Energy Audit Report

Energy Efficiency Study for SFA 2006 – St. Vincent and the Grenadines

National Archives

St Vincent

August 2010

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Contents

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Chapter 1 - Executive Summary

A walk-through energy audit[1] was conducted at the National Archives, Kingstown, St. Vincent, by Egis Bceom International, during the month of April 2010, as part of the Energy Efficiency Study for SFA 2006 – St. Vincent and the Grenadines.

This institution aims to provide the archived of the country, and the possibility to come and consult them. This activity occupies a two floors building in St Vincent.

A summary table of results of recommended energy conservation measures is shown below.

Significant parameter	*Value*
Electricity Reduction per Annum	*27,985 kWh*
Load saving	*25 kVA,*
Annual Cost Savings (EC$)[2]	*$.20,425*
Percent Energy Reduction[3]	*51 %*
Energy Measures Project Cost (EC$)[2]	*$.171,198*
Simple Payback Period	*8,4 years*

Principal electricity end uses in the facility are:

- Air conditioning for 67%
- Lighting for 17%.

Therefore, it is important that strict attention be paid to ensure operation and maintenance for optimum performance of the systems in use.

Based on the energy audit results, we recommend two types of the Energy efficiency (EE) measures to be implemented in order to reduce energy costs, and enhance occupant comfort:

1. "Low cost" EE measures with a payback period of less then one (1) year from energy and maintenance savings. These measures consist in adopting 'energy efficient' behaviours mainly by switching off lighting, computers when they are not in use, and air conditioning when space is not occupied.
2. EE measures with longer payback period and more significant investment cost

   These measures require some investment on critical consuming points, as replacing non-efficient equipments by new ones. In addition, we suggest a few measures to reduce the energy consumption by productive installations.

[1] It is important to note that the walk-through-audit aims at identifying general efficiency opportunities and does not provide extensive electrical measurements as a detailed or comprehensive energy audit. Hence, it is recommended that additional measurements and analysis be carried out before any major modification or retrofit.
[2] Exchange rate : 1 US$ = 2.70 EC$
[3] The Percent Energy Reduction is only based on the "Recommended Investment Package" which does not include the "Low cost" EE measure and the "Other Projects Under Consideration"

Chapter 2 - Facility Description and Findings

This National Archives aims to collect, classify, and store the archives of the State of St Vincent and the Grenadines. The activity includes also the scan of documents in microfilms, and the availability of consultation rooms for the public who is authorised to consult the documentation. This activity occupies a two floor building in a St Vincent.

Principal use:	classification and storage of document; consultation rooms for the public
Date of construction:	very new building, put in use in 2010
Area of occupied floors:	888m²
Air conditioned area:	888m²
Occupancy:	12 staff + public consultation
Number of rooms:	15 to 18 rooms, mainly storage rooms and offices

Daily hours in Building:

	From	*To*
Monday	8am	4pm
Tuesday	8am	4pm
Wednesday	8am	4pm
Thursday	8am	4pm
Friday	8am	4pm
Saturday	8am	4pm
Sunday	-	-

Premises occupy the 2 floors of a new building in Kingstown, not far from the grammar school. The last floor is directly under the roof, mainly pitched roof made of a wood frame and metal sheets, and partly flat roof with a concrete slab. Walls are in concrete or masonry; windows are single glazed, in aluminium; roof slab is in concrete.

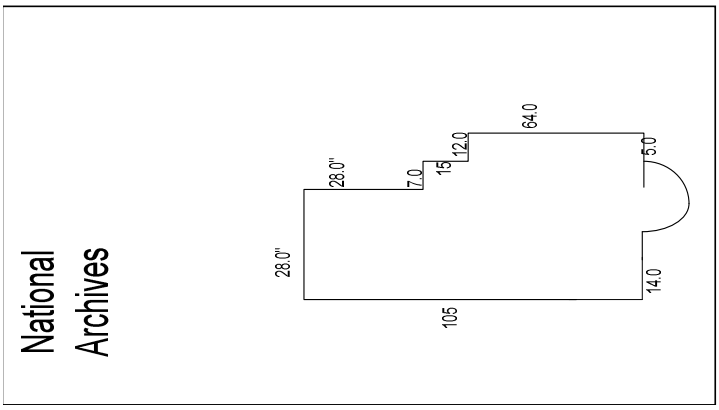

Figure 1: Foot print of National Archives

1. Analysis of consumption and load per end use

The breakdown of relative energy demand (kVA), consumption (kWh), and costs, of the electrical end uses are presented hereafter. Based on the energy audit, a breakdown of the annual electricity consumption has been reconstituted and is presented in Table 1 and Figure 2.

Table 1: Estimated Annual Electricity End Use

	Estimated		*Annual Cost*	
Description	*Installed (kVA)*	*Annual kWh*	*US$*	*EC$*
Lights	10	8 990	3 057	8 253
Electrical equipment	3	4 589	1 560	4 213
Computers	2	2 854	970	2 620
Refrigeration	0	577	196	529
Transformers	5	437	149	401
Air Conditioning	35	35 338	12 015	32 440
Total	**55**	**52 784**	**17 946**	**$48 455**

This diagram below reveals that air conditioning and lighting are the primary electrical end uses, with respectively 67 % and 17% of total annual electricity consumption.

