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Ministry of Industry and Trade

United Nations

Industrial Development Organization

ASSESSMENT REPORT

IMPACTS & RESULTS OF THE PROJECT TRAINING PROGRAM

Project "Promoting Industrial Energy Efficiency through System Optimization and Energy Management Standards in Vietnam"

Conducted by:

November 2014

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EXECUTIVE SUMMARY

The Industrial Energy Efficiency (IEE) Project in Vietnam is being jointly implemented by UNIDO and the Ministry of Industry and Trade (MOIT). Project implementation began in mid-July 2011 and is planned to finish by end-March 2015. The Project aims at assisting industries to adopt a systems approach in improving energy efficiency at the system levels and the new ISO 50001 energy management standard. Through adoption of energy management standards, energy management practices is to be integrated into the management cycle and realize energy efficiency improvements on a continuous basis.

The project has primarily focused on capacity building of stakeholders that include industrial enterprises, equipment suppliers, distributors, engineering/energy service companies and government planners. Energy efficiency improvements on steam and compressed air systems based on the system optimization approach are expected to lead to higher energy savings (15 to 30% for compressed air systems and 10 to 15% for steam systems). The targeted sectors are: food, textiles, rubber and pulp & paper. The project has also trained national experts in energy management and delivered capacity building to industries for the introduction of ISO 50001. Compliance with this new ISO Standard will provide the requisite incentives for continuous attention to improved end-use efficiency.

It is expected that the project will contribute substantially towards meeting Vietnam's goals of improving energy efficiency in the industry as envisioned in the National Energy Efficiency Program. The expected outcomes of the project are:

Outcome 1: i) A policy instrument (compatible with ISO 50001) in place delivering sustainable improvements in EE in industries; (ii) A cadre of EE professionals within industrial facilities, consultants and suppliers is created to provide services on energy management and optimize industrial systems

Outcome 2: Increased adoption of ISO 50001 energy management standards and system optimization projects by industry

Outcome 3: Increased financial capacity support for industrial EE initiatives
In order to realize the above mentioned outcomes, the project is designed with the three following components:

Component 1: National Program to Build Capacity on Energy Management and System Optimization

Component 2: Implementation of Energy Management and System Optimization Demonstration Project

Component 3: Financial Capacity Development to Support Energy Efficiency Projects in Industry

The below table outlines how the technical project components relate to the planned outputs and expected outcomes:

Table - Project Components and expected outputs

Project Component	Expected Outputs	Expected Outcomes
1. National Program to Build Capacity on Energy Management	**Output 1.1** Training materials, software and tools developed	A policy instrument (compatible with ISO 50001) in place delivering sustainable

and System Optimization	**Output 1.2** National awareness campaign to promote industrial energy management. **Output 1.3** A peer-to-peer network developed between industrial enterprises **Output 1.4** Trained national experts and factory personnel on energy management. **Output 1.5** Trained national experts, factory personnel and vendors on systems optimization	improvements in EE in industries. A cadre of EE professionals within industrial facilities, consultants and suppliers is created to provide services on energy management and optimize industrial systems.
2. Implementation of Energy Management and System Optimization Demonstration Projects	**Output 2.1** Energy management projects implemented. **Output 2.2** Documented industry demonstration projects. **Output 2.3** Recognition program developed	Increased adoption of ISO 50001 energy management standards and system optimization projects by industry
3. Financial Capacity Development to Support Energy Efficiency Projects in Industry	**Output 3.1** Training materials developed and harmonized project evaluation criteria. **Output 3.2** Industrial enterprises trained to enhance financial capacity to develop bankable projects	Increased financial capacity support for industrial EE initiatives

To achieve **Outcome 2** – "Increased adoption of energy management system (EnMS) and system optimization (SO) projects by industry", the project has carried out a number of activities aimed at increasing national technical capacity to support industrial EE&EC initiatives , including EnMS and SO projects, such as: provision of training on EnMS and SO for industry personnel & national experts; provision of training on financial analysis of EE&EC projects for national experts and staff of some financial institution involved in EE&EC financing services, provision of technical assistance in implementing EnMS and SO projects by industries.

In order to collect data and information on the impacts/results of the project intervention vs. project setforth targets presented in the Project Logical Framework, a survey based on data collection of EnMS and SO project implementation from national experts and industrial enterprises that have participated in the UNIDO training programs on EnMS and SO (steam and compressed air systems) under the guidance of the PMU has been conducted by Energy Conservation Center of Ho Chi Minh. This report summaries the findings of surveyed conducted during 15 September to 15 November 2014. Survey questionaires have been sent to 54 trained national experts and 179 participating enterpises of the project use training courses. ECC – HCMC got respondents from 46 trained national experts and respondents from 127 enterprises. The collected data show an impressive level of adoption energy management system and implementation of SSO and CASO solutions as follows:

- 77 factories adopted EnMS plans and implemented operational improvement projects, of which14 factories fully implemented EnMS & certified ISO 50001;

- 62 enterprises have implemented some SSO projects varies from low cost solutions such as condensate and flash recovery, piping insulation, replacement of valves and broken trap, etc. to the replacement of the old - inefficient boiler with new EE boilers;

- 77 enterprises have implemented some CASO projects varies from low cost solutions such as overcome steam leakage, resetting pressure point, relocation of compressors, changing pipe size to replacement of inefficient compressors with EE ones;

- The percentage of enterprises that applied SSO and CASO solutions after the User Training is relatively high (SSO: 44/77 = 57%; CASO: 51/79 = 64%), in comparison with other projects (around 25%). The percentage of enterprises having implemented SSO and CASO solutions after receiving consultations provided by trained national experts is even higher (SSO: 86%; CASO: 78%).

- The achieved annual energy savings and GHG reductions are estimated at 1,119,388 GJ (56,034 MWh, 21,735 TOE) and 106,394 ton CO_2 eq, respectively. Actual investment figures for these implementation projects are estimated at USD 8,013,316 which originates from various funding sources such as self-investment, banks, etc.

1 INTRODUCTION

1.1 General Introduction

Within the framework of project "***Promoting industrial energy efficiency through systems optimization and energy management standard in Vietnam***", jointly implemented by the Ministry of Industry and Trade and the United Nations Industrial Development Organization (UNIDO), the Project management unit has organized training courses for national expert trainees and energy management personnel as well as technical staffs from nearly 300 enterprises on energy management system (EnMS) in line with ISO 50001, steam system optimization (SSO) and compressed air system optimization (CASO).

Objectives of the project:

- For the national expert trainees: to form a cadre of national experts who are equipped with knowledge, skills and tools necessary to support industrial enterprises for the application and implementation of (1) energy management system in line with ISO 50001, (2) compressed air system optimization, (3) steam system optimization, for the overall objective of energy savings and greenhouse gas reduction.

- For enterprises: to form a cadre of personnel who are capable, knowledgeable and skilful so that they can do best operation practices in the optimization of the compressed air and steam systems at enterprises; and step by step establish an energy management system in line with ISO 50001, for the overall objective of energy saving and production costs reduction.

The Energy Conservation Centre of Ho Chi Minh city (ECC-HCMC) was selected by the project management unit to carry out the assessment of the impacts/results of all these training courses.

1.2 Goals and Objectives of the Survey and Assessment

The survey aims to assess the effectiveness and impacts of the training courses organized by the industrial energy efficiency project (IEE project) with regards to the consultation activities carried out by the trained national experts and the application/adoption and implementation of the solutions by industrial enterprises which have sent their energy manager and technician to participate in the project use training courses.

Specific objectives of the assessment include:

1. Assess the achieved results of the training courses regarding the percentage of enterprises that apply solutions as a result of the training and the percentage of experts who implement the consultation activities after the training.

2. Assess experts' and enterprises' degree of application of the training contents/knowledge into real life scenarios.

3. Initially assess the effeteness of training courses organized by the project in terms of energy saving and energy efficiency and GHG emissions reductions.

1.3   Survey Timeline

The survey has been implemented from 15 September to 15 November 2014 and has three phases:

Phase 1: Preparation phase, including: literature review, implementation planning, preparation of documents, drafting of questionnaires, testing of questionnaires, finalization of questionnaires, updating of contact information and confirmation of contact list, etc...

Phase 2: Sending of questionnaires via email and express post, follow up with phone calls confirmation, provision of guidelines for answering of questionnaires, reminder and receipt of questionnaires, analysis of questionnaires, formulation of excel tables for analysis, etc...

