

Proposed SMART Management System for BEEO Execution and Operations – “SMART 610”

In response to

EMSD E&M InnoPortal Submission – I&T Wish List

Energy Analytics for Buildings in Hong Kong

Submitted by: **Building Energy Analytics Co. Limited**
(A Carbon Exchange (Hong Kong) Limited company)

Prepared by: **Ir Tony HO**
Tel.: 92797353/ 34210027
Email: tony.ho@buildingenergy.hk
Website: www.buildingenergy.hk

Date: March 2019

Proposal Ref. no. : BEA-181010-001

1.0 COMPANY EXPERTISE AND RELEVANT AREAS OF BUSINESS

Building Energy Analytics Company Limited (BEA) was founded in Hong Kong since July 2013, is a local professional energy management consulting company. BEA is the energy consultancy arm of Carbon Exchange (Hong Kong) Limited (CEX). CEX was established by team and alliance of local professional engineers, environmental research professional, energy management specialist, technologies providers, environmental modelling specialist, project management professional and data analytics specialist in Hong Kong since 2010. Basing in Hong Kong Science and Technology Park since our establishment, we have been focusing on works and professional development for mitigating environmental problems, energy data analytics and research and development projects for Hong Kong.

As a local Hong Kong company, we pioneer in providing one-stop energy management total quality services in Hong Kong. BEA team members offer high-level expertise in energy efficiency and savings consultancy and solutions for clients from various industries.

BEA's professional team comprises REA, energy management experts, academics, software professional, IoT expert, data analyzers and building engineers. Since the Building Energy Efficiency Ordinance (BEEO) was launched, our founded members considered it a valuable opportunity to echo the movement of the Hong Kong Government and society in the expectation on further promoting energy efficiency for buildings. We established the company in response to the developing energy policies of Hong Kong.

After 5 years of diligent and evolution, we have gone through an unequal path, overcome various challenges and is facing various new opportunities in the energy professional circles both locally and in the other places of the world. One of our strengths is to integrate different professional sectors to deliver creative solutions to the clients by means of solid expertise resources networks.

Our members have practiced in the local market for over 28 years. Serving both commercial and government sectors in energy management projects covering hotel projects, shopping malls, office buildings, non-profit making institutes, residential buildings, education institutions, infrastructural development in Hong Kong and China.

We have carried out over 600 numbers of building energy audit and FOC/COCR projects since we founded the company. We are also experienced in ISO50001 energy management consultancy services and other international energy management compliance programmes.

Currently, BEA is providing comprehensive energy management services for real estate and property development industry. Our scope of services cover energy audit, environmental technical assessment services, energy retrofit consultancy, building energy efficiency statutory compliance, ISO50001 energy management system consultancy, M&V planning and implementation, green procurement management, green financing planning, environmental reporting, carbon audit and management, and various energy and carbon corporate training services.

2.0 UNDERSTANDING OF THE PROJECT

2.1 Background

The Building Energy Efficiency Ordinance (BEEO) launched in September 2012 has become the biggest and most influential driver promoting building energy efficiency for Hong Kong. The efforts made by EEO in executing and operating the statutory frameworks is well recognized by the society while supports by the building sector are proven by referring to the increasing amount of energy efficiency compliance submissions by REAs. The Ordinance covers almost any kinds of building premises and venues and its effectiveness is continuously monitored by Energy Efficiency Office (EEO) of EMSD. The EEO can analyze the data in the compliance submissions and monitors the progress of the society to achieve the 40% energy intensity reduction target by 2025 in the Energy Saving Plan For Hong Kong's Built Environment 2015~2025+. The data are also subjected to the Smart Government initiative in the Hong Kong Smart City Blueprint in 2017 and should be organized for analytics and potentially opened to the public after removing of sensitive information.

After several years of execution, there are increasing needs for enhancing the operation efficiency and practices of daily execution of information management of BEEO. In addition, the data collected via huge amount of paper submission in COCRs, FOCs and Energy Audits based on various Codes of Practices (COPs) and Technical Guidelines (TGs) shall be handled with a more effectively or SMARTly in order to avoid losing important energy data and information for following up works e.g. analysis or even analytics works. It is considered critical to develop insights through analyzing the collected energy data for continual enhancing the context of BEEO and its executions to meet the 40% energy intensity reduction target. The old and upcoming submissions should also be organized digitally to support the Smart Government initiative. It is also believed that the collected data base shall be formed as a foundation of future energy policy roadmap of Hong Kong.

