



***Project Summary Report:  
Energy Audit Management  
Scheme (EAMs) and  
Contingent Support  
Mechanism (CSM) for  
Mauritius***

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## Executive Summary

This is the final summary report of a project to develop an ***Energy Audit Management Scheme (EAMs) and Contingent Support Mechanism (CSM) for Mauritius***.

The project was funded by the UNDP and was initially managed by the Ministry of Energy and Public Utilities (MEPU) with each step requiring the approval of the National Steering Committee (NSC). Once the Energy Efficiency Management Office (EEMO) and its smaller steering group were formed, they took over this function leading to a much more responsive management structure.

The project itself was divided into 11 major elements each requiring the delivery of several outputs. A set of 12 major deliverables was spread over an initial period of 10 months.

Another element, a Harmonisation workshop, was added 9 months into the project to ensure coordination between this and the following related projects:

- Building Control Bill, and
- Standard Designs of Buildings.

The work underpinning each element of the project and each accompanying deliverable is summarised in the corresponding sections of the report. This includes the production of a dedicated tool for this scheme – the Mauritius Building Energy Audit Tool (MBEAT).

The project over-ran its original timetable by 10 months and the report contains an explanation of the factors which led to this.

Overall, the project was a success. It has generated all the groundwork necessary for the implementation of a successful EAMs and CSM in Mauritius, and highlighted the next steps which need to be carried out to make this a reality.

The next stage is for the following actions to be addressed:

- Enact both section 23 of the EEA and the Energy Efficiency Building Code and ensure that the EEA is fit for purpose, so that the draft EAMs regulation can be brought forward for inclusion in the statute book.
- Build up the capacity of the EEMO to run and manage the scheme.
- Set up a National registry and an EEMO customer database.
- Carry out the interim certification of the auditors and accreditation of the scheme.
- Build up the capacity of the MSB and Mauritas to take over the certification and accreditation roles, respectively.
- Identify a source of funding to pay for the year-on-year cost of the audits.
- Transfer of the MBEAT website from BRE to the EEMO before the end of March 2012.

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## 1. Introduction

The UNDP Mauritius Country Office has hired, on behalf of the Ministry of Renewable Energy and Public Utilities, the Building Research Establishment Ltd (BRE), along with its Partners in Mauritius, as consultants to prepare and develop a new regulatory framework for the implementation of an Energy Audit Management Scheme (EAMs) and a Contingent Support Mechanism (CSM) for the Non-domestic Building Stock in the Republic of Mauritius.

The objectives of this project were to develop:

- an Energy Audit Management Scheme, an Energy Audit Manual and a Compliance Mechanism Scheme;
- a Certification programme for energy audit certifications and secure accreditation of a future Certification body in Mauritius by a recognized accreditation body;
- a certified Training scheme and materials for energy auditors;
- a Contingent Support Mechanism (CSM).

At the time the development of the Energy Audit Management scheme was to be undertaken within the framework of the Energy Efficiency Bill which was planned to be enacted before mid-2010.

The project was part of a larger UNDP programme “*Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings*”. This was due to run from July 2008 until April 2012 with financial management through the UNDP Country Office. The technical management was through the Project Management Unit (PMU) within the Ministry of Energy and Public Utilities (MEPU), who are the executing agency. This programme was overseen by a steering committee which contains all the major government stakeholders.

### Initial view of the project implementation and expected outcomes

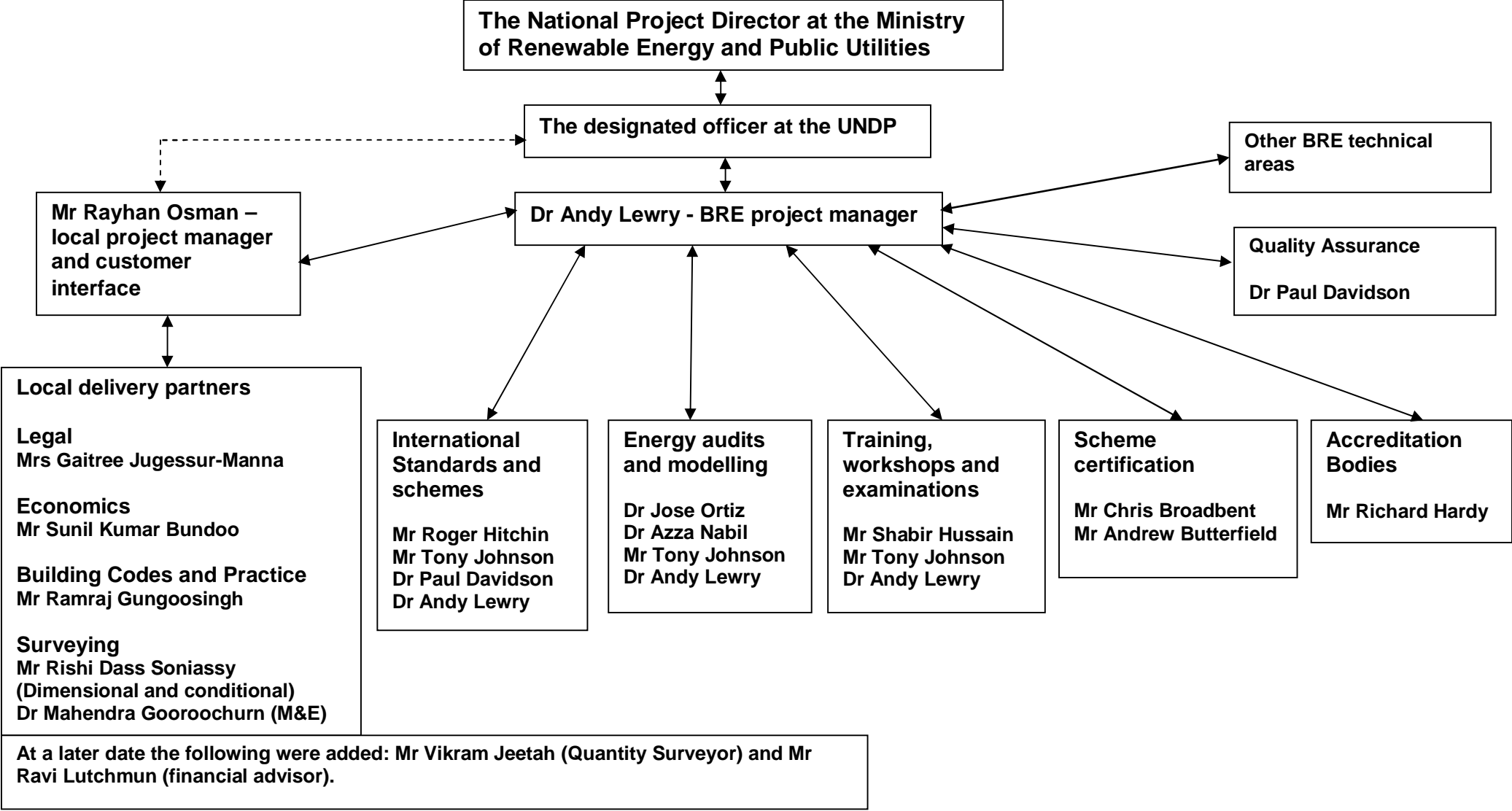
	Item	Description	Deliverables	Receivables	Expected date
1	<b>Inception meeting</b>	Attend an inception meeting with the client, produce an inception report and disseminate/brief the BRE team and local delivery partners.	Inception report	None	1 November 2010
2	<b>Desk review of International Standards and existing regulations in Mauritius</b>	Carry out a desk review of the international standards and best practices for Energy Audits; Identify and specify measures to improve energy efficiency and energy conservation in existing Buildings; and a needs analysis for a Contingent Support Mechanism.	Draft report of the desk study; a draft report of local Building Codes and Practice identifying energy efficient measures; and a needs analysis of possible fiscal vehicles to support the audit process.	Client feedback on the draft report	7 December 2010
3	<b>Energy Audit Management Scheme</b>	Based on the final report from the desk study described above, produce an	Final report of the desk study and recommendations	Client approval to proceed with the recommendations	8 February 2011

		Energy Audit Management Scheme with a version of iSBEM for Mauritius and an Audit manual based on the iSBEM user guide	on the format of the Energy Audit Management Scheme, accreditation scheme and Contingent Support Mechanism	of the Desk Review report.	
4			A version of iSBEM for Mauritius and an Audit manual	Client comments on software	17 January 2011
5	<b>Accreditation of Energy Audit Management Scheme</b>	Develop a scheme framework, based on the iSBEM methodology, that will provide the procedural and management criteria for scheme operation, including scheme procedures, documentation and an examination	Procedural and management criteria for scheme operation, scheme procedures, scheme documentation and an examination	None	28 February 2011
6	<b>Training of Trainers and Auditors</b>	Based upon the iSBEM methodology, develop a training programme that will allow auditors to assess non-domestic buildings.	Produce a Training pack containing all the documentation and computer files.		14 March 2011
7		Deliver training sessions that offer places to at least 5 trainers from a designated national training/educational institution and 50 local auditors.	Deliver two training sessions for up to 30 people each.	Office space for consultants and venues for the holding of the workshops, where the venue will need 32 computers to service this part of the project.	31 March 2011
8	<b>Contingent Support Mechanism</b>	Develop a Contingent Support Mechanism that supports the Energy Audit Management Scheme and provide guidelines on the management of its implementation.	Produce a proposed mechanism to encourage implementation of energy efficiency measures that links to the outputs from the energy audit software and is consistent with the Energy Efficiency Bill.		31 March 2011
9	<b>Workshops Part A</b>	Contribute to the running of workshops on: The Energy Audit Management Scheme; Energy Audit Tool and	Provide relevant experts to each of these areas who will give an	UNDP will provide logistical support for the organization of	15 March 2011

