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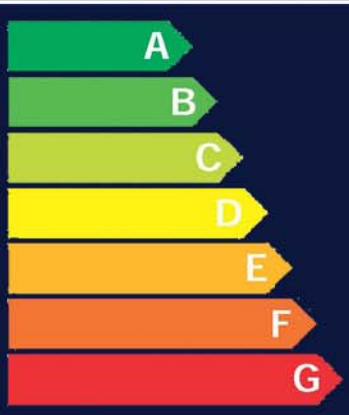

Feasibility Study - Building Energy Labeling Scheme for Mauritius 1st Draft

UNDP - 00058178/
Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings – PS/MAR2010/002

Preparation of Building Control Bill, Building Regulation and Code for Energy Efficiency and Compliance Mechanisms.

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ecosis

BUILD-GREEN CONSULTING
Sustainability consultancy services for the built environment

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Table of Contents

1 Executive Summary

Building Energy Labels are broadly similar to the label which is provided with domestic appliances such as refrigerators and washing machines. The purpose of the label is to indicate how energy efficient a building is. It provides an energy rating of the building from e.g. A to G, where A denotes a very efficient building and G is the least efficient one. Energy Labels are normally required for buildings which are constructed, sold or rented out, and should be user-friendly; simple, easy and providing reliable information on energy performance in the building.

To ensure a successful implementation of a new Building Energy Labeling Scheme (BELS) in Mauritius it is essential to face the need for resources, legislative framework, financial incentives and capacity building. It is recommended to follow the road-map outlined in this report and benefit from experiences from other countries where similar schemes has been developed, implemented and operated, and finally to involve international experts in developing the scheme.

It is suggested to implement the energy labeling scheme as a mandatory scheme, but with a smooth implementation and step-by-step development. The first step is suggested to cover new private and public air-conditioned buildings focusing, i.e. large non-residential buildings and multi-dwelling blocks larger than 5.000 m^2. In the second step, the scheme could be increased to cover all new buildings in the same category with a floor area larger than 1.500 m^2. The third step will cover all existing large (larger than 1.500 m^2) non-residential buildings, all public buildings larger than 250 m^2 and multi-dwellings blocks. Finally the scheme can be developed to include all new and existing residential air-conditioned buildings. Exempted buildings shall be defined and harmonized with present legislation, comprising The Building Control Act, Regulation and Codes.

The Public Sector have to lead the way and set an example for energy efficiency in buildings, by including mandatory proposals for energy efficiency initiatives and subsequently implementation if the simple pay-back time is below 5 years, for example. Furthermore it can be considered if the energy label shall require the implementation of a mandatory energy management system in public buildings.

An active infrastructure for developing, managing and administrating the scheme must be established with relevant bodies. A *Building Energy Labeling Scheme Implementation Committee* will manage development and implementation of the scheme in Mauritius. It is vital that all key-stakeholders in the building community are represented and engaged in the process. An *Administration Committee* will oversee the development and strategic elements of the scheme, when established and a *Building Energy Label Secretariat* will manage the day-to-day operation of the scheme.

An overall quality control assurance scheme including everything from training, validation of labels to auditing process shall be developed in order to ensure quality and highlight points for future refinements. Training must be provided to all new consultants and shall be followed up by running courses every year to keep consultants updated and give them the opportunity to share knowledge.

Targeted awareness activities and campaigns must be arranged over the course of the scheme's implementation stage, to inform stakeholders, policy makers, building owners and tenants about the requirements, processes and implications attached to the Energy Labeling Scheme.

Financial and fiscal support mechanisms are necessary to support the BELS. Development of these support mechanisms are complementary measures to ensure the success of the BELS.

Building Energy Labeling may create economic pressure for either the substantial upgrading of the energy performance of older commercial buildings or their demolition and replacement by modern buildings, depending on the residual useful value of the buildings.

The Building Energy Labeling Scheme in Mauritius may have an impact on the marketability of commercial buildings. Building owners and developers may be concerned about the potentially adverse impact of a relatively poor energy labeling on the marketing of property to clients seeking environmentally sustainable buildings, or to energy and cost-conscious business users.

2 Introduction

In 2009, the Ministry of Renewable Energy & Public Utilities defined a Long-Term Energy Strategy 2009-2025 and Action Plan for The Republic of Mauritius. It puts great emphasis on developing the energy sector up to 2025 including development of renewable energy, reduction of the dependence on imported fossil fuel and the promotion of energy efficiency.

One initiative to meet the goal regarding energy efficiency in the building sector is the project: 00058178/Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings – PS/MAR 2010/002, funded by GEF/UNDP and AFD which includes consultancy for preparation of a Feasibility Study for a Building Energy Labeling Scheme (BELS) in Mauritius.

The overall project goal for the mother-project, "Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings" is to reduce GHG emissions sustainably through a transformation of the building energy efficiency market for existing and new buildings. The project is intended to overcome barriers to energy efficiency in buildings in Mauritius and reinforce the development of a market approach to improving residential and non-residential building energy efficiency in both existing stock and future buildings.

This report covers a feasibility study of a building energy labeling system appropriate for Mauritius. During our study and review of existing similar labeling schemes, we have experienced that The International Energy Agency (IEA) newly (November 2010) has prepared a so-called Policy Pathway for Energy Performance Certification of Buildings. The Policy Pathway is one in a series of pathways providing details on how to implement specific recommendations drawn from the IEA's 25 Energy Efficiency Policy Recommendations. We find this pathway serious and in line with our suggested road-map for the BELS, hence we recommend letting this IEA pathway form the backbone of the implementation plan for Mauritius.

Our feasibility study is partly based on review of similar international schemes and partly on direct experience from involvement in European Energy Labeling or Sustainable Rating Schemes. Danish Energy Management A/S has for many years been in charge of developing and operating the Quality Assurance System for the Danish Energy Labeling Scheme. It includes overall quality assessment of all energy labels (desk and on-site assessment), training of quality assessors and

pending evaluation of the scheme for The Danish Energy Authority. Other team members are LEED Accredited Professionals and BREEAM Bespoke International assessors. This experience is of course brought into the study and our recommendations for the suggested Building Energy Labeling System in Mauritius.

The aim of this report is to provide a step-by-step road map for the further development of a labeling scheme, to give an insight into other similar schemes being reviewed, and to analyse the constraints and opportunities for the implementation in Mauritius. Being in the initial stages of developing its own labeling scheme, Mauritius will especially benefit from European countries which have developed and implemented similar systems newly or years ago, by learning about issues such as how certain challenges were addressed and what measures were taken to overcome any barriers towards implementation of the energy labeling schemes.

3 Background for the study

This study proposes a roadmap for a Building Energy Labeling Scheme (BELS) in Mauritius.

The basic research approach of the study is based on:

- Literature research and study
- International review and comments
- Assessment of the local context
- Critical evaluation including risk assessment
- Strategy development

The roadmap shall follow the four stages:

- Plan
- Implement
- Monitor
- Evaluate

Based on the research approach the above roadmap will be developed into step-by-step instructions to provide useful information for the development of strategies for a robust, accurate and cost-efficient Building Energy Labeling Scheme.

4 Building Energy Labeling Schemes in general

Building Labelling Schemes have been introduced in European countries mainly as a result of European Union Directive 2002/91/EC on the energy performance of buildings (also known as *Directive on the energy performance of buildings (EPBD))*, with the aim of influencing the attitudes of developers and occupiers to the energy efficiency of buildings.

The Directive 2002/91/EC was inspired by the Kyoto Protocol and came into force on 4 January 2003. It had to be implemented by the EU Member States by 4th January 2006 latest. The directive required EU member states to comply with Article 7, which concerns the production of “Energy Performance Certificates” for buildings. Article 7 states, interalia, that ”*Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be. The validity of the certificate shall not exceed 10 years*”.

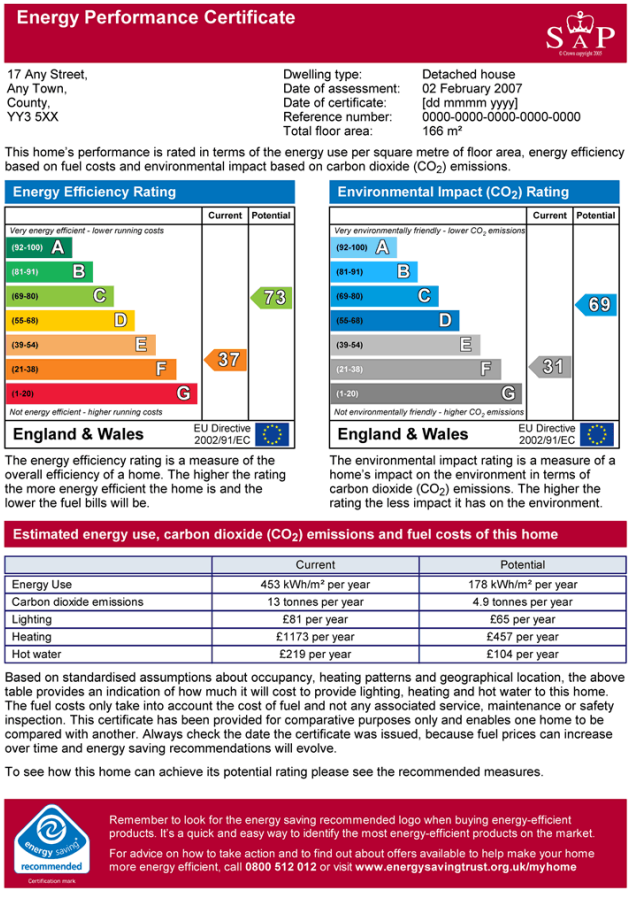
Article 7(3) of the European Union Directive 2002/91/EC also states that "*Member States shall take measures to ensure that for buildings with a total useful floor area over 1 000 m2 occupied by public authorities and by institutions providing public services to a large number of persons and therefore frequently visited by these persons an energy certificate, not older than 10 years, is placed in a prominent place clearly visible to the public.*"

4.1 Energy Performance Certificates

Therefore, in EU member states, Energy Performance Certificates are required for buildings which are constructed, sold or rented out. Certain building types and those which are frequently visited by people are also required to have a Display Energy Certificate (DEC) places in a prominent place in the building.

The Energy Performance Certificate acts as a Building Energy "Label" and is broadly similar to the label which is provided with domestic appliances such as refrigerators and washing machines. The purpose of the certificate is to indicate how energy efficient a building is. It provides an energy rating of the building from A to G, where A denotes a very efficient building and G is the least efficient one. Building Energy Labeling and is a means of informing potential buyers or tenants about the energy performance of a building, so that they can consider energy efficiency in their decision to buy or occupy that building and as part of their investment decision.

An example of an Energy Performance Certificate for a home in UK is shown below:



Energy Performance Certificate

SAP

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type:	Detached house
Date of assessment:	02 February 2007
Date of certificate:	[dd mmmm yyyy]
Reference number:	0000-0000-0000-0000-0000
Total floor area:	166 m²

This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92-100) A		
(81-91) B		
(69-80) C		73
(55-68) D		
(39-54) E		
(21-38) F	37	
(1-20) G		
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating

	Current	Potential
Very environmentally friendly - lower CO_2 emissions		
(92-100) A		
(81-91) B		
(69-80) C		69
(55-68) D		
(39-54) E		
(21-38) F	31	
(1-20) G		
Not environmentally friendly - higher CO_2 emissions		
England & Wales	EU Directive 2002/91/EC	

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

energy saving recommended

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

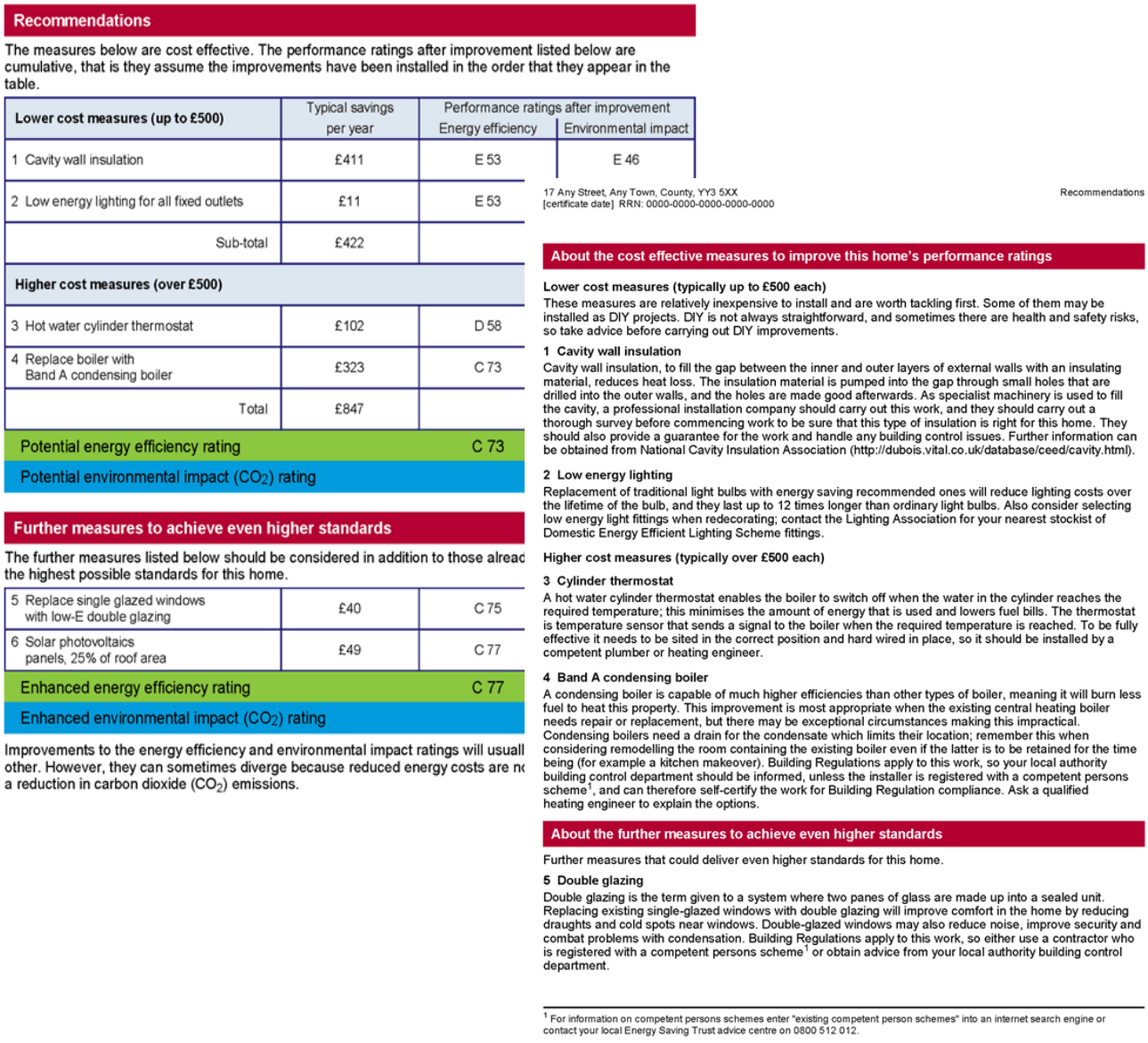
For advice on how to take action and to find out about offers available to help make your home more energy efficient, call **0800 512 012** or visit **www.energysavingtrust.org.uk/myhome**

Figure 1. Example of an Energy Performance Certificate from UK

An EPC provides an energy rating for a building based on the *potential* performance of the building envelope (the building fabric) and the building services (i.e. heating, cooling, ventilation and lighting). It is sometimes known as the asset rating. The building energy rating shown on the EPC reflects the energy performance of the building relative to a benchmark, which can then be used to make comparisons with other rated buildings.

The Energy Performance Certificate is accompanied by a recommendation report, which provides recommendations on how the energy performance of the building could be improved and the indicative annual payback.

An example of the recommendations accompanying the EPC is shown below:



Recommendations

The measures below are cost effective. The performance ratings after improvement listed below are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

Lower cost measures (up to £500)	Typical savings per year	Performance ratings after improvement: Energy efficiency	Environmental impact
1 Cavity wall insulation	£411	E 53	E 46
2 Low energy lighting for all fixed outlets	£11	E 53	
Sub-total	£422		
Higher cost measures (over £500)			
3 Hot water cylinder thermostat	£102	D 58	
4 Replace boiler with Band A condensing boiler	£323	C 73	
Total	£847		
Potential energy efficiency rating		C 73	
Potential environmental impact (CO_2) rating			

Further measures to achieve even higher standards

The further measures listed below should be considered in addition to those alread the highest possible standards for this home.