2.2 Objectives of the Project

The key issues identified and revealed after examining the project scopes and preliminary information on I&T InnoPortal are presented as follows:

1. Minimize hardcopy submission and facilitate web base submission
2. Storing submissions of different years in an analytics-friendly manner
3. Quantitative – ease and guidance of data input to reduce the data input progress and to avoid incorrect submission entries
4. Qualitative Analysis - dashboard is provided for monitoring the applicant submission
5. Facilitate the approval process automation by workflow engine
6. Provide approval status monitoring for BEEO team, REA and Property Owner
7. Allow BEEO team officers to visualize data trends in BEEO submission interactively to understand the society through data
8. Develop Artificial-Intelligence (AI)-based analytics engine on BEEO submission data for effectiveness of BEEO in reducing building energy use and to make energy efficiency policies based on smart government technology
9. Report findings from analytics on BEEO submission data automatically

10. Create base building models from BEEO submission analytic results for testing effects of new energy saving technologies on building energy use in Hong Kong
11. Major user of the web base submission system - REA, Property Owners/Responsible Officers and BEEO team officers
12. Major user of other systems - BEEO team officers

2.3 Scope of Works

The scope of works of the project is detailed as follows:

1. Design and develop Web Form Portal for the BEEO submission (include COCR, FOC and Energy Audit). The platform shall also allow the extension for future version/revision of BEC & EAC code.
2. Database setup for data storage and data analysis
3. Bi-directional communication platform on application status (e.g. submission received, in progress, completed, rejected, etc.) for each case.
4. Integration with existing Data Management System (DMS) platform
5. Design and develop an interactive data visualization application on BEEO submission database, government open data and maps
6. Design and develop a data analytics engine on BEEO submission data in the database
7. Design and develop a data visualization application based on the data analytics result, government open data and maps
8. Design and develop an automatic report generator on analytics result from the BEEO submission data
9. Create base building energy models for major types of buildings identified through building energy analytics on the BEEO submission data

3.0 Deliverables

Part 1 – Setting up of BEEO Web Portal and Pre-Launch of BEEO Web Portal

1. Platform Setup – BEEO Web Form Portal and BEEO Approval Platforms delivery
2. EE1 and EE-SU web forms delivery (years 2012/2015/2018)
3. EE1 and EE-SU approval workflow design
4. Hardware installation and IT security audit
5. REA Database migration so that existing REA users can access the on-line portal
6. Building Information migration from existing DMS to on-line portal
7. EE2 & EE4 and All Technical web forms delivery (years 2012/2015/2018)
8. Mail merge function or auto reply function for BEEO standard document issuing (e.g. minute, certificate, approval letter ... etc.)
9. BEEO forms approval workflow design
10. Platform launch to public

Part 2 – Development and Launch of Data Visualization Platform, Data Analytics Platform, Engine, Report Generator and Base Building Models

1. Develop a web-based interactive data visualization platform based on the

- database design, other government open data and maps
2. Platform launch to the BEEO team officers
 3. Design KPIs and performance metrics of technologies and other factors based on BEEO submission forms
 4. Develop a building energy analytics engine based on AI technologies
 5. Design a visualization platform for the analytic results
 6. Develop an automatic report generator based on the analytic engine and the report template on the platform
 7. Platform, engine and report generator launched to the BEEO team officers
 8. Design base building energy models based on analytic result of major Hong Kong buildings from the Data Analytics Platform and Engine
 9. Design a manual to use the base building energy models for testing effects of energy policies to building energy use in Hong Kong