Phase 3: Information processing and reporting, including: input of information from questionnaires into excel files, processing and analysis of information, drafting of report, receiving consultative review for the report, finalization and submission of report.

1.4   Survey Restrictions

The population of the survey includes 100% of the national experts and enterprises' personnel who have participated the project training courses. The main survey method employed is information collection through designed questionnaires. Actual questionnaires were sent to experts and enterprises together with official documents of the General Directorate of Energy. Afterwards, ECC-HCMC called each individual participant for detailed explanation of the survey object and desired results and reminded for resubmission of questionnaires. However, response rate is not 100% and responses are slow/delayed. In some cases, information was collected via phone.

Besides, many enterprises have implemented the solutions as a result of the training but do not provide information on energy saving and investment costs, this leads to inaccurate final results on energy saving, GHG emissions reduction and investment costs. In fact, the total energy saving and investment costs for implementing the solutions may be higher than what's reported. There is a quite a number of questionnaires reporting the energy saving about 5% - 15% of total energy consumption as a result of the solutions implemented but do not indicate the figures in amount.

Furthermore, the figures and data provided on one's own accord, there is no official method to verify these reported results against the actual.

2 SURVEY METHOD, SAMPLE AND MAIN CHARACTERISTICS OF RESPONDENTS

2.1 Information Collecting Method

The main method employed to collect information is the use of questionnaires. Based on the training contents and assessment objectives, ECC-HCMC has designed 02 questionnaires to be sent out to two different groups of participants, experts (to individuals) and enterprises (to enterprises and their personnel).

With the expert group: the questionnaires were sent directly to the trained participants, attached is an official document from General Directorate of Energy via email and/or express post.

With the enterprise group: The questionnaires and an official document of General Directorate of Energy were sent to the enterprises' management via express post. The questionnaires are also sent directly to the training participants.

Most questionnaires are obtained via email. In some cases, ECC-HCMC has to conduct the interview via phone to collect or confirm the information provided because enterprises could not assign a responsible person.

In-depth interviews are conducted with 5% of enterprises and experts in order to assess the advantages, difficulties and practicalities of the activities implemented after the training.

The calculation method of energy saving and GHG reduction is formularized and computed on Excel.

The data collected from the questionnaires were processed in SPSS. All the information and data provided in these questionnaires were checked, filtered before inputting in the software for processing.

Apart from information collecting via questionnaires and in-depth interviewing, ECC-HCMC also collected and reviewed existing literature, especially: project document, training materials, training reports, implementation assessment reports, and etc... Literature review has helped ECC-HCCM to design the questionnaires, check data and analyse information more appropriately.

2.2 Survey Sample and Characteristics of Respondents

2.2.1. Survey Sample

The survey sample is 100% of experts and 100% of enterprises which have personnel who participated the project's training courses - based on the list of participants provided by the IEE project.

With the expert group: There are in total 54 trained experts, among which: 21 trained on EnMS, 12 on SSO, 14 on CASO; There are 7 experts who participated all three training courses.

Graph 1: Number of trained experts
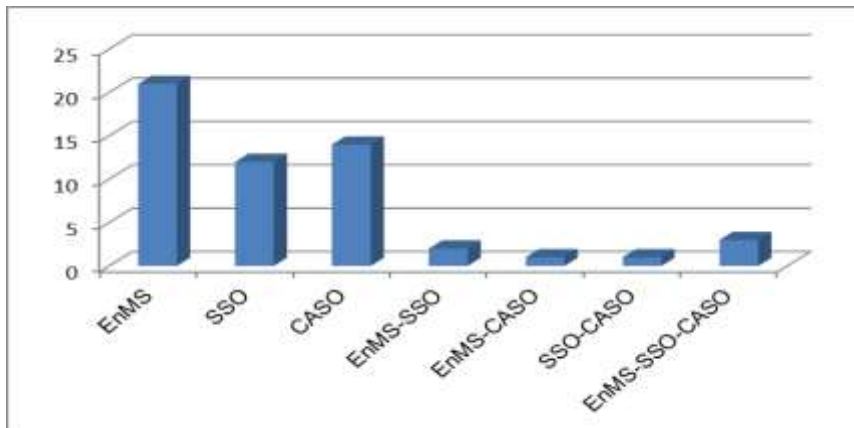
With the enterprise group: Individual class based, there are 282 participating enterprises times (EnMS: 126; SSO: 77; CASO: 79) with 434 trained personnel. However, there is quite a number of enterprises who assigned their personnel to 2 or even 3 different courses, this makes the total number of participated enterprises only 179 (please refer to table 1 below).

EnMS	SSO	CASO	EnMS & SSO	EnMS &CASO	SSO &CASO	EnMS &SSO &CASO	**Total**
67	22	16	11	19	15	29	**179**

Table 1. Number of trained enterprises

Before sending out the questionnaires to the trainees, every and single one trainee was contacted by phone for contact details confirmation and for notification of the assessment objectives. Based on the confirmed contact information, ECC-HCMC sent out the questionnaires and official document of General Directorate of Energy (through express post and email) to all experts and enterprises. After sending the questionnaires, ECC-HCMC followed up with phone calls to provide instructions and remind for reverting.

Results on the collected questionnaires as follows:

- Expert group: Total number of collected questionnaires is 46/54, equivalent to 85.18%

- Enterprise group: Total number of collected questionnaires over participating enterprises is 127/179, 71%.

Graph 2. Percentage of received questionnaires
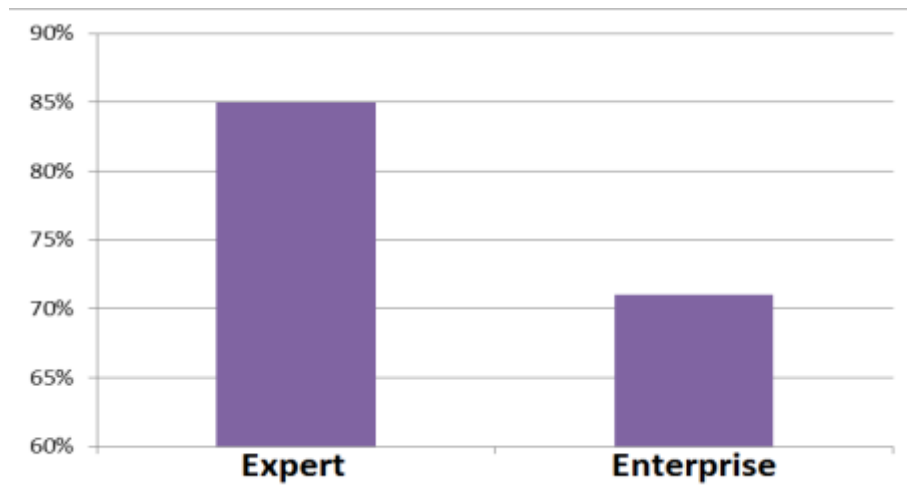
2.2.2. Characteristics of Enterprise Respondents

Training courses participated:

Out of 127 respondent enterprises, a number of enterprises have sent their personnel to participating either two or three training course therefore it makes the total respondent enterprises time participating in the project training courses is 215 , there are 90 enterprises times of them joining the training on "energy management system in line with ISO 50001 (EnMS)", 69 enterprise times joining the "Compressed Air System Optimization (CASO)", 56 enterprises times joining the "Steam System Optimization (SSO)". Please refer to the below table 2.

Table 2: Enterprise respondents by training programs

Training program	Number of participating enterprises times
EnMS	90
SSO	56
CASO	69
Total	215

Type of business:

Out of 127 respondent enterprises, there are 33 state own enterprises (26%), 33 enterprises with foreign investment (26%), 18 private enterprises (14.2%) and 43 are joint stock ventures or other types (33.9%). Please refer to Table 3 and Graph 3 below.