5 Replace single glazed windows with low-E double glazing	£40	C 75	
6 Solar photovoltaics panels, 25% of roof area	£49	C 77	
Enhanced energy efficiency rating		C 77	
Enhanced environmental impact (CO_2) rating			

Improvements to the energy efficiency and environmental impact ratings will usuall other. However, they can sometimes diverge because reduced energy costs are n a reduction in carbon dioxide (CO_2) emissions.

17 Any Street, Any Town, County, YY3 5XX
[certificate date] RRN: 0000-0000-0000-0000-0000

Recommendations

About the cost effective measures to improve this home's performance ratings

Lower cost measures (typically up to £500 each)

These measures are relatively inexpensive to install and are worth tackling first. Some of them may be installed as DIY projects. DIY is not always straightforward, and sometimes there are health and safety risks, so take advice before carrying out DIY improvements.

1 Cavity wall insulation

Cavity wall insulation, to fill the gap between the inner and outer layers of external walls with an insulating material, reduces heat loss. The insulation material is pumped into the gap through small holes that are drilled into the outer walls, and the holes are made good afterwards. As specialist machinery is used to fill the cavity, a professional installation company should carry out this work, and they should carry out a thorough survey before commencing work to be sure that this type of insulation is right for this home. They should also provide a guarantee for the work and handle any building control issues. Further information can be obtained from National Cavity Insulation Association (http://dubois.vital.co.uk/database/ceed/cavity.html).

2 Low energy lighting

Replacement of traditional light bulbs with energy saving recommended ones will reduce lighting costs over the lifetime of the bulb, and they last up to 12 times longer than ordinary light bulbs. Also consider selecting low energy light fittings when redecorating; contact the Lighting Association for your nearest stockist of Domestic Energy Efficient Lighting Scheme fittings.

Higher cost measures (typically over £500 each)

3 Cylinder thermostat

A hot water cylinder thermostat enables the boiler to switch off when the water in the cylinder reaches the required temperature; this minimises the amount of energy that is used and lowers fuel bills. The thermostat is temperature sensor that sends a signal to the boiler when the required temperature is reached. To be fully effective it needs to be sited in the correct position and hard wired in place, so it should be installed by a competent plumber or heating engineer.

4 Band A condensing boiler

A condensing boiler is capable of much higher efficiencies than other types of boiler, meaning it will burn less fuel to heat this property. This improvement is most appropriate when the existing central heating boiler needs repair or replacement, but there may be exceptional circumstances making this impractical. Condensing boilers need a drain for the condensate which limits their location; remember this when considering remodelling the room containing the existing boiler even if the latter is to be retained for the time being (for example a kitchen makeover). Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme[1], and can therefore self-certify the work for Building Regulation compliance. Ask a qualified heating engineer to explain the options.

About the further measures to achieve even higher standards

Further measures that could deliver even higher standards for this home.

5 Double glazing

Double glazing is the term given to a system where two panes of glass are made up into a sealed unit. Replacing existing single-glazed windows with double glazing will improve comfort in the home by reducing draughts and cold spots near windows. Double-glazed windows may also reduce noise, improve security and combat problems with condensation. Building Regulations apply to this work, so either use a contractor who is registered with a competent persons scheme[1] or obtain advice from your local authority building control department.

[1] For information on competent persons schemes enter "existing competent person schemes" into an internet search engine or contact your local Energy Saving Trust advice centre on 0800 512 012.

Figure 2. Example of the recommendations accompanying the EPC

4.2 Display Energy Certificates

Display Energy Certificates (DEC) give the *Operational Rating* of the building. This is based on actual in-use data and is used to incentivise improvements. Buildings which require a DEC need to measure and record their energy consumption.

An example of a flow diagram to determine whether a building requires a DEC is shown below:

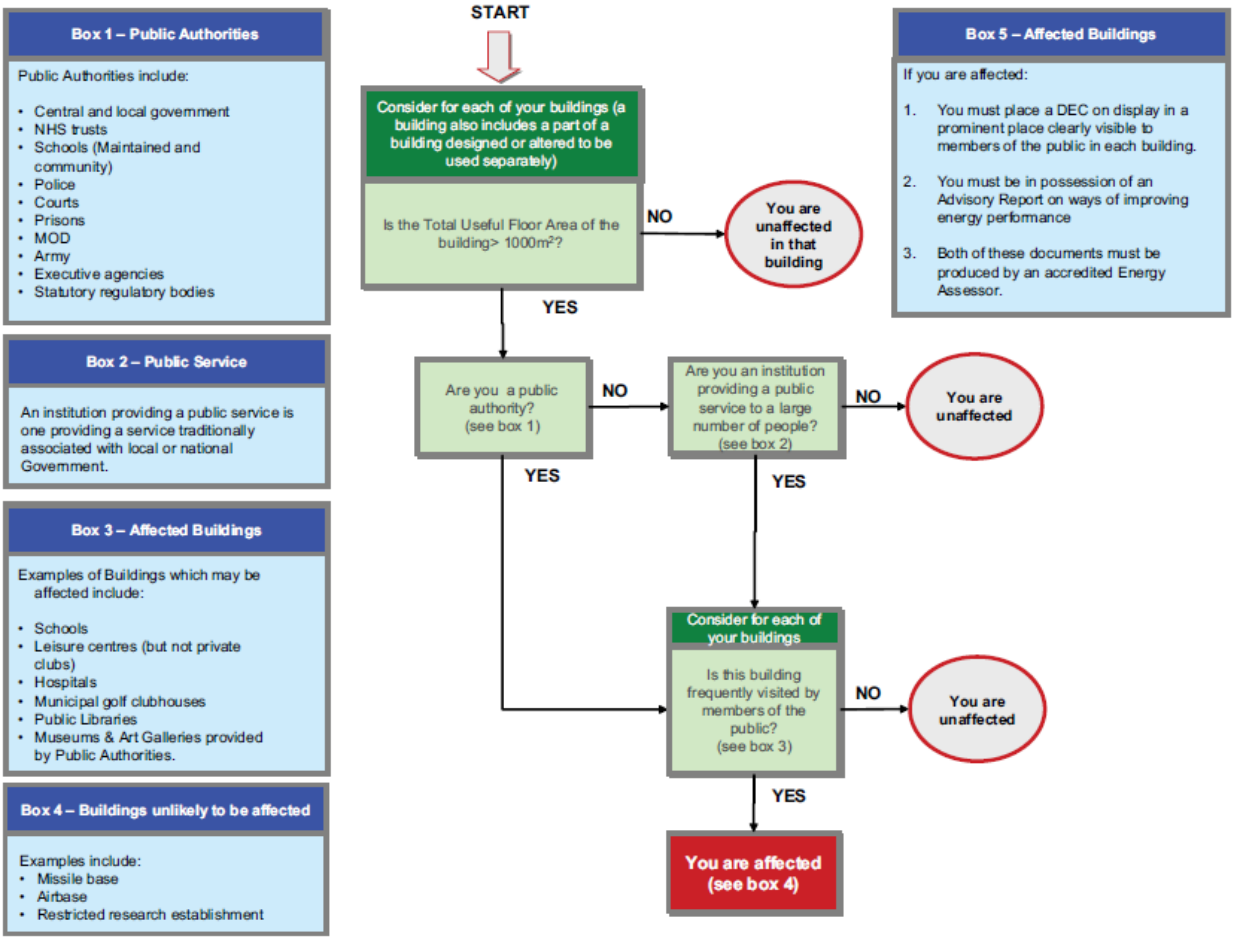


Figure 3. Example of a flow diagram to determine whether a building requires a DEC

An example of a DEC is shown below:

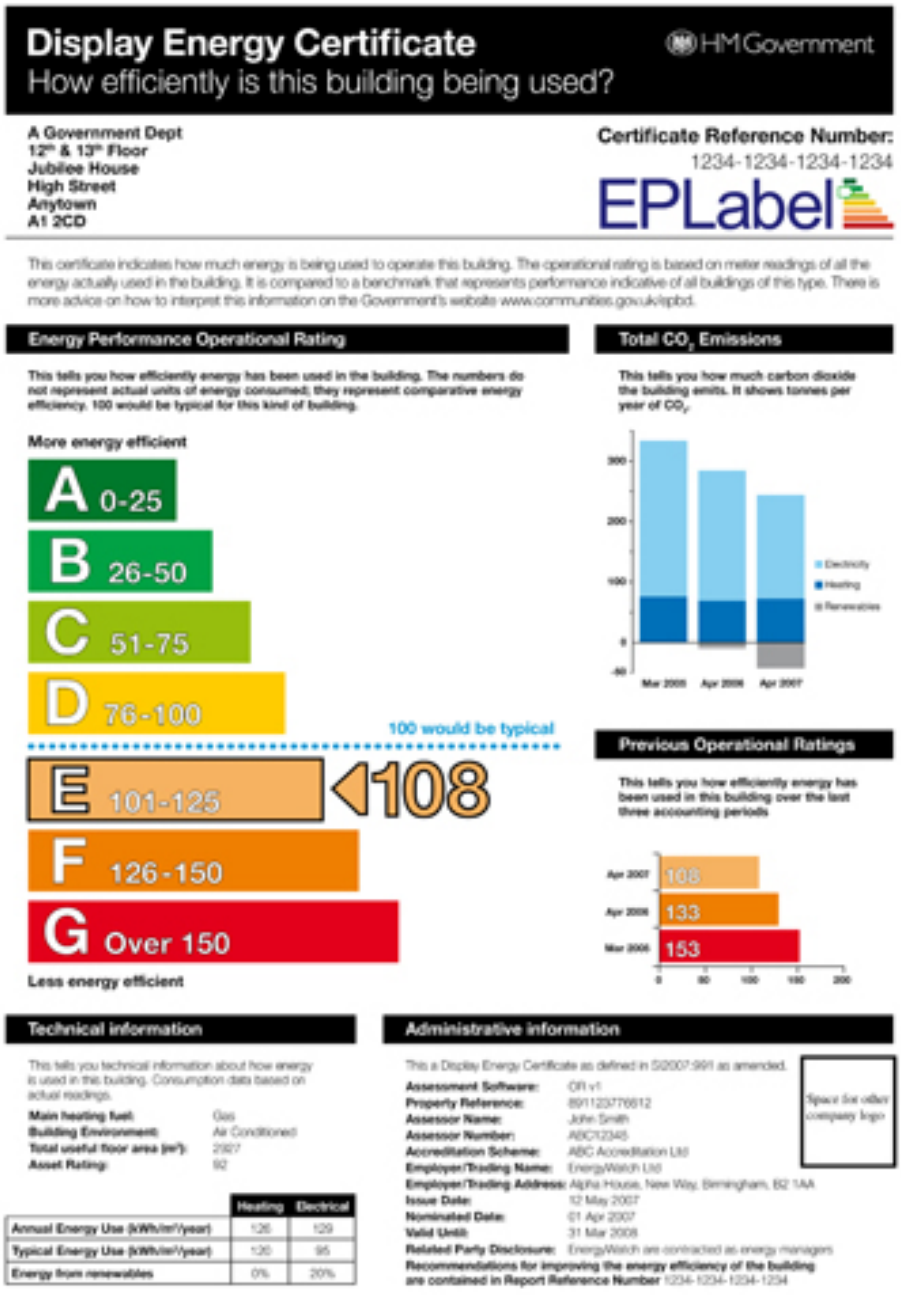


Figure 4. An example of a DEC

4.3 Energy performance assessors

The Directive also states that member states should ensure that the certification of buildings and the drafting of the accompanying recommendations are carried out in an independent manner by qualified and/or accredited experts, whether operating as sole traders or employed by public or private enterprise bodies. In order to be approved, the energy labeling schemes need to make provision to ensure that the experts are persons who are qualified (by their education, training and experience) to carry out the assessment and certification.

4.4 The difference between Building Energy Labeling and Green Building Certifications

Certification schemes for buildings emerged in the early 1990's, however, from the beginning their definition and implementation processes have occasionally caused confusion to building sector stakeholders. A number of different terms and concepts are used, such as energy performance, energy efficiency, ratings, benchmarking, certification, labelling, etc., some of which have overlapping meanings. This can cause misleading interpretations by regulatory bodies, energy agencies and consumers.

Green Building Certification schemes have gained popularity over the last years, and schemes such as BREEAM and LEED have widespread around the world. In this context, "Green" buildings are those buildings which are sometimes referred to as intelligent, sustainable or ecological buildings, and which satisfy a number of environmental performance criteria, which includes energy as one of the aspects assessed.

A clear distinction need to be made however, between the two schemes: Building Energy Labelling and overall Green Building Certification schemes.

Energy labeling was introduced in Europe by the EPBD with the aim to influence the attitudes of developers and occupiers to the energy (carbon) efficiency of buildings. Building energy labeling is therefore mainly focused on energy efficiency. In comparison, green building labeling standards, such as BREEAM and LEED, rate the more expansive *sustainability* performance of buildings, which includes energy and more aspects such as water conservation, health and well-being, transport, ecology, etc. Consequently, a high rating achieved through a green building labeling scheme does not necessarily mean that the building offers high energy performance.

4.5 Benefits of Building Energy Labeling

There are several benefits attached to Building Energy Labeling. Some of the main benefits are:

- Energy (carbon) savings.
- Reduced energy bills for building owner/occupier.
- The EPC's can be used to influence investment / leasing decisions.
- The EL scheme can be used as a means of providing impartial recommendations and information on cost effective energy efficiency improvements of buildings.
- DEC's act as a demonstration of public awareness with regards to energy efficiency, with public sector leading.
- With the problem of split incentives of landlord and tenants, or homeowners and businesses who do not intend to stay in their building long enough to realise the payback from investments in Energy Efficiency. The labelling scheme can encourage builders and building owners to consider energy efficient solutions, even though they would not otherwise gain by doing so.

Additionally, the requirement of an energy performance certificate at the time of marketing a building for sale or for rent will not only advise the client about the energy performance of a property but will also lead estate agents to recognise that it as an important feature of the negotiation process.

The requirement for certain buildings to publicly display the energy performance certificates, and to make recommendations towards better energy efficiency, will further emphasize the importance of the certificate.

5 Road Map for an Building Energy Labeling Scheme

When developing and implementing a governmental strategy, policy or scheme it is always advisable to find and follow a road map suitable for the context of which the initiative shall comply with. In the following a road map for planning, implementing, monitoring and evaluating of the Building Energy Labeling Scheme will be presented. Many road maps have been developed over years with more or less success. During our study and review of existing similar labeling schemes we have experienced that The International Energy Agency (IEA) newly (Autumn 2010) has prepared a so-called Policy Pathway for Energy Performance Certification of Buildings. The Policy Pathway is one in a series of pathways providing details on how to implement specific recommendations drawn from the IEA's 25 Energy Efficiency Policy Recommendations.

We find this pathway being a very serious tool in line with our suggested road-map, why we recommend letting this pathway forming the backbone of the BELS for Mauritius. The IEA Policy Pathway is based on direct experience, comprehensive research and best practice country stories altogether given general recommendation on the entire approach for an energy labeling or rating system. The roadmap will furthermore include specific recommendation and reflections in order to roll out the most applicable way forward for the Mauritian context.

5.1 10 Critical Steps in the Road Map

The overall roadmap follows the four stages during the process as shown in the figure. The approach visualized in the below circle is based on experiences from countries in which the implementation has been most successful and cost effective.

Figure 5. Policy Pathway comprises four main stages.

It is furthermore experienced, that there is a substantial need to prepare an approach adaptable enough for unexpected challenges and barriers coming up during the process, why we strongly

recommend focusing on the following ten major critical steps for the energy labeling scheme process.

Figure 6. The 10 Critical Steps during the energy labeling scheme process.

5.2 Phase 1 – Planning

5.2.1 Step 1. Term of Reference

5.2.1.1 Objective

The objectives for the Building Energy Labeling Scheme shall be made very clear from the beginning of the process, in order to be able to follow and stay on the right track during development, implementation and when controlling and evaluating the scheme. The key to a successful labeling scheme is the clear definition of the labeling objectives and an adequate methodology to reach the policy targets efficiently. Energy labeling is a powerful communicator; it presents simple and instant communication of energy performance levels. Giving a tangible 'face' to energy performance is the first step to raising awareness about buildings.