3.0 Our Offers

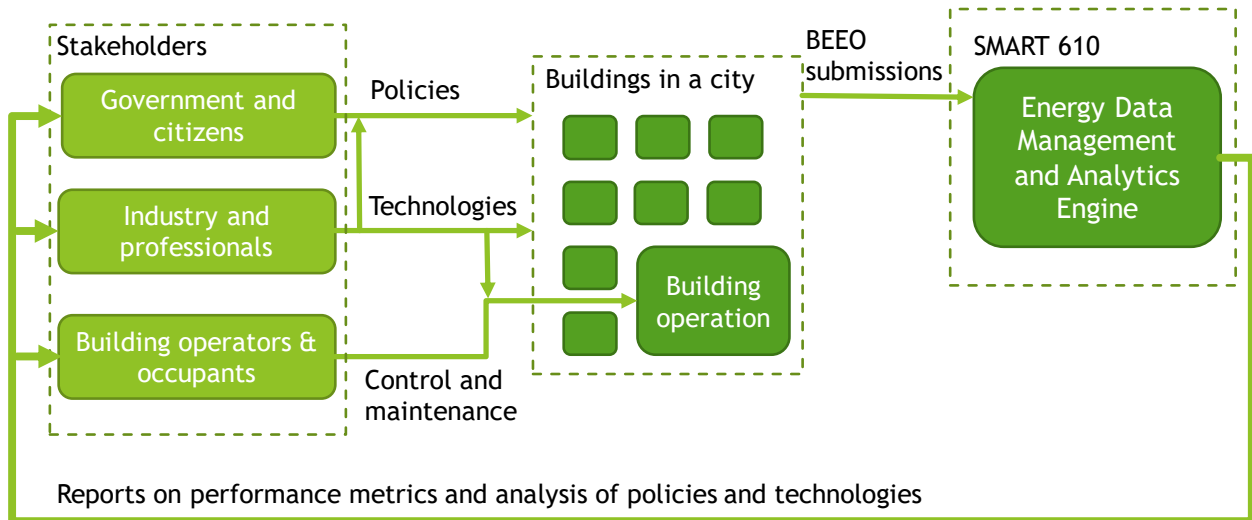
A Smart Management System for BEEO Execution and Operations (hereinafter called “SMART 610”) is proposed. The system shall make use of a web-based platform in the format of a web-portal that can automatically manage and digitize the complete processes of BEEO related statutory submissions, provide an interactive platform to analyze and extract analytic results on BEEO submission data and to obtain representative building models to assess the effects of energy policies on building energy use in Hong Kong. SMART 610 can organize numerous and inconsistent data entries to facilitate analysis of the submissions. It can minimize current paper submission which contributes to eco-barrier of the BEEO. It can assist EEO team members’ analysis on the BEEO submission data. It can analyze the effect of existing technologies on energy use of different types of buildings in Hong Kong. It can provide tools to further predict effects of new technologies on building energy use.

In the front end of the web portal, “SMART 610” can support on improving efficiency of the execution of the BEEO. The features shall include users’ login, registration for submission of premises/buildings, job-base REA employment registration, energy forms filling, auto-reply on FAQs, submission progress monitoring, notification of important messages (including submission deadlines and comments by EEO), building information changes management, etc.

On the backstage, EEO can administrate the database effectively. Features for data analysis, mining, or even data analytics could be made possible with fast and robust software programming algorithms. The data visualization features allow EEO to conduct simple analysis and understands AI-based analytic solutions on BEEO submission results in different years. The data processing feature can help producing reports in various format for review by different stakeholder who may be interested in submission quality management, energy performance review, various KPIs and benchmarking governance, policy target setting, statistical analytics, BEC review, etc. The building model feature allows EEO to predict the effect of new technologies and policies on building energy use and to choose what technologies are needed to meet the 40% energy intensity reduction target by 2025.

Further data analytics to the collected data will be carried out based upon various algorithm and targets of study. It is proposed that the data shall be serving the benefits of short term promotion of BEEO and improving the long term policy efficiency. The analytic

result shall be considered a direction of local city base energy footprint and is expected to be a reference for determining the energy policy road map in the coming future in responding to the government climate policies. The resultant flowchart for the operation of SMART 610 to all stakeholders of building energy efficiency issues in Hong Kong is summarized below.