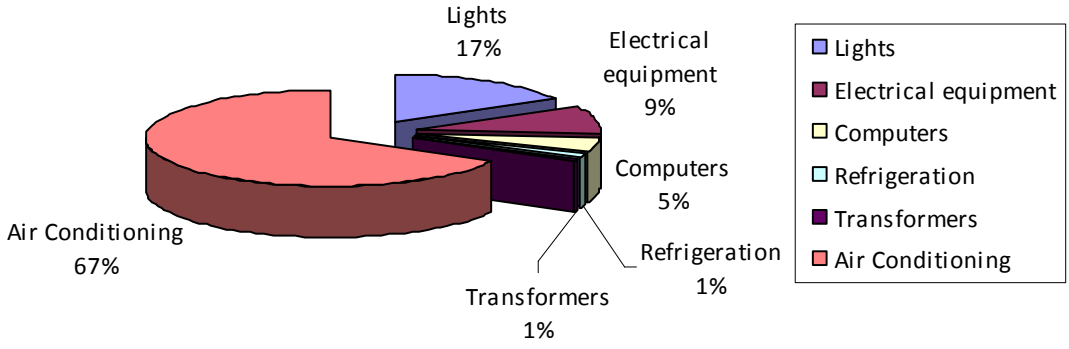

Figure 2: Breakdown of Estimated Electricity (kWh/year) End Use

Air conditioning consumption is proportionally high because:

- other uses of energy are quite small, and
- the second floor of the Archives' building is under a non insulated roof slab.

Therefore the air conditioning needs are increased with the solar radiation heating the last floor slabs.

2. Benchmark Analysis

Table 2 summarizes the historical energy consumption and indicates that the average monthly energy use compared to the recommended benchmark is higher than expected. This results in a consumption increase of 31% above the recommended benchmark. This clearly indicates that there is room for energy efficiency improvement, and effort should be made to implement the optimization measures recommended in this report.

Table 2: Electricity Use Summary and Benchmark

ENERGY USE SUMMARY			
ARCHIVES		Recommended Benchmark	Difference
Electricity (kWh/mth)	54,997	27,985	48%
Estimated kVA Demand	55	30	45%
Energy Index calculated (kWh/m²)	62	30	49%
Energy index billing (kWh/m²)	59	30	51%

Chapter 3 - Energy Efficiency Measures

1. Lights

We recommend replacing the existing fluorescent tubes (electro static ballasts) with new tubes equipped with electronic ballasts, having negligible losses. Capacity will be the same, new tube will be 32-Watts T-8 tubes equipped with electronic ballasts consuming 25% less.

Motion sensors will be installed in meeting room and few used space. Estimated saving: 5%

Saving with universal lighting control will be used to decrease the electricity consumption for lighting, in particular by scheduling all lighting lines. If required in the future, this system can be used for peak load reduction.

Figure 3: Fluorescent tubes and fixtures in the offices

2. Air Conditioning

Air conditioning is the largest energy end use. We recommend increasing space cooling thermostat settings to 25º C. The building is new, but the AC units are inefficient. They could be replaced with new ones rated at minimum energy efficiency ratio (EER) 13 or Coefficient of Performance (COP) of 3.7, whenever they will have to be replaced

The second option, recommended, is to install a Chiller, a condenser, on the roof and a air handling unit. We recommend this option which be implemented with a comment chiller with the next building which is also state owned.

3. Refrigeration

To optimize refrigeration system efficiency, we recommend that HCFC and HFC refrigerants should be replaced with Hydrocarbon (HC) Refrigerants.

4. Transformers

All the transformers should be removed and their resistive consumption will be saved. Their use is not necessary as the computers can be switched from 110 V to 230 V.

5. Roof Radiation

There is important radiation coming from the roof. We recommend installing appropriate roof insulation to decrease the sun radiation coming from the roof and reduce the use of air conditioning.

The insulation material will be laid down on the attic floor when pitched roof. For the concrete slab of the flat roof, it needs to take out the existing water proof roofing and to install the insulation material on the concrete slab before putting new roofing.

The simple payback of this EE measure is 3.4 years.

6. Renewable Energy Opportunities

The following measures have to be considered but are not recommended at this time, because of their long payback period.

1. Installation of solar photovoltaic (PV) lighting.	Not yet cost effective with an estimated payback period of 12 years. Energy efficiency improvements in lighting and air conditioning should first be applied to enable reducing the investment cost for PV installation. This should be reviewed based on PV price reduction.
2. Solar air conditioning with absorption chiller	This is technically viable. However the payback period is beyond the 4-year threshold. Presently this is approximately 11-years.