The major overall objective by implementing BELS's is to improve the energy performance of the Mauritian building stock, and consequently reducing energy supply and emissions, including CO_2 emissions. Data and knowledge achieved will become a central element in future energy efficient building design, as this knowledge might be made available to the building construction and property sectors to promote the energy performance of the buildings. Additionally, the databases might be of high value for future surveys of energy saving potentials, for compiling energy saving measures, for benchmarking buildings and for policy making. In the long run the accumulated knowledge will facilitate more systematic generation of energy savings with a more solid basis, especially if the quality of the building stock knowledge attained by implementing energy certificates is of high quality.

Energy labeling of new buildings serves as a control mechanism of compliance with energy efficiency requirements set in the new Energy Efficiency Building Code an ensure buildings are built as designed. Energy labels for existing buildings and new buildings with a low rating will

furthermore include proposed energy and cost savings as well as life time of investment and pay-back period for potential investment.

The energy label must inform building owners, and potential investors, on the energy performance of the building and the expected energy cost for normal usage of building.

For service appliances and building material manufacturers and suppliers, energy labeling of buildings may increase business opportunities towards an increased demand for energy efficient products and solutions. For consumers and building owners, energy labeling schemes are expected to provide additional information on energy demand and improve consumer awareness of energy efficiency.

The aim can be summarized as to:

• Provide an energy label that facilitates the comparison of buildings' performance.
• Provide an energy label based on a building's design and its estimated energy consumption.
• Provide an energy label for a building's actual energy consumption and operation.
• Provide meaningful indicators of the building's impact on the environment such that the greenhouse gas emissions can be estimated.
• Provide recommendations for energy efficiency improvements.

5.2.1.2 Scope of building categories – development step by step

All buildings with energy consumption for building operation will in principle be suitable for an energy labeling scheme, but it is recommended to develop and implement the scheme step by step, in order to minimize the complexity.

The major building typologies can be categorized as follows:

- New or existing buildings
- Small or large buildings
- Public Non-residential Buildings
- Residential Buildings
    - Individual owned single family housing
    - Individual owned apartments
    - Multi-family buildings owned by a private real estate investor/housing association or municipality
- Private commercial buildings

There is a difference between preparing an energy label for a new building or for an existing building. For new buildings it is normally easy to obtain the building and system characteristics. For existing buildings, especially older ones, this can be very labour-intensive. In this case an energy-consultant may be engaged to conduct an audit of the building and system characteristics and, even then, for some characteristics a non-destructive and acceptably labour-intensive inspection will yield only approximate information. For a new building it is normally quite simple to obtain the building characteristics from the design specifications, or from inspection at the building site.

As a part of the Program "Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings" an Energy Audit Management Scheme for the building sector is under preparation. The

scheme develops standards procedures for energy audit of existing buildings, including training and certification of energy auditors.

It is recommended that the ***first step*** for the energy labeling scheme covers **new private and public air-conditioned buildings** and is delimited to **large non-residential buildings** and **multi-dwelling blocks** with one building owner. Large buildings can be defined as buildings with an air-conditioned floor area **larger than e.g. 5.000 m^2.**

The ***second step*** can be to require an energy label for construction for all new buildings in the same category with a floor **area larger than 1.500 m^2**.

The ***third step*** will be to coordinate with the energy audit scheme in order to cover **all existing large (larger than 1.500 m^2) non-residential buildings, all public buildings larger than 250 m^2** and **multi-dwellings blocks.**

The ***final step*** increases the scheme to include all **new and existing residential air-conditioned buildings.**

Exempted buildings shall be defined and harmonized with present legislation, i.e. The Building Control Act, Regulations and Codes. Furthermore it is recommended that the energy label scheme not covers buildings, such as places of worship, non-residential agricultural buildings, industrial sites, workshop, power plants etc. And for buildings, larger than 1500 m^2, with mixed occupancy, a building with more than 50% of the above mentioned occupancy is exempt from the energy labeling scheme.

5.2.1.3 Public Sector to lead the way in energy efficiency

In The Long-Term Energy Strategy for Mauritius 2009-2025 it is made clearly that the Public Sector shall lead the way towards energy efficiency, as stated in article 6.5.1:

"Government is committed to the Public Sector leading the way in energy efficiency. This will be the fundamental sustainable energy principle for public sector institutions and will be reflected in highest standards of sustainable energy and energy efficiency being applied in all public sector activities, even if is at the expense of higher investment. The aim of Government is to maintain energy expenditure on the basis of life cycle costs at a reasonable level."

And further in article 6.5.9:

"The overall strategy is to reduce energy consumption in the public sector by half of its current level by the year 2015 and to sustain the energy efficiency objectives with the support of new technologies".

The Energy labeling scheme can be one means to meet the goals defined for this building sector. Energy labels for new public buildings can be increased to include mandatory proposals for energy efficiency initiatives and subsequently implementation, if the simple pay-back time is below e.g. 5 years. Furthermore it can be considered if the energy label shall require the implementation of a mandatory energy management system.

Similar to the requirement in the European Energy Performance of Buildings Directive (EBPD), it is recommended that public authorities, and institutions providing public services to a large number of persons, who occupy space in a building with a total useful floor area larger than 1.000 m^2 and are visited by the public, must display a valid energy label at all times and have a valid advisory report in their possession. In practice it means all governmental and municipal buildings.

5.2.1.4 Method of Assessment

The method of assessing the energy performance and collect data can rely on either an *asset rating* or and *operational rating*.

The operational rating, based on meter reading, is appropriate for existing buildings and is relative simple and can easily document how energy savings influences on energy consumption. On the other hand the asset rating, where energy consumption is calculated, is appropriate for both new and existing buildings.

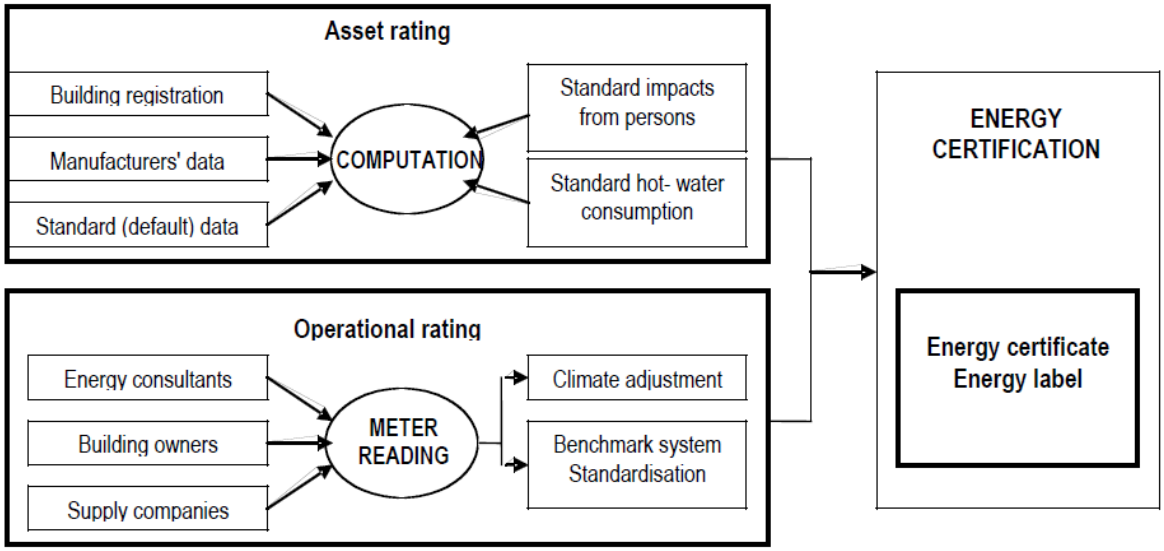


Figure 7. Energy labeling approaches showing the possible data flow for an asset rating and an operational rating.

It is recommended to use the asset rating for the suggested first generation energy labels, to characterize their as-designed energy efficiency features. This rating can be based on an energy simulation of the building, following the criteria for calculating energy performance in the Energy Efficiency Building Code or can be done by a more simple energy simulation tool developed for the energy labeling scheme. Alternatively the energy simulation program developed under the energy audit scheme can be modified and used for energy labeling of new buildings. Whichever simulation approach is chosen it is important to keep it as simple as possible, and it can then be refined afterwards. The Asset Rating can be valid for the lifetime of the building or until the building undergoes Significant Renovation. The extent of “Significant Renovations” has to be defined further.

For example, in Denmark, the labeling of a building shows the building’s energy performance calculated according to a method based on the general framework provisions provided in the EPBD (European Energy Performance of Buildings Directive). In Denmark the method is also used in connection with building regulations to calculate the energy efficiency of new and renovated

buildings. The computer software used for the calculation of the energy label is based on a calculation engine developed by the Danish Building Research Institute. However, the design of the user interfaces is open to all market actors. Currently two companies have made such interfaces, which are also used to report the energy labels to a central database system.

Another example of how building code simulation tools are used for energy labeling is the ASHRAE Building Energy Labeling Program, where an asset rating for new buildings should include the use of ASHRAE/IESNA Standard 90.1.

The accuracy of the energy label calculation should be such that an investment decision can be made upon it. For this a static calculation is sufficient, if certain dynamic aspects are taken into account properly. An example is the utilisation of heat gains. The dynamic aspect can be modelled by introducing a mass dependant correction coefficient.

The energy saving measures can include a number of initiatives. It can be a change of building part, a change of construction layer, the adding of a building part, the adding of a construction layer, a change of installation component, the adding of an installation component etc. It can be difficult to put all these options into the energy calculation. But a calculation scheme as described below can be appropriate for calculating the energy saving measures:

Step 1. First the current situation (existing situation) is described, and the energy consumption is calculated.
Step 2. Then the building is adapted by applying a number of measures. This leads to a variant building description and new calculated energy consumption.
Step 3. The savings are calculated as the difference in energy consumption between current situation and variant situation.
Step 4. The costs of the measures are calculated in a separate calculation.
Step 5. The results of the calculations are integrated to calculate the simple payback time.

All in all the software tool may be specially developed for the Mauritian context and harmonized with existing regulation for energy efficiency in buildings; but it is strongly recommended to conduct a separate study of available energy labeling calculation methodologies in other countries, as it is expected that some of them might easily be transformed into local context of Mauritius.

5.2.1.5 Energy Label Certificate Frame

The objectives for the energy label have to transform into a clear list of requirements for the labeling method. The requirements could address issues like: the specific **properties to be expressed** by a label; **what to compare** with each other; the **magnitude of accuracy of the effect** to be monitored by the label.

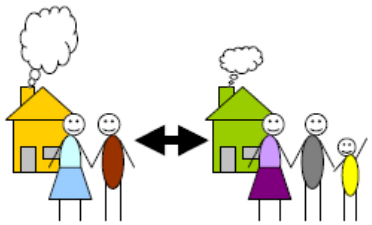
Which properties to express?

A label must have the ability to express the energy performance of a building. This can be realised in several ways. It is recommended, that the label expresses the energy performance of the building, excluding the user behaviour; but operating hours related to specific occupancy should at least be given. In that case the label is a building property and a comparison of buildings with same occupancy is then possible.

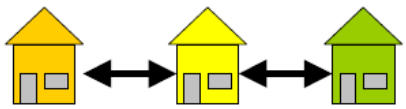
What to compare?

Labeling, for example, can serve the aim to:

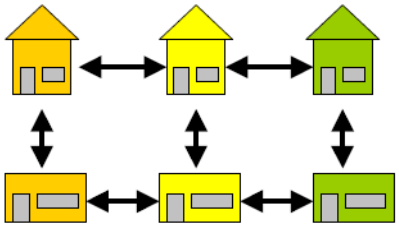
1. Make the actual energy consumption explicit (including occupant behaviour)



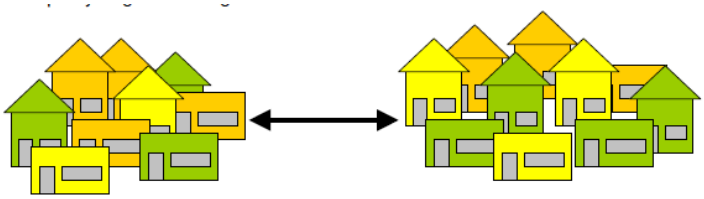
2. Establish the energy performance of a building (excluding occupant behaviour) in order to compare similar buildings and show the effect of energy saving measures.



3. Compare the energy performance of different building types, using the same labeling approach

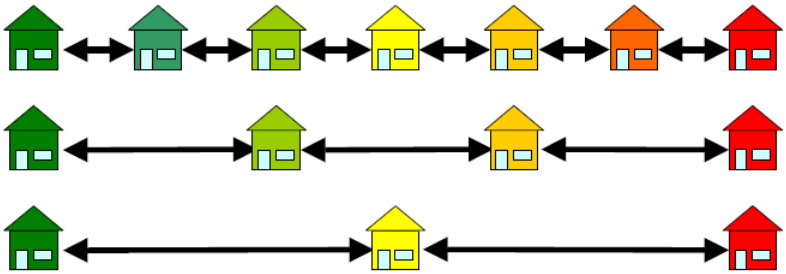


4. Establish the energy performance of a group of buildings or a building stock; for instance to define policy targets on a higher scale



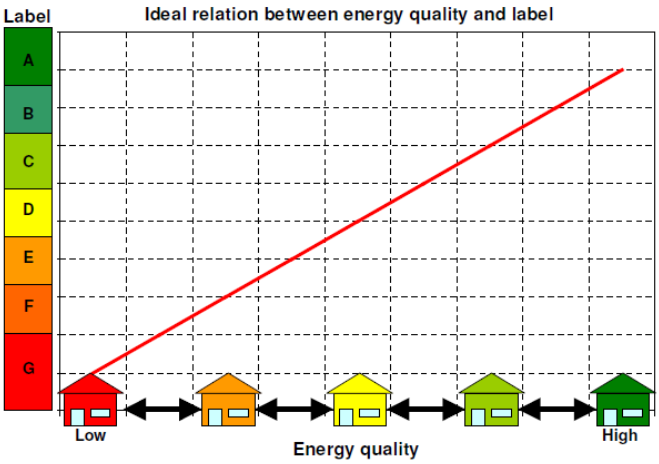
In many situations, labeling can serve one or more of the aims mentioned. For instance, a labeling scheme for the comparison of different buildings (3) can be easily adapted for the comparison on stock level.

What magnitude and accuracy?
An important requirement is the magnitude of the effect that should be made explicit by the labeling. Showing effects on a detailed classification or on a less detailed classification affects the use of the label and relates to the accuracy of the labeling scheme.



Is it the intention to get a rough estimate of the energy performance or is the objective for instance to stimulate the owners by rewarding them with a better rating if they apply a few energy saving measures? In that case a more refined scheme is needed with a higher accuracy. For some purposes a simplified assessment method will be the most adequate and relevant to the objectives. In other situations a more robust assessment method should be implemented to ensure that a high level of accuracy is maintained and the objectives are fulfilled.

The following figure demonstrates an ideal *'test tube state'* labelling system where there is a linear relation between the labelling and the energy quality related to the energy saving measures applied in the buildings. The rating assumed here is a measure of the energy performance of individual buildings. Buildings with similar energy saving measures get the same label. The more measures implemented the higher the rating.



The rating scale should allow for quick comparison of performance levels between similar buildings, and should be based on realistic benchmarks (reflecting building standards and building stock. However, the lack of knowledge of existing energy consumption in building sector is a major barrier when developing the energy scale. It will in the beginning be necessary to rely the scaling on calculations of relevant reference buildings and international best practice for similar building typologies with same weather conditions.

It is crucial, that the energy label is a user-friendly label: simple, easy and providing reliable information on energy performance in the building.

Energy labels should be designed for the convenience of consumers. Many energy labels convey too much technical information. In many cases, the information provided may not be used by consumers. Energy labels should be simple and easy to understand. Only then will they influence

purchasing decisions. However, a simple label can be accompanied with supplementary in-depth information provided by brochures or user manuals. Another crucial concern of label information is its reliability no matter how simple it is. Labels should not mislead or misinform consumers.

It is recommended that label designs and can be improved over time through the active involvement of consumer organizations or environmental groups.

