

TERMS OF REFERENCE (TOR)

BUILDING ENERGY PERFORMANCE BASELINES

Final version: July 5, 2016

1	INTRODUCTION	2
2	OFFER DEADLINE	2
3	PROPOSAL SUBMISSION	2
4	PROJECT INTRODUCTION	2
	USAID VIETNAM CLEAN ENERGY PROGRAM	2
	ENERGY EFFICIENCY PROMOTION IN THE BUILDING SECTOR.....	2
5	PURPOSE OF THE RESEARCH	3
6	DATA AVAILABILITY FOR THE WORK	3
6.1	BUILDING STOCK	3
6.2	DETAILED BUILDING SURVEYS	5
6.3	WEATHER DATA COLLECTION.....	8
7	METHODOLOGY OF RESEARCH	8
7.1	PRELIMINARY DATA ANALYSIS.....	8
7.2	MODEL DEVELOPMENT AND APPLICATION	9
7.3	REQUIRED ANALYSIS.....	9
8	THEMATIC WORKSHOP	11
9	EXPECTED RESULTS	11
9.1	ENERGY BASELINES.....	11
9.2	PROJECTIONS (ESTIMATES).....	11
9.3	POLICY RECOMMENDATIONS	12
10	DELIVERABLES.....	12
10.1	DELIVERABLE 1: ENERGY MODEL DEVELOPED AND WORKSHOP ORGANIZED	12
10.2	DELIVERABLE 2: COMPLETE STUDY	12
11	LEVEL OF EFFORT (LOE).....	13
12	CONSULTANT OR ORGANIZATION QUALIFICATIONS	13

1 INTRODUCTION

Winrock International is a nonprofit organization that works with people in the United States and around the world to empower the disadvantaged, increase economic opportunity, and sustain natural resources. Winrock manages over 100 projects in 73 countries. Headquartered in Arkansas, Winrock maintains a professional staff of 160 U.S.-based staff, 900 field-based staff and offices in 31 countries, including Bangladesh, Cambodia, Ethiopia, Liberia, Malawi, Nepal, Rwanda, South Sudan, Tanzania, Uganda, Zambia and Vietnam. Additional information about Winrock and its areas of interest are available through the external website: www.winrock.org

Winrock International (Winrock) is the implementer of the **USAID Vietnam Clean Energy Program (VCEP) - Energy Efficiency Promotion in the Building Sector Project** (*“the Project” or “the Program”*).

Winrock International is looking for a qualified Consultant or Subcontractor (*“Consultant”*) to carry out a research study on energy performance baselines of typical buildings in Vietnam.

2 OFFER DEADLINE

Proposals should be received no later than **17:00** of **July 18, 2016**.

Quotes should be valid for 90 days.

3 PROPOSAL SUBMISSION

Quantity:

- 1 printed English and 1 printed Vietnamese copies;
- 1 soft copy in Word or PDF format (signed & stamped), in a USB or CD/DVD

Proposals should be submitted to:

USAID Vietnam Clean Energy Program
Implemented by Winrock International
8thFloor, 193C3 Ba Trieu Str., HQ Building, Hanoi, Vietnam
Tel: (+84 4) 3974 3696
Fax: (+84 4) 3974 3695
Attention: Phong Han
thephongh@winrock.org - 0933668466

4 PROJECT INTRODUCTION

USAID Vietnam Clean Energy Program **Energy Efficiency Promotion in the Building Sector**

In recent decades, Vietnam has experienced robust economic growth from industrialization and urbanization, which has resulted in increased greenhouse gas (GHG) emissions. The Vietnam Clean Energy Program - Energy Efficiency Promotion in the Building Sector, by the United States Agency for International Development (USAID) supports the Government of Vietnam's (GVN) Building Sector's Green Growth Strategy and related action plan, which fit the U.S.

Government's framework for strengthening lower emission development strategies.

The project partners with the Ministry of Construction (MOC) to reduce electricity consumption in the country through improved energy efficiency in the building sector by implementing the Vietnam Energy Efficiency Building Code (VEEBC) and promoting a green building program.