		Manual; and the Compliance Mechanism Scheme and the accreditation of a future Certification body in Mauritius	introductory presentation; help to run a whole group discussion; assist in running break-out groups and produce a list of actions for incorporation into the final stages of the project	workshops and mobilization of key staff. The Government of Mauritius through project funding and in-kind assistance will provide office space for consultants and venues for the workshops.	
10	<b>Workshops Part B</b>	Contribute to the running of workshops on the delivery of Training on Energy Audits and the Contingent Support Mechanism.	Provide relevant experts for these areas who will give an introductory presentation; help to run a whole group discussion; assist in running break-out groups and produce a list of actions for incorporation into the final stages of the project	UNDP will provide logistical support for the organization of workshops and mobilization of key staff. The Government of Mauritius through project funding and in kind assistance will provide office space for consultants and venues for the holding of the workshops.	15 April 2011
11	<b>Final project report and meeting</b>	Produce a project summary and an executive summary report at the end of the project. Attend a final project meeting will be held between the UNDP project manager, representatives of Ministry of Renewable Energy and Public Utilities, the project manager of the consultant and the local project manager.	Produce a project summary and an executive summary report. Attend a final project meeting.		31 May 2011

This report describes the activities and processes which have underpinned the production of each of these deliverables. As can be seen the project has overrun by 10 months. Although there have been some technical difficulties, the main issue has been the unwieldy nature of the National Steering Committee (NSC). Due to the number of members and the infrequent meetings this has led to slow responsiveness on executive decisions and changes in directions. The formation of the Energy Efficiency Management Office (EEMO) and its smaller steering committee will hopefully address these issues going forward. So far the first indications are that this is a more responsive management structure.

The BRE delivery team (see below) was a partnership between the skills and technical expertise of BRE and a number of local delivery partners who provided local knowledge and networks so that the project could be delivered in the Mauritian context.





## 2. Inception meeting and report

The purpose of the kick-off meeting held in September 2010 was for the client and consultant to:

- Clarify the brief and terms of reference;
- Put procedures and processes into place regarding delivery and finances;
- Flesh out the specifications of the deliverables;
- Iron out any other details.

As a result the project management team constructed a revised and more detailed project plan – see Appendix A of the inception report (Client report number 266-261). This included all the tasks and actions required to deliver the project. There was some slight slippage in this initial part of the project but we were confident at this time that it would be caught up before the originally planned completion date.

Meetings were arranged during visits in September and October 2010 with a view to:

- Engaging with all of the stakeholders.
- Collecting intelligence, especially on:
  - how the building process works in Mauritius;
  - sources of expert information;
  - data sources especially those tied in to the building stock and energy usage;
  - identifying the key players.
- Painting an initial picture of the Mauritius context.

As a result of our initial studies it was apparent that Mauritius has no current legislation covering this area apart from the proposed Energy Efficiency Bill which was planned to be enacted before mid-2010. There are also no formal building regulations related to energy, an incomplete or non-existent dataset covering the building stock and no method of capturing building stock information. Therefore, this project starts with an almost clean sheet, although certain information about the methods of construction etc. needed to be collected from the Government and industry sources.

Following our studies during this inception phase we drew the preliminary conclusions that:

- *We must liaise with other parts of the UNDP programme “Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings”, especially the revisions of the Building Code.*
- *The energy audit process should bring together regulatory experience and UK best practice.*
- *SBEM will provide the best vehicle to deliver this energy audit scheme, because it will allow calculation of indicative energy savings due to improvement measures. As part of the process of providing a tailored tool, the Mauritius Government will need to request a user licence from UK’s CLG. A draft of the proposed letter to be sent to Mr Andrew De Lord is given in Appendix D and we recommend this should be sent by a high ranking politician or civil servant.*
- *We should capitalise on the professional endorsement and enthusiasm for the project to collect data from local sources to underpin the calculation and tailor it to Mauritius.*
- *The accreditation process should only accept fully qualified professionals as auditors.*
- *The contingent support mechanism needs consultation with the client on how it will operate and confirmation is required of the use of energy savings as the only metric.*
- *A registry should be set up to collect the data from both the EAMS and future data from any Building Regulations Compliance and Energy Performance Certification schemes. This would then provide the data to underpin a stock model that could be used to update benchmarks.*

The inception report (Client report number 266-261) also presented an outline vision of the proposed EAMS process where a qualified auditor goes in to review a building, prompted by a trigger, in order to:

- § Come away with enough information to drive the iSBEM asset calculation;
- § Enter data and run the calculation;
- § Form an opinion on measures to be advocated (adding to recommendations from the software);
- § Enter operational energy data into the tool;
- § Enter measures and re-run calculation, to produce ranking with approximate savings;
- § Reconcile the savings figures/ratings with operational energy information for the building;
- § Feed these into the application process for the contingency support mechanism, using the currency kWh savings per MUR invested.

Alongside this the accreditation of the EAMs was considered and we recommended that:

- § MAURITAS be accepted as the accreditation body for this scheme, in light of their experience of accrediting ISO 9001 and 14001 management schemes.
- § MSB be the first certification body and later roll it out to private certification bodies. They have experience of certifying ISO 9001 and 14001 management schemes amongst others, and keeping the process initially within one certification body gives an element of control when ironing out minor problems and setting standards.

We envisage the certification process should be one where:

- § The applicant who applies to be an auditor must have minimum qualifications of an honours degree or equivalent in a relevant construction based subject plus membership of a professional body such as the Council of Registered Professional Engineers (CRPE) or the Mauritius Architects Association. During this application process the applicant should provide evidence of this and their experience in relevant skill sets – e.g. surveying, building services, energy modelling etc.
- § The applicant would undergo a training program which covers the following competencies:
  - Using the Mauritius Energy Audit tool based on Simplified Building Energy Model (SBEM).
  - Commercial building construction and surveying.
  - Building Services.
  - Advanced services, zoning and new build issues.
- § After a period of practice with the tool (we recommend at least a week's worth), the applicant then sits an exam. This exam should be set by a technical manager(s) who could be based either in the certification body or in the Energy Efficiency Management Office (EEMO) within the Ministry of Energy and Public Utilities (MEPU). In either case the proposed technical manager would need to have the same qualifications and training as the applicants, and will need further training in the production, marking and QA of the exam.
- § On passing the exam the applicant would be registered with certification body and we recommend that a national registry of auditors should also be kept by the EEMO.
- § The certification body would then QA the scheme by regular auditing (e.g. by checking a sample of energy audits), with a disciplinary procedure to deal with poor performance.
- § All energy audits would be passed through the certification body and then lodged on a national register held by the EEMO.

### 3. Desk review of International Standards and existing regulations in Mauritius

The desk study - *Desk review of International Standards for Energy Audits and recommendations for Mauritius*, BRE Client report number 268-129 - came to the following conclusions:

1. *A number of Energy Audit and Energy Performance Certification schemes from various countries have been reviewed. They either address Asset performance (the intrinsic performance calculated on the basis of the building fabric and equipment standards, but excluding the variation due to usage by people) or Operational performance (based on meter readings and so unable to allow calculation of the impact of fabric and equipment changes); in a few rare cases they address both issues.*
2. *None of them provide a linked analysis, essential to evaluate current performance and determine the impact of improvements that could be replicated in Mauritius. However, the proposed methodology for the Mauritius EAMS based on SBEM will integrate the asset and operational aspects of building performance and thus will give a better overall picture of the energy use within the buildings.*
3. *The proposed linked analysis between the calculated performance of the building and the metered data reduces the initial need for sub-metered data which is demanded by other energy audit processes. However as the scheme matures one of the recommendations likely to occur is the installation of sub-meters and associated monitoring and targeting (M&T) programmes. This will encourage a culture of better energy management based on measurement and understanding.*
4. *iSBEM is a proven building model and calculation procedure for regulative purposes along with a mature methodology with respect to the collection of data and interpretation of results. Using iSBEM as the core of the proposed energy audit tool will provide consistency of approach and reduced deviation of the final output.*
5. *The review has demonstrated that there are mature Accreditation and Certification schemes which have been shown to ensure that the levels of expertise and competencies required for the energy audits are continually met by the auditors. This is done by appropriate entrance and training requirements backed up by an examination of the auditors and a quality assurance scheme to ensure their work is to an acceptable standard. A similar approach is recommended for Mauritius.*
6. *We have chosen a building model that is already being used for building regulation compliance, the production of Energy Performance Certificates (EPCs) and to build up national registries. This will help facilitate possible future integration with the proposed Mauritian Building regulations. It will also allow, through the formation of a national registry, a national stock model to be built up over a period of time that could be used to inform future policy and regulatory decisions.*
7. *We understand that the Contingent Support Mechanism is intended by the Government to support energy audits rather than the implementation of measures. We have proposed a methodology for determining which should be the designated consumers that will undertake the audits and receive funding to do so. Whether the recycling of these funds is feasible is a matter for further discussion with the client while the basis for the Contingent Support Mechanism is finalised.*
8. *This report has been modified to respond to comments made by the Mauritius National Steering Committee, which were attached to the e-mail from Mr Chaundee dated 22 March 2011.*

The desk study also recommended that the energy audits should be required for “designated consumers” who meet a set of criteria to be confirmed in discussion with the Government. It was hoped that the Central Electricity Board (CEB) will be willing and able to make the selection against these criteria by applying a preliminary check to all non-domestic consumers as part of the billing process.

The most important points were that the auditors were to be certified, the EEMO were pivotal in policing the scheme and a National Registry would be needed to store the data. The auditors lodge their audits with the certification body (the Mauritius Standards Board – MSB), who after the specified Q/A procedures then lodge them on the National Registry which is managed by the EEMO.