5.2.1.6 The Energy Label Structure

The energy label shall document the buildings calculated energy performance on the basis of normal building use. For the energy label, energy consumption for cooling, heating, ventilation, domestic hot water and lighting should be calculated, as well as other technical installation, appliances for normal building usage. The calculation will not cover energy consumption for e.g. process appliances, office equipment etc. related to the occupant behaviour.

The energy label can be structured as in the following example:

- **Headline**
  - General building information. Name of energy consultant, report number and date. Pictures of building.
- **Calculated Energy Consumption, Cost and related CO_2 Emission**
  - Total Primary Energy Consumption for normal building use [kWh/year] //[kWh/year/m^2]
  - Total Annual Energy Costs
  - Total CO_2-emission [kg CO2/year], [kg CO2/year/m^2]
- **Energy Label**
  - Scale rating from e.g. A to G, related to energy consumption
- **Energy Saving Potential**
  - A list of energy saving measures. Each measures includes:
    - Short description
    - Annual saving potential for each measure [kWh, GJ Fuel, m^3 gas etc]
    - Annual cost saving for each measure
    - Estimated investment cost for each measure
    - Estimated simple-payback time for investment
- **Overview of total savings if all energy saving measures is executed**
  - Total Annual Energy saving
  - Total investment
  - The new potential scale rating
- **Conclusion from energy consultant**
- **Inspection by energy consultant**
  - Detailed description of building elements and building services
  - Potential energy saving measures under each building element or service
- **Main Data for the building**
  - Building name, address, building area, conditioned building area, year of construction, renovation, owner, occupancy, occupancy hours etc
- **Energy Unit Prices**
- **Additional Information**
  - General information on energy labeling of buildings
  - Assumptions
    Complaint

In annex 2 and 3 examples of energy labels can be found.

5.2.1.7 Preparation of the Energy Label

The procedure for the preparation of the energy label will normally include the following steps and actions to be taken:

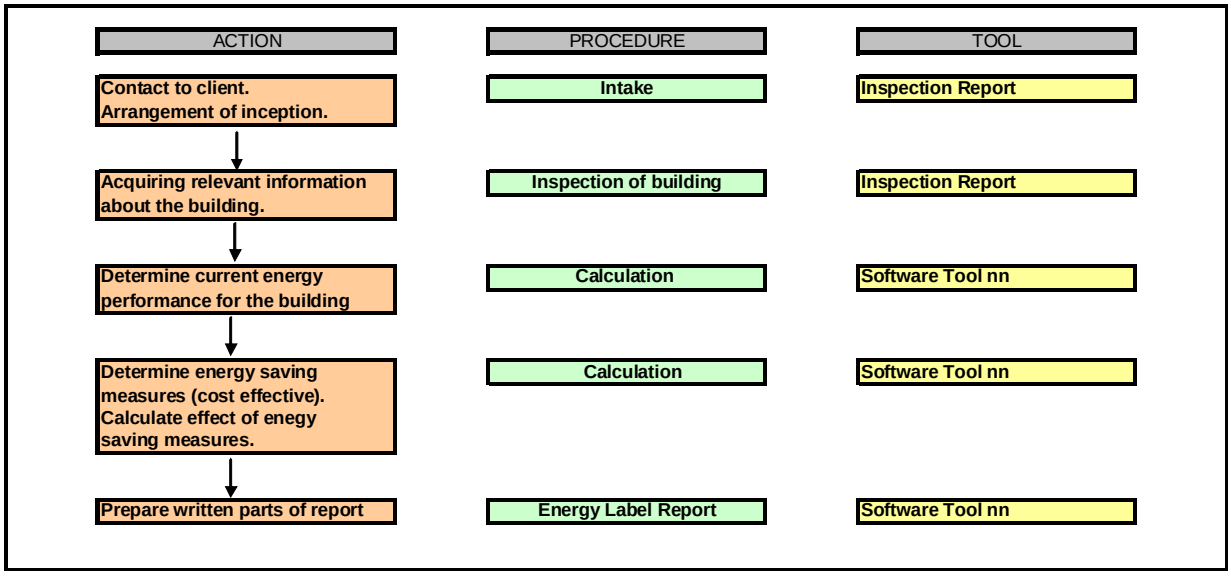


Figure 8. Procedure for Energy Label Preparation

Procedure 1. Intake

The contact with the building's owner or administrator is the first step to be taken in order to arrange a meeting for building inspection. The Inspection Report should be prepared. The tool that accompanies the intake step is an Intake/Inspection Form.

Procedure 2. Inspection of building

The acquisition of data starts with a clear understanding of the building in terms of thermal characteristics. The inspection of the building is a crucial step in the energy performance assessment as its quality and accuracy greatly influences the calculation. The quality depends on the skills and experience of the consultant. Especially in the case of a more complex building it is necessary to derive a clear understanding on how to interpret the building.
When the interpretation of the building is made clear, it is possible to define the necessary data for the calculation. By means of desk research (building description and drawings), inspection, interviews, etc. the necessary data is collected and verified. Also the assumptions made will be verified.
In order to facilitate the inspection, an Intake/Inspection Form template shall be developed. The Intake/Inspection Form is a list with all required data that should be collected during the inspection.

Procedure 3. Calculation of the energy performance

When all data has been collected the actual input stage for the calculation starts. The energy performance is calculated with the developed Software Tool. First the existing situation is described to the tool. After the input phase the results of the energy consumption are determined, as well as primary energy use and related CO_2-emmission.

Procedure 4. Determination of cost-effective energy saving measures in relation with the energy performance
Based on the skill of the consultant, the knowledge gained during the intake and the inspection as well as on the calculation of the existing situation, the energy saving measures can be defined and quantified together with the overall energy performance of the building. The measures are calculated in the Software Tool. It is necessary to develop a comprehensive guideline and Energy Labeling Handbook available for the consultant. These guidelines address important aspects that can be considered during the determination of the measures.

Procedure 5. Preparing the Energy Label Report
The final set of measures leads to the Energy Label Report. The form of this report has to be determined, but shall at least include information's as listed in the previous section in this study.

In order to secure a high quality of the input and output for the energy label, an in-depth quality assessment procedure is needed. See 5.4.1 for more on quality control.

5.2.1.8 Registering Energy Labels

The implementation of the Energy Labeling Scheme will lead to a large amount of data on energy performance of new buildings and from the Energy Audit Scheme on existing buildings. These data can be, on one side quality control of the scheme, but also a basis for adaptation or introduction of policies, as financial incentives for energy saving measures. In order to be able to utilize the collected data, they have to be registered on a central level, and resources shall be allocated for the evaluation of data. In Denmark, a certification scheme for energy performance in buildings has been in place since the 1980s, and in 1997 the energy labeling certification has become mandatory for smaller buildings and apartments at the time of sale, and at regular intervals for large buildings. All key data from this scheme has systematically been reported to a central register, and the information's has been a very useful parameter when assessing future energy saving potential in the building stock and for the development of energy policies and strategies.

It is recommended to store all data in a national official register developed and maintained by the Energy Efficiency Management Office. Each building and appurtenant energy label shall be provided with a unique reference number to identify the building and/or energy label. A database with public access gives building owners, tenants, real estates, etc. the opportunity to gather useful information on the specific energy performance and related costs for the building. Data available for all should be restricted to a certain level of information, like e.g. energy rating, energy consumption and annual costs. It is recommended that access to upload energy labels is free of charge, but for more comprehensive data extract from the database, a fee can be charged. Access to the entire database information can be restricted, so only those who have the unique reference number can access the energy label registered for a particular building, apart from certain provisions allowing access to accreditation and enforcement bodies, and on an anonymous basis to government.

If there is any other existing building data bases available it should be considered to harmonize and collect all data in one database, rather than having a number of building data bases.

It is suggested to prepare a study to review administration and ICT systems in operation or in preparation in some of the countries which already has established energy rating schemes, such as Denmark, The Netherlands, Austria, UK, Ireland, Portugal etc. The study can evaluate options for the administration system and the National Database/s to be developed in Mauritius.

5.2.2 Step 2. Administrative and Policy Framework and Action Plan

5.2.2.1 Implementation and Administration Committee / Secretariat

An infrastructure for developing, managing and administrating the scheme will be required. It could involve the establishment of the following bodies:

Building Energy Labeling Scheme Implementation Committee (BELSI Committee); to manage the development and implementation of the first BELS in Mauritius. Members from local ministries, financial funds and institutions, real estates, architects and engineers, local authorities, international experts etc. should attend the body. In general all key-stakeholders in the building community shall be represented and engaged in the development phase.

BELS Administration Committee; to oversee the development and strategic elements of the scheme, when established, with membership based on a Building Energy Labeling Scheme Implementation Committee.

The responsibilities of the Administration Committee could include the following:

- Overseeing all aspects of the administration of the BELS and recommending any necessary changes in the light of experience;
- Advising Ministers on the initial setting and periodic revision of maximum fees for ratings, registration, training, etc;
- Supervision of a mechanism for dealing with complaints;
- Overseeing development and maintenance of ICT systems for data collection, national databases, document generation and statistical analyses;
- Annual report on the implementation and operation of the BELS

Building Energy Label Secretariat; to manage the day-to-day operation of the scheme.

The responsibilities of the Secretariat could include the following:

- Provide all support services necessary to enable the Administration Committee to carry out its work;
- Provide all support to energy consultants and quality assessors
- Dissemination of the scheme to public
- Advise on the contracting out of specialised work.

Provisions of the Secretariat function can be by a competitive tendering process.

The figure below shows an example of a proposed administrative system. The example is from the Irish development of the Building Energy Rating Scheme and reflects the different bodies and responsibilities for a similar scheme.

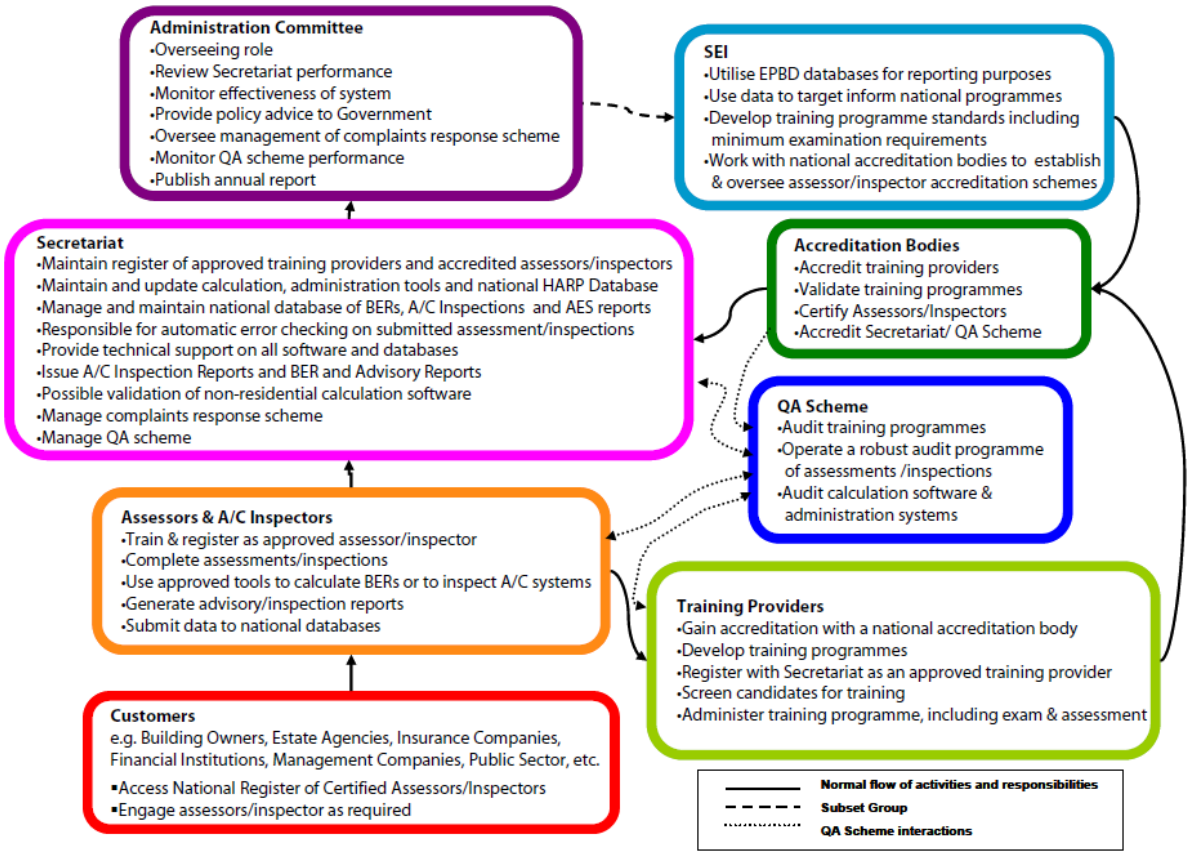


Figure 9. Proposed Structure for the EPBD Administration System in Ireland. (SEI: Sustainable Energy Ireland, BER: Building Energy Rating:

5.2.2.2 Mandatory or voluntary Scheme

It is recommended that the suggested energy labeling is mandatory for the buildings categories mentioned earlier in the report, and follows the steps for implementation. Since a very comprehensive energy strategy and related energy efficiency legislation already has been rolled out it is seen as a sound decision to go for a mandatory scheme from the very beginning. If one wants to go even further, other voluntary energy rating or sustainable rating scheme can of course be complied with alongside the energy label requirement.

5.2.2.3 The moment of intervention

Moments of intervention are typical situations that occur several times during the life span of a building, and can been seen as the moment to carry out an energy label for the building.

As the first step in the plan for the energy labeling scheme it is suggested to carry out energy labels in new buildings. Later, when the scheme has been fully implemented it is recommended to carry out energy labeling in existing buildings:

Scheme for new buildings:

- When constructed

Scheme for existing buildings:

- When a building or dwelling is sold and rented out

- Regularly (every 5 year) for existing buildings larger than 1.500 m^2 (residential and non-residential buildings)
- Regularly (every 5 year) for all existing public buildings larger than 250 m^2
- When major renovation projects will influence on energy performance

If an energy label is valid for e.g. 5 years, it will not be necessary to prepare a new label if a building is sold within the period of validity.

5.2.2.4 How to finance Building Energy Labels?

It might be possible to develop a cost neutral energy labeling scheme, if a fee structure provides the income to cover costs of operating a secretariat, quality assessment scheme, education of assessors etc. The costs of the energy label itself can be defrayed by the building owner, but it is recommended to set maximum fee rates for energy labels in order to avoid unacceptable high prices for certifying buildings, at least in the beginning of a new certification scheme.

The energy label price can consist of a basic amount and some additional amounts depending on the specific building conditions, such as the area, year of construction, complexity etc.

In some countries there is no standardized fee or fee limit for an assessment, for which reason a competitive market created among assessors.

5.2.2.5 Financial/fiscal support mechanism

Research has shown that supporting initiatives is necessary to ensure the effectiveness of a building energy labeling scheme. The review of existing labeling scheme has shown that the scheme alone did not necessarily lead to significant lower energy consumption. For instance in the United Kingdom, a survey showed that 60% of the cases do not implement the certificate recommendations, and 9% intend to implement some of the recommendations in the future.

Financial and fiscal support mechanisms are necessary to support the BELS. Development of these support mechanisms are complementary measures to ensure the success of the BELS.

An example of fiscal incentives is tax reduction in the property rates, charged by Municipalities, of building owners if it is proven that the buildings are energy efficient. The opposite of such fiscal mechanism is to have an additional tax for poor performing buildings. Some countries have adopted national grant schemes for energy retrofit. Subsidies or tax exemption can be given on technologies that will help improve energy efficiency. Taxes and subsidies can also be linked through payment of the fees for the energy label certificates.

Currently international donors are funding the “Green Lending Scheme” through commercial banks whereby there is a percentage cash back for investment falling within the set criteria. Similar financial incentives can be developed in the BELS context. This can be also in the form of reduced interest rate on loans.

5.2.2.6 Proposed Action Plan

Implementation of an Building Energy Labeling Scheme in Mauritius is not subject to the European Union Directive 2002/91/EC on the energy performance of buildings (also known as *Directive on*

the energy performance of buildings (EPBD)), for which reason the development can be done independent of these requirements, also on with regards to deadlines for implementation. But it is strongly recommended to rely on experiences from other countries, who have implemented Energy Label Schemes under the Directive.