Table 3: Number of enterprises by business types

Types of enterprises	Number of enterprises	Total number of enterprises	%
State own enterprise	33	127	26.0%
enterprises with foreign investment	33	127	26.0%
Private enterprises	18	127	14.2%
Other	43	127	33.9%

Graph 3. Type of business
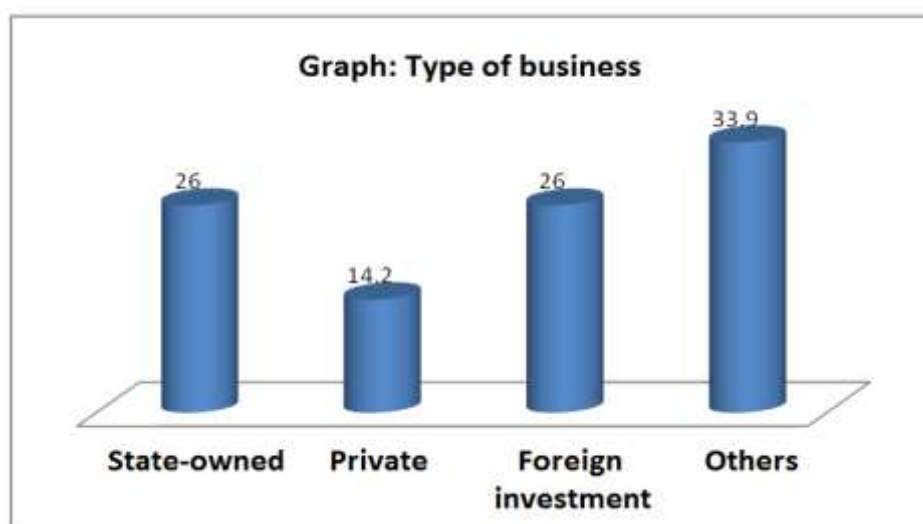
Sector of respondent enterprises

Out of 127 respondent enterprises, the majority of enterprises belong to the food and beverage processing sector with 59 enterprises (46.5%); next comes textile and leather footwear with 25 enterprises (19.7%); 10 enterprises are in building materials (among which there are 9 cement and 1 brick enterprises) (7.9%); 8 enterprises in the paper and pulp sector (6.3%); 06 enterprises in rubber processing and the remaining 19 are in chemicals, pharmaceuticals, polymers, fertilizers, etc... (15%). Please refer to Table 4 and Graph 4 below.

Table 4: Percentage of respondent enterprises by sectors

Sector	Number of enterprise	Total respondent enterprise	%
Food Processing and beverage	59	127	46.5%
Textile-Garment - Leather	25	127	19.7%
Building Materials	10	127	7.9%
Paper and Pulp	8	127	6.3%
Rubber	6	127	4.7%
Others	19	127	15.0%

Graph 4. Sectors of respondent enterprises

Graph: Sector of respondent enterprises
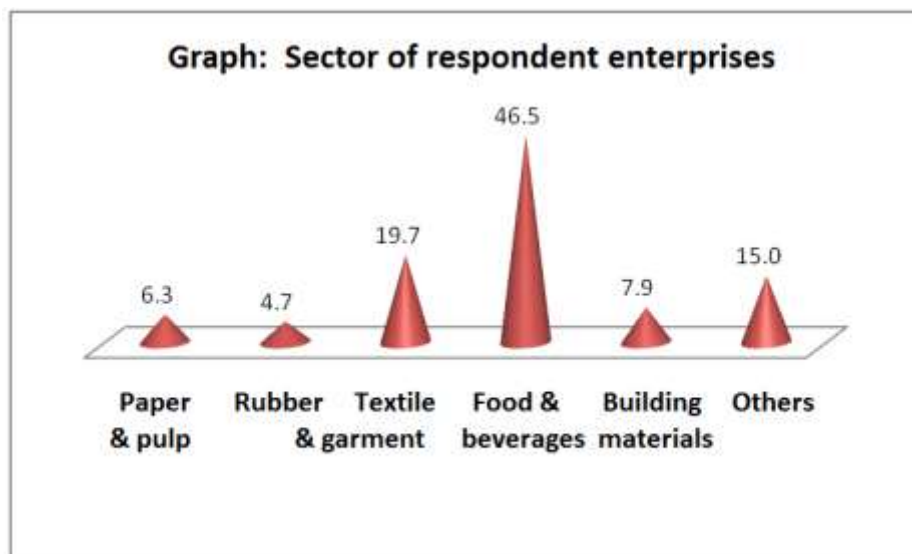
2.2.3. Characteristics of Expert Respondents

Training courses participated:

According to the collected questionnaires provided by participating national experts, in the 3 training courses, the number of respondent experts participating in the EnMS in line with ISO 50001 course is 22, the number of SSO and CASO courses are both same of 16 national experts. See table 5 below.

Table 5: Number of participating national experts by courses

Training courses	Number of national experts	Total
EnMS	22	46
SSO	16	46
CASO	16	46

Type of organizations that these experts work in:

The majority of experts are working for public organizations such as Energy Conservation Centers and Technology Transfer Center (61%), joint stock companies' account for 17% of the total experts, science and technology organizations and universities account for 13%, certification bodies and limited companies account for the remaining 9%.

Table 6: Number of national experts by types of working organization

Types of organization	Number of national experts	Total	%
Public organizations such as Energy Conservation Centers and Technology Transfer Centers	28	46	61%
Joint stock companies	8	46	17%
Science and technology consultation organizations and universities	6	46	13%
Limited companies	1	46	2%
Certification bodies	3	46	7%

Positions of experts:

Out of the 46 respondents, the majority of experts 25 people account for 54.3% are technical staffs of energy conservation centers, 04 people (8.7%) are staff from technology transfer centers belong to provincial departments of science and technology, 8 people account for 17.4% are technical personnel from energy service companies, 5 people account for 11% are university lecturers, 3 people account for 5.8% are consultants from certification bodies such as Quarcert and the Quality and metrology institute and 01 person is a technical staff from one industrial corporation. Please see Table 7 and Graph 5 below.

Table 7: Number of national experts by their position

Position	Number of national experts	%
Staff of Energy Conservation Centers	25	54.3

Staff of Technology Transfer Centers	4	8.7
Consultants from Consultancy Organization	8	17.4
Lecturers from Technology Universities	5	10.9
Staff of Certification Body	3	5.8
Technical Staff of Industrial Corporation	1	2.8
Total	46	100.0

Graph 5. Position of experts in their organization
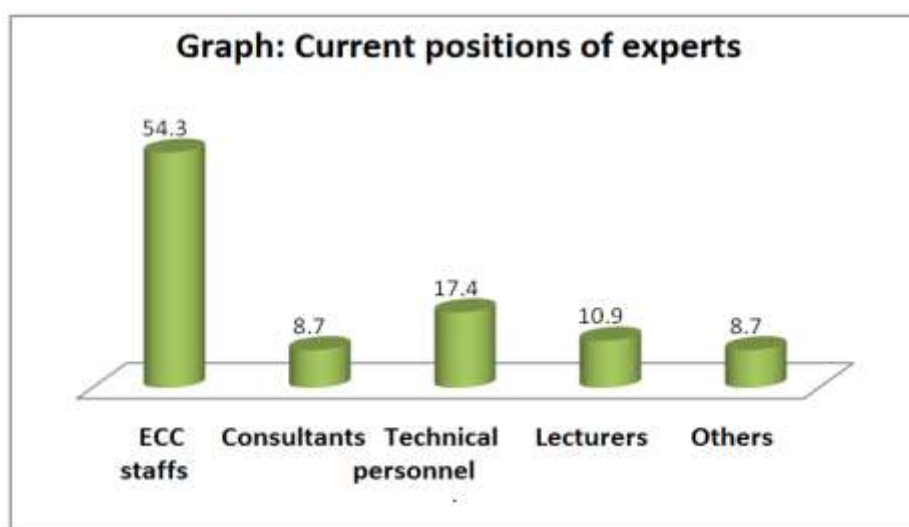
Qualifications of experts:

All experts are university graduates and post graduates. Among which, there are 26 graduates and 20 post graduates. Please see graph 6 below.

Graph 6. Qualifications of experts
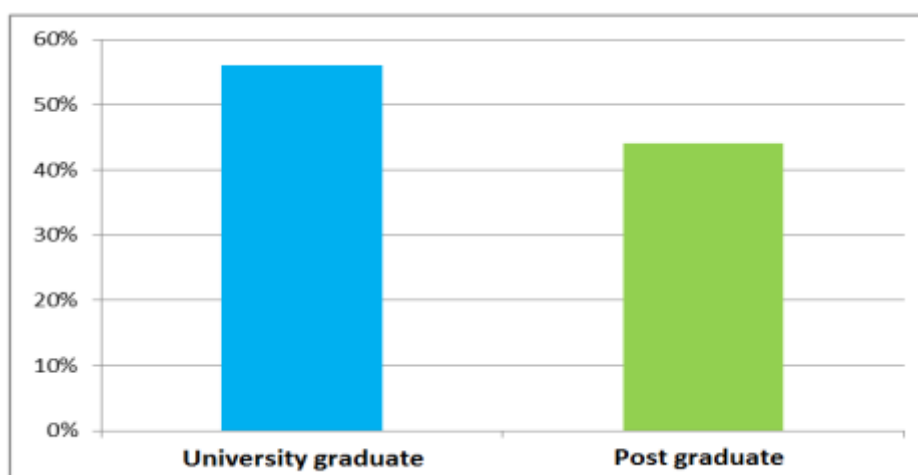
Length of working time at present organization:

Most of the experts 57% have been working with the current organization between 5 and 10 years; 21.7% have been working between 2 and 5 years; 20% of experts have more than 10 years experience; only 01 expert about 2% have working experience in their current organization less than 2 years. Please see Table 9 and Graph 6 below.