Issues arising were:

- Mauritius Building Energy Audit Tool (MBEAT) could be used to generate output files which could be the basis of a registry system for the Government of Mauritius that offers administrative support to the controlling body (Government or accreditation scheme). Using this registry, a stock model could be constructed that would be the basis of benchmarking and provide underpinning evidence for future regulation and market transformation. The other advantage to adopting such a tool is that it can be adapted in the future to carry out compliance checks that all new buildings meet a minimum standard for Energy Efficient Building Regulations and produce the associated documentation. As a result this can be used as a starting point for an integrated approach to the improvement of the building stock with respect to energy efficiency of new buildings and in the future for Energy Performance certification of the existing stock. These EPCs could be in the form of A-G ratings, similar to those already used in the EU for buildings and white goods.

Although, at this time there was no funding available for this additional functionality within MBEAT a National registry of some form will need to be set-up.

- MAURITAS be accepted as the accreditation body for this scheme but will not be ready to accredit this scheme until mid 2012 at the earliest.

### 3.1 The co-ordination and workshop and other activities

The loss of the UNDP project manager, Mudassir Husaunndee, who was responsible for UNDP programme “*Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings*”, resulted in a lack of coordination between the following related projects:

- Building Control Bill,
- Energy Audit Management Scheme, and
- Standard Designs of Buildings.

As a result the following activities were carried out during 12-15<sup>th</sup> April 2011:

- Consultant's coordination meeting in Mauritius.
- A half-day joint technical meeting at the MEPU.
- A Harmonisation Workshop held on 14<sup>th</sup> April 2011 at La Cannelle, Domaine Les Pailles.
- A meeting with the project director and other officials at the MEPU.

At this time the opportunity was taken to meet with the key participants to this scheme - Mauritas, MSB, MITD and the CEB in order to keep them fully informed.

This activity was an additionally funded item on this contract.

## 4. Energy Audit Management Scheme

In line with the recommendations of the desk study the project was to produce a version of iSBEM for Mauritius and an Audit manual. BRE adapted the UK's NCM and SBEM into the energy auditing methodology and produced the Mauritius Building Energy Audit Tool (MBEAT), an energy auditing software tool for non-domestic buildings in the Republic of Mauritius.

The MBEAT tool comprises a calculation engine with a user interface. The purpose of MBEAT and its interface is to produce consistent and reliable evaluations of energy use in non-domestic buildings for energy auditing purposes. Although it may assist the design process, it is not primarily a design tool and should **not** be used for making strategic design decisions.

### 4.1 Asset and operational energy usage and the energy management tool

The Mauritian Building Energy Audit Tool, or MBEAT, compares and adjusts both the asset and operational energy usage of a building. To understand and manage the energy use in a building, both modes of energy assessment are required as they show different aspects of a building's total energy performance. The operational energy usage benchmarks a building against buildings of similar use. The asset energy assessment models the theoretical, as designed, energy efficiency of a particular building, based on the performance potential of the building itself (the fabric) and its services (such as heating, ventilation, and lighting), compared to a benchmark, if available.

The intrinsic building quality (provided by the asset energy rating) has a large impact on the total emissions (from the operational energy usage), but does not explain all emissions. Other factors such as unregulated loads (e.g. IT, plug-in appliances) or building user behaviour also create emissions, which are reflected in the operational energy usage. However, in order to understand what is driving these emissions, the asset energy calculation is critical in separating the influence of building quality from other influences such as end user behaviours. To truly understand the energy used, and carbon emitted from a building, there is a need for both types of assessment.

The asset energy rating is a measure of fundamental building quality and the higher the predicted consumption, the worse the building is and the greater the opportunity to reduce carbon emissions and improve the building itself. However, two offices, for example, with the same asset energy ratings could have very different operational energy usages. The lower usage reflects a building operated and managed well by the occupants. The higher usage reflects a building used badly, where behavioural, end user focused measures are the best options for carbon reduction.

### 4.2 The workings of MBEAT

MBEAT captures and quantifies the degree of Energy Management within the building by the use of a spreadsheet tool. The data from this tool and the meter readings are then input into a version of iSBEM that has been adapted for this purpose and for the Mauritian building stock and climate.

When comparing the Asset and its operational performance one must first define the building and then create a model of it in MBEAT. The building services systems, zones, envelope elements, windows, and doors are all referred to as "**building objects**" in MBEAT. Figure 1 shows each of these building objects and demonstrates how they are linked together so that MBEAT can calculate the energy consumption of the building. This diagram gives an overview of what information is required and where it has to be entered in MBEAT.

MBEAT calculates the energy demands of each space in the building according to the activity within it. Different activities may have different temperatures, operating periods, lighting standards, etc. MBEAT calculates heating and cooling energy demands by carrying out an energy balance based on monthly average weather conditions. This is combined with information about system efficiencies in order to determine the energy consumption. The energy used for lighting and hot water is also calculated. This requires information from the following sources shown in Table 1.

Building object	Key parameters needed to define this building object	Object(s) to which it needs to be linked	Where it is defined in MBEAT
Zones	Dimensions, activity type, details on lighting, heating, and ventilation strategy.	HVAC and HWS	Geometry form > Zones tab and in the Building Services form > Zones tab
Envelope elements	Type of envelope (wall/floor/roof), area, orientation, construction type, perimeter length, and condition of adjoining space.	Zone	Geometry form > Envelopes tab <u>or</u> the Geometry form > Zones tab > Quick-Envelopes sub-tab
Windows	Dimensions, glazing type, shading system, frame factor, aspect ratio, and whether it is a display window or not.	Envelope element	Geometry form > Windows & Rooflights tab <u>or</u> the Geometry Form > Zones tab > Quick Envelopes sub-tab
Doors	Area, construction type and type of door.	Envelope element	Geometry form > Doors tab
HVAC	System type, heat source, fuel type, further details on efficiencies, duct leakage, specific fan power, and controls.	Zone	Building Services form > HVAC systems tab
HWS	Generator type, fuel type, details on efficiency and whether it is a storage system.	Zone	Building Services form > HWS tab
SES	Dimensions, orientation, inclination, storage.	HWS	Building Services form > SES tab
PVS	Dimensions, orientation, inclination and type.	-	Building Services form > PVS tab
Wind generator	Terrain type, dimensions, and power.	-	Building Services form > Wind generator
CHP generator	Fuel type, details on efficiency, building heat and hot water supplied, and thermal and electrical efficiencies.	HVAC	Building Services form > CHP tab
TSC	Type, operation, control type, absorptivity, and design air flow.	Zone and Envelope element	Building Services form > TSC tab, Geometry form > Envelopes tab, and Building Services form > Zones tab

The diagram illustrates the hierarchy of MBEAT building objects. It shows how different components like PVS, Wind generator, CHP, HVAC systems, HWS, SES, and TSC are interconnected through various building zones and their envelope elements (walls, floors, ceilings, doors, windows).

**Figure 1: Structure of MBEAT objects**

Information	Source
Building geometry such as areas, orientation, etc.	Energy auditor reads from drawings or direct measurement.
Weather data	Internal database.
Selection of occupancy profiles for activity areas	For consistency, these come from an internal Activity Database – energy auditor selects by choosing building type and activity from the database for each zone.
Activity assigned to each space	Energy auditor defines within MBEAT by selecting from internal database (the user should identify suitable zones for the analysis by examining the building or drawings).
Building envelope constructions	Energy auditor selects from internal Construction and Glazing databases or inputs parameters directly. Energy auditor can also define their own constructions in the user-defined construction database.
HVAC systems	Energy auditor selects from internal databases or inputs parameters directly.
Lighting	Energy auditor selects from internal databases or inputs parameters directly.

**Table 1: Calculation parameters for MBEAT**

The internal Construction and Glazing databases and HVAC and lighting databases have been constructed using intelligence from our local partners. It was envisaged that an initial version of MBEAT would be produced and then run out to the first set of trainees. Using the feedback from these trainees a new and final iteration would be produced.

The other database that needed to be populated was that concerned with the climatic data and this resulted in a number of issues:

- The number of climatic zones for Mauritius.
- Has each climatic zone a complete and representative data set?
- The purchase of the weather data by the MEPU from Mauritius Meteorological Services (MMS).

Technically only one zone was required but a political decision was made to have two - one for the central plateau, represented by typical data from Vacoas and the other for coastal regions represented by Plaisance/St Felix. However, the data from Plaisance/St Felix was incomplete and the NSC finally made the following decision after 6 months of deliberations:

*The request for 2 climate zones is from our local key stakeholders and the NSC members, not from BRE. Our key stakeholders and NSC members have also requested that SBEM/iSBEM be customized with weather data for 2 climate zones.*

*The National Project Director (NPD) has therefore decided that the ratio for the Vacoas weather data will be used to split the global solar radiation hourly data for St Felix. The NPD will assume any responsibility for the use of approximations for the St Felix solar radiation data.*

The MMS were not willing to carry out the calculation; however BRE agreed to work out (on the NSC's behalf) the split for the solar radiation data for St Felix.

The resources to carry out this part of the project were depleted by this time and it was agreed that BRE be allowed to pull forward resources from those allocated to the final report – the agreed amount was for 5% of the total budget.

### 4.3 MBEAT and the energy management tool

MBEAT compares and adjusts both the asset and operational energy usage of a building. However, in order to adjust the asset energy usage, one must first address the issue of the Poorly Energy Managed Building (PEMB) definition. The PEMB is needed to calculate one end of a scale between well-managed (equivalent to the asset energy usage, where the building is perfectly controlled to the requirements of the activity databases) and poorly managed (where the activity database parameters are not adhered to). A separate scoring exercise places the actual building on this scale, which is transposed from the calculated to an “actual” scale. The position on the scale indicates where the metered performance is expected to be, and hence the theoretical split between asset and operational performance can be transposed onto the actual scale, and theoretical predictions about the impact of improvements can also be transposed to the actual scale.