5 PURPOSE OF THE RESEARCH

One of the specific objectives of the USAID Vietnam Clean Energy Program is to develop a comprehensive *National Database On Building Energy Performance* that may be used for decision-making, for trainings, and for energy simulation purposes.

The Program carried out detailed surveys and collected comprehensive data on 280 large buildings in 5 big cities of Vietnam, including the cities of Hanoi and Hai Phong (northern region), Da Nang (central region), and Ho Chi Minh and Can Tho (southern region) cities, representing the 3 typical climate zones of Vietnam.

The Program is planning to carry out detailed analyses of collected data in order to:

- Improve the availability of quantitative information of some selected building categories concerning energy consumption, energy use intensity, and greenhouse gas emissions.
- Support government authorities such as the MOC, provincial DOCs in policy making and management of buildings in the cities.
- Help public and private sector building owners and commercial real-estate management companies by providing clear data about current and projected energy intensity levels for Vietnam as whole, for the three climate regions, and for the building type categories analyzed.
- Provide useful data about current and projected energy use of buildings to practitioners (architects, engineers...), and researchers, faculty, and students at key Vietnamese universities that are concerned with building energy use.
- Supply useful information to other interested stakeholders.

6 DATA AVAILABILITY FOR THE WORK

6.1 Building stock

The Program has collaborated with the Departments of Constructions of 5 cities to identify almost all larger buildings (with Total Floor Area [TFA] equal to or greater than 2,500 m²) that have been constructed during the last 10 years. (Building stock).

The Program's Building Stock contains some **1,400 large buildings** of all categories and representative of 3 typical climate zones.

- Northern zone (Hanoi & Hai Phong cities): 490 buildings
- Central zone (Danang city): 316 buildings
- Southern zone (Ho Chi Minh and Can Tho cities): 623 buildings

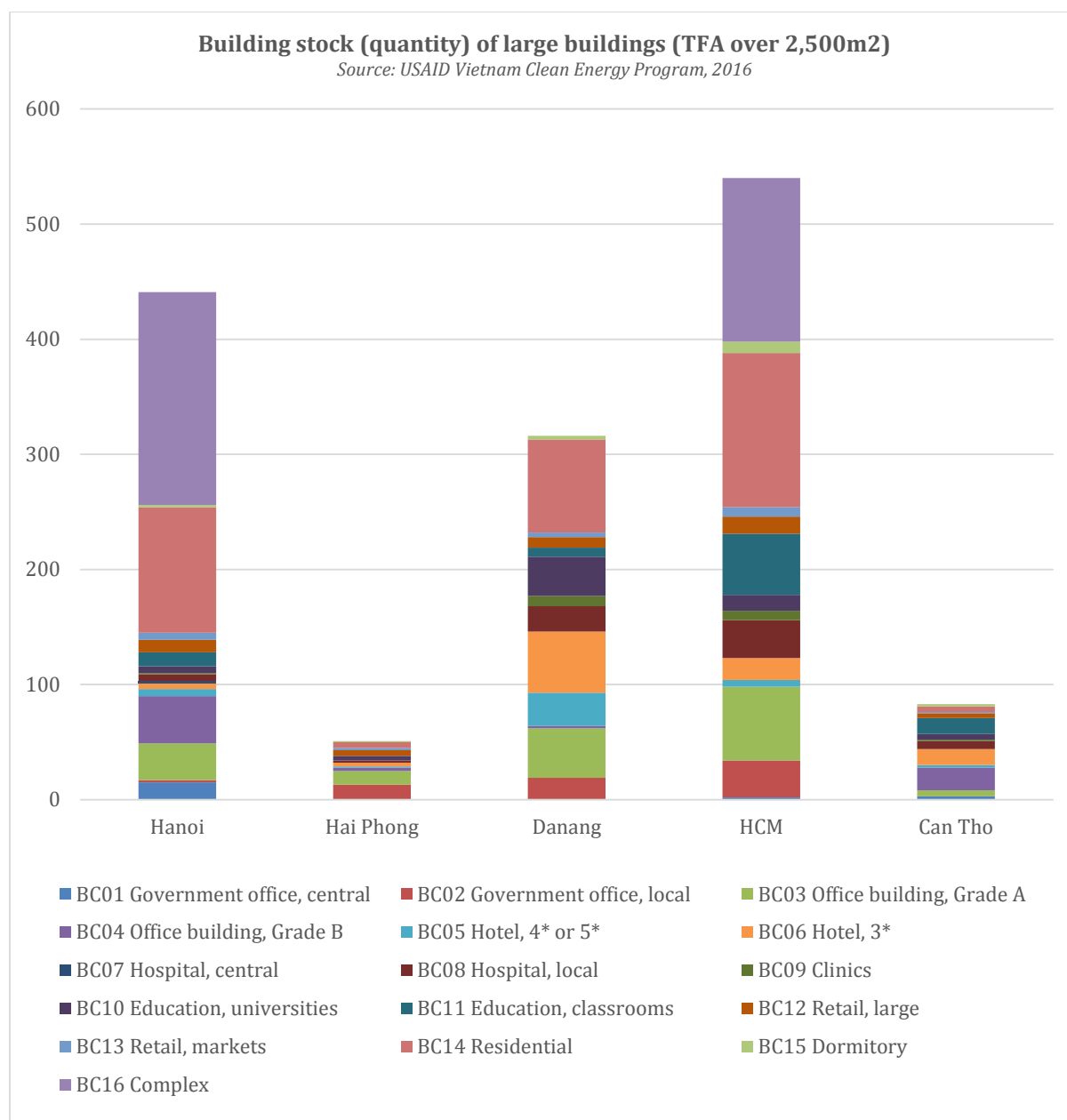
The stock data contains basic information for each building, including building type, location, year built, total floor area; many buildings contain extra information such as number of stories, number of lifts, type and size of electric generator etc. The data was categorized into 16 building types as follows:

- | | | | |
|--------|----------------------------|--------|-------------------------|
| ▪ BC01 | Government office, central | ▪ BC09 | Clinics |
| ▪ BC02 | Government office, local | ▪ BC10 | Education, universities |
| ▪ BC03 | Office building, Grade A | ▪ BC11 | Education, classrooms |
| ▪ BC04 | Office building, Grade B | ▪ BC12 | Retail, large |
| ▪ BC05 | Hotel, 4* or 5* | ▪ BC13 | Retail, markets |
| ▪ BC06 | Hotel, 3* | ▪ BC14 | Residential |
| ▪ BC07 | Hospital, central | ▪ BC15 | Dormitory |
| ▪ BC08 | Hospital, local | ▪ BC16 | Complex |
-

However, in the scope of this study, similar building types should be grouped. For example, grouping BC01 and BC02 into the “Administrative” category, grouping BC03 and BC04 into the “Office” category...

Details in the following sections.

Consultant will have access to full data of the above-mentioned 1,400 buildings for the purpose of this study.



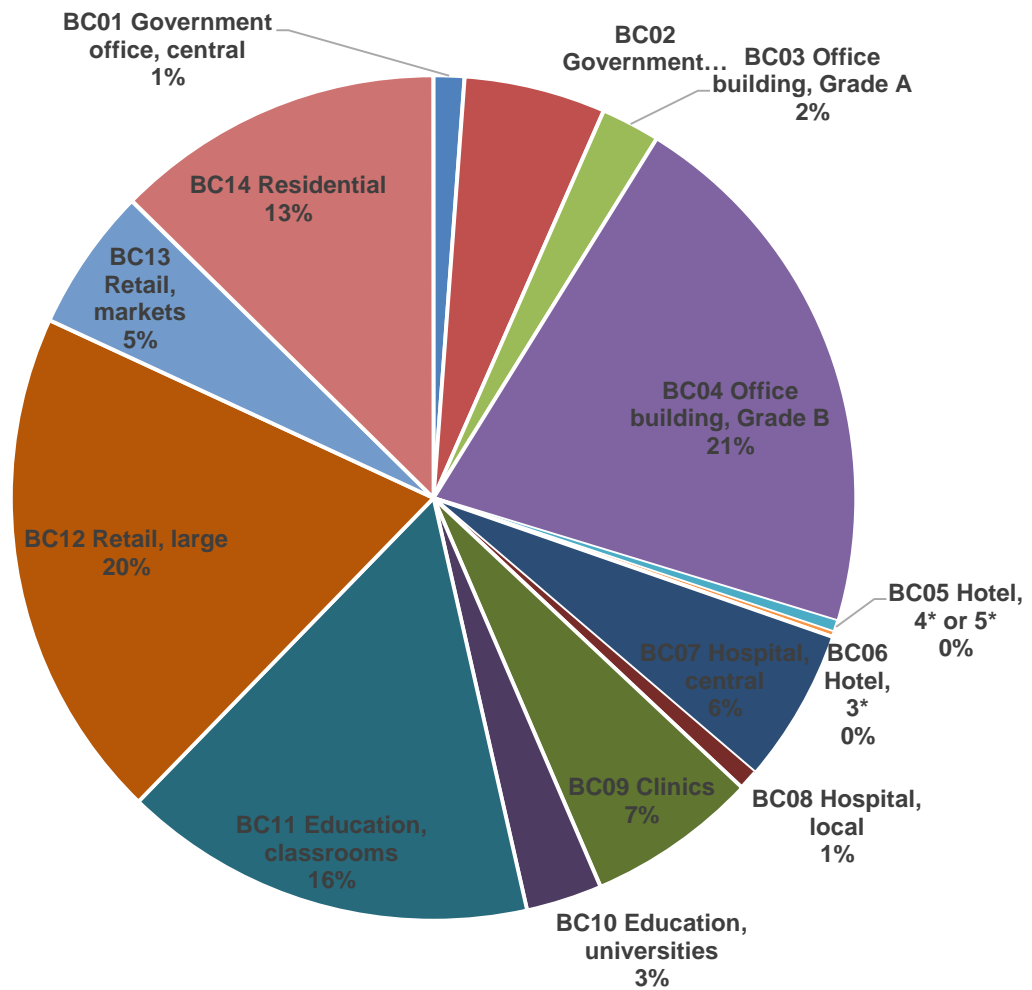
6.2 Detailed building surveys

The Program has also carried out detailed energy surveys of **280 buildings** in the above cities. The Program's approach has been to randomly select 280 sample buildings from our stock for detailed surveys. For each of the three climate regions, the sample set included at least 5 buildings in each of the building categories.

See attached VCEP Survey Template for more details of data to be collected through the surveys.