3.1 Details of Works Proposed

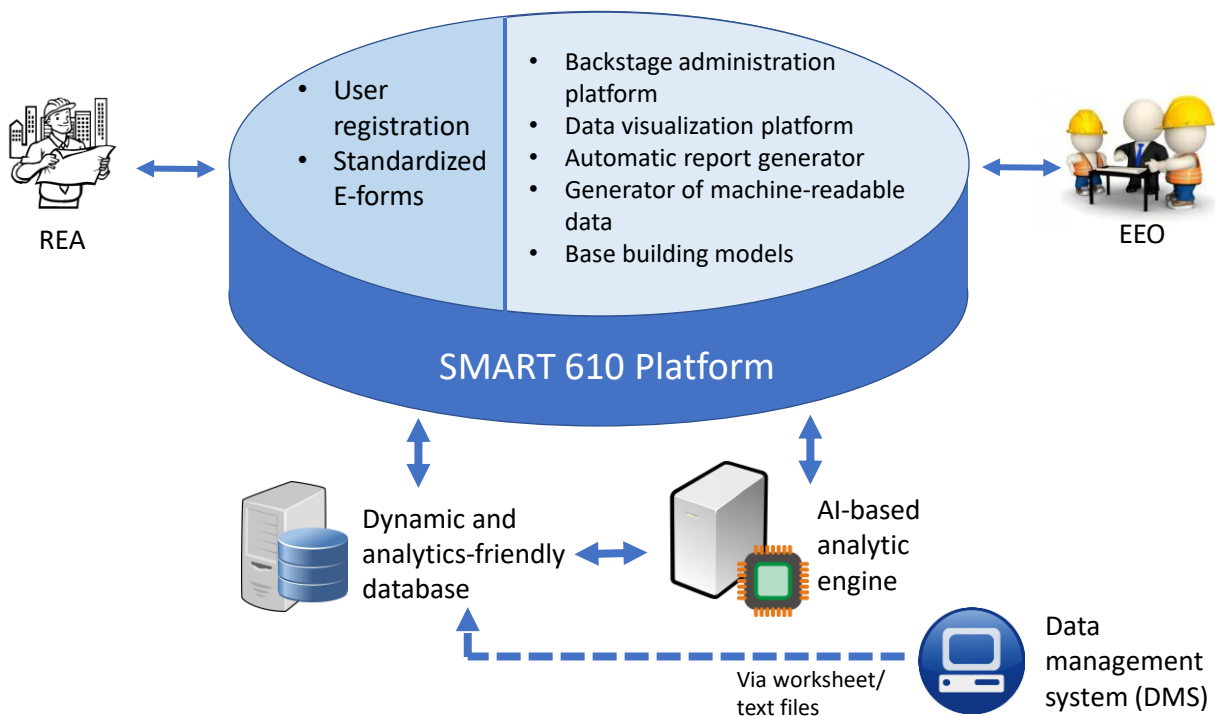
The “SMART 610” platform shall be created in five (9) parts. The platform shall be established with features below:

1. User registration – registration for project, employed REA, preliminary project information, etc.
2. Form submission standardization – The current EE form in editable PDF format shall be reviewed to increase contents with standardized entries for effective data and information management
3. E-Forms – Create online form-filling feature for users so that the logistic and submission efficiency of project stakeholders can be increased
4. Backstage administration platform – management submission registration and progresses. Data mining and management, statistical reporting and trending tracking. Performance benchmarking and KPIs setting.
5. Connection to a dynamic and analytics-friendly database – Connect to a dynamic database that is structured to allow submissions of different nature (e.g. following different years of guidelines) to be stored and allow statistical analysis or even analytics on the data
6. Connection to an AI-based analytic engine – Conduct analytics on the database of BEEO submissions to compute KPIs designed to measure the effectiveness of the existing technologies to reduce energy intensity in different types of buildings
7. Connection to an interactive visualization platform – Users can make plots on the

data stored in the database interactively to conduct their own analysis using plotting and visualization techniques.

8. Automatic report generator – Automatically generate reports on the visualization of analytics results to facilitate analysis on the effectiveness of technologies to reduce building energy use
9. Base building models – Model the energy use of buildings based on the analytics result on the categorization of common building types in Hong Kong. They can be used to test the effects of new technologies on the building energy use in Hong Kong.

The interactions between the features can be illustrated by the following diagram.



In addition to the above features, “SMART 610” shall integrate with existing Data Management System (DMS) platform. We can make data interchange via Excel Table or standard Text File Format for data migration.

3.2 Server and Database

1. Domain Registration

It is proposed that SMART 610 Web Portal shall be registered under EMSD domain. A fixed IP for SMART 610 Web Portal shall be provided by EMSD and domain registered by the government accordingly.

URL suggested: <https://www.SMART610.emsd.gov.hk>

2. Server Location

It is proposed that the SMART 610 Web Portal Server shall be located at data centre of EMSD and under the same system of network security protection.

3. Server Configuration

Rack mount Server with O/S Windows Server 2012 R2 Standard is proposed. Server Configuration shall be equipped with at least two cores, 32GB RAM and 2TB Hard Disk storage. It is suggested the maintenance of hardware be included in current EEO regular IT maintenance package.

The proposed Server for both operation and backup shall be Dell PowerEdge R530 or R730.

4. Database Model

Microsoft SQL Server 2016 Standard Edition with 5 User Licenses are proposed for the initial stage.

5. Software for AI-based Engine Development

5 User Licenses for Anaconda Distribution 3 for the machine learning engine and Docker Enterprise for application deployment are proposed for the initial stage.

6. Other Software installed

Anti-Virus Software and Microsoft Office Standard Edition while 1 User License is proposed.

7. Data Backup Solution

Daily backup of database shall be provided for the web portal system. In addition to the provision of hard disk to the web portal system, it is suggested that the existing backup hard disk of EMSD shall be utilized for the backup of the BEEO Portal to align with current IT quality management standard.