The definition of the PEMB allows the sliding scale to the well-managed building to be calibrated. However, the extent of the energy management within the building needs now to be defined and quantified so that it can be positioned on this scale. The production of a series of new matrices with weighted scores was initially carried out through a series of information and data gathering exercises which engaged the building professionals in Mauritius. This was then tailored by producing an energy management tool which dovetailed to the asset tool.

The energy management tool, which is contained within a locked excel workbook, calculates an energy management score. This score is calculated on the basis of the data collected by the auditor from the real building. The tool contains a number of worksheets which address all the energy management issues (see Table 2). Each worksheet contains a single matrix, for example that covering Central Plant level controls which is shown in Figure 2.

Matrices	Summary Score	Total possible score
Matrix 1: Use of Controls	0	40
Matrix 2: Use of Controls - Local (zone level) comfort controls	0	40
Matrix 3: Use of Controls - Lighting	0	36
Matrix 4: Quality of maintenance - Building	0	40
Matrix 5: Quality of maintenance - HVAC plant & Lighting	0	40
Matrix 6: Motivation - Occupants & Management	0	32
Final score	0	228

**Table 2: Summary table of the Energy Management Matrices**



	A	B	C	D	E	F
1	<b>Matrix 1: Use of Controls</b>					
2	<b>Building:</b>	0 (Enter name on summary scores sheet)				
3						
4	<b>Topic</b>	Use of Controls				
5	<b>Subject</b>	Central plant level controls				
6	<b>Question</b>	Location of controls	Operating times	Time response to day to day changes	Central plant temperature settings	Energy manager understanding
7	<b>Score</b>					
8		4 BEMS with trained personnel to operate it	Different schedules for each day	Optimum start and stop depending on internal temperature performance on previous day	Cold set points adjusted to allow highest evaporating temperature and hence highest COP consistent with providing cooling needs based on exterior weather conditions	Rigorous checking of controls function, settings, and system balance carried out once per year. Documented procedures and comprehensive records of results.
9		3 Computer-based building energy management system (BEMS)	Set to exactly normal occupancy	Optimum start (only) depending on internal temperature performance on previous day	Cold set points adjusted depending on differing dehumidification requirements based on exterior weather conditions	Full checking of controls function, controls, settings, and system balance carried out once per year. Documented procedures exist for each check. Some results on record.
10		2 Central control panel from which time, temperature etc settings can be adjusted	Turned on/off by staff	Time switch with seasonal differences	No central chiller plant	Informal checking of controls function and system balance carried out once per year. Schedule of checks exists but no proof of occupancy
11		1 Controls dispersed around building	More hours than normal occupancy	Time switch only	No changes (eg evaporator or chilled water temperatures as set by manufacturer)	Annual functional checks carried out although these are not well documented.
12		0 Don't know where controls are OR There are no controls	No control (enabled constantly)	No response to changes	Don't know what settings are OR what you mean by this	Maintenance is on breakdown basis and controls are checked only when things go wrong.
13	Weighting for relevance to calculation	1	3	2	1	3
14	<b>Overall Score</b>	1	0	0	0	0
15	<i>Enter scores on red row above, not here</i>					
16	<b>Total score</b>	1				
17						
18	<b>Total possible score</b>		40			
19						

**Figure 2: Screen shot of Central plant level controls matrix**

The first version of MBEAT was produced for the training course held in August 2011. It was refined using the comments from the trainee auditors and a final version produced. This was supplied to the EEMO, along with an audit manual and an auditor checklist, on CDs in October 2011.

A website was set-up for the EEMO to host all the materials, so that the auditors can download them directly.

<http://www.isbem.co.uk/downloads/MBEAT/index.php?clave=JDF9AJFJFAASDJFKJIWOFJDK>

user: mbeatuser  
password: eaudit2U

BRE are currently hosting it and will continue to do so until the end of March 2012. We have suggested to the EEMO, over the last 6 months, that they transfer it to their own website.

## 4.4 Compliance Mechanism and draft Secondary Legislation

### 4.4.1 Compliance Mechanism

In client report 275-019 - *Contingent Support Mechanism - Review and Recommendations* - BRE have proposed how the Designed Customers are identified along with a mechanism for the Contingent Support Mechanism. It is proposed that the Compliance Mechanism and proposed legislation dovetail with these as much as possible to avoid any duplication of effort and keep administrative costs to a minimum.

The CEB provided the finalised dataset of the CEB's top 700 clients which was passed to BRE on the 25<sup>th</sup> August 2011. BRE carried out a filtering procedure to remove process based companies and identified 320 clients, of which the top 50 energy users can be targeted in the first year. The data provided by CEB is limited, due to customer confidentiality, to the following identifiers:

- § An Account Reference – so that the CEB customer can be traced back to the CEB base data.
- § An Installation Type.
- § Economic Activity – An up to 5 word description.
- § KWh usage data for the last 12 months – per month, total annual and monthly average.

Based on the limited information required, a filtering process was carried out to remove possible process based companies or those with not enough information to identify as building based. This left a total of 320 CEB customers remaining, of which the 50 with the highest annual electricity usage were designated are those targeted for energy audits in the first year of the EAMS – **the Designated customers**.

The NSC wishes to:

- § Target 5000 customers over the lifetime of the scheme.
- § Have the top 320 clients identified above carry out energy audits on their buildings in the first 5 years of the EAMS
- § Require an audit to be carried out on all new buildings, 3 years after they are built but with no link to the building regulations thresholds on floor area and to be identified by the date of start of the CEB Contract.
- § Require that an audit should be repeated every five years.

These aspirations will require the EEMO to have a sophisticated database and we recommend that this is updated on an annual basis. This initially would be with the top 320 CEB customers and refreshed with data from the CEB each year. This needs to be carried out to take into account:

- § Changes in ownership.
- § Changes in activity on the site.
- § Construction or demolition on the site.
- § Changes in energy usage – possibly due to updated processes and /or changes in staff numbers.

We also recommend that the new buildings identified have an energy usage threshold before they are audited. This is because with rapid urban growth there may be issue with capacity building of the auditors. Also, there is an issue with the possible cost effectiveness of the audit and we initially suggest that the energy usage of the baseline 320<sup>th</sup> CEB customer be used. This threshold can then be revisited and tailored as the EAMS matures as a scheme. An alternative is to only audit the new buildings that exceed the 500m<sup>2</sup> threshold that triggers the Energy Efficiency Building Regulations which are part of the Building Control Bill, although the NSC have appeared to discount this approach.

These designated customers will then be subject to the compliance mechanism and the contingent support mechanism. The proposed design of the scheme for the contingent support mechanism is shown as an overview of the envisaged process in the figure on the next page. As can be seen there will significant overlap with any proposed compliance mechanism.

In Client report 276-325 - *Compliance Mechanism and draft Secondary Legislation*, BRE proposed a compliance mechanism where the designed customer identified, on an annual basis, by the CEB data was

legally obliged to carry out the audit within 12 months of being notified by the EEMO or is fined. The EEMO plays a pivotal role in managing the process and handholding the designated customer through it.

The role of the EEMO is to act as “Gate Keeper” for this scheme and show due diligence in checking that the EAMs audits are correctly carried out. This role will involve the EEMO carrying out checks at both the pre and post energy audit stages to ensure:

- § The correct site is audited.
- § A qualified and certified auditor is used.
- § A “fit for purpose audit” report is produced.

Pre-audit, the EEMO will have to check consistency of the data submitted by the **Designated Customer** with data sourced from the CEB database and obtain confirmation from the certification body (i.e. Mauritius Standards Bureau (MSB)) that the auditor details are correct and the auditor is certified to carry out the energy audit.

The EEMO will then be expected to monitor the progress of the **Designated Customer** informally during the Energy Audit stage including the production of the EAMs energy audit report and associated documentation.

At the post audit stage, the EEMO confirms that the auditor that actually carried out the audit was the one proposed or any alternative is certified and a member of a valid scheme. It carries out a second set of checks which are concerned with the audit itself, to ensure that it has been carried out correctly and in line with the procedures required by the **Mauritius Energy Audit Certification Scheme**.

#### 4.4.2 Draft Secondary Legislation

Draft legislation was also produced which was intended to be an amendment to the **ENERGY EFFICIENCY ACT 2011- To provide for the setting up of the Energy Efficiency Management Office**. The draft regulation produced was the “**Energy Audit Management Scheme (EAMs) regulation for Mauritius**”. This regulation was designed to be applied to Non-Residential Buildings only.

At this point a number of legal issues were raised:

1. **Whether the proposed regulation is correctly formulated** - As submitted our legal expert was of the opinion that the proposed regulations are not legally in order since they are not covered under section 23 of the EEA.
2. **How can the EEA be amended to allow the regulations to work properly?** - our legal expert proposed that section 23 of the EEA be amended to:
  - (a) give power to the Minister to make regulations for the energy audit management scheme in residential and non-residential buildings; and
  - (b) impose a penalty on non-compliance with the energy audit management scheme.
3. **Whether the Non-residential definition is in the Building Regulations and Code?** – In the draft Energy Efficiency Building Code the distinction is made clear between residential and non-residential buildings. To make it more binding the MEPU may want to make mention of it in the regulations.

The draft regulation needs both the section 23 of the EEA and the Energy Efficiency Building Code to be enacted before it can be brought forward for inclusion in the statute book.

As a result of further consideration our legal advisor Mrs Gaitree Jugessur-Manna also recommends that Section 23 of the Energy Efficiency Act is not enough to permit the introduction of the proposed regulations.

The Regulation is about an energy audit management scheme. The scheme requires the EEMO, in conjunction with CEB, to identify Designated Customers requiring energy in their non-residential buildings. There is a procedure of notification and payment of fines in case of non-compliance among other duties. Under the EE Act, one of the functions of the EEMO is to develop and implement strategies, programmes and action plans, including pilot projects, for the efficient use of energy.