Table 8: Number of national experts by working time at present organization

Working time	Number of national experts	%
< 2 years	1	2.2
2- 5 years	10	21.7
5-10 years	26	56.5
>10 years	9	19.6
Total	46	100.0

Graph 6. Length of working time of national experts at present organization
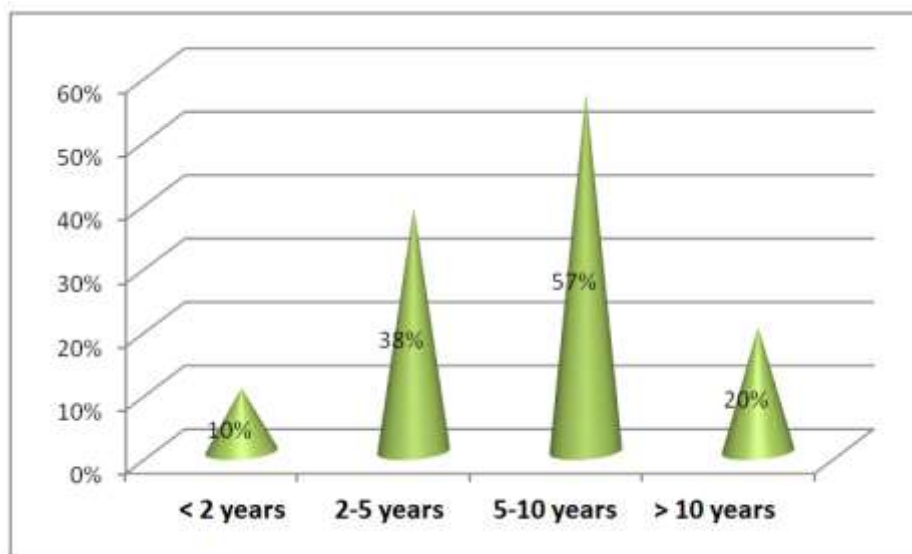
Job movement after training:

Among the 46 respondents, 42 of them (91%) are still working at the same organization, only 4 (9%) of them moved to different organizations after the training.

Graph 7. Percentage of experts remain working for the same organizations
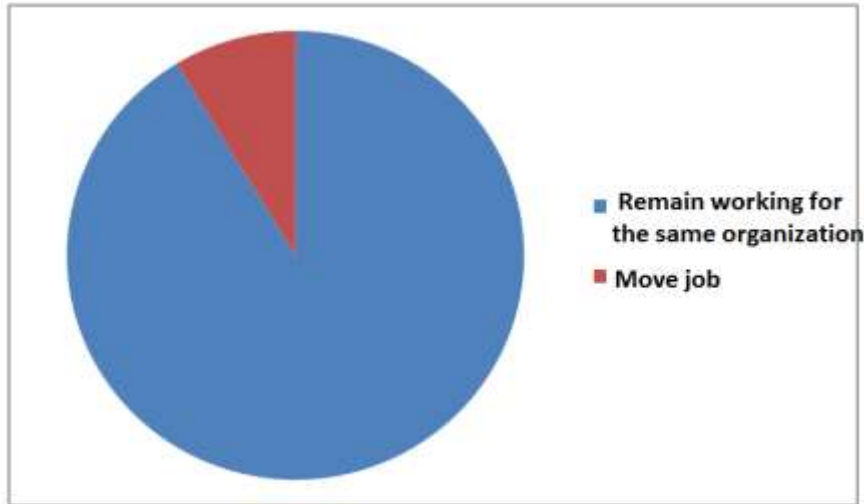
Relativity between training content and current job:

The current jobs of all experts are related to the participated training programs. Only 6 respondents (accounting 13%) stated that their current works are more or less related to the participated training program. The rest 40 respondents (87%) reported that their current works are much or totally related to the participated training. Please see Table 9 and graph 8 below.

Table 9: Number of training working in the training program field

Degree of relativity between training content with current job	Number of national experts	%
Less related to training content	6	13.0
Much related to training content	12	26.1
Majority of work related to training content	11	23.9
Totally related to training content	17	37.0
Total	46	100.0

Graph 8. Relativity between training content and current job

Relativity between training content (EnMS & SO) and current job

Category	Value
Completely related	37
Majorly related	23.9
Moderately related	26.1
Scarcely related	13
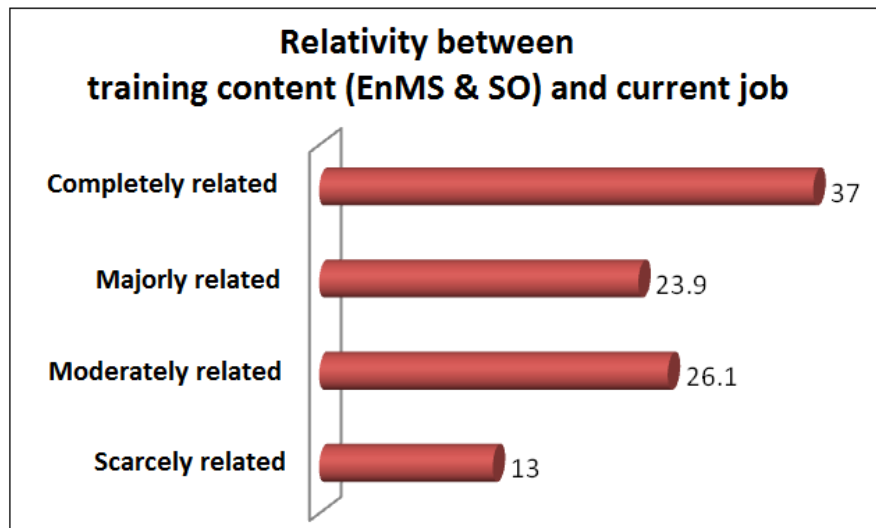
Post-training training activities of experts:

Out of 46 respondents there are 19 (41%) have conducted training to enterprises. Among which, 10 experts have conducted training on EnMS to enterprises, 5 experts on SSO and 4 on CASO.

Training on EnMS is most prevalent. There have been 67 courses conducted on EnMS to 515 enterprises, 18 courses on SSO to 88 enterprises and 12 courses on CASO to 242 enterprises.

3 TOTAL NUMBER OF ENTERPRISES THAT IMPLEMENTED SOLUTIONS AFTER TRAINING AND RECEIVING CONSULTATION

After the training and receiving national experts' consultation, the number of enterprises that implemented energy efficiency solutions is relatively high. Results from the answered questionnaires show that there are 77 enterprises which applied EnMS solutions, 77 enterprises applied CASO solutions and 62 applied SSO solutions.

Table 10. Number of enterprises by implemented solutions

Training content	Number of enterprises implemented EE solutions after training by themselves			Number of enterprises implemented EE solutions after receiving consultation provided by trained national experts			Total number of enterprises implemented EE solutions		
	Number of enterprises implemented EE solution groups	Number of respondent enterprises	%	Number of enterprises implemented EE solution group after receiving consultation	Number of enterprises received the national experts' consultation	%	Total number of enterprises implemented EE solution group	Total number of enterprises received training and consultation	%
(1)	(2)	(3)	(4)=(2)/(3)	(5)	(6)	(7)=(5)/(6)	(8)=(2)+(5)	(9)=(3)+(6)	(10)=(8)/(9)
EnMS	41	90	46%	36	37	97%	77	127	61%
SSO	44	56	79%	18	21	86%	62	77	81%
CASO	51	69	74%	26	34	76%	77	103	75%
Total	136	215	63%	80	92	87%	216	307	70%

In average, the percentage of enterprises which applied solutions in their facilities are relatively high, about 70%. In which, solutions with highest application by enterprises are SSO (81%), CASO (75%) and EnMS (61%). Please see Graph 9 below.