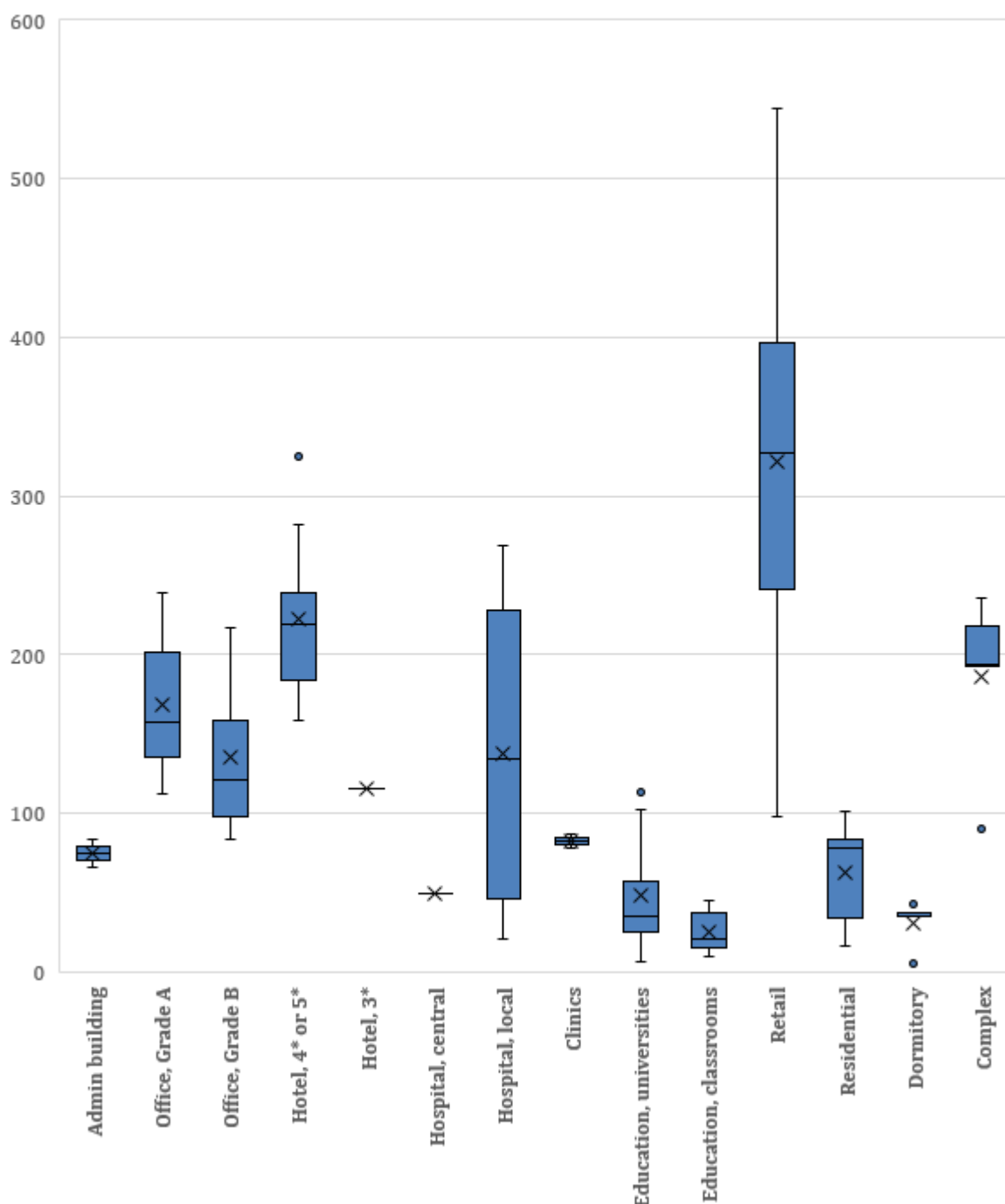
Surveyed Buildings by Total Floor Area 81 buildings in Ho Chi Minh city

Source: USAID Vietnam Clean Energy Program, 2016



Energy Use Intensities of surveyed buildings in HCMC (kWh/m2.year)

Source: USAID Vietnam Clean Energy Program, 2016



Some initial data analysis has been done by the Program team; the charts above give some overview and comparison of Energy Use Intensities (EUI) of surveyed buildings for the Southern Climate Region (represented by buildings in Ho Chi Minh and Can Tho cities). The Program has surveyed in total 100 buildings in this region, and each individual building category contains 3 to 5 samples.

The Consultant will have full access to detailed data of all 280 surveyed buildings, representative of 3 typical climate regions as defined by the Program.

6.3 Weather data collection

The Program team will supply Consultant with hour-by-hour weather data of the 3 climate regions studied.

- Northern: Hanoi & Hai Phong cities
- Central: Da Nang city
- Southern: Ho Chi Minh and Can Tho cities

Consultant will review the weather data and use this for this study.

7 METHODOLOGY OF RESEARCH

The Consultant must employ the following methodology and analyses:

7.1 Preliminary data analysis

The Consultant will analyze the Program's building stock and detailed survey data that the Program has collected. The Consultant will conduct the following analyses:

a) Select and categorize buildings into different types of groupings.

Under this study, we have used, and give priority to, the following building type categories:

- Government/Administrative (BC01+BC02)
- Commercial office buildings (BC03+BC04)
- Hotels (BC05+BC06)
- Universities and Schools (BC07+BC08)
- Hospitals and Clinics (BC09+BC10+BC11)
- Retails (BC12+BC13)
- Residential buildings (BC14)
- Complex buildings (BC16)

These building type categories should continue to be used by the consultant.

