ON-LINE ENERGY-USE BENCHMARKING SYSTEM FOR INDUSTRIES IN MALAYSIA

By

KAMALA ERNEST

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Partial Fulfilment of the Requirements for the Degree of Master of Science

February 2004

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

ON-LINE ENERGY-USE BENCHMARKING FOR INDUSTRIES IN MALAYSIA

By

KAMALA ERNEST

February 2004

Chairman: Syed Abdul Rahman Al-Haddad

Faculty: Engineering

The study is intended to explore the viability of developing a web-based tool to facilitate a holistic approach to energy-use benchmarking management in the Malaysian Industrial sector. Energy-use benchmarking uses the measure of the plant's specific energy consumption to assess its energy performance, which latter can be used as a baseline for future energy efficiency and energy conservation activities. The measures can also be used to chart out future energy policies related to the development of national energy sector.

The system developed is a migration of the manual data collection system which has limitations to the number of companies that can use the same. The energy-use benchmarking community which is customarily known as the Industrial Energy Efficiency Community (IEEC) was created as part of the National Productivity Corporation's (NPC) Benchmarking On-line Networking Database (BOND). Currently, the community has a membership of industries from eight energy intensive sectors in Malaysia, and this will be extended to the entire industrial sectors in stages.

Among others, the on-line tool developed can perform automatic statistical analysis in computing energy-use benchmarks, evaluating performance of the community, and ranking companies' performance according to selected indicators.

In order to evaluate the usability of the system, a sample of four companies from the wood sector were selected. A survey conducted among the selected factories on the usability of the system showed 83 % favorable. However, there are still opportunities available for enhancement of the tool for better usability that can result in more competitive benchmarking analysis. Further descriptive statistics can be derived from the collected and analyzed data. Analysis shows that there is a performance gap of 59 % among the selected sample companies, which can work together to close this gap through end-use energy efficiency.

Through daily monitoring and setting targets for determining slack in energy performance and improving end-use energy efficiency respectively, the participating industries can arrest not only fast depletion of fossil fuel reserves but also the negative impact to the environment due to the excessive emission of greenhouse gasses (GHG).

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

SISTEM PANGKALAN DATA SECARA ON-LINE UNTUK TANDA ARAS PENGGUNAAN TENAGA DI SEKTOR PENGELUARAN DI MALAYSIA

Oleh

KAMALA ERNEST

Februari 2004

Pengerusi : Syed Abdul Rahman Al-Haddad

Fakulti : Kejuruteraan

Kajian mencadangkan satu aplikasi pengkomputeran antara manusia dengan komputer dibangunkan untuk memudahkan aktiviti tanda aras penggunaan tenaga di kalangan industri di Malaysia. Tanda aras penggunaan tenaga megukur tahap penggunaan tenaga secara spesifik terhadap produk yang dikeluarkan. Ini merupakan salah satu cara untuk mengetahui tahap penggunaan tenaga bagi sesebuah industri dan informasi ini boleh dijadikan rujukan pada masa depan mengambil kira faktor kecekapan dan penggunaan tenaga.

Sistem yang dibangunkan ini merupakan peralihan daripada sistem pengumpulan data dijalankan secara manual dan penggunaannya amat terhad untuk sesetengah industri sahaja. Oleh itu, sebuah komuniti – Kecekapan Tenaga Sektor Pengeluaran ditubuhkan , sebagai sebuah badan atau komuniti kepada “rangkaian pangkalan data benchmarking” secara on-line menerusi Internet di Perbadanan Produktivit Negara. Pada masa kini, komuniti ini terdiri daripada 8 sektor yang terlibat secara langsung di Malaysia dan pada masa depan ianya akan merangkumi ke seluruh sektor pengeluaran yang lain.

Sistem yang disediakan di Internet ini adalah percuma. Ianya boleh digunakan untuk mengira analisis statistik dengan cepat. Contohnya : pengiraan penggunaan tenaga benchmark, menilai prestasi komuniti atau sektor yang terlibat, dan tahap/pencapaian industri berdasarkan tanda aras.