Graph 9. Percentage of enterprises have implemented EE solutions after participating in the project training courses or supported by trained national experts
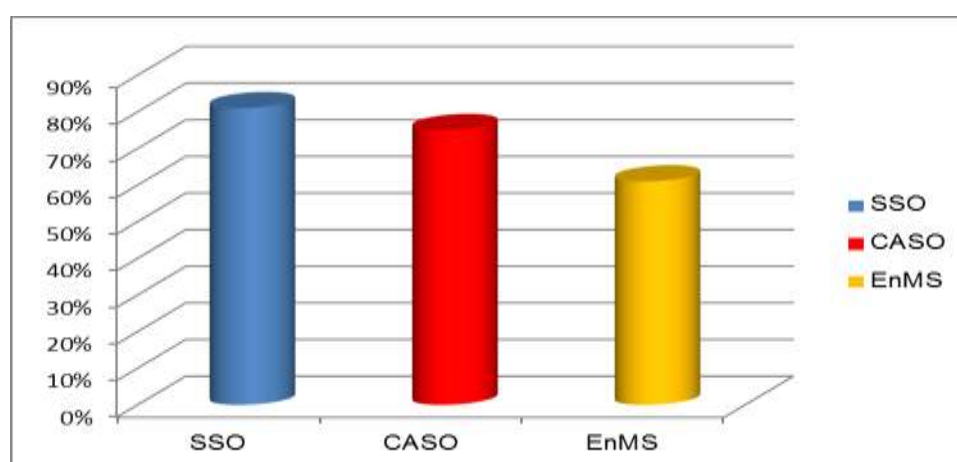
Since there is quite a number of enterprises which participated in more than one training program, the number of enterprises that have implemented more than one

solution groups is relatively high (after there called EnMS solution group, CASO solution group and SSO solution group). Results from the answered questionnaires provided by enterprises and trained national experts indicate that 140 enterprises only apply one solution group, 20 enterprises apply 2 solution groups and 12 apply all three solution groups.

Table 11: Number of enterprises implemented EE solutions by solution groups

Implemented solution group	Number of enterprises	%
EnMS	58	34%
SSO	34	20%
CASO	48	28%
CASO and SSO	13	8%
EnMS and CASO	4	2%
EnMS and SSO	3	2%
EnMS, SSO, CASO	12	7%
Total number of enterprises implemented EE solution group	172	100%

Graph 10. Applications by Solution Groups
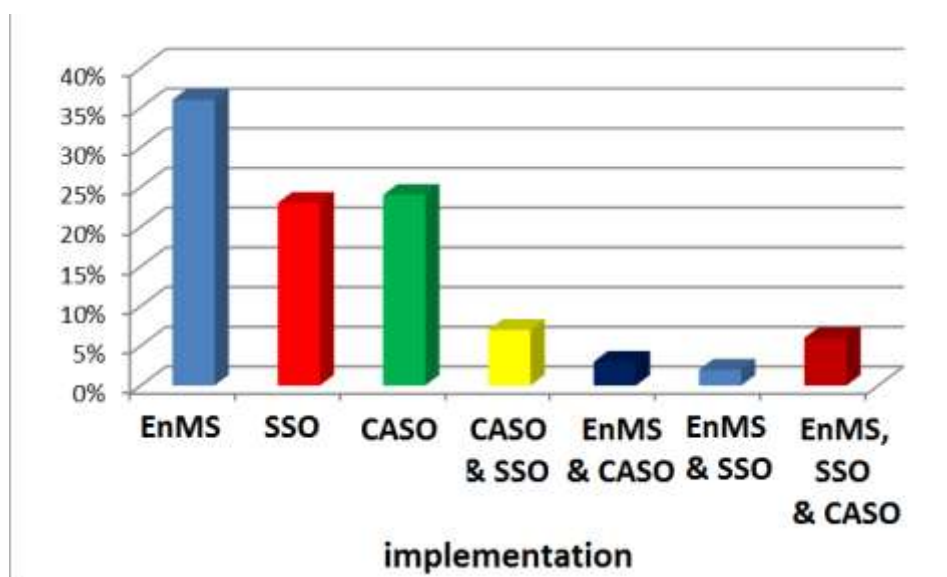
The above graph indicates that results achieved after the training and receiving consultation for all three solution groups are very positive. Not only that there is a high number of enterprises which have applied their acquired knowledge from the training and consultation into energy efficiency improvement, trained experts and enterprise's personnel have been involved in carrying out some kind of activities. This has created a positive impact on energy consumption and GHG reduction and help enterprises to cut their energy costs.

4 ENMS IMPLEMENTATION RESULTS

Out of the total questionnaires received, the number of respondent enterprises which have been trained on and consulted with EnMS in line with ISO 50001 is 127. Among which the number of enterprises that have implemented and are implementing EnMS in line with ISO 50001 is 77, accounting for 61%.

Graph 11. Percentage of trained/assisted enterprises implemented EnMS in line with ISO 50001
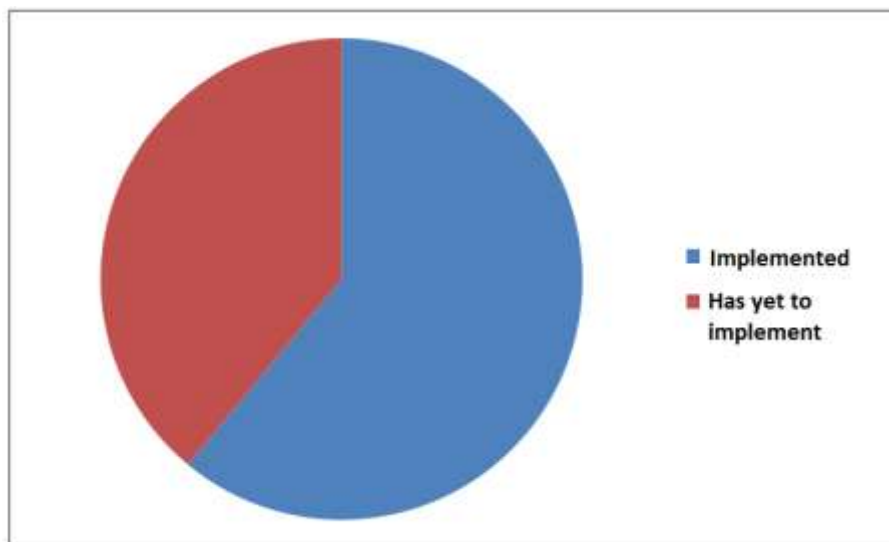
The percentage of enterprises which implemented EnMS solution group after being trained is 46% while the percentage of enterprises which implemented EnMS solution group after being consulted is 97%. The number of enterprises who implemented the EnMS solution group after being trained directly by the project is 41 and after being provided consultation by the national experts is 36. Please see table 12 below.

Table 12. The number of enterprises which applied EnMS after training or receiving consultation by trained national experts

Training content	Percentage of enterprises implemented EnMS by themselves			Percentage of enterprises implemented EnMS with consultation provided by national experts			Total number of enterprises implemented EnMS		
	No. of enterprises implemented EnMS after training	Respondent enterprises	%	No. of enterprises implemented EnMS w with national expert's consultation	No. of enterprises received consultation from experts	%	Total no. of enterprises which implemented EnMS	Total no. of enterprises which received both the project training and consultation	%
(1)	(2)	(3)	(4) = (2)/(3)	(5)	(6)	(7)= (5)/(6)	(8)=(2)+(5)	(9)=(3)+(6)	(10)= (8)/(9)
EnMS	41	90	46	36	37	97	77	127	61

Among the 77 enterprises which adopted EnMS in line with ISO 50001, 14 of them were certified ISO 50001, accounting for 18.16%. Please see graph 11 below.