**Section 23 of the E.E. Act provides that**

- (1) The Minister may, for the purposes of this Act, make such regulations as he thinks fit.
- (2) Any regulations made under subsection (1) may provide –
  - (a) for the minimum energy performance standards for any equipment, machine or appliance which is imported, manufactured or sold in Mauritius;
  - (b) for the labelling requirements and specifications for any equipment, machine or appliance which is imported, manufactured or sold in Mauritius;
  - (c) for the criteria to classify energy consumers;
  - (d) for the minimum qualification standards for certification of energy auditors and related procedures for energy audits;
  - (e) for any other matter related to energy efficiency;
  - (f) that any person who contravenes them shall commit an offence and shall, on conviction, be liable to a fine not exceeding 100,000 rupees.

Section 23 (2) (e) gives power to the Minister to make regulations for any other matter related to energy efficiency and (c) for the criteria to classify energy consumers. These two subsections may be considered for making the regulations. The MEPU may also consider putting a draft contract in a schedule, which will be applicable between the CEB and the Designated Customers and have guidelines in the schedules for them to comply with.

The EEMO may also consider consulting the officers of the Ministry, who have worked on the drafting of the Act, with a view to ascertaining what the legislators had in mind with respect to the two sub sections.

## 5. Accreditation of Energy Audit Management Scheme

In terms of an energy audit scheme the desk study revealed:

- That there are currently no standards in place that fully define the processes and procedures required, although there are standards that define these generically. In some cases, these are underpinned by national best practice which lays out the operational details.
- In the European Union, the Energy Performance of Buildings Directive (EPBD) legislative and regulatory requirements for accredited Energy Assessors to provide Energy Performance Certificates (EPCs) has led to the formation of national standards and methodologies in order to meet these requirements. These are underpinned by national schemes run by certification bodies, which in turn have these schemes accredited by their national accreditation bodies.

In order to accredit such a scheme the accreditation body should comply with the following standard:

- ISO 17011 - Conformity assessment General requirements for accreditation bodies accrediting conformity assessment bodies - First Edition 2004; Corrected Version 2/15/2005.

ISO 17011 specifies general requirements for accreditation bodies assessing and accrediting conformity assessment bodies (CABs). It is also appropriate as a requirements document for the peer evaluation process for mutual recognition arrangements between accreditation bodies. Accreditation bodies operating in accordance with this International Standard do not have to offer accreditation to all types of CABs.

For the purposes of this International Standard, CABs are organizations providing the following conformity assessment services: testing, inspection, management system certification, personnel certification, and product certification.

The route that has been used in the UK to roll out the successful certification schemes to provide certified energy assessors in support of building regulation compliance checking, and production of EPCs and DEC's is to accreditation standard EN 45011:1998 - General requirements for bodies operating product certification systems. BRE therefore recommends that EN 45011 should be used in Mauritius.

Other alternatives are to use:

- ISO 17020 - General Criteria for the Operation of Various Types of Bodies Performing Inspection. Or
- ISO 17024 - Conformity Assessment - General Requirements for Bodies Operating Certification of Persons

As the vehicle for the scheme they are not as good a fit as EN 45011. However, it has been decided by the National Steering Group (NSG), after consultation with Mauritas, to follow the ISO17024 route as this approach is the one that best fits the Mauritian context.

The extra requirements of ISO17024 are that this standard requires an entrance examination for the auditors as well as evidence of competency. It also requires a pro-active surveillance process to monitor the auditor's compliance. BRE will recommend a Quality Assurance process to meet this requirement and also recommends best practice which is to fully re-assess assessors every 3 years, and this could include a re-sit of the exam. The exam must be under the control of the certification body or their agents and there must be a clear divide between the certification body and those organisations providing the training, i.e. one body cannot both train and examine the candidates.

This standard also requires the certification body to meet the following requirements:

- Have a scheme steering group in place, which consists of stakeholders from Government, Industry and the accreditation body, along with an expert from the field covered by the scheme.
- This steering group has to undertake a full review and evaluation of the scheme and its members every five years but best practice is to do this three years.
- The certification body will need an internationally recognised management standard such as ISO 9001 in place for this scheme.
- The certification body will need to appoint an appropriately qualified and trained Scheme manager.
- The certification body will need to appoint an appropriately qualified and trained Technical manager.

## 5.1 Certification and Accreditation bodies in Mauritius

Following our meetings with MAURITAS (the Government Accreditation body) and with the Mauritius Standards Bureau (MSB), in September 2011, we recommend that:

- MAURITAS be accepted as the accreditation body for this scheme, in light of their experience of accrediting ISO 9001 and 14001 management schemes.
- MSB be the first certification body. They have experience of certifying ISO 9001 and 14001 management schemes amongst others, and keeping the process initially within one certification body gives an element of control when ironing out minor problems and setting standards. Later it can be rolled out to private certification bodies

At this point we recommend that the certification process should be as follows:

- The applicant to be an audit assessor must have minimum qualifications of an honours degree or equivalent in a relevant construction based subject plus membership of a professional body such as the Council of Registered Professional Engineers (CRPE) or the Mauritius Architects Association. During this application process the applicant should provide evidence of this and their experience in relevant skill sets – e.g. surveying, building services, energy modelling etc.
- The applicant would undergo a training program which covers the following competencies:
  - Using the Mauritius Building Energy Audit Tool (MBEAT) based on Simplified Building Energy Model (SBEM).
  - Commercial building construction, zoning and surveying.
  - Building Services.
- After a period of practice with the tool (we recommend at least a week's worth), the applicant then sits an exam. This exam should be set by a technical manager(s) who should be based in the certification body. The proposed technical manager would need to have the same qualifications and training as the applicants, and will need further training in the production, marking and quality assurance (QA) of the exam. We envisaged training the proposed technical managers directly after the first training programme and showing them how to produce the first exam. BRE will also support them by responding to queries on the marking of the first examination. BRE could produce, invigilate, mark and Q/A to exam but this would have to be costed separately.
- On passing the exam the applicant would be registered with the certification body. We recommend that a national registry of auditors should also be kept by the EEMO.
- The certification body would then QA the scheme by regular auditing (e.g. by checking a sample of energy audits), with a disciplinary procedure to deal with poor performance.

- All energy audits would be passed through the certification body and then lodged on a national register held by the EEMO.

The proposed certification process has changed very little during the lifetime of the project except the requirement for membership of a professional body such as the Council of Registered Professional Engineers (CRPE) or the Mauritius Architects Association has been removed. This has been replaced by a requirement for a minimum of 2 years working experience in at least one or a combination of the following domains:

- building surveying,
- building services,
- facilities management,
- building energy modelling,
- building automation,
- building engineering physics,
- energy management, or
- any other equivalent.

Since our initial meeting with Mauritas we have been in constant dialogue, which led to BRE proposing that the preferred route for certification of the Energy Audit Management Scheme (Mauritius) by an accredited certification body was EN45011. This is because this was the vehicle for the successful UK schemes. Mauritas are working towards complying with ISO 17011 in order to accredit certification bodies to this standard as they do not have the other accreditation standards in place to make certification of this scheme possible.

Mauritas indicated that they do not have the ISO/IEC 17011 in place yet, but have started work and were initially expected to complete the preparation work for it by October 2011. They will then be ready for pre-peer-evaluation and peer evaluation by the International Laboratory Accreditation Cooperation (ILAC) and International Accreditation Forum (IAF) in mid 2012. This project is being implemented with the financial assistance of Agence Française de Développement (AFD) and technical assistance of their French counterpart (COFRAC/AFNOR).

In addition they have not embarked on Product Certification for the simple reason that the only Certification Body in Mauritius offering the programme has not shown any interest yet in applying for this particular accreditation. In the light of the scheme proposals made by BRE they originally agreed that the suggested approach by BRE should be carried forward, i.e. EN 45011 product certification under ISO 17011 operations. However, they also informed us that resources may be an issue and they will need further internal discussions before taking the final decision on any implementation.

The issues arising from this are:

- The EAMs project was expected to end in May 2011 and Mauritas will not be ready until Oct. 2011 to mid 2012;
- Even when Mauritas have obtained ISO 17011 they may not offer EN 45011 which is essential for the accrediting the certification body to run the scheme.

Further discussions and decisions of the NSG shifted the focus to the use of ISO 17024 - Conformity Assessment, as the accreditation vehicle. However, the issues above still remain and there is a need for an interim solution.

On BRE's last visit in January 2012, both Mauritas and MSB have still not received any funding from Government to put this scheme into place. They estimated that it would be 6 and more likely 9 months, from when funds were received, for them to build up sufficient capacity and put, into place the specialised staff, the processes and procedures to run this scheme.

## 5.2 BRE's obligations under the existing contract

It is helpful at this time to reiterate what BRE was expected to provide under the existing EAMs contract:

- A scheme framework will be developed to provide the procedural and management criteria for scheme operation; this will include development of the following procedures and documentation:
  - Scheme Document;
  - Code of Conduct;
  - Complaints Procedure;
  - Appeals Procedure;
  - Membership Agreement;
  - Application form.

The final versions were sent to MSB and the EMMO in June 2011. An additional meeting was held on 17th August 2011 at MSB's offices, with the EMMO present, where BRE did an in-depth briefing covering all aspects of the documentation and roadmap.

- Technical input for the scheme (including the production of the examination template materials – both papers and computer files), marking and process/quality control documentation and processes. We envisage that the proposed Mauritian certification body technical managers would need to have the same qualifications and training as the applicants. They would also need further training in the production, marking and quality assurance (QA) of the exam; this training would take place directly after the auditor training.

All examination materials were produced and sent to the EEMO in November 2011. The materials were saved in a password protected WinZip file burnt onto disc. The EMMO were informed that the reason for this is that the accreditation/certification process requires these to remain secure and access limited to the sponsoring body (the EMMO) and the technical manager of the certification body (MSB). The technical manager of the certification body (MSB) has not yet been appointed because no funds, for capacity building, have been released to the MSB by government at this time.