Dalam menilai tahap penggunaan sistem aplikasi yang dibangunkan ini, satu kajian ke atas satu sub-kelompok komuniti yang terdiri daripada 4 buah industri dari sektor perkayuan, telah dijalankan. Daripada hasil kajian, tahap penggunaan ke atas sistem aplikasi yang diperolehi amat menggalakkan iaitu 83%.

Daripada kajian yang dijalankan, analisis dan keputusan yang diperolehi juga berdasarkan daripada data yang dikumpul melalui 4 buah industri yang dinyatakan. Kajian menunjukkan terdapat jurang perbezaan yang besar di kalangan rakan kongsi activiti tanda aras peggunaan tenaga iaitu 59%. Ini menunjukkan potensi yang besar bagi penjimatan tenaga.

Sebagai satu proses yang berterusan, satu model perancangan berterusan telah diperkenalkan untuk memastikan dan menggalakkan penggunaan tanda aras penggunaan sebagai satu alat/kaedah untuk mempromosikan kecekapan tenaga dalam sektor industri.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincere gratitude and appreciation to the chairman of my supervisory committee, Tn Syed Abdul Rahman, Department of Computer and Communications Engineering UPM for his guidance, assistance and supervision of this thesis study.

My appreciation to my industrial supervisor, Mr. R. Ponudurai, Chief Technical Advisor of the Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) for his guidance, motivation and strong dedication to see that the study attains a highly practical value for future reference.

I would like to acknowledge the Malaysia Energy Centre for supporting the research and providing me with a study grant.

I would also like to thank the National Productivity Corporation for the excellent collaboration given in enhancing my research work as an online interactive activity for the future.

I also wish to convey my heartfelt gratitude to, Mr. Ramvir Sharma, Manager for Energy Efficiency Technology Demonstration Programme of MIEEIP for his constant support and help.

To all my lecturers, friends, relatives and associates who have contributed towards my work.

And last but by no means least, to my beloved mother, Mdm. Leela Somasundram and sister, Shamala Ernest for their continuous love, support and encouragement

Thank you

I certify that an Examination Committee met on …… to conduct the final examination of Kamala Ernest of her Master of Science thesis entitled "On-Line Energy-Use Benchmarking for Industrial Sector in Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Prof. Madya Ir. Dr. Norman Mariun
Head of Department
Faculty of Electrical and Electronic Engineering
Universiti Putra Malaysia
(Chairman)

Syed Abdul Rahman Al-Haddad
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

Ponudurai Rajamanikam
Chief Technical Advisor-MIEEIP
Malaysia Energy Centre
(Member)

SHAMSHER MOHAMAD RAMADILI, Ph.D,
Professor/Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

Syed Abdul Rahman Al-Haddad
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Member)

Ponudurai Rajamanikam
Chief Technical Advisor-MIEEIP
Malaysia Energy Centre
(Member)

AINI IDERIS, Ph.D.
Professor/Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institution.

_____

KAMALA ERNEST

Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BOND	Benchmarking On-line Networking Database
DAS	Data Acquisition System
DEDP	Department of Energy Development Programme
DoS	Department of Statistics
EC	Energy Conservation
EE	Energy Efficiency
EPU	Economic Planning Unit
EMIS	Energy Management Information System
ESCO(s)	Energy Services Companies
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Green Houses Gasses
GoM	Government of Malaysia
INEDIS	International Network for Energy Demand Analysis for Industrial Sector
MBS	Malaysian Benchmarking Services
MDF	Medium Density Fibreboard
MEC	Malaysia Energy Centre
MIEEIP	Malaysian Industrial Energy Efficiency Improvement Project
MVC	Model Viewer Controller
M & T	Monitoring and Targeting
NPC	National Productivity Corporation
PAC	Presentation-Abstraction-Controller

PTM	Pusat Tenaga Malaysia
SEC	Specific Energy Consumption
TFP	Total Factor Productivity
TQM	Total Quality Management
UVM	User Virtual Machine
UMIS	User Management Information System