Graph 12. Percentage of enterprises which have been certified ISO 50001
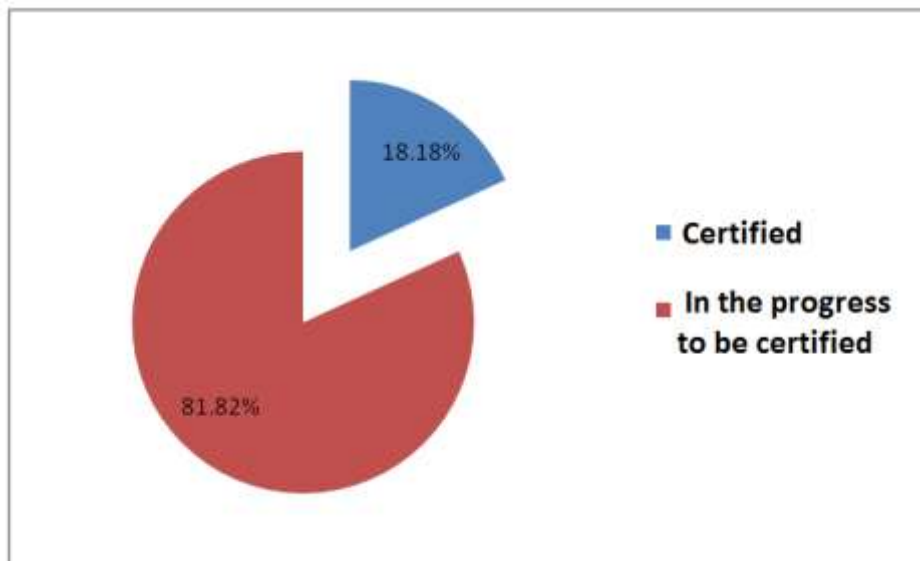
A large number of enterprises which have not been certified, however all have implemented a good deal of activities that meet with ISO 50001 requirements. The collected results show that out of 63 enterprises which have not been certified and are still implementing the EE solutions, there are 24 enterprises which have implemented more than 7 solutions which account for 37%, 19 enterprises which implemented 5-6 solutions accounting for 29%, 19 enterprises which implemented 3-4 solutions accounting for 29%, and only 2 enterprises which implemented 1-2 solutions accounting for 3%. Please see graph 13 below.

Graph 13. The percentage of enterprises which implemented the EnMS solutions according the solution number
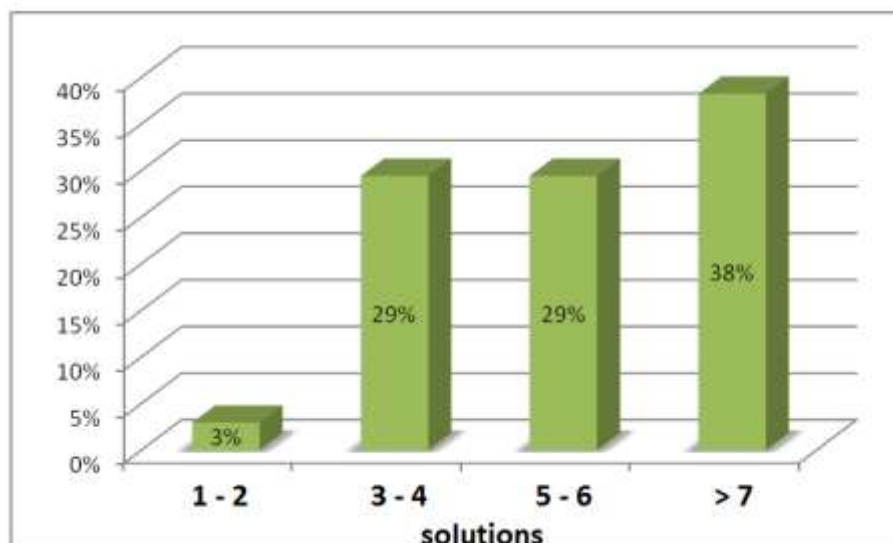
Among actions on EnMS development have been implemented by enterprises, results collected from the questionnaires show that the number of enterprises which carried out energy audit/energy review account for the highest percentage which is 88%, the second highest action is the issuance of energy policy which is 85%, development of energy plan is 82% and implementation of operational control is 79%, etc... Please see graph 14 below.

Graph 14. The percentage of enterprises which have implemented key elements that meet the requirement of ISO 50001
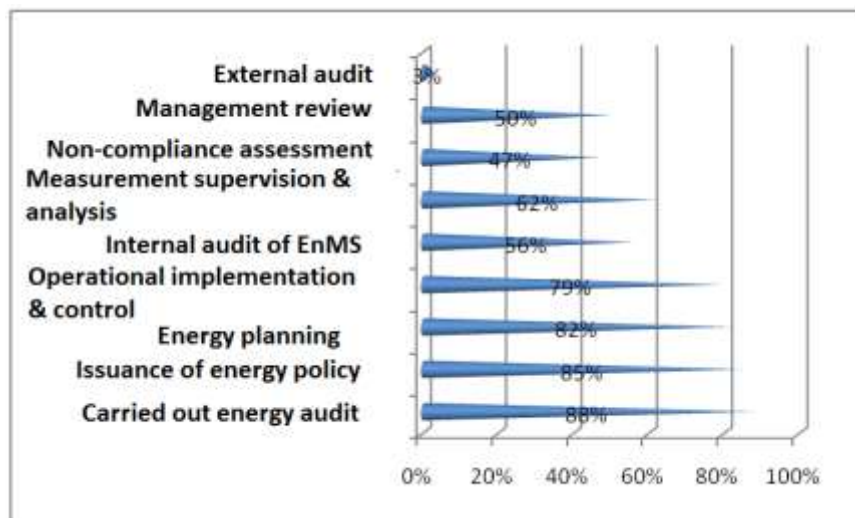
Considering sector-based enterprises adopted EnMS in line with ISO 50001, the results indicate that the rubber sector has the largest share of enterprises which implemented these solutions, next are building material, textile and leather footwear sector. Please see graph 19 below.

Graph 15. Sector-based EnMS implementation
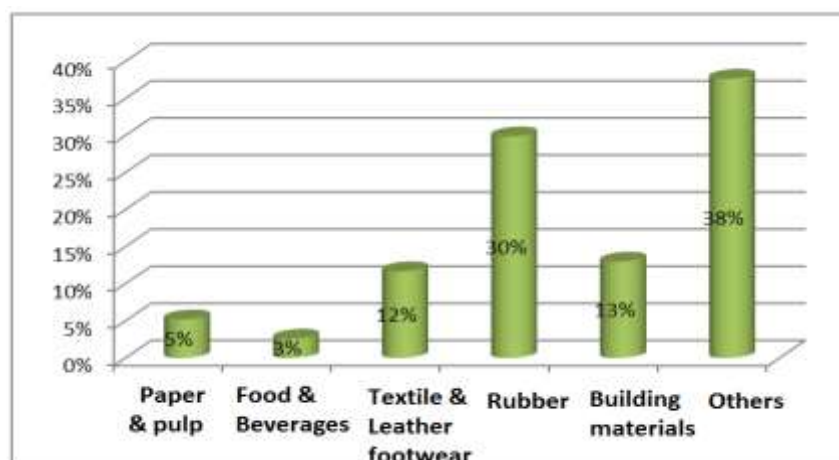
Reasons for non-application/adoption of EnMS in line with ISO 50001: There are 50 (39%) enterprises who have not implemented the EnMS. Reasons could be

production size of these enterprises is still small, their productions are meeting with difficulties, enterprise management is not ready to invest for the ISO 50001 certification, and etc...

The above results show that although the there is not much enterprises which have been certified ISO 50001 but the majority of the enterprises have been and are step by step applying the regulations, and implementing the actions that aim towards EnMS in line with ISO 50001. These are the proofs that show that the project training programs are suitable with the practical situations of enterprises. The final results of EnMS will be to contribute to the energy efficiency, through which production costs will be cut and GHG emission will be reduced.

5 STEAM SYSTEM OPTIMIZATION - SSO

As consolidated data of collected questionnaires, there are total of 77 enterprises participated in project training courses on SSO or got SSO consultancy provision by trained national experts, of which 62 enterprises have implemented SSO solutions (achieved 81%). See detail in Table 13 below.

Table 13. Number of enterprises that implemented SSO solutions

Training contents	Percentage of respondent enterprises implemented SSO solutions by themselves			Percentage of enterprises implemented SSO solutions by national experts' consultation			Total percentage of enterprises implemented SSO solutions		
	No. of enterprises which implemented SSO after training	No. of respondent enterprises	%	No. of enterprises which implemented SSO with the trained expert's consultation	No. of enterprises received consultation	%	Total no. of enterprises which implemented SSO	Total enterprises received both the project training and consultation	%
(1)	(2)	(3)	(4)= (2)/(3)	(5)	(6)	(7)= (5)/(6)	(8)=(2)+(5)	(9)=(3)+(6)	(10)= (8)/(9)
SSO	44	56	79	18	21	86	62	77	81

Among the 62 enterprises which implemented the SSO solutions, the rubber enterprises have the highest number of implementing solutions: 30 enterprises (48%), tetile and leather footwear has 11 enterprises (18%), paper and pulp has 8 enterterprises (13%), food and beverages etc...