7. Energy Efficiency Measures with a Payback Period of less than 1 year

We recommend some immediate measures that would make a positive impact on the energy cost reduction effort, and enhance occupant comfort without major capital expense, with a payback period of less than one (1) year from energy and maintenance savings:

General

1. Reduce “phantom loads” by switching off all office equipment.

Lighting

2. Turn off the lights in all unoccupied offices and corridors.
3. Disassemble and clean all lighting diffusers.
4. Measure lighting intensity and reduce fluorescent tube quantity where practical.

Refrigeration

5. Retrofit all refrigeration unit compressors with high efficiency (Frigitech) lubricant if the cost is equal or less than US$50.00/hp/compressor.

6. De-scale evaporative cooled condensers utilizing specialized chemicals.

Air Conditioning

7. Service all split systems
8. Increase space cooling thermostat settings to 25º C
9. De-scale related evaporative cooled condensers utilizing specialized chemicals.
10. Replace the existing inefficient mini-split AC units with new ones rated at minimum energy efficiency ratio (EER) 13 or Coefficient of Performance (COP) of 3.7 whenever one unit has to be replaced.

8. Recommended Investment Package

The table 3 summarizes all the effective measures which require a payback period of more than one year. The first part, called "Recommended Investment Package", relates to the most effective measures. The second part, called "Other Projects Under Consideration" are a few optional suggestions.

Table 3: Summary of Recommended Energy Efficiency Measures (EEM) and Optional Energy Measures

#	EEM Description	Potential Savings			Project	Simple
		Energy	Demand	Cost	Cost	Pay back
		kWh-e	kVA	US$	US$	years
Air Conditioning						
1	Option 1- Change the compressor, condenser, air handling unit	7 853	8	3 098	40 450	13,1
2	Option 2- New Chiller and change condenser, air handling unit	11 779	12	4647	55 440	11,9
Building envelope						
3	Insulation of top roof - kWh-t	2 592	4	1 033	3 551	3,4
Lighting- Fluorescent						
4	Change fluo lamps, and electronic ballasts, motion sensors, new switch lines	4 763	4	1 847	4 366	2,4
Resistive						
5	Taking out the transformers	8736	5		0	0
Refrigeration						
6	Retrofit from R12 or R134a to HC	115	-	39	50	1,3
Total Recommended Investment Package:		**27 985**	**25**	**7 565**	**63 407**	**8,4**
Measures 2-3-4-5-6			**EC$**	**20 425**	**171 198**	

The figure below illustrates the potential effects on the energy use of the proposed with the "Total Recommended Investment Package" measures.

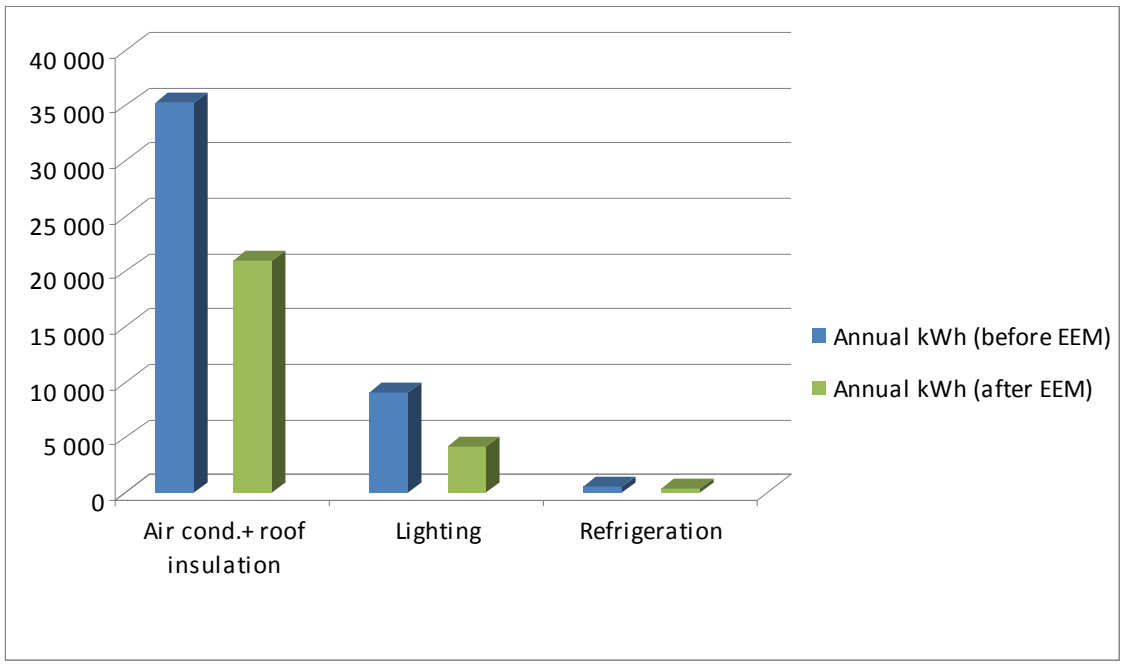

Figure 4: Potential Effects of Energy Optimization Projects