regarding the third reason 'protect the environment', South Africa did ratify the UNFCCC and Kyoto Protocol; but due to socio-economic constraints energy efficiency did not become a national priority in the last ten years. This is now changing;

the government is currently addressing the issue of energy conservation and efficiency in general and in commercial buildings as well.

F.6 Bibliography GBfA Case Study

Council for Scientific and Industrial Research (CSIR) 1998, *Green Buildings for Africa: Interim steering committee meeting*, unpublished document, PowerPoint Presentation 15 May CSIR, Pretoria.

Council for Scientific and Industrial Research (CSIR) 1999, *Green Buildings for Africa,* Marketing brochure, CSIR, Pretoria.

Council for Scientific and Industrial Research (CSIR) 2000a, *Green Buildings for Africa: Project status and development opportunities,* unpublished document, CSIR, Pretoria.

Council for Scientific and Industrial Research (CSIR) 2000b, *Green Buildings for Africa: Showcase programme,* unpublished document, CSIR, Pretoria.

Grobler, LJ, Singh, V 1997, *Green Buildings for Africa Programme: A guide for implementation,* CSIR, Pretoria.

Grobler, LJ, Singh, V 1998, *Green Buildings for Africa Programme: Work plan for introducing the Green Buildings for Africa Programme into the commercial building sector*, CSIR, Pretoria.

Grobler, LJ and Singh, V 1999, 'The Green Buildings for Africa programme', *Building Research & Information*, vol. 27, no. 3, pp.183-193