Graph 16. Percentage of enterprises which carried out SSO by sector-based implementation
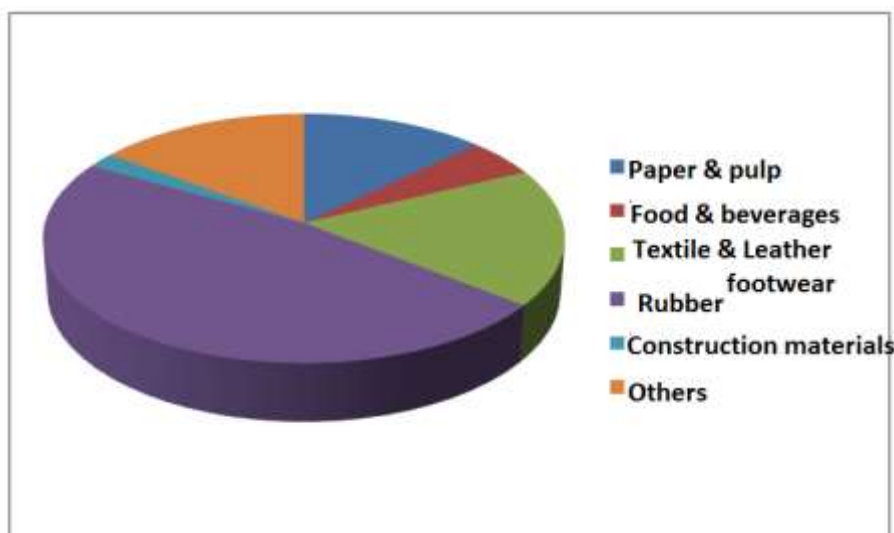
Among those enterprises have implemented SSO solutions, almost enterprises implemented many different SSO measures. Among the enterprises group have sent their personnel to the project training courses, the number of enterprises implemented

insulation solution accounting for 98%, reducing and overcome steam leakage (82%), steam losses reduction (80%), improving the condensate recovery (75%), particularly, switching fired fuel (25%); and 15 enterprises have replaced the old boiler with an energy efficiency boiler.

Graph 17. Implementation status of SSO solutions implementation
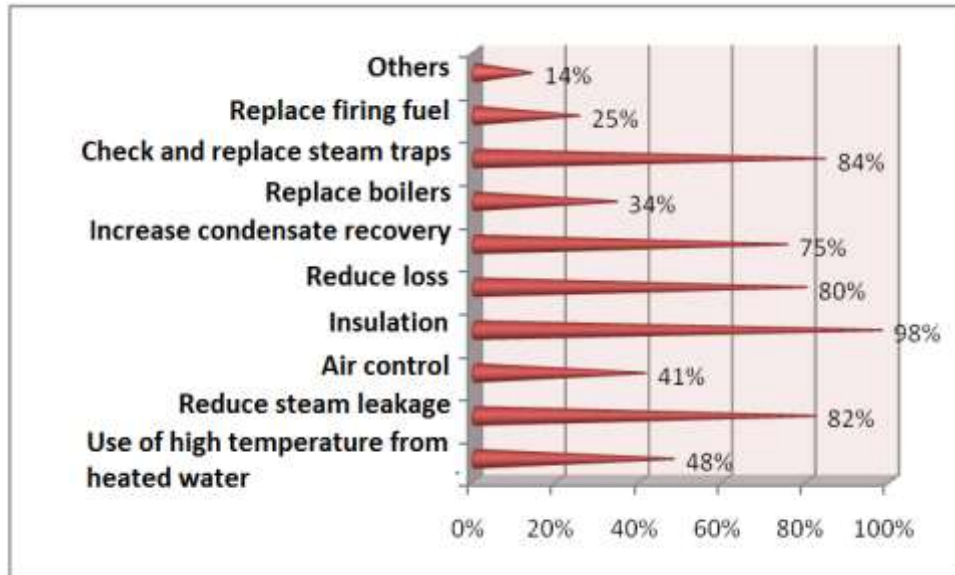
Based on the number of SSO solutions that enterprises have applied, out of 62 enterprises, there are 21 which implemented more than 7 solutions (34%), 27 implemented 5-6 solutions (43%), 10 implemented 3-4 solutions (16%) and the remaining 4 implemented 1-2 solutions (7%).

Graph 18. Percentage of enterprises which carried out SSO implementation based on the number of solutions
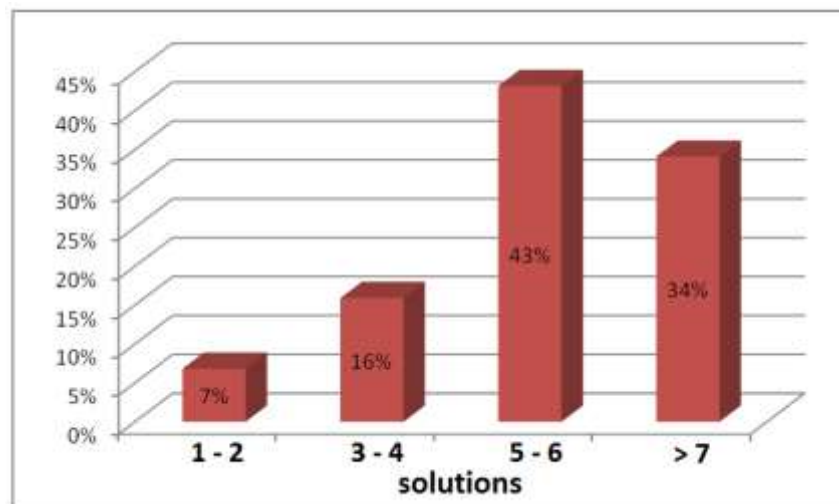
A number of exceptionally characterized enterprises have implemented other highly effective solutions, such as: purchase of steam from green energy companies that use biomass-fired boilers, use heat generated from acid sulfuric production to produce steam, take full use of materials such as tree barks, sawdust from paper production to invest in the purchase of new biomass boiler.

Reasons for non-application of SSO solutions

Although there are a number of enterprises which have not been able to apply any SSO solutions after the training, about 15 (total 77) enterprises due to various reasons. Some of their given reasons are: the majority of these enterprises think that their existing systems are still functioning well; some believe that since their current operation is unstable thus demand for steam usage was not so high which result in unnecessary to implement SSO solutions. However, in general, there is still a high percentage of enterprises which applied SSO solutions, especially in sectors such as rubber, textile and leather footwear. This reflects weaknesses as well as high energy saving potential of the current situation in steam usage and steam system operation of enterprises through the strengthening of SSO solutions implementation. On the other hand, the results collected help to identify the necessity in awareness raising and information dissemination on SSO solutions for application by other enterprises.

6 COMPRESSED AIR SYSTEM OPTIMIZATION - CASO

The number of enterprises which implemented CASO solutions is 77, accounting for 75% of the total number of respondent enterprises who received the project training and the trained national expert's consultancy. There are 51 enterprises which implemented solutions after training (74% of respondent enterprises) and 26 enterprises which implemented solutions after receiving consultancy provided by the trained national experts (accounting 76% of enterprises which have received consultation provided by trained experts). Please see table 14 below.

Table 14. Number of enterprises which implemented CASO solutions after training and consultation

Training contents	Percentage of respondent enterprises implemented CASO solutions by themselves			Percentage of enterprises implemented CASO solutions by national experts' consultation			Total percentage of enterprises implemented CASO solutions		
	No. of enterprises which implemented CASO after training	No. of respondent enterprises	%	No. of enterprises which implemented CASO with to trained experts consultation	No. of enterprises which received trained experts' consultation	%	Total no. of enterprises which implemented CASO	Total no. of enterprises which received training and trained experts' consultation	%
(1)	(2)	(3)	(4)= (2)/(3)	(5)	(6)	(7)= (5)/(6)	(8)=(2)+(5)	(9)=(3)+(6)	(10)= (8)/(9)
CASO	51	69	74	26	34	76	77	103	75

Among the enterprises which implemented CASO solutions, there are 26 rubber enterprises (34%), next is the number of enterprises in textile and leather footwear, building materials, food and beverages, etc...