The implementation must go hand in hand with other initiatives on energy efficiency in the building sector, among these the Energy Efficiency Building Regulation, Energy Efficiency Building Code and The Energy Audit Scheme. As mentioned earlier in the study it is suggested to develop and implement the scheme gradually.

The following main implementation schedule is recommended:

Mandatory Energy Labeling to come into force		
Step 1	**New private and public air-conditioned non-residential buildings and multi-dwelling blocks > 5000 m2 (Asset Rating)**	***Year 1***
Step 2	**New private and public air-conditioned non-residential buildings and multi-dwelling blocks > 1500 m2 (Asset Rating)**	***Year 1***
Step 3	**Existing private air-conditioned non-residential buildings and multi-dwelling blocks > 1500 m2 and all new and existing public buildings > 250 m2 (Operational + Asset Rating)**	***Year 2***
Step 4	**New and existing residential air-conditioned buildings (Operational + Asset Rating)**	***Year 2***

Figure 10. Overall implementation plan for Building Energy Labeling Scheme

Developing an Energy Labeling Scheme involves an extraordinary amount of activities and many actors, for which reason it is vital in an early stage to prepare and reach consensus on an action plan, which will involve the engagement of all key stakeholders. Experiences from European countries show that it is not unusual that developing, implementing and first evaluation can take up to two or three years. Furthermore refining and maintaining the Energy Labeling Scheme is a lifelong process, which can be illustrated by the Danish scheme dated back to 1997, and it is still undergoing constant refinements and adjustments.

The team recommends the following overall main activities to be included in an action plan. Detailed individual order and duration shall be developed as part of preparing the Detailed Implementation Plan by the BELSI Committee.

Main Implementation Activities
Administration (Planning Phase)
Establish Building Energy Labeling Scheme Implementation Committee (BELSI Committee)
Establish BELS Administration Committee (Operation Phase)
Establish Building Energy Label Secretariat (Operation Phase)
Draw up legislative and financial framework
Study on Best Practice Implementation Plans
Publish Detailed Implementation Plan
Calculation Software and Hardware Tools (Implementation Phase)
Study on Best Practice Software and Hardware Tools
Develop/validate calculation methodology
Develop/validate software (Asset and Operational Rating)
Develop/validate hardware (handbooks, guidelines etc)
Energy Labeling Form (Implementation Phase)
Study on energy labeling forms and scales
Develop/validate the energy labeling scale
Develop/validate the energy label form
Administrative Database System (Implementation Phase)
Study on Best Practice ICT and data administration systems
Develop/validate central database for data collection
Training and Accreditation of Consultants (Implementation Phase)
Establish Assessor Accreditation Body
Identify criteria and need for qualified consultants
Develop training material
Training and accreditation of consultant corps (+ Operating Phase)
Quality Assurance (Implementation Phase)
Establish Quality Assurance Body
Develop QA Procedure
Training material and training of QA consultants (+ Operating Phase)
Dissemination and Information (Implementation Phase)
Develop Web-Site
Consultative Workshops and Conferences
Develop information campaign material and activities
Pilot Project (Monitoring Phase)
Before launching the scheme and once the calculation methodology, survey methodologies, associated software and consultants has been trained, all should be piloted in targeted buildings in order to identify any issues, difficulties and adjustments that might be required.
Evaluation (Evaluation Phase)
Quarterly and yearly operation evaluation reports

Figure 11. Main activities for the implementation plan

5.2.2.7 Key Actors to be involved

A mandatory energy labeling scheme will make major inroads to the existing building community in Mauritius, as a successful implementation will need a number of key actors to be engaged in the development, such as:

Building Owners and Developers —To meet the needs of this community, the label should be framed as a marketing opportunity, a way to differentiate one building from other buildings. Programs like e.g. ENERGY STAR and LEED have demonstrated financial benefits from participating in these programs—such spaces are very desirable to perspective tenants and owners.

Finance and Insurance Community —As mentioned above, energy-efficient buildings can be seen as an asset while inefficient buildings can be considered a liability. Adoption of labeling requirements by these groups can be a benefit to both the market penetration of the label and the implementation of a consistent mechanism for measuring the liabilities associated with a particular building.

Building Designers — Professional architects and engineers and others in the design community already recognize the benefits of energy efficiency. Marketing the label as an opportunity to illustrate these benefits to clients will provide an incentive within the design community to recommend to their clients that they obtain a label. Also, the label can serve as a source of competition among members of the design community.

Legislators/Regulators—An initial focus on the public sector may be beneficial as it can illustrate to the public the responsible use of energy and can lead the way towards sustainable building approaches. Once adopted and successfully implemented in public buildings, others will be more willing to implement.

5.2.2.8 Policy Framework

Translation of Energy Labeling Schemes into new policies or adaption of existing policies has to meet a number of needs in order to achieve successful implementation. Though policy in Mauritius may differ from European Member Countries, who have developed similar schemes, some general guidelines for implementation can be useful to study and benefit from.

5.2.2.9 Regulation

In order to set up a building labeling scheme, legislation/regulation needs to be enacted on a number of issues. The following aspects need to be covered:

- Minimum Energy Performance Requirements;
- Adoption of a methodology for calculation;
- Minimum requirements/training for Experts;
- Act (or regulation, depending on the country) for Certification of Energy Performance of buildings.

We now go one by one and analyze whether this is already covered in the legal framework in Mauritius or whether new legislation is needed.

Minimum Energy Performance Requirements

These have not yet been defined in Mauritius, but are part of the present project. Danish Energy Management A/S has presented a first draft of the Energy Efficiency Building Code where these aspects are covered.

Methodology for calculation
As the above, these aspects are covered in the first draft of the Energy Efficiency Code presented by Danish Energy Management A/S.

Minimum requirements/training for Experts
As part of the Program "Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings" an Energy Audit Management Scheme for the building sector is under preparation. The scheme develops standard procedures for energy audit of existing buildings, including training and certification of auditors.

The consultant assumes that this aspect is under preparation by another team of consultants. Much of the content of the training will be similar and therefore a large share of these aspects is already being covered. There are however some differences in the training requirements for energy audits in new buildings (where what needs to be verified is compliance with the code) or for existing buildings (where audits are based on meter reading). On sections on Certification of Assessors and Training of Assessors and dissemination of information, we have provided our suggestions. One way of implementing this into legal requirements would be the enactment of an Act similar to the Registered Professional Engineers Council Act or the Registered Professional Architects Council Act. To avoid overlapping, this needs to be done in coordination with the work developed (or in the process of being developed) under the Energy Audit Management Scheme Project.

Act on Labeling on Energy Performance of buildings
This is the one aspect that needs still needs to be developed in full. In previous sections we have provided our recommendations on how to approach the different issues. Here we provide a list of the issues that need to be covered under a new potential Building Certification/Labeling Bill (final name to be decided later). The proposed content of each issue is described under different sections of the document.

Please note that the following is a preliminary suggestion and some issues could vary once the aspect is studied in depth.

- Objectives of the Act;
- Scope (types of buildings covered);
- Where should the "label" be displaced (e.g. on a visible place for public buildings, should be provided to the new owner or tenant when the building is sold or rented, etc);
- Refer to the code for minimum energy performance requirements and for method of calculation;
- Energy label structure and frame;
- Procedure for preparation of the label;
- Procedure for administration of labels and responsibilities, including the setting up of a BELS Administration Committee and Secretariat;
- Registration of labels;
- Period of validity of the labels (for instance at EU level this is 10 years or as suggested 5 year).

5.2.3 Step 3. Allocation of necessary Resources

Many types of resources are needed to ensure effective implementation of the energy label scheme, including a number of new energy consultants skilled to carry out the assessments. Experiences form European countries, shows that the bottle neck for implementation is the lack of such consultants, which give rise to major delays in implementing the EPDB in the specific country. It is therefore important to prepare an in-depth analysis of the necessary amount of especially energy consultants. Of course other relevant administrative resources will be needed as well in order to operate and maintain the entire scheme.

5.2.3.1 Sizing the Consultant Corps

The requirement for energy consultants shall be estimated as a part of developing the scheme. It might be assumed that for the majority of certified consultants the provision of preparing energy labels will be a part time activity integrated with or supplementary to their core professional services – probably as architects, engineers or surveyors. It is however possible that some qualified consultants will practice exclusively as Energy Label Consultants.

Some over-capacity of certified consultants relative to market demand is important in the interests of ensuring competitiveness on price and satisfactory turnaround times. Experience in some EU countries suggests that a proportion of trained and duly qualified consultants may carry out – or choose to carry out – Energy Labels on an infrequent basis.

It is suggested to carry out a study mapping the number of buildings to be assessed according the suggested implementation plan, in order to specify the sizing of the consultant corps.

From similar studies, it is estimated, that for preparation of Building Energy Labels for compliance with Building Regulations (new buildings), a full time practitioner (for example, an architect.) servicing private or social housing could deliver assessments covering up to 600 units per year, but in practice, allowing for other commitments, might cover an average of 150-200 units per year. For buildings with more complexity, such as commercial buildings a smaller amount of assessments might be expected.

In respect of sale or rental of existing housing, delivery of an Energy Label it is estimated that a full time practitioner (surveyor) servicing sales or rentals might in practice cover an average of 200 units per year. In relation to existing housing in Denmark it has been reported that the most active consultant complete 300 – 400 assessments per year.

Two factors may however serve to reduce the demand on amount of consultants over time:

(a) Given that an energy label may have a validity of up to e.g. five years then, some decline in the demand for assessments may take place over time.
(b) Normal efficiencies deriving from experience, allied to improvements in ICT technologies for surveying and integration with calculation procedures, may offer some prospect of improved productivity.

However, in the early years of the process, it can be expected that the overall volume of property market activity, will be the most significant factor determining the need for assessments.

5.2.3.2 Certification of Consultants

Regarding accuracy of the measured energy performance of building, data collected by the consultant in the inspection of a building have a very strong impact on the outcome of the calculation of the Energy Performance Indicator. For a reliable data basis and the comparability of the collected data, consultants have to be aware of what the sensible points in the stage of inspection are.

Requirements regarding qualification of the consultants have therefore to be defined, as additional training helps promoting a more accurate result. Requirements regarding qualification can be a certain number of working years and/or a certain level of education and specific requirements to technical topics. Registration of the consultants helps building owners to find a qualified and reliable consultant.

The process of developing the certification scheme will include the following activities:

- Setting up a subcommittee of subject matter experts
- Creating the body of knowledge for the certification
- Developing the outline of topics for approved certification program
- Developing the unique and specific eligibility criteria for that program

In order to be certified as an energy consultant, it is recommended, that the applicant must be certified by an accredited certification body with the competence to certify energy labeling assessors. A certification process can entail the following, amongst other things as an example:

1. Certification in accordance with ISO 9001 and/or other supplementary requirements for companies or individual persons which perform energy labeling.
2. Preparation of a quality manual for the consultant's energy-labeling work.
3. Preparation of procedures for self-inspection and processing of complaints.
4. Requirements for the personnel performing the tasks to have the required skills (Education, professional back-ground, technical experience within specific topics etc.)

Before issuing the certification, the certification body from which an applicant receives its certification should have been the subject of an inspection visit by the certification body to ensure that all procedures have been followed, and the certification body should carry out an inspection e.g. once a year. The certification can be considered to renew every three years.

Individually appointed energy consultants play a very important role in the scheme as the persons who actually carry out the labeling. In other countries two types of appointment are mostly available in the scheme: some consultants cover single family houses and perform building inspections, while some cover larger residential buildings, public buildings and the trade and service sector. It is possible to be appointed within both types. In order to become an authorised energy consultant, the consultant must be a trained engineer, architect, construction designer or similar and must have at least 3 years of documented, relevant experience in building technology and energy consultancy. The consultant must have compulsory professional indemnity insurance, which must be kept in force at least 5 years after ending as a practicing consultant.

5.3 Phase 2 - Implementation

The implementation phase is a very important one, whereby the scheme is in the process of being launched in the real context, and where the implication of the scheme's introduction can be seen. It is imperative that during this phase, appropriate information is made available to decision-makers, the various professionals of the building sector, manufacturers, and building users. Awareness-raising is a key consideration because many developers and end-users will have little understanding of Building Energy Labeling and what the implications are with respect to them. Capacity building and training amongst professionals of the building sector is also very important to ensure that building energy assessor and energy-efficiency specialists are appropriately trained and have access to the relevant materials and technologies to carry out the energy performance calculations.

5.3.1 Step 4. Capacity Building

It is critical that adequate training and capacity-building are carried out in order for a Building Energy Labeling scheme to be successfully implemented in Mauritius. The objective of training and capacity-building is to extend and expand knowledge among government officials, stakeholders and building users with regards to the energy-related information of buildings, and best practice recommendations that accompany the Building Energy Certificate.

The various stakeholders will need to be made aware of the implications of a Building Energy Labeling scheme and in what ways they will be affected. Architects, engineers, and contractors will need to participate in workshops and training sessions to allow them to actively engage in the implementation phase of the scheme.

Additionally, qualified energy consultants will be required to carry out building energy assessments.

It is very important to ensure that energy consultants are appropriately trained and experienced, and therefore it is recommended that special training courses are made available, and that consultants can follow a periodical (e.g. yearly) additional training course and that they are kept aware of any new regulations, changes and general information with respect to the scheme. The challenge of training and ensuring quality assurance of building energy consultants will certainly require significant effort, but is essential for the correct implementation of the Building Energy Labeling scheme.

In order to ensure that there are enough qualified and/or accredited energy consultants, it is proposed to have a period of two or three years from the launching of the scheme as a period during which adequate training and capacity building would be carried out extensively.

Training can be undertaken by a variety of training providers; but it is recommended to define and set requirements for quality and skills for trainers and their training packages. In Ireland trainers and training packages must be certified to a standard agreed by the National Qualifications of Ireland and meet specific requirements in a consultant training programme.

In Denmark energy consultants are obliged to take the admission course for the Energy Labeling Scheme and must have passed the final examination. In addition to this, all consultants have to follow an annual one-day follow-up training course, and they receive a newsletter telling about new rules, clarifications, frequently asked questions and general information on the development of the scheme. Information for the consultants is based on experience from the quality control, reported energy labeling, as well as technical research and development. It is essential that the consultant have a very thorough knowledge of the Energy Labeling Handbook and the computer programmes.

To support and administrate all certification and quality assessment procedures, training procedures, Q & A etc. it is strongly recommended to develop a web-based portal, where the consultants can gather all necessary information for the energy-labeling work. Some information can be open to public while some must be restricted to consultants and operators within the energy labeling scheme. The portal can contain information, such as,

- Information for the property developer, building owner and user
- Registry of assessment, certificates and advisory reports
- Registry of consultants (procedures, application forms etc)
- Quality assurance procedures
- On-line Energy Labeling Handbook
- Tool Box including all relevant forms, templates etc.
- Announcement of training courses and material
- Software programme
- Statistical material
- Relevant Legislation
- Q & A for energy labeling consultants and quality assessors

The web-portal can be developed and maintained under a new Energy Labeling Secretariat possible set up as a new body under the Energy Efficiency Management Office. A best practice example of a web-portal for an Energy Labeling Scheme, is the Irish portal, and be visited on: http://www.seai.ie/Your_Building/BER/

5.3.2 Step 5. Awareness Raising

Awareness-raising is another important issue, and needs to be promoted to all the actors involved (engineers, designers, contractors, building users, etc.). Raising awareness and communication plays a key role in bringing about change, both in buildings and the behaviour of people involved. One of the main challenges is to create the motivation in end-users and the building industry to opt for energy efficient buildings.

Therefore, it is proposed that targeted campaigns are arranged over the course of the scheme's implementation stage, to inform stakeholders, policy makers, building owners and tenants about the requirements, processes and implications attached to the Energy Labeling Scheme.

The campaigns for awareness-raising should be tools to stimulate discussions and share ideas during the implementation process, rather than being just a rigid "how-to" formula.

Some common methods for raising awareness include:

- Direct communication with relevant people through meetings, presentations, workshops and informal social events.
- Strategic partnerships or alliances with other organisations (universities, learning centres, libraries, etc.) to provide seminars or training.
- Mass media interviews and informative news items on radio and television.
- Political advocacy and lobbying.

- Printed materials - for example, brochures, billboards, cartoons, comics, pamphlets, posters, and resource books.
- Exhibitions and displays at places frequently visited by people.
- Websites, email discussion lists and Web Logs (blogs).
- Structured training programs for people who would like to obtain more detailed information about the scheme.