- Provision of the materials, roadmap and technical advice necessary for the accreditation of a future certification body in Mauritius by a recognised accreditation body. This would be achieved by provision of the following services:
  - Advice on the structure of the accreditation standard and the types of documentation likely to be required.
  - Advice on the governance structure required for a certification body.
  - Advice on key issues such as competency, certification decisions, conflicts of interest and impartiality.
  - Advice on internal audit, corrective actions and management structure.
  - Review of top level documents the body prepares following the above advice and feedback on improvements – this will require top level documentation from the proposed certification body.
  - The roadmap would be a clause by clause guide to what they should do and prepare in order to comply with 17024. This will pick up and advise on some particular areas which are easily overlooked or where there are quite significant impacts on the service they provide. A couple of examples are:
    - governance and how to set up a governing body; and
    - requirements for dealing with candidates who may be handicapped or have other similar difficulties.



The roadmap was produced in June 2011 and presented to the MSB and EMMO at a meeting held on 17th August 2011 at MSB's offices. The roadmap highlights and indicates the key requirements and steps to becoming accredited. Following the introductory paragraphs there is a general overview of requirements which is then followed by a reproduction of each clause of the accreditation standard. The International Accreditation Forum (IAF) has produced a guide to the standard to help certification bodies interpret the clauses of the standard. This document is called "IAF GD 24:2004 - IAF Guidance on the Application of ISO/IEC 17024:2003". As a result the detailed roadmap has taken the standard and under each clause highlighted the relevant guidance notes from the IAF document and given additional explanatory notes using our experience of its implementation

### 5.3 Additional tasks

To help set-up the certification body is an additional task to those agreed to in our bids – both original and revised. We have already discussed this issue with the steering group representatives through two teleconferences. As a result we provided the following quote for these additional services:

1. To help set up the certification body we would estimate that the cost would be: £17000 including travel and subsistence for up to two trips to Mauritius. This would include:
  - Some on-site training
  - More in-depth advice on required documents
  - Checking operational documents and procedures

This quote is on the basis that BRE will guide and advise MSB but MSB will be responsible for the actual preparation and writing of procedures and quality documents.

An important point that may have been missed by previous emails and telephone calls is that in giving the above help and advice, the MSB should be in a good position to deliver other certification schemes should they wish to do so in the future. Other than specific scheme documents for individual schemes much of the other documentation for the certification body is generic. The quote above will concentrate on the energy schemes; if at a later date MSB want help extending their scope we could help for an additional contract.

2. To run the scheme until Mauritius is ready

The aim would be for BRE to initially conduct all the work with MSB staff observing and gradually hand over more and more of the work to MSB so that eventually BRE would only make the certification decision and issue the certificates whilst MSB do all the rest of the certification work. This will help MSB to become accredited in the own right.

Assuming BRE had conducted 1 above. The cost would include:

- On-site hand-holding for the initial QA audits in conjunction with 1 above
- Certify energy audit assessors at £600 each. This is based on the candidates having passed the appropriate qualifications and having the appropriate experience and that the evidence is presented in consistent application packs for evaluation.
- BRE would help MSB staff to define the contents of the evidence packs required to be submitted by the candidates. BRE would assess each application in conjunction with MSB staff and make the appropriate recommendations and issue the certificates.
- Quality assurance of the initial batch of energy audit assessors £5000.
- Thereafter assuming MSB staff are fully trained and conducting the QA audits BRE would charge a fee based on the fee charged to assessors by MSB. This was originally quoted as 10% but as there is no indication of the fees MSB intend charging this would need to be negotiated to monitor and manage the certification QA audit process.

- BRE would conduct an on-site audit every 6 months to ensure everything is working well - £3000 per audit plus travel and subsistence. This could be extended to annually if everything was going well after the first two audits.

If all the initial 45 assessors were done at one time and two audits covering the first year this would equate to £ 38000 plus T&S (for the two audits) and a charge relating to the QA subsequent audits.

As explained in a previous email BRE is an accredited certification body for similar schemes however if MSB want BRE to specifically get the MSB scheme accredited by UKAS there would be at least a further fee of £10000.

### 3. To prepare and mark the exam

The price is £600 per exam to prepare the papers and £125 per candidate to mark. This assumes that MSB print the papers, invigilation the day and send the papers to BRE. It also assumes a minimum of 10 candidates per exam. If all the initial 45 assessors were done at one time this would equate to £6225, more realistically this would be 2 tranches. If BRE was required to invigilate and run the exam this would cost an additional £4000.

BRE were informed at the time that the MEPU would be going out to competitive tender for these services in the near future – see section 5.4.

## 5.4 Interim certification

Due to the issue of Mauritas and MSB not being ready in time, BRE proposed the following options:

- Run an uncertified scheme through the Mauritius Standards Bureau until Mauritas is ready. MSB will also need to form a scheme steering group, which would consist of stakeholders from Government, Industry and the accreditation body, along with an expert from the field covered by the scheme. Also MSB will need in place an internationally recognised management standard, such as ISO 9001, and to appoint appropriately qualified and trained Scheme and Technical managers. When Mauritas is in compliance with ISO 17024 they would then accredit the scheme and retrospectively allow MSB to certify the auditors. Any handholding and training of MSB staff during this process is not covered by our project specification and would have to be costed separately.
- BRE Global could help set-up MSB as a certification body to run the scheme until Mauritas is ready. Once MSB have the certification systems/procedures in place, we estimate that BRE Global would take a further month to certify the scheme. MSB will then run the scheme; set, run and mark the examinations; with the documentation of each candidate passed onto BRE global for final certification. Again, once Mauritas are in a position to accredit MSB the documentation etc. of each auditor could be passed back to MSB for certification under the auspices of Mauritas. This is not covered by our project specification and would have to be costed separately.

The 15<sup>th</sup> NSC meeting held on Friday 7<sup>th</sup> Oct 2011 confirmed Additional funds have been acquired by the Ministry of Energy and Public Utilities (MEPU) and it will now be possible for the EEMO to proceed with the following supplementary project activities:

- (i) Interim Certification of the initial batch of 45 trained Auditors;
- (ii) Implementation of the EAMS, including capacity building of MSB;
- (iii) Accreditation of the Certification Body, including capacity building of MAURITAS.

The MEPU will appoint an International Certification Body already accredited to ISO 17024 and running a similar scheme, through a tendering process, for the implementation of the EAMS and for the interim certification of the auditors.

An International Accreditation Body will also be appointed for the Accreditation of the Certification Body and for the necessary capacity building of MAURITAS.

All additional activities related to the Building Control Bill Project (e.g., amended scheme, amended MBEAT, etc.) and the setting up of a National Registry will be implemented at a later stage, with the appointment of a suitable Consultant.

In an email of the 12<sup>th</sup> December 2012, Mr. Preetam Chaundee, of the EEMO, informed BRE that:

*We have drafted an addendum to the UNDP-GEF Project Document and have already secured additional funding for the interim certification of the 45 trained Building Energy Auditors and for the accreditation of the Certification Body to ISO 17024. A Consultant shall be appointed for the interim certification by the end of February 2012; an External Accreditation Body shall be appointed for the accreditation part, tentatively by the end of May 2012.*

At this point the tender notice the tender notice(s) have yet to be issued.

## **5.5 Training body**

Under the prescriptive clauses of ISO17024, the certification body (which acts as the examination body) must be split from the role of the training providers. Therefore the exam must be under the control of the certification body or their agents and there must be a clear divide between the certification body and those organisations providing the training. This means that the same organisation cannot train and examine the candidates.

The national steering committee has decided that Mauritius Institute of Training & Development (MITD) will be the future Training Body.

## 6 Contingent Support Mechanism

In section 4.4.1 we mentioned that in client report 275-019 - *Contingent Support Mechanism - Review and Recommendations*- BRE have proposed how the Designed Customers are identified along with a mechanism for the Contingent Support Mechanism which is dovetailed with the Compliance Mechanism and proposed legislation.

The NSC has decided that in the first year of the Energy Audit Management scheme (EAMs) there will be 50 audits with 70% part-financing from the project funds and the remaining 30% from other sources of funding. The total cost for the 50 audits in the first year has been estimated to be a maximum of 7,500,000MUR. With the government providing 70% part financing, the cost will be a maximum of 5,250,000MUR from the project funds, with other possible sources of funding needed to meet the remaining 30% (2,250,000MUR).

As part of this study KPMG were commissioned to carry out a desk survey with the following brief:

- Identify institutions (local and international) that provide financial support for energy audits and implementation of recommendations;
- Conduct a desk / phone survey to obtain information on the nature, form and amount of support, and related conditions;
- Outline the possibilities and scope for Government intervention.

The results of this study revealed limited prospects of financial support for energy audits and / or implementation of the audit recommendations. On the local market, with the exception of four banks which are already participating in the Agence Francaise de Developpement (AFD) scheme, the other banks surveyed do not have a green funding scheme. There may be an opportunity for the Ministry to start another scheme with these banks along the same lines as the AFD scheme where the banks provide the capital and the government pays the interest, effectively producing an interest free loan.

Regionally, some major financial institutions have dedicated funds for energy and climate change programmes for Africa, which represent potential support for energy audits and implementation in Mauritius.

Given that the availability of financial support is a critical success factor and that energy efficiency is a national Government-led initiative, it would make a greater impact with increased likelihood of a commitment from the regional institutions if it is Government that directly makes the request for financial support for Mauritius.

The Government may also consider requesting funding support from the European Union (EU), as the EU is currently the main development partner of Mauritius.

The client report also describes how the CEB customer database was filtered to identify the top 320 building energy users. Of these, the 50 with the highest annual electricity usage were designated are those targeted for energy audits in the first year of the EAMS – **the Designated customers**.

On the premise that a financial partner or partners will be found to underpin the scheme, a robust Contingency Support Mechanism (CSM) is proposed with sufficient checks and balances incorporated within the application process.