For each building type category, the consultant will analyze the distribution of:

1. Annual total energy use
2. Monthly total energy use:
3. Annual Energy Use Index (EUI), in kWh/m²-year
4. Annual Greenhouse Gas Emissions, tons of CO₂/m²-year

For each of the four analyses listed above, the analysis will separately consider results:

- For all 3 regions combined
- For each of the 3 climate regions separately

For each of the four analyses listed above, the analysis will also separately consider results:

- For gross building floor area.
- For gross building conditioned space.
- ...

b) Apply other **grouping methods for better analysis of data, such as:**

- Grouping of buildings by year-built periods: for example, before 2005 & after 2005
- Grouping of buildings by type of ownership
- Groups of buildings within at least some building type categories by, say:
 - Number of building stories
 - **By typical building envelopes**
 - **By standard Windows-to-Wall ratio (WWR)**
 - Quality of building services provided, e.g.:
 - **Ventilation/Fresh Air supply**
 - Occupied temperatures maintained
 - Presence of humidity control
 - Level or quality of lighting provided (lux, of W/m^2 of lighting)
 - Equipment installed (other than AC and Lighting).
- Etc.

c) Research additional data and do necessary data handling and compilation for the analyses required in this study.

Within their power and ability, the USAID Vietnam Clean Energy Program and the Ministry of Construction will support the Consultant in collecting additional information and data for this research.

7.2 Model development and application

Consultant will develop a representative **energy model** that predicts the **correlations** between the **energy consumption** of buildings and **multiple variables** including:

- Weather zone & seasons
- Outdoor temperature and humidity
- Building type
- Floor areas
- Etc.

Consultant will use several econometric techniques to identify the most suitable method for whole- building energy consumption modeling.

After having identified a suitable model, Consultant will test the selected model in order to confirm the reliability of the proposed model, by:

- Conducting regressions
- Conducting error analyses
- Predicting results

Especially, it is necessary to **compare the results** against other similar studies and independent researches done by different institutions.

7.3 Required analysis

7.3.1 Analysis of **architectural and energy building stock data**

Consultant will analyze the data made available under this study in order to:

a) Present data from some popular perspectives:

- By regions
- By building types (categories)
- By total floor areas
- By number of stories of buildings
- By types of HVAC/Lighting systems used
- Etc.

b) Forecast the following:

- Building stock
- Energy consumptions...

Include the assumptions being made.

7.3.2 Energy consumption data analysis

Consultant will carry out at least the following analysis of buildings' energy use:

a) Architectural features having impacts on buildings' energy performance

- Impacts of building envelopes' materials/structures on energy performance
- Impacts of building WWR on energy performance
- Impacts of building ventilation & fresh air supply systems on building energy performance and human comfort

b) Total Energy Consumption

- Total
- Fuel consumption
- Renewable energy generation/consumption

c) Energy End-use

- HVAC
- Lighting
- Equipment
- Water heating
- Other

d) Energy Use Intensities of different building types

- By building types
- Energy use intensities of whole building floor areas (EUI, kWh/m².year)
- Energy use intensities of Air-conditioned areas

e) Greenhouse Gas Emissions

- By building types
- Based on fuel sources
- Total emissions.

f) Other analyses that the Consultant thinks necessary and relevant.

8 THEMATIC WORKSHOP

Once the Consultant has developed an energy model and done the analyses as required in the Section 7, Ministry of Construction and USAID Vietnam Clean Energy Program will organize a thematic workshop in Hanoi (Tentative schedule: 9/2016).

The Program will be responsible for the organization, invitation and all other related logistics support for the workshop. Tentative invitees include experts in the construction and energy sector, consultants, government officials...

The Consultant will present and defend his/her methodology and analysis results in the workshop; and will collect comments in order to complete and improve the quality of the research.

9 EXPECTED RESULTS

Below are the results that the Consultant is expected to present for this study:

9.1 Energy baselines

Consultant will propose a detailed energy model for representing building data and related analyses as required in the Section 7:

- Current Building stock as represented by the data collected
- Trends through time
- Total energy consumptions
- Greenhouse gas emissions
- ...