5.3.3 Step 6. Dissemination Activities

Following the initial process of general awareness-raising, dissemination activities need to be carried out. Dissemination needs to be an ongoing process throughout the implementation phase, to ensure that key people involved are made aware of news about the scheme, updates, important dates, etc.

Traditional dissemination activities include the use of printed materials such as leaflets, newsletters and posters to transfer information. Traditional dissemination methods are usually efficient at transferring information to a wide audience through accepted and habitual means, especially for the general public, as Internet and email distribution is not always relevant.

Dissemination activities can further be enhanced through electronic newsletters, posters, brochures, and regular workshops and conferences. The setting up of a website dedicated to providing information about the scheme, news and updates, schedules of training sessions, etc., can also be an effective dissemination method.

Technical papers and guidance documents are also valuable tools, especially because Building Energy Labeling would be introduced as a new concept in Mauritius. These documents can be made available at workshops and conferences, to ensure that they are distributed to the relevant stakeholders and end-users, and that the required assistance and guidance is provided to the latter.

5.4 Phase 3 – Monitoring

Monitoring and evaluation of procedures and quality of the energy labeling scheme is the key to a successful and sustainable scheme. An overall quality control assurance approach including everything from training, validation of labels to auditing process shall be developed in order to quality and highlight points for future refinements.

5.4.1 Step 7. Quality Assessment

Confidence in the energy label is the most important factor in achieving the main aim of the labeling scheme - energy savings. The user must at all times have confidence in the registrations made, the calculations, the label itself, and especially that the suggested energy saving measures are viable and will result in improved economy. Thus, it is essential to maintain a high level of quality in the energy labeling scheme. If quality is poor, the users will lose confidence in the labels. Quality assessment is essential, as although good consultant might do good work without it, less good consultant will not. Credibility may be lost very fast as a few poor labels can do a lot of damage.

The Danish Energy Labeling has over years developed a comprehensive and effective independent quality control system that takes place at all levels of the scheme. No labeling would be possible if

the work were not subject to internal quality management. As mentioned above, active quality management of the labels and the work performed by the consultants is a central part of the labeling scheme. Both the secretariat and the technical auditor have specific quality tasks within the scheme.

One of the main purposes of the quality management scheme is to ensure that the consultant is doing exactly as instructed in the Energy Labeling Handbook of the scheme. Furthermore the aim is to ensure transparency for the consultant and the user of the label.

The quality management scheme in Denmark, of which Danish Energy Management A/S has the project management, is outlined below.

Automatic screening: Every energy label produced must be reported to a central database, including detailed information about the label, information registered, calculation results and energy saving proposals. Prior to entry on the database, labels are automatically screened field by field in order to validate data. The label cannot be sent to the user unless reported to the database. The Danish Energy Authority is responsible for the validation system.

Electronic screening: Automatic, statistical screening of all data in the database is performed by the secretariat in order to locate statistical outliers.

Manual screening: Advanced statistical analyses of the development and trends in the reported labels are performed. This task is performed by the Danish Energy Authority.

Desktop control: Five per cent of all reported labels are taken randomly from the database and checked by the secretariat, and implies going through the labels and checking whether general information stated about the building is correct and whether the labels fulfil the demands in the handbook. Defective labels are extracted for technical auditing.

Technical auditing: Field control of half a per cent of all labels is performed by the technical auditor with a visit to the labeled premises. The auditor carries out a new label and compares it with the label being audited. There are in general three possible outcomes of the audit:

1. No comments,
2. Considerable remarks and
3. Not acceptable.

All consultants of the labels subject to technical auditing are informed and the audit includes a dialogue with the relevant consultant. If a label is assessed "considerable remarks", the consultant will be informed, asked to correct the label and subject to increased quality control. If a label is assessed "not acceptable" the consultant can be warned and may in severe cases be removed from the labeling scheme. In all cases the Energy Authority makes the final decision.

The flowchart below illustrates the quality assessment procedure for the Danish energy labeling scheme.

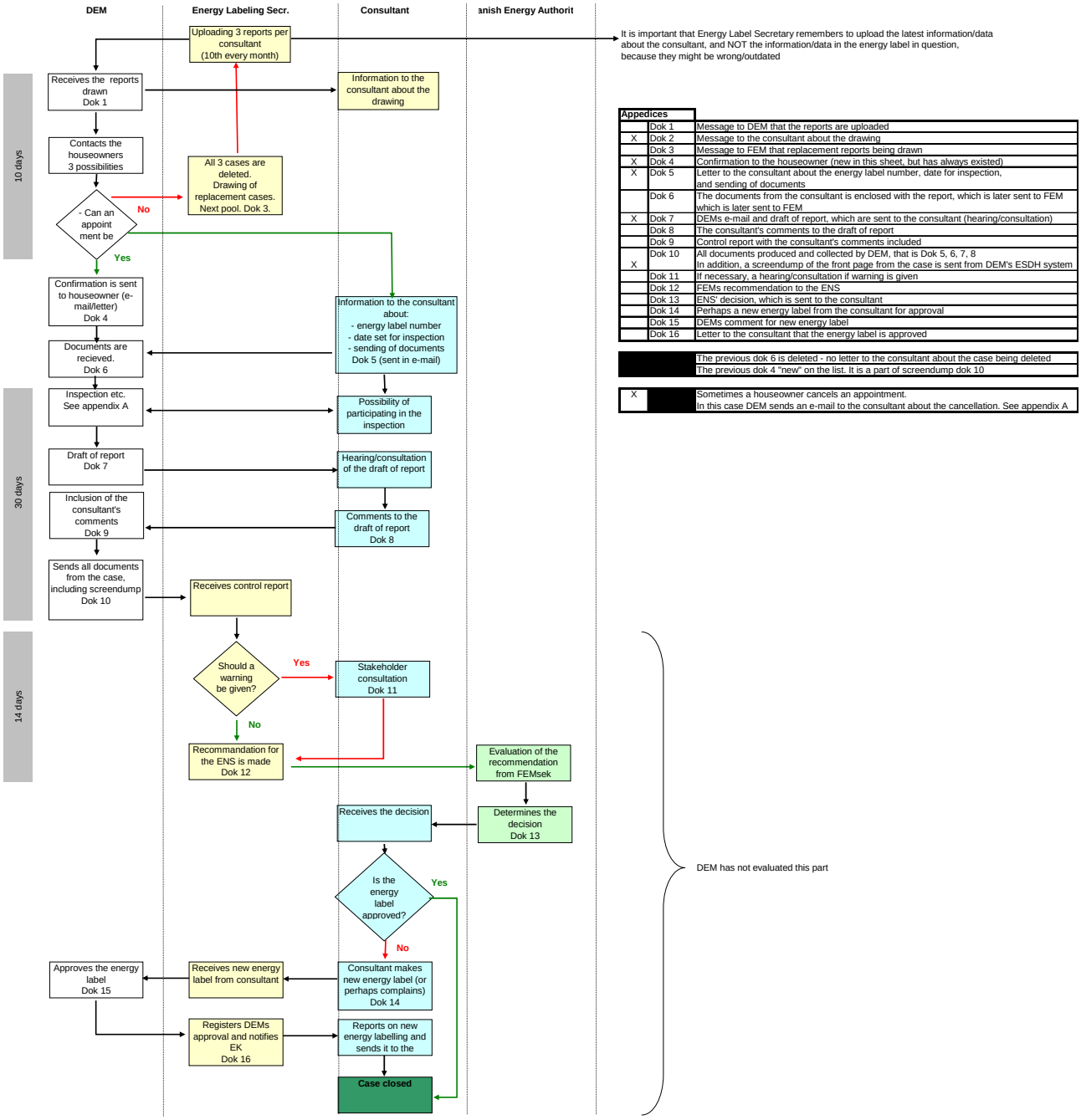


Figure 12. Flowchart showing the QA Procedure in the Danish Energy Labeling Scheme

In annex 1 an example of a Quality Assessment Report can be found. The report is used as a QA tool in the Danish Energy Labeling scheme.

5.4.2 Step 8. Transparency and credibility in Energy Labels

Transparency in all steps of the energy labeling scheme is vital in order to achieve the best results for the scheme and highest grade of implementation of energy efficient building design and energy saving means in the existing building stock.

It is important that messages in an energy label are user friendly and easy to understand, and the benefits from suggested energy saving mean is clearly stated. Complicated technical descriptions, data and results shall be transformed into simple text. The focus on be on the potential energy savings improvements, in order to motivate the building owner to implement the energy saving means. Training, guidelines and handbooks shall provide the consultant with necessary examples and tool to communicate user-friendly, and the quality assessment should assess the comprehensibility for the user.

It is important to achieve an open dialogue between the consultant and the energy labeling secretary on the quality of the energy labels. Through e.g. monthly newsletters and the web-portal, consultants can be provided with useful information on observations from the quality assessment work.

Evaluation and quality assessment procedures shall openly communicate any weaknesses and errors, to ensure and improve the quality of the scheme. Statistics on observed errors and the frequency can with advantage form the basis of an open dialogue for improvement and enhancement of quality. In the early stages of the Energy Labeling Scheme in Denmark the media more or less hounded the scheme because of discrepancies in some results. This massive media focus, has however, over years led to this exhaustive quality control system, assessors and their work is subject to today, and now resulted in a very high quality of energy labels. By giving the public access to evaluation results it has put pressure on quality level and resulted in refinements in order to obtain public acceptance and confidence of the scheme.

5.5 Phase 4 – Evaluation

5.5.1 Step 9. Continuously Evaluation

To ensure high quality of energy labels and form basis for refinements of scheme consciously evaluation should be undertaken. The main purpose of the evaluation is to assess if it complies with the overall targets defined in policies and strategies on energy efficiency in the building sector, and measure if the strategy is feasible. The evaluation can give rise to new path-ways and new process leading to a more efficient and feasible scheme, just as adjustments according to the national building regulation and code can be necessary.

Experiences from scheme evaluation in other countries show a tendency for improvements on e.g.:

- More user-friendly and less complicated energy labels
- More focus and higher motivation on energy saving measures in order to meet overall energy strategies
- Increase of target group involvement
- Increase of capacity building among consultants
- Refinement of software tools and training material

5.5.2 Step 10. Development towards Sustainable Labeling Scheme

Globally, buildings account for over a third of greenhouse gas emissions, with most of the emissions resulting from the energy used in air conditioning, lighting and ventilation of

buildings. Public awareness of sustainable development and the legislative demands for more environmentally-friendly and less energy-intensive buildings is growing across the world. Mauritius is already seen to be following the global trend and to see the development of more stringent building regulations, and eventually an increased public demand for energy efficiency and reduced environmental impacts of buildings. ”Greener” buildings will result in better air quality and less damage to the environment, which can have a positive effect on foreign investors and tourists.

Sustainable building certification schemes such as LEED, BREEAM and Green Star are widely used around the world, and have often proved to bring about a number of benefits, which include:

- Cost savings due to more efficient use of energy and resources (both in construction and operation of the buildings).
- Healthier buildings, with a more productive indoor environment due to access to daylight and natural ventilation.
- Best practice management is achieved.
- Higher market value, due to green credentials of buildings.

There is however a number of obstacles and challenges associated with the development and use of a sustainability labelling scheme. Some of the main ones are that:

- Ownership of a building varies across the building lifecycle. For instance, developers are the main players in commercial building construction, however it is often the case that the building is then sold or let. Where buildings are sold, especially to several owners, it can make it difficult to consider incentives towards the building's environmental footprint. When buildings are rented out, the building occupants have little or no incentive to consider investments in energy-efficiency, especially if they are on a short-term lease. This can make the choice of opting for sustainability labelling difficult.
- There is often a lack of cooperation between different professionals of the building sector. For instance, designers, architects, engineers and contractors/construction companies are major players at the design and construction stages, and may have the knowledge or wish to design more environmentally-friendly buildings, but they can sometimes be restricted by traditional building contracts and requirements from the client. Sustainability Labelling Schemes often require close collaboration between members of the design team to ensure that the targeted result is achieved.
- Green building labelling schemes usually are very resource-demanding, requiring detailed evidences to be submitted and assessors to review a large amount of documents and paperwork through the assessment process. Assessors would need to be qualified and trained to carry out assessments according to Quality Assurance policies to ensure that assessments are carried out properly. Training of assessors will take time and require staff resource and funds.
- In order for a scheme to be successfully developed, there needs to be ways to make sure that the proposed scheme and its requirements are accepted and clearly understood, both by the design and construction professionals and also by marketing firms. The benefits of green building labelling are often not fully understood, especially with regards to costs. This needs to be more thoroughly set out so that all relevant people involved understand how they can benefit.

- Sustainability Labelling Schemes usually depend on results from simulations or in-depth calculations for certain criteria. For example, in most schemes, it is required to show the energy performance of the building and the daylight factor levels throughout the building. There may not be the required capacity or availability of professionals able to carry out those calculations or simulations. There can also be reluctance by professionals to move away from rules of thumb which have been used for decades, rather than going towards more realistic and predictive design techniques such as building performance simulation.
- The limited access to environmentally friendly building materials locally can cause difficulty in developing a green building labelling scheme, as the latter should cover the use of "eco" building materials. Products such as ozone-friendly insulation and low-flush toilets, which have known environmental merits, are not readily available in Mauritius and therefore not considered.
- The ability of the Mauritian market to support a green building labelling scheme is a critical factor to both its initial start up phase and its ongoing success. Mauritius has a relatively small building market size as compared to larger countries where schemes have been developed; therefore a reliable support structure will be needed to ensure the successful development of the scheme and its implementation.

In order to successfully develop and implement a green building rating scheme in Mauritius, there needs to be continuous public awareness to create an interest in the issue of sustainable building development, and to increase the market demand. This will certainly take some time, especially because of the size of the market in Mauritius, the availability of resources, access to environmentally-friendly building materials, etc. However, positive changes already being initiated, such as the improvements to the building regulations and introduction of energy codes, will drive change and behaviour among stakeholders. The development of an Energy Labelling Scheme will also aid in the development of an overall green building scheme, as energy is highly regarded and highly weighted in existing green building schemes such as BREEAM and LEED. Therefore owners of energy-efficient buildings might consider achieving an overall building label to further enhance their market image.

6. Drivers for Building Energy Labeling Scheme

The drivers for building energy labeling scheme can be categorized into 5 types:

- Institutional
- Economic
- Socio-cultural
- Technological
- Environmental

6.1 Institutional drivers

The government may provide incentives for the building sectors to participate in energy labeling programmes through policies and bills, and fiscal mechanism described earlier.

The implementation of energy codes and standards is another incentive for building energy labeling as it will raise awareness among architects to design energy efficient buildings.

In many countries, the Government is leading the way, by displaying the labeling certification and other relevant information in public buildings. This can demonstrate the responsible use of tax payers funds.

6.2 Economic drivers

Cost of Energy
Electricity is the most greenhouse gas intensive energy source. Electrical energy is mainly used for lighting (26%), HVAC (48%) and for equipment. The higher energy prices increase the energy efficiency awareness among building owners and at the same time increase the cost savings potential of energy efficiency measures in buildings.

Economic decisions
The BELS will provide effective information. Disclosure of the energy performance of the building at time of marketing of the building for rental or sale, will provide the possibility of a more informed decision on the purchase or rental. This will result in making energy efficiency a necessary requirement for real estate transactions, hence making building energy efficiency a valued commodity.

Furthermore, it will protect consumers from future costs.

Economic incentives
The challenges of the construction boom associated with high energy costs can be dealt by the implementation of a building energy labeling scheme. The energy labeling scheme used with the codes will provide financial information such as calculations of potential energy savings, life cycle costing. Same can encourage building professionals/building owners to include energy efficiency as a component or priority in the building design.

Information about energy consumption will help reducing energy use.

Business opportunity
Building energy labeling scheme will increase the business opportunities for energy efficient technologies and products as building owners will be investing in same. The incentives will stimulate investment in innovative energy savings measures, hence creating business opportunities.

6.3 Socio-cultural drivers

The Building Energy Labeling scheme will provide effective information which raises public awareness.

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

Educational programmes
Educational programmes regarding energy efficiency in buildings can be developed and included in the school curriculum. The programme can be multi-disciplinary and accessible to students from different backgrounds. Behavioural change can be brought about among the public through these programmes.