The report also considers options for future government intervention with the best option for future consideration being a levy raised against the largest and/or most energy intensive users with a rebate for agreed reductions in their usage. This rebate would not be 100% and the remainder of the receipts would be ring fenced to fund the provision of:

- Energy audits and the provision of energy efficiency advice (helpline and publications) through the Energy Efficiency Management Office (EEMO), and

- Tax breaks through an Accelerated annual allowance underpinned by list of technologies and qualifying criteria. The list would be managed by the EEMO.

Interest free loans could be used to support the implementation of measures within smaller companies but the cost of rolling this out over the whole of the scheme would be prohibitive. As a result tax breaks are considered a better vehicle to engage the larger organisations.

It is essential that the EEMO has a ring fenced budget so it can plan and run projects over the longer term, rather than be limited by an annual government department bidding process for funds.

## 7 Training of Trainers and Auditors

On the 10<sup>th</sup>, 11<sup>th</sup>, 12<sup>th</sup>, 15<sup>th</sup> and 16<sup>th</sup> August 2011 BRE held a 5 day training course for 45 prospective auditors and trainers at MITD House in Phoenix.

The final training programme and its content are given in Appendix A. The feedback from the trainees was used to refine the materials and a revised final version of all the materials were supplied to the EMMO in October 2011.

## 8 Workshops Parts A and B

Between January 24<sup>th</sup> and 27<sup>th</sup> 2012 the following workshops were held:

- Day 1 (Tuesday 24<sup>th</sup> Jan 2012): Full Day – La Cannelle, Domaine Les Pailles - **Energy Audit Certification Scheme for Non-Residential Buildings.**
- Day 2 (Wednesday 25<sup>th</sup> Jan 2012): Full Day – La Cannelle, Domaine Les Pailles - **Mauritius Building Energy Audit Tool (MBEAT) for Non-Residential Buildings.**
- Day 3 (Thursday 26<sup>th</sup> Jan 2012): Full Day – Clos St Louis, Domaine Les Pailles - **Energy Audit Certification Scheme for Non-Residential Buildings.**
- Day 4 (Friday 27<sup>th</sup> Jan 2012): Half Day – Clos St Louis, Domaine Les Pailles - **Energy Audit Certification Scheme (Contingent Support Mechanism) .**

The final workshop programme and their content are given in Appendix B.

During this mission Andy Lewry was also invited to participate in a half-day Brainstorming Session on the 30<sup>th</sup> January at EEMO with the Energy Efficiency Committee, to finalise the Action Plan for the period 2012 - 2013.

In addition, on the 31<sup>st</sup> January, 2012 he gave a briefing to Hon. Dr. A. R. Beebeejaun, Deputy Prime Minister; Minister of Energy & Public Utilities at his office in the Ministry of Energy & Public Utilities.

## 9 Concluding remarks

BRE have delivered high quality outputs for all aspects of this project and have, without receiving additional resource, met customer requirements outside the project scope.

The project has overrun by 10 months, and although there have been some technical difficulties, such as the acquisition of the weather data, the main issue has been the unwieldy nature of the National Steering Committee (NSC). Due to the number of members and the infrequent meetings this has led to slow responsiveness on executive decisions and changes in directions.

The formation of the Energy Efficiency Management Office (EEMO) and its smaller steering committee will hopefully address these issues going forward. So far the first indications are that this is a much more responsive management structure.

Going forward from this project the main issues that need to be addressed in the short term are:

- Enacting both section 23 of the EEA and the Energy Efficiency Building Code and ensuring that the EEA is fit for purpose, so that the draft regulation can be brought forward for inclusion in the statute book.
- Capacity building of EMMO to run and manage the scheme.
- The setting up of a National registry and an EMMO customer database.
- Interim certification of the auditors and accreditation of the scheme.
- Capacity building of MSB and Mauritas to take over the certification and accreditation roles, respectively.
- Identification of a source of funding to pay for the audits – the cost for the 50 audits in the first year has been estimated to be a maximum of 7,500,000MUR and this will be year-on-year.
- Transfer of the website from BRE to the EMMO before the end of March 2012.

## Appendix A – EAMs training programme

### MAURITIUS BUILDINGS ENERGY AUDIT TRAINING PROGRAMME

**VENUE : LECTURE THEATRE, MITD HOUSE (EX-IVTB HOUSE), PHOENIX** 10<sup>th</sup> August 2011

<b>DAY 1</b>		<b>Presenter</b>
<b>08:30-09:00</b>	<b>Registration</b>	
<b>09:00-09:15</b>	Official Launching Ceremony	Dr The Hon. A. R. Beebeejaun, Deputy Prime Minister, Minister of Energy & Public Utilities
<b>09:15-10:00</b>	Introduction and overview of the Energy Management Scheme	Andy Lewry
<b>10:00-10:30</b>	Introduction and overview of the Mauritius Building Energy Audit Tool (MBEAT) <ul style="list-style-type: none"> <li>Demonstration of the Energy Management Audit software</li> </ul>	Andy Lewry & Shabir Hussain
<b>10:30-11:00</b>	Understanding the difference of Asset and operational ratings	Andy Lewry
<b>10:30-10:45</b>	<b>Coffee break</b>	
<b>10:45-11:15</b>	Introduction to the zoning rules	Shabir Hussain
<b>11:15-11:45</b>	Exercise: Case study to apply the zoning rules	Shabir Hussain
<b>11:45-12:15</b>	Introduction to Gathering details of envelope elements	Shabir Hussain
<b>12:15-1:00</b>	Exercise: Case study to gather envelope elements for each zone	Shabir Hussain
<b>1:00-2:00</b>	<b>Lunch</b>	
<b>2:00-3:00</b>	Introduction to the MBEAT software <ul style="list-style-type: none"> <li>basics, order of data entry and</li> <li>General form</li> <li>Project Database form</li> </ul> Exercise: Entering general and building fabric details (using Case Study )	Shabir Hussain
<b>3:00—3:15</b>	<b>Coffee break</b>	
<b>3:15-4:45</b>	Introduction to the MBEAT software <ul style="list-style-type: none"> <li>Geometry Form</li> </ul> Exercise: Entering the geometry of a building (using Case Study)	Shabir Hussain
<b>4:45-5:00</b>	Questions and close	

## MAURITIUS BUILDINGS ENERGY AUDIT TRAINING PROGRAMME

11<sup>th</sup> August 2011

<b>DAY 2</b>		<b>Presenter</b>
<b>9:00-10:00</b>	Presentation on Cooling and hot water systems, lighting options, exhaust and ventilation.	Andy Lewry
<b>10:00-10:45</b>	Exercise Building Services form and Renewables demo. Entering building services details using Case Study	Shabir Hussain
<b>10:45-11:15</b>	Ratings and Building Navigation form using Case study	Shabir Hussain
<b>11:15-11:30</b>	<b>Coffee break</b>	
<b>11:30-11:50</b>	Audit Trail and Demonstration	Andy Lewry
<b>11:50-12:10</b>	Recommendations report and Demonstration	Andy Lewry
<b>12:10-12:40</b>	Exercise: Produce rating and certificate using Case Study Exercise: Modify recommendations report using Case Study Exercise: Examine effect on ratings of adopting recommendations	Shabir Hussain
<b>12:40-1:00</b>	Accessing output files from outside MBEAT	Shabir Hussain
<b>1:00-2:00</b>	<b>Lunch</b>	
<b>2:00-2:30</b>	Exercise:- own working: Case Study 2 – zoning and gathering geometrical information	Shabir Hussain
<b>2:30-3:15</b>	Exercise:-own working: entering Case Study 2 into MBEAT software	Shabir Hussain
<b>3:15-3:30</b>	<b>Coffee break</b>	
<b>3:30-4:30</b>	Exercise: Exploring options with Case Study 2, produce rating, make recommendations, implement recommendations and record results.	Shabir Hussain
<b>4:30-4:45</b>	Questions and close	Team



## MAURITIUS BUILDINGS ENERGY AUDIT TRAINING PROGRAMME

12<sup>th</sup> August 2011

<b>DAY 3</b>		<b>Presenter</b>
<b>9:00-10:00</b>	Using the energy management quality questionnaire. Entering the management score into the MBEAT software	Shabir Hussain
<b>10:00-11:00</b>	Basic principles of energy management <ul style="list-style-type: none"> <li>• Why manage energy?</li> <li>• Energy management systems</li> </ul>	Shabir Hussain
<b>11:00-11:15</b>	<b>Coffee break</b>	
<b>11:15-1:00</b>	Basic principles of energy management (continued) <ul style="list-style-type: none"> <li>• Establishing the facts</li> <li>• Utility bills</li> <li>• Metering</li> </ul>	Andy Lewry
<b>1:00-2:00</b>	<b>Lunch break</b>	
<b>2:00-3:15</b>	Energy surveys / audits / walk-around	Andy Lewry
<b>3:15-3:30</b>	<b>Coffee break</b>	
<b>3:30-4:30</b>	Measuring and surveying techniques	Andy Lewry
<b>4:30-5:00</b>	Conventions consistency how to measure, walls, floors, door and window openings, roof heights and shading options	Shabir Hussain

## **MAURITIUS BUILDINGS ENERGY AUDIT TRAINING PROGRAMME**

**15<sup>th</sup> August 2011**

### **DAY 4 Morning session**

#### **GROUP 1**

#### **30 DELEGATES SPLIT INTO TWO GROUPS OF 15**

Group A taken around the building by Andy Lewry and a representative from MITD. Starting on the ground floor.

Group B taken around the building by Rayhan Osman and a representative from MITD. Starting on the second floor.

During the survey of the building each group will measure key areas on each floor and take important notes.