Graph 19. Percentage of enterprises which carried out CASO solutions by subsectors
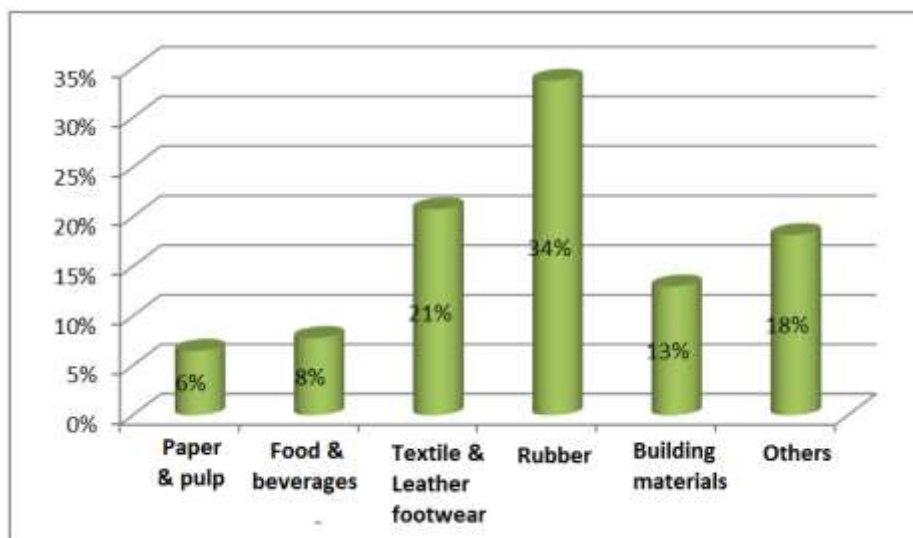
There are a lot of CASO solutions which have been implemented by enterprises, including management and investment solutions. Statistics data colected from enterprises who received training from the project shows that 100% of enterprises which implemented regular maintenace for compressed air system. Enterprises are well aware that leakage assessment is highly important in CASO implementation, up to 98% of enterprises implemented this solution. Apart from this, other solutions of high importance are: re-setting a suitable pressure level of compressors, adjust air production capacity, installation of condensate discharge valve, avoiding the abuse of compressed air, replacement of compressors, etc... Especially, there is up to 39% of enterprises which changed to usage of higher efficiency compressors.

Graph 20. Implementation CASO by Solutions/Measures
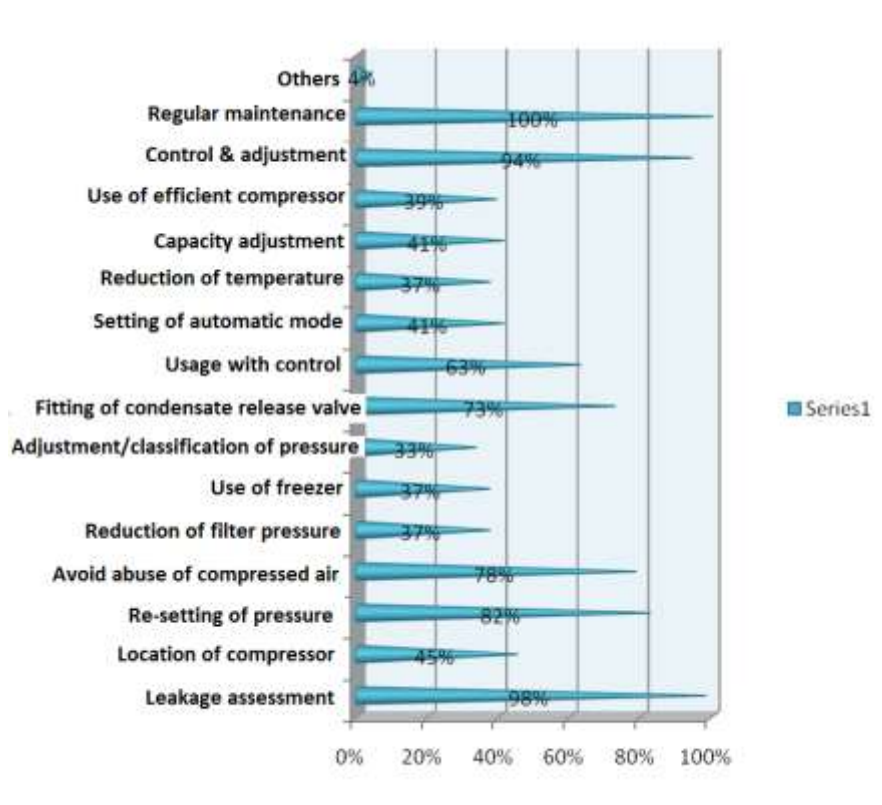
Among the 77 enterprises which implemented CASO solutions, there are 33 of them implemented more than 10 solutions (43%), 20 implemented 8-9 solutions (25%), 14 implemented 6-7 solutions and 11 implemented less than 5 solutions (14%).

Graph 21. Percentage of enterprises that have implemented CASO solutions in groups
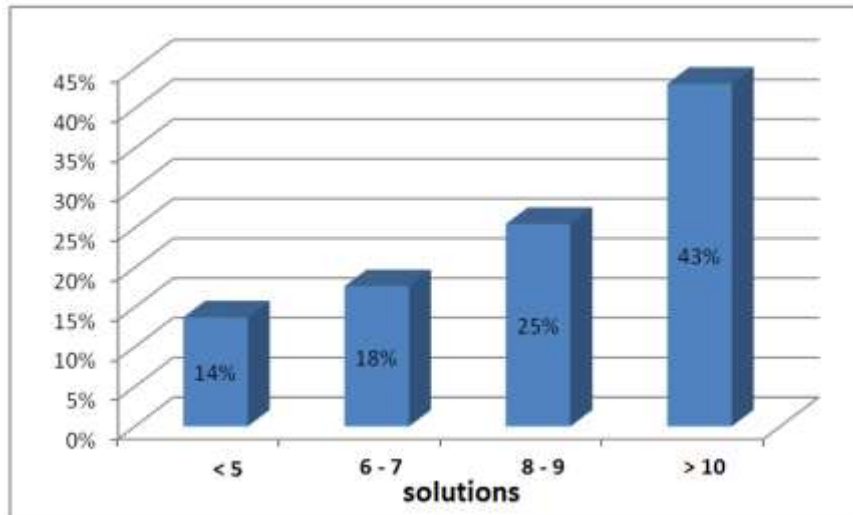
Reasons for non application of CASO solutions

Among the enterprises which have received training or national expert's consultation on CASO, there are about 25% of them which have yet being implemented. The majority of the respondent enterprises think that their existing compressed air system has been optimized or the fuel consumption for the system is not significant. A few of enterprises believe that in order to implement these solutions it would mean they have to delay production; some ones have plans to move their plants. However, the percentage of application of the training/consultation contents into practicality is 75%, only after SSO solution group. This shows that the demand for improvement in management, maintenance, even replacement to higher energy efficient compressors is relatively high. Also, the application percentage of various solutions shows that the training contents have successfully met the actual demand of enterprises.

7 TOTAL ENERGY SAVING AND GHG EMISSIONS REDUCTIONS

From the data/results collected from enterprises who have implemented the solutions after the training, the total annual energy saving is about 26,553 TOE. In which, coal: 12,966 tons, oil: 8,825 tons, gas: 2,683 tons, biomass: 3,269 tons, electricity: 56,034 MWh. Please see Table 15 below.

Table 15. Annual energy savings achieved by enterprises

#	Solution Group	Actual total energy saving achieved				
		Tonne of coal/yr	Tonne of oil/yr	MWh/ yr	Tonne of Gas/yr	Tonne of Biomass/yr
1	EnMS	22	1,589	47,673	175	150
2	SSO	12,944	7,236		2,508	3,119
3	CASO			8,361		
Total		**12,966**	**8,825**	**56,034**	**2,683**	**3,269**

If we are considered to compare the enterprise group who themselves initiated implementing the solutions after attending the project training (formal group) and the enterprise group who also initiated implementing the solutions based on consultation provided by trained national experts (later group), the former group has lower energy saving than the latter with sources such as: coal, oil and gas. The exception is electricity and biomass whereby the latter group has higher energy saving the former. Please see tables 15.1 and 15.2 below.

Table 15.1 – Enterprises Group implemented EnMS, SSO and CASO by themselves