Marketing campaigns
The concepts of energy labeling in buildings will be promoted among building owners by creating a positive public image. Building energy labeling can stimulate improved energy efficiency in buildings through competition in the marketplace. Market driven forces involve the spread of information to consumers so that they can make their own decisions on what saves them money.

6.4 Technological drivers

BELS will promote the widespread use of new/alternative technologies.

Technologies facilitate energy efficiency rather than driving it. Energy efficient technologies are in general more expensive than conventional ones. Although the costs are easily recovered, the initial investment costs of energy efficient technologies are higher. For example, a normal light bulb is cheaper than an energy efficient light bulb.

The widespread use of the new/alternative technologies will increase skills, knowledge and support on the use of such technologies. This will increase availability on the market, and drive the cost down. Deployment stage will be faster with BELS.

6.5 Environmental driver

Climate change
The effects of climate change is the main factor to cause market change within an industry. The implementation of BELS will reduce the emissions of Green House Gases. This will promote buildings to be designed with low carbon running costs and low carbon technologies.

Renewable energy
The methodology of BELS can favour investment by building owners in renewable energy and clean energy sources. Renewable energy can be deducted before the building is rated so as to obtain credit for displacing utility-purchased energy.

7. Risk Assessment

The risk assessment carried out showed numerous barriers as well as forces to the development of BELS.

7.1 Technological and administrative capacity

It is important to develop from the start a comprehensive administrative system with integrated data collection.

Market failure has occurred where poor systems have been in place and many resources are spent in trying to fix same.

The elements of an integrated technological and administrative system include the development of calculation methodologies and software, and delivery of an integrated administrative system.

Consultations amongst the stakeholders are necessary for proper future adoption of same.

These systems must be developed well in advance as past experiences have shown an under-estimation of the time required to develop same. Time must be allocated to thorough testing of same.

Clear procedures and appropriate quality control must be developed to avoid incoherent results which will undermine confidence of the building industry and the public.

7.2 Human Resources and Organisation

BELS implies allocation of skilled human resources.

In this case also an underestimation of the human resources required can lead to market failure. This must be done at an early stage of the development for the effectiveness of implementation. Appropriate training programmes will be necessary with a knowledge support structure.

Examinations and continuous professional development will be necessary to ensure the quality of the human resources. As for assessors, audits will be necessary for assessment of their strengths and weaknesses.

Over and above additional allocation of resources, the existing organisational structure can be often fragmented. Appropriate restructuring can be required for proper functioning of the scheme. Effective co-ordination between relevant governmental bodies and main actors is essential.

7.3 Financial resources

Financial resources are needed to develop and administer scheme, train the assessors, establish support systems and ensure quality by testing all aspects of the scheme.

Experiences have shown that insufficient funds have damaging effects on the impact and credibility of the scheme.

Furthermore, a mandatory scheme has proven to be costly compared to voluntary schemes, although it generates a higher impact.

7.4 Building materials and technologies

Market failure can arise due to the limited availability of building materials and technologies to achieve energy efficiency in buildings. This can also be coupled with lack of awareness on new technologies and energy saving tools among stakeholders in the building industries leading difficulties in obtaining an adequate level in the BELS.

Adequate capacity for intake of new material can also be a barrier amongst professional. A learning phase also has to be accounted for, which retards implementation further.

In addition to the above, the materials and technologies can be costly.

The appropriate support mechanisms (training, financial and fiscal incentives) must be in place to deal with these problems.

7.5 Marketing and raising of awareness

Market failure can be due to slow or no uptake from the market. Appropriate marketing and raising of awareness of all relevant information of the BELS is necessary.

7.6 Split incentives

A large problem in the scheme is that the person who sells a house has to obtain the energy labeling and has to pay for the labeling and sometime gets a negative impact of the energy labeling. If the labeling results in a low rating of the building and the energy plan include many proposals, the energy labeling can reduce the price of the building.

Furthermore, it is difficult to let the buyer, who has the major interest in the energy labeling, pay for the energy labeling because often more buyers are in competition and they would either have to make a common agreement or they have to make several energy labels of the same house.

7.7 Potential threat of abuse of the regulatory system

There is a potential threat of abuse of the regulatory system for economic self-interest. Transparency of the organization has to be taken into consideration.

An audit system is required to ensure quality assurance, and strong disciplinary action must be implemented.

7.8 Information

Inaccurate and incoherent information can lead to failure of the BELS. Incomplete information refers to insufficient, inaccurate or untrustworthy information. This can lead to discrepancies in assessments.

On the other hand, a major force to the implementation of BELS is that the energy labeling scheme has identified a large energy saving potential in existing buildings; energy savings which would be difficult to identify in other ways.

Secondly, the energy labeling scheme will provide a very large source of information on the present building stock. This information can be used in monitoring and evaluation of other initiatives and can be used to identify possible savings and measures such as general information, etc.

It is important that all results are communicated transparently and openly to retain confidence of the building industry and public.

7.9 Additional work/cost

BELS will require additional work and cost.

For example, many real estate agents feel that the energy labeling gives additional work for the real estate transaction. In some cases the labeling even has to be paid by the salesmen out of the total fee for selling the house.

It is a strong possibility that BELS increase the price of property, firstly by its labeling fees but moreover by capital expenditure required to achieve adequate level for the BELS.

8. Recommendation and Conclusions

A building energy labeling program provides the general public, building owners and tenants, potential owners and tenants, and building operations and maintenance staff with information on the potential and actual energy use of buildings. This information is useful for a variety of reasons:

- Building owners and operators can see how their building compares to peer buildings to establish a measure of their potential for energy performance improvement.
- Building owners can use the information provided to differentiate their building from others to secure potential buyers or tenants.
- Potential buyers or tenants can gain insight into the value and potential long-term cost of a building.
- Operations and maintenance staff can use the results to inform their decisions on maintenance activities and influence building owners and managers to pursue equipment upgrades and demonstrate the return on investment for energy efficiency projects.

Beyond the benefit received by individual building owners and managers, the increased availability of building data - specifically the relationship between the design and operation of buildings - will be a valuable research tool for the building community.

The study has given a number of recommendations, which can be summarized as follows:

It is recommended,

- That the energy labeling scheme is developed step by step and is mandatory.
  - The *first step* covers new private and public air-conditioned buildings and is limited to large non-residential buildings and multi-dwelling blocks with one building owner and a net floor area larger than e.g. 5.000 m^2
  - The *second step* for all new buildings in the same category with a net floor area larger than 1.500 m^2.
  - The *third step* will be to coordinate with the energy audit scheme in order to cover all existing large (larger than 1.500 m^2) non-residential buildings, all public buildings larger than 250 m^2 and multi-dwellings blocks.
  - The *final step* increases the scheme to include all new and existing residential air-conditioned buildings. Exempted buildings shall be defined and harmonized with present legislation such as The Building Control Act.

- To follow the suggested implementation road-map based on The IEA Policy Pathway and that the implementation at least covers the activities outlined in the activity plan.
- To involve all relevant key-stake holders in the development and implementation
- To review similar existing scheme mainly in Europe and USA, and to involve international experts in developing the scheme or parts of the scheme
- To make the objectives for the Building Energy Labeling Scheme very clear from the beginning of the process, in order to be able to follow and stay on the right track during development, implementation and when controlling and evaluating the scheme.
- That the Public Sector lead the way towards energy efficiency in buildings, by including mandatory proposals for energy efficiency initiatives and subsequently implementation, if the simple pay-back time is below e.g. 5 years. Furthermore it can be considered if the energy label shall require the implementation of a mandatory energy management system.
- That energy labels, are user-friendly; simple, easy and providing reliable information on energy performance in the building.
- To restore all data in a national official register developed and maintained by the Energy Efficiency Management Office
- That an infrastructure for developing, managing and administrating involves the establishment of:
    - A *Building Energy Labeling Scheme Implementation Committee* (BELSI Committee) to manage the development and implementation of the first BELS in Mauritius with members from local ministries, financial funds and institutions, real estates, architects and engineers, local authorities, international experts etc. In general all key-stakeholders in the building community shall be represented and engaged in the developing phase.
    - A *BELS Administration Committee* to oversee the development and strategic elements of the scheme, when established, with membership based on a Building Energy Labeling Scheme Implementation Committee.
    - A *Building Energy Label Secretariat* to manage the day-to-day operation of the scheme.
- That the costs of the energy label itself can be defrayed by the building owner, but it is recommended to set maximum fee rates for energy labels in order to avoid unacceptable high prices for certifying buildings, at least in the beginning of a new certification scheme.
- That training is provided to all new consultants and shall be followed up by running courses every year to keep consultants updated and give them the opportunity to share knowledge.
- That targeted awareness activities and campaigns are arranged over the course of the scheme's implementation stage, to inform stakeholders, policy makers, building owners and tenants about the requirements, processes and implications attached to the Energy Labeling Scheme.
- That an overall quality control assurance approach including everything from training, validation of labels to auditing process is developed in order to quality and highlight points for future refinements

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Annexes

Annex 1. Example of Quality Assessment Protocol for Larger Buildings (Denmark)

Technical Revision of Energy Label, new building

J.nr. EMS10.02.019-2	Owner: Municipality of Greve

Adress of the building:
Promenadebyen 2
5000 Odense C

Owner's adress:
Promenadebyen 2
5000 Odense C



Photos of the building

Energy label number	200027982	TR carried out (date):	7. april 2010	Overall conclusion:
Date of issuance	12. februar 2010	Drawings used:	Ja, men tegninger ikke vedlagt sagen	
Energy consultant	Camilla Nyholm	Technical inspector:	Knud Jensen	Will normally require preparation of a new label
Energy consultant number	103286	Heating	FJERNVARME	

Subject:	Consultant		Technical inspector		Deviance in kWh	Deviance in %	Ref. no.	Tone and fair	Misleading
heating scale	B		B					-	X
Consumption, kWh	kWh 447.240		kWh 382.670		kWh 64570	17%	1		

Subject:	Consultant	m2	Technical inspector	m2	Deviation in m2	Deviation in %	Ref. No.	Insufficient, but acceptable	Not acceptable
Opvarmet areal		5.142 m2		5.142 m2	0 m2	0,0%	2		

Subject:	Energy label report	kWh	Registration	Explanation	kWh	Deviation in kWh	Deviation in %	Ref. No.	Insufficient, but acceptable	Not acceptable
Registration on the building	Windows and doors All windows and doors are registrered with the following data: U-value: 1,65 Transmission of solar heating: 0,63	447.240	No documentation for this data has been sent, for example through Velfac documents. The technical inspector has asked the energy consultant for this documentation by phone. EC has informed, that she does not possess this documentation. The documentation is necessary in order for the EC to test these values, and should therefore be procured. If this does not happen, it should be informed in the status description. Furthermore, it should be evident in this status description what methods/procedures are used instead.	Cf. section 2.6.3 in Handbook. The flaw does not cause a deviation, as the TI cannot test these data.	447.240	0	0,0%	3		X
	Windows and doors All windows and doors are registrered with left and right shadows at 4°. Facing north and south, the eaves are registrered at 0°.		The shadowareas differ, depending on the placement of the windows and doors. Sideshadows vary between 0° - 70°, which is used instead. Eaves facing north and south vary between 0° - 75°, which is used instead.	Cf. Section Shadows in SBi-instruction 213.	444.790	2.450	0,6%	4	X	
	Ventilation The following types of ventilation and zones are registrered: Kitchen: Mechanical extraction Toilets: Mechanical extraction Utility room: Mechanical extraction Shop: Mechanical extraction Garbage chute: Mechanical extraction Stairs, depot etc: Natural extraction		Mechanical extraction from garbage chute should not be included, because it is similar to process equipment. There is no mechanical extraction in the shop. Mechanical extraction is necessary from the shop toilet. Building unit is normally considered a zone. Instead, mechanical extraction is used in the whole building, and the following data is registrered for the ventilation equipment: Mᵇ: 5142 Fo: 1 qn: 0 qn,s: 0 qm: 0,35 qm,s: 0,35 SEL: 0,74	Cf. Section Ventilation in SBi-instruction 213. Changed from 340.470 kWh to 382.670 kWh	382.670	62.120	16,2%	5		X
	Energy frame A maximum energy demand is registrered at 90,8 kWh/m², incl. a supplement of 20,4 kWh/m². It is not specified how this supplement has been found/calculated.		The energy frame for the building is calculated to have a maximum energy demand of 70,4 kWh/m². To this may be added a supplement of 6,5 kWh/m², which is caused by a change of air above 0,3 liter/sek. m² cf. the requirements for indoor climate in BR95. This must be specified in the energy label report. Instead, a maximum energy demand plus supplement of 76,9 kWh m2 is used.	Cf. section Supplement to the energy frame in buildings with mechanical exhaustion in SBi-instruction 213. This does not cause a deviation in the calculation, but it is shows if the building respects the energy frame, which it does. The current energy demand of the building is ~~66,2~~ 74,2 kWh/m², which is below the demands of the building regulations incl. supplement, which is 76,9 kWh/m² in total. Changed from 340.470 kWh to 382.670 kWh	382.670	0	0,0%	6	X	
						0	0,0%			
						0	0,0%			
						0	0,0%			
				~~Cl list 340.470kWh -106.770kWh -31,4%~~		0	0,0%			
			Total (numerisk afvigelse)		382.670	64.570	16,9%			

Subject:	Energy label report	*Explanation*		Ref. no.	Insufficient, but acceptable	Not acceptable
Intelligibility for the users	Comments from the consultant The present energy label relates to the following building: Stævnen, Promenadebyen 2-4, 5000 Odense The building is a newly constructed apartment house with 10 stories with partial basement. In the making of the energy label, the following documents have been at disposal: Architectual drawings Calculation the energy frame (xml-file) No destructive investigations of the building constructions have been made. At the inspection, access was given to the apartment Promenadebyen 2, 1 lejl. 2, business area, and basement. In the calculation, the same level regarding radiator valves, water consuming fittings, toilets etc. have been presupposed.	Cf. section 2.3.3 in the HB it is described how a heated area should be measued and calculated, which is missing. Furthermore, it should be specified that there is a supplement to the energy frame, and on what grounds this is given, cf ref nr. 6. Cf. section 2.6.1 in the HB, the EC is to test if there are discrepancies between the current conditions and the building regulations. The building regulations should be accessible, which is not clear. Cf. section 2.6.3 in the HB, the following background documentation is gathered for the calculation of the energy frame, which has not been at disposal: - documentation for the isolation and the U-values of the building parts - documentation for the U-values of the windows - adjustment report for the ventilation plant - documentation for adjustment of the heating system - documentation for the isolation of the hot water container, and perhaps for the other technical installations - documentation for hidden and inaccessible building parts, for example photos The documentation is necessary in order for the EC to test the background material, and should therefore be procured. If this does not happen, it should be informed in the energy label report. Further		7	x	

Technical Revision of energy label, new building

J.nr.	EMS10.02.019-2	Energy label no.	200027982

CONCLUSIONS		
Subject:	**Partial conclusions of the technical inspector**	**Points**
Building registration	The major faults in the building registration are partly because of wrong shadow data for windows and doors, partly because of wrong ventilation data. Furthermore, there are parts of the building that cannot be tested, since the necessary background data has not been procured. The numeric deviation is app. ~~31,4~~ 16,9 %.	**20**
Energy label/energy demand	The above mentioned defects and flaws in the building registration causes the energy frame calcucation to be ~~31~~ 17 % less than calculated in the EC's energy label report, which corresponds to a deviation of app. ~~106.800~~ 64.600 kWh. Furthermore, the supplement to the energy frame is not correct. The scale value remains "B".	**0**
Intelligibility for the users	There are flaws in the "result" area, as the maximum energy demand at 90,8 kWh/m² is wrong. It is not evident on what basis the supplement to the energy frame is calculated. Furthermore, it is not clear what background data have not been at disposal, and what methods have been used instead. Also, it should be specified, that the building permit is given according to the BR95 regulations, which means that the energy label should respect these regulations. Besides the above, the descriptions are clear and easy to understand for a non-professional.	**10**
	Sum	**30**

Subject:	**Overall conclusion of the technical inspector**	
Overall Conclusion	The energy label has flaws in the building registration, which causes the energy frame calculation to be ~~31~~ 17 % less, but the scale value remains "B". The maximum energy demand is not correct, and it is not specified how the supplement to the energy frame has been calculated. Furthermore, the supplement to the energy frame is wrong. It is not clear what background documentation has been at disposal, and what methods have been used instead. As an example, no information has been given for the supplier of the windows and doors. It is not mentioned, that the building has to respect the BR95 demands. The EC did not participate in the examination of the building. TI has contacted EC and asked for her XMI-file???? and more window documentation, which could not be delivered.	**Will normally require preparation of a new energy label**