The Model should characterize:

- The energy use intensities of different building types, and
- Variations of intensities within the building types studied.

9.2 Projections (estimates)

By using the proposed model and analyses, the Consultant will give and present the following projections (estimates):

The analyses' results must be presented graphically with necessary details.

- a) Energy consumption (by building types, through time...)
 - b) Greenhouse gas emissions (by building types, through time...)
 - c) Different scenarios:
 - Business as Usual
 - Meeting Vietnam Building Energy Efficiency Code, with no increase in stringency in the future.
-

- Meeting Vietnam Building Energy Efficiency Code, with a 5% increase in stringency from the previous version each 5 years.
- Low Green Buildings scenario assuming 5% of newly constructed large buildings are GB certified.
- High Green Buildings scenario assuming 20% of newly constructed large buildings are GB certified.
- Assumptions about transfer of future energy policies to small buildings, in addition to the large one. (Note: in the US, at least 80 percent of buildings are less than 2,000 m2).

d) The projections should be given for the periods up to 2030 & 2050.

9.3 Policy recommendations

The study will recommend, to the government of Vietnam, at both national and major city levels, how to:

- Improve data sharing between stakeholders
- Improve data control and management
- Develop/Improve policy recommendations to curb or reduce energy consumptions and greenhouse gas emissions of the building sector.
- Achievable targets in terms of energy efficiency and greenhouse gas emission reduction.

10 DELIVERABLES

10.1 Deliverable 1: Energy model developed and Workshop organized

This Deliverable include:

(1) 01 soft copy and 06 hard copies of a **Research Outline**, containing at least the following information:

- Methodology of research
- Data processing results
- Proposed Energy Baseline Model
- Analyses as required in the Section 7

Requirement:

- Deliverable must be presented in both English and Vietnamese (English version is separated from Vietnamese version).
- Soft copy must be submitted in both Word and PDF formats, together with all related files (in Excel or other suitable formats) used for data analyses and modelling work; including detailed formulas, calculations, inputs, charts, and other outputs.

(2) 01 soft copy and 02 hard copies of the **Workshop Materials** that the Consultant use for presentation in the workshop as mentioned in the Section 8.

10.2 Deliverable 2: Complete Study

This Deliverable include:

- (1) 01 soft copy and 06 hard copies of a **Complete Study**, containing all information and analyses required in this TOR.

Requirement:

- Deliverable must be presented in both English and Vietnamese (English version is separated from Vietnamese version).
- Soft copy must be submitted in both Word and PDF formats, together with all related files (in Excel or other suitable formats) used for data analyses and modelling work; including detailed formulas, calculations, inputs, charts, and other outputs.

11 LEVEL OF EFFORT (LOE)

The total LOE for the activities under this TOR is **90 days** to be used to complete all activities and deliverables no later than **November 30, 2016**

12 CONSULTANT or Organization QUALIFICATIONS

- Consultant can be an individual expert or an organization. All organizations must have the proper Vietnamese business registration and license.
- M must be able to demonstrate substantial experience in working on similar energy efficiency projects and, in particular, to demonstrate past experience in working with organizations similar to Winrock or with interests in international, environmental, or economic development is a plus.
- Must have at least 15 years of experience working in collecting and processing data related to building energy.
- Must have at least 10 years of experience working in the Construction sector in the Vietnamese context.
- Must demonstrate this capacity to perform energy modeling work, having appropriate training and experience. Consultant must submit the following documents together with the Cost Proposal:
 - A CV that briefly outlines overall technical capacity and experience in energy modelling, building energy modelling.
 - A summary that outlines three recent building performance modelling projects worked on; the project description should include modelling scope, methodology, and software.
- Must have excellent communication skills and methods, and be able to communicate very clearly at every step of development, both providing information to the Winrock team as well as requesting, understanding and closely following guidance from the Winrock team.

- Must have good level of English, must be able to speak the language with sufficient structural accuracy and vocabulary to participate effectively in most formal and informal conversations on practical, social, and professional topics; must be able to read within a normal range of speed and with almost complete comprehension of a variety of authentic prose material on unfamiliar subjects.
-