#### **Group 2**

#### **30 auditors will remain in the lecture theatre.**

Group 2 will measure and survey the lecture theatre to start with. They will be given floor plans of the ground floor and first floor of the MITD building in which they will need to zone the building and identify the envelope elements for each zone using the zoning and conventions rules. Shabir Hussain will be there to help and answer any questions.

### **DAY 4 Afternoon session**

#### **GROUP 2**

#### **30 DELEGATES SPLIT INTO TWO GROUPS OF 15**

Group A taken around the building by Andy Lewry and a representative from MITD. Starting on the ground floor.

Group B taken around the building by Rayhan Osman and a representative from MITD. Starting on the second floor.

During the survey of the building each group will measure key areas on each floor and take important notes.

#### **Group 1**

#### **30 auditors will remain in the lecture theatre.**

Group 1 will measure and survey the lecture theatre. They will be given floor plans of the ground floor and first floor of the MITD building in which they will need to zone the building and identify the envelope elements for each zone using the zoning and conventions rules. Shabir Hussain will be there to help and answer any questions.

## MAURITIUS BUILDINGS ENERGY AUDIT TRAINING PROGRAMME

16<sup>th</sup> August 2011

DAY 5		Presenter
9:00-10:00	Group discussion from the walk around survey of the MITD building, highlighting key points and issues.	Andy Lewry
10:00-11:15	Data entry of the MITD building	Shabir Hussain
11:15-11:30	Coffee break	
11:30-11:50	Continue data entry of MITD building	Shabir Hussain
1:00-1:45	Lunch	
1:45-3:15	Continue data entry of MITD building	Shabir Hussain
3:15-3:30	Coffee break	
3:30-4:00	<b>Exercise:</b> Exploring options with Case Study MITD building, produce EPC rating, make recommendations, implement recommendations and record results.	Shabir Hussain
4:00-5:00	Discussion and close	Team

## Appendix B – Workshop programme

### TRAINING PROGRAMME (Full Day) - TUESDAY 24<sup>th</sup> JANUARY 2012

<b>TRAINING TITLE</b>	<b>Energy Audit Certification Scheme for Non-Residential Buildings</b>
<b>TRAINING SUBJECTS</b>	<ul style="list-style-type: none"> <li>• Energy Audit Certification Scheme</li> <li>• Compliance Mechanism</li> <li>• Road Map for Accreditation to ISO 17024</li> <li>• Requirements for local Certification Body and local Accreditation Body</li> <li>• Interim Certification of Building Energy Auditors</li> <li>• Code of Conduct of Building Energy Auditors</li> <li>• Quality Plan and Quality Assurance Guide</li> </ul>
<b>PROGRAMME</b>	<p><b>Morning 8h30-12h00</b></p> <ul style="list-style-type: none"> <li>• Registration and Welcome</li> <li>• Presentation on an Overview of the Energy Audit Certification Scheme and Compliance Mechanism (Part I)</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea Break (10h15-10h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on an Overview of the Energy Audit Certification Scheme and Compliance Mechanism (Part II)</li> <li>• Q &amp; A session</li> </ul> <p><b>Lunch 12h00-13h00</b></p> <p><b>Afternoon 13h00-15h30</b></p> <ul style="list-style-type: none"> <li>• Presentation on a Road Map for Accreditation to ISO 17024</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea break (14h15-14h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on Code of Conduct of Building Energy Auditors, Quality Plan and Quality Assurance Guide</li> <li>• Q &amp; A session</li> </ul> <p><b>End 15h30</b></p>
<b>FACILITATOR</b>	<ul style="list-style-type: none"> <li>• Dr Andy Lewry – CChem, MRSC, CEng, MIMMM, CEnv Principal Consultant Building Research Establishment (BRE) Watford, U.K.</li> </ul>

**The programme was amended with an opening ceremony added- see below.**

## **PROGRAMME**

### **Official Launching Ceremony of Final Training Workshop on “Energy Audit Certification Scheme for Non-Residential Buildings in Mauritius”**

**Venue : La Cannelle, Domaine Les Pailles**

**Date : Tuesday, 24<sup>th</sup> January 2012**

*08.30 Registration of Participants*

*09.00 Welcome Address by Dr P. M. K. Soonarane, National Project  
Director, Deputy Director Technical Services, Ministry of Energy  
& Public Utilities*

*09.05 Address and Official Launching by Hon. Dr. A. R. Beebeejaun,  
Deputy Prime Minister, Minister of Energy & Public Utilities*

*09.15 Speech by Dr Andy Lewry, Principal Consultant, BRE*

*09.25  
End of Launching Ceremony*

*09.30 Refreshments*

**TRAINING PROGRAMME (Full Day) - WEDNESDAY 25<sup>th</sup> JANUARY 2012**

<b>TRAINING TITLE</b>	<b>Mauritius Building Energy Audit Tool (MBEAT) for Non-Residential Buildings</b>
<b>TRAINING SUBJECTS</b>	<ul style="list-style-type: none"> <li>• Overview of the Mauritius Building Energy Audit Tool</li> <li>• Building Energy Audit Manual</li> <li>• Case Study : Energy Audit of Mauritius Qualification Authority (MQA) Building</li> </ul>
<b>PROGRAMME</b>	<p><b>Morning 8h30-12h00</b></p> <ul style="list-style-type: none"> <li>• Registration and Welcome</li> <li>• Presentation on an overview of the Mauritius Building Energy Audit Tool (Part I)</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea Break (10h15-10h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on an overview of the Mauritius Building Energy Audit Tool (Part II)</li> <li>• Q &amp; A session</li> </ul> <p><b>Lunch 12h00-13h00</b></p> <p><b>Afternoon 13h00-15h30</b></p> <ul style="list-style-type: none"> <li>• Presentation on the Building Energy Audit Manual</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea break (14h15-14h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on a Case Study on Energy Audit of the Mauritius Qualification Authority (MQA) Building</li> <li>• Q &amp; A session</li> </ul> <p><b>End 15h30</b></p>
<b>FACILITATOR</b>	<ul style="list-style-type: none"> <li>• Dr Andy Lewry – CChem, MRSC, CEng, MIMMM, CEnv Principal Consultant Building Research Establishment (BRE) Watford, U.K.</li> </ul>

**TRAINING PROGRAMME (Full Day) - THURSDAY 26<sup>th</sup> JANUARY 2012**

<b>TRAINING TITLE</b>	<b>Energy Audit Certification Scheme for Non-Residential Buildings</b>
<b>TRAINING SUBJECTS</b>	<ul style="list-style-type: none"> <li>• Energy Audit Certification Scheme</li> <li>• Compliance Mechanism</li> <li>• Road Map for Accreditation to ISO 17024</li> <li>• Requirements for local Certification Body and local Accreditation Body</li> <li>• Interim Certification of Building Energy Auditors</li> <li>• Code of Conduct of Building Energy Auditors</li> <li>• Quality Plan and Quality Assurance Guide</li> </ul>
<b>PROGRAMME</b>	<p><b>Morning 8h30-12h00</b></p> <ul style="list-style-type: none"> <li>• Registration and Welcome</li> <li>• Presentation on an Overview of the Energy Audit Certification Scheme and Compliance Mechanism (Part I)</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea Break (10h15-10h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on an Overview of the Energy Audit Certification Scheme and Compliance Mechanism (Part II)</li> <li>• Q &amp; A session</li> </ul> <p><b>Lunch 12h00-13h00</b></p> <p><b>Afternoon 13h00-15h30</b></p> <ul style="list-style-type: none"> <li>• Presentation on a Road Map for Accreditation to ISO 17024</li> <li>• Q &amp; A session</li> </ul> <p><b>Tea break (14h15-14h45)</b></p> <ul style="list-style-type: none"> <li>• Presentation on Code of Conduct of Building Energy Auditors, Quality Plan and Quality Assurance Guide</li> <li>• Q &amp; A session</li> </ul> <p><b>End 15h30</b></p>
<b>FACILITATOR</b>	<ul style="list-style-type: none"> <li>• Dr Andy Lewry – CChem, MRSC, CEng, MIMMM, CEnv Principal Consultant Building Research Establishment (BRE) Watford, U.K.</li> </ul>

### TRAINING PROGRAMME (Half Day) - FRIDAY 27<sup>th</sup> JANUARY 2012

<b>TRAINING TITLE</b>	<b>Energy Audit Certification Scheme (Contingent Support Mechanism)</b>
<b>TRAINING SUBJECTS</b>	<ul style="list-style-type: none"> <li>• Brief Overview of Energy Audit Certification Scheme</li> <li>• Contingent Support Mechanism</li> <li>• Identification of Designated Consumers</li> <li>• Suggestions for future Government Interventions</li> </ul>
<b>PROGRAMME</b>	<p><b>08:30 – 09:00</b></p> <ul style="list-style-type: none"> <li>• Registration and Welcome</li> </ul> <p><b>09:00 – 10:15</b></p> <ul style="list-style-type: none"> <li>• Presentations on :               <ul style="list-style-type: none"> <li>(i) Brief Overview of the Energy Audit Certification Scheme</li> <li>(ii) Overview of the Contingent Support Mechanism (CSM)</li> </ul> </li> <li>• Q &amp; A session</li> </ul> <p><b>Tea Break (10h15-10h45)</b></p> <p><b>10:45 – 11:15</b></p> <ul style="list-style-type: none"> <li>• Presentation on Identification of Designated Consumers for mandatory building Energy Audits</li> <li>• Q &amp; A session</li> </ul> <p><b>11:15 – 12:00</b></p> <ul style="list-style-type: none"> <li>• Presentation on Suggestions for future Government Interventions</li> <li>• Q &amp; A session</li> </ul> <p><b>End 12:00</b></p>
<b>FACILITATOR</b>	<ul style="list-style-type: none"> <li>• Dr Andy Lewry – CChem, MRSC, CEng, MIMMM, CEnv Principal Consultant Building Research Establishment (BRE) Watford, U.K.</li> </ul>