KOMMENTARER		
Subject: **Reference number**	**The energy consultant's comments**	**Technical inspector's comments to the EC's comments**
	Generally Drawings sent to TI EC energy consumption is calculated to be 447.240 kWh, where does this number come from? At EMR the calculated heat consumption is 336.260 kWh	Drawing were received, but they had not been uploaded electronically on the case. The consumption of 447.240 kWh is the total energy demand of the building according to the energy frame calculation (heated area x energy frame number kWh/m²).
3	3 windows and doors Windows and doors are registered as Velfac 2-layer energy A (2007) with Ug = 1,2 A standard/general u-value of 1,65 and solar heat tranmittance of 0,63 seems to be reasonable I do not consider the registration to be neither insufficient nor unacceptable	TI stands by his accusations
5	5 Ventilation The energy frame calculator??? has been given his ventilation calculation in great detail, and I assumed that the calculation was thorough and correct. Business area was not established at the inspection and I presumed that a mechanical extraction would be installed at the establishment. I was not aware of the ventilation in the garbage chute, but I consider this to be a minor flaw. Calculation according to TI model: There are 38 apartments in the building with extraction from kitchen, toilet and itility room. Kitchen 38 pcs. at 20 l/s, Toilet 42 pcs. at 15 l/s, Utility room 38 pcs. at 10 l/s, shop 10 l/s In total 1780 l/s ~ 0,35 l/s m² = qm = qm,s qn,s = 0,9 – 0,35 = 0,55, which TI has set to 0 All together, I consider the flaw to be considerably less significant than what the TI has concluded, and do not see the calculation as insufficient and unacceptable.	TI has used a qn,s 1,2 l/s m², which does not show on ref.no. 5 because of misspelling. It is correct that 0,55 l/s m² is used, which should be corrected in the TI report and used instead.
6	6 Energirammen The supplement for change of air over 0,3 liter/sek m² is calculated automatically. Of course there will be changes in the supplement when TI changes the volumes of air, but this has no effect on the energy frame, since volume of air and supplement "go hand in hand". I do not consider the subject as insufficient.	TI stands by his accusations.
7	7 Intelligibility for the users TI points out several flaws in the description, and lack of background material. Since the subject deals with intelligibility, this aspect seems irrelevant. I consider this report to be easy to understand for the user and neither insufficient nor unacceptable.	TI stands by his accusations
	Conclusions Registration of buildings Apart from the wrong shadow data, I believe that the registration of buildings has been made correctly. Architectual drawings have been at disposal at the inspection, and the buildings are considered to have been constructed as drawn. The shadow data registers a deviation of 0,6 % Energy label/energy demand I made a mistake with the garbage chute. Beside that, I do not believe that the calculation of the ventilation is considerably wrong. The supplement changes depending on the volume of air, and therefore TI cannot take this as a flaw. Intelligibility for the users TI himself states that the descriptions are clear and easy to understand for a non-professional. T In conclusion, I cannot agree with the conclusions of the TI, and I believe that I have made a good and informative report.	TI does not change his partial conclusions, nor the overall conclusion

Annex 2. Example of an Asset Rating Energy Label (Energy Performance Certificate for a UK home) and accompanying recommendations

Energy Performance Certificate

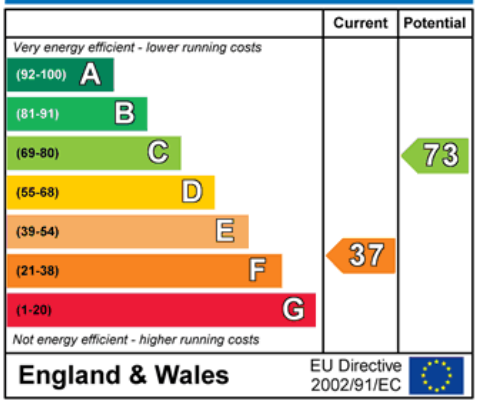
SAP

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type:	Detached house
Date of assessment:	02 February 2007
Date of certificate:	[dd mmmm yyyy]
Reference number:	0000-0000-0000-0000-0000
Total floor area:	166 m²

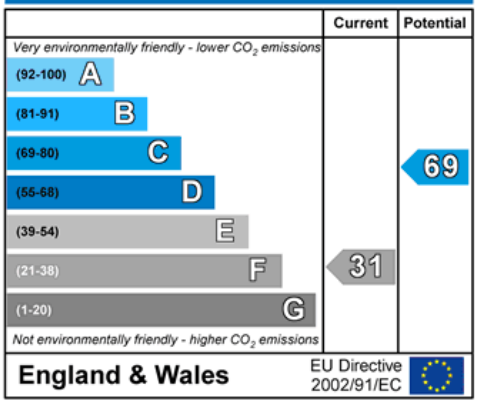
This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

energy saving recommended
Certification mark

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call **0800 512 012** or visit **www.energysavingtrust.org.uk/myhome**

Page 1 of 6

About this document

The Energy Performance Certificate for this dwelling was produced following an energy assessment undertaken by a qualified assessor, accredited by [scheme name], to a scheme authorised by the Government. This certificate was produced using the RdSAP 2005 assessment methodology and has been produced under the [regulations]. A copy of the certificate has been lodged on a national register.

Assessor's accreditation number:	[accredition number]
Assessor's name:	[assessor name]
Company name/trading name:	[company name]
Address:	[company address] [address continued]
Phone number:	[phone]
Fax number:	[fax]
E-mail address:	[e-mail]
Related party disclosure:	[disclosure]

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from our website at [website address] together with details of their procedures for confirming authenticity of a certificate and for making a complaint.

About the bulding's performance ratings

The ratings on the certificate provide a measure of the building's overall energy efficiency and its environmental impact, calculated in accordance with a national methodology that takes into account factors such as insulation, heating and hot water systems, ventilation and fuels used. The average energy efficiency rating for a dwelling in England and Wales is band E (rating 46).

Not all buildings are used in the same way, so energy ratings use 'standard occupancy' assumptions which may be different from the specific way you use your building. Different methods of calculation are used for homes and for other buildings. Details can be found at www.communities.gov.uk.

Buildings that are more energy efficient use less energy, save money and help protect the environment. A building with a rating of 100 would cost almost nothing to heat and light and would cause almost no carbon emissions. The potential ratings in the certificate describe how close this building could get to 100 if all the cost effective recommended improvements were implemented.

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The way we use energy in buildings causes emissions of carbon. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions and other buildings produce a further one-sixth.

The average household causes about 6 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. You could reduce emissions even more by switching to renewable energy sources. In addition there are many simple every day measures that will save money, improve comfort and reduce the impact on the environment, such as:

- Check that your heating system thermostat is not set too high (in a home, 21°C in the living room is suggested) and use the timer to ensure you only heat the building when necessary.
- Make sure your hot water is not too hot - a cylinder thermostat need not normally be higher than 60°C.
- Turn off lights when not needed and do not leave appliances on standby. Remember not to leave chargers (e.g. for mobile phones) turned on when you are not using them.

Visit the Government's website at www.communities.gov.uk to:

- Find how to confirm the authenticity of an energy performance certificate
- Find how to make a complaint about a certificate or the assessor who produced it
- Learn more about the national register where this certificate has been lodged
- Learn more about energy efficiency and reducing energy consumption

Recommended measures to improve this home's energy performance

17 Any Street,
Any Town,
County,
YY3 5XX

Date of certificate: [dd mmmm yyyy]
Reference number: 0000-0000-0000-0000-0000

Summary of this home's energy performance related features

The following is an assessment of the key individual elements that have an impact on this home's performance rating. Each element is assessed against the following scale: Very poor / Poor / Average / Good / Very good.

Element	Description	Current performance	
		Energy Efficiency	Environmental
Walls	Cavity wall, as built (no insulation)	Poor	Poor
Roof	Pitched, 250 mm loft insulation	Good	Good
Floor	Solid, no insulation (assumed)	–	–
Windows	Partial double glazing	Poor	Poor
Main heating	Boiler and radiators, mains gas	Average	Average
Main heating controls	Programmer, room thermostat and TRVs	Average	Average
Secondary heating	None	–	–
Hot water	From main system, no cylinderstat	Poor	Poor
Lighting	Low energy lighting in 75% of fixed outlets	Very good	Very good
Current energy efficiency rating		F 37	
Current environmental impact (CO_2) rating			F 31

Recommendations

The measures below are cost effective. The performance ratings after improvement listed below are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

Lower cost measures (up to £500)	Typical savings per year	Performance ratings after improvement	
		Energy efficiency	Environmental impact
1 Cavity wall insulation	£411	E 53	E 46
2 Low energy lighting for all fixed outlets	£11	E 53	E 46
Sub-total	£422		
Higher cost measures (over £500)			
3 Hot water cylinder thermostat	£102	D 58	E 51
4 Replace boiler with Band A condensing boiler	£323	C 73	C 69
Total	£847		
Potential energy efficiency rating		C 73	
Potential environmental impact (CO_2) rating			C 69

Further measures to achieve even higher standards

The further measures listed below should be considered in addition to those already specified if aiming for the highest possible standards for this home.

5 Replace single glazed windows with low-E double glazing	£40	C 75	C 71
6 Solar photovoltaics panels, 25% of roof area	£49	C 77	C 74
Enhanced energy efficiency rating		C 77	
Enhanced environmental impact (CO_2) rating			C 74

Improvements to the energy efficiency and environmental impact ratings will usually be in step with each other. However, they can sometimes diverge because reduced energy costs are not always accompanied by a reduction in carbon dioxide (CO_2) emissions.

About the cost effective measures to improve this home's performance ratings

Lower cost measures (typically up to £500 each)

These measures are relatively inexpensive to install and are worth tackling first. Some of them may be installed as DIY projects. DIY is not always straightforward, and sometimes there are health and safety risks, so take advice before carrying out DIY improvements.

1 Cavity wall insulation

Cavity wall insulation, to fill the gap between the inner and outer layers of external walls with an insulating material, reduces heat loss. The insulation material is pumped into the gap through small holes that are drilled into the outer walls, and the holes are made good afterwards. As specialist machinery is used to fill the cavity, a professional installation company should carry out this work, and they should carry out a thorough survey before commencing work to be sure that this type of insulation is right for this home. They should also provide a guarantee for the work and handle any building control issues. Further information can be obtained from National Cavity Insulation Association (http://dubois.vital.co.uk/database/ceed/cavity.html).

2 Low energy lighting

Replacement of traditional light bulbs with energy saving recommended ones will reduce lighting costs over the lifetime of the bulb, and they last up to 12 times longer than ordinary light bulbs. Also consider selecting low energy light fittings when redecorating; contact the Lighting Association for your nearest stockist of Domestic Energy Efficient Lighting Scheme fittings.

Higher cost measures (typically over £500 each)

3 Cylinder thermostat

A hot water cylinder thermostat enables the boiler to switch off when the water in the cylinder reaches the required temperature; this minimises the amount of energy that is used and lowers fuel bills. The thermostat is temperature sensor that sends a signal to the boiler when the required temperature is reached. To be fully effective it needs to be sited in the correct position and hard wired in place, so it should be installed by a competent plumber or heating engineer.

4 Band A condensing boiler

A condensing boiler is capable of much higher efficiencies than other types of boiler, meaning it will burn less fuel to heat this property. This improvement is most appropriate when the existing central heating boiler needs repair or replacement, but there may be exceptional circumstances making this impractical. Condensing boilers need a drain for the condensate which limits their location; remember this when considering remodelling the room containing the existing boiler even if the latter is to be retained for the time being (for example a kitchen makeover). Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme[1], and can therefore self-certify the work for Building Regulation compliance. Ask a qualified heating engineer to explain the options.

About the further measures to achieve even higher standards

Further measures that could deliver even higher standards for this home.

5 Double glazing

Double glazing is the term given to a system where two panes of glass are made up into a sealed unit. Replacing existing single-glazed windows with double glazing will improve comfort in the home by reducing draughts and cold spots near windows. Double-glazed windows may also reduce noise, improve security and combat problems with condensation. Building Regulations apply to this work, so either use a contractor who is registered with a competent persons scheme[1] or obtain advice from your local authority building control department.

[1] For information on competent persons schemes enter "existing competent person schemes" into an internet search engine or contact your local Energy Saving Trust advice centre on 0800 512 012.

6 Solar photovoltaics (PV) panels

A solar PV system is one which converts light directly into electricity via panels placed on the roof with no waste and no emissions. This electricity is used throughout the home in the same way as the electricity purchased from an energy supplier. The Solar Trade Association has up-to-date information on local installers who are qualified electricians and any grant that may be available. . Planning restrictions may apply in certain neighbourhoods and you should check this with the local authority. Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme[1], and can therefore self-certify the work for Building Regulation compliance. Ask a suitably qualified electrician to explain the options.

Annex 3. Example of an Operational Rating Energy Label (Display Energy Certificate)

Display Energy Certificate

HM Government

How efficiently is this building being used?

A Government Dept
12th & 13th Floor
Jubilee House
High Street
Anytown
A1 2CD

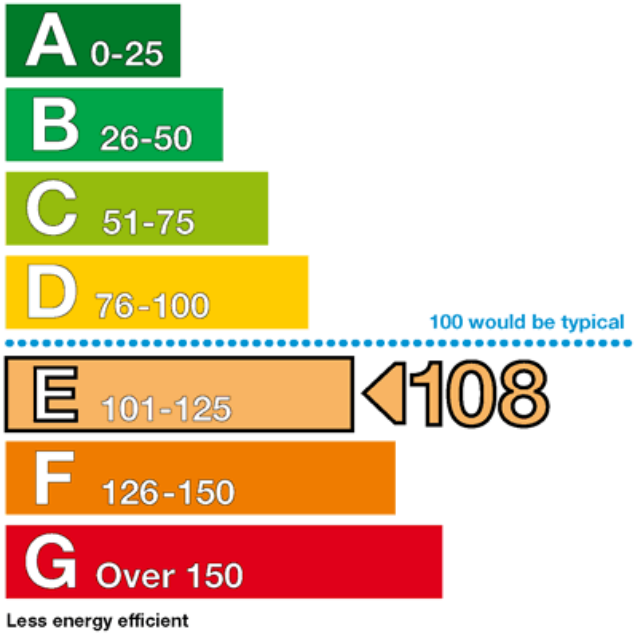
Certificate Reference Number:
1234-1234-1234-1234

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

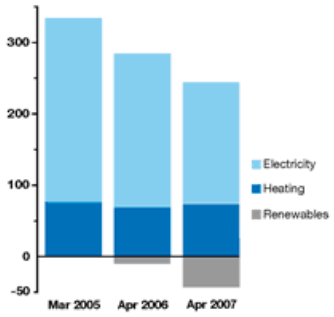
More energy efficient



Less energy efficient

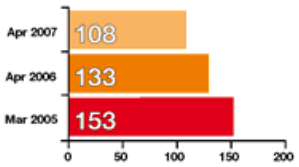
Total CO_2 Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO_2.



Previous Operational Ratings

This tells you how efficiently energy has been used in this building over the last three accounting periods



Technical information

This tells you technical information about how energy is used in this building. Consumption data based on actual readings.

Main heating fuel: Gas
Building Environment: Air Conditioned
Total useful floor area (m^2): 2927
Asset Rating: 92

	Heating	Electrical
Annual Energy Use (kWh/m^2/year)	126	129
Typical Energy Use (kWh/m^2/year)	120	95
Energy from renewables	0%	20%

Administrative information

This a Display Energy Certificate as defined in SI2007:991 as amended.

Assessment Software: OR v1
Property Reference: 891123776612
Assessor Name: John Smith
Assessor Number: ABC12345
Accreditation Scheme: ABC Accreditation Ltd
Employer/Trading Name: EnergyWatch Ltd
Employer/Trading Address: Alpha House, New Way, Birmingham, B2 1AA
Issue Date: 12 May 2007
Nominated Date: 01 Apr 2007
Valid Until: 31 Mar 2008
Related Party Disclosure: EnergyWatch are contracted as energy managers
Recommendations for improving the energy efficiency of the building are contained in Report Reference Number 1234-1234-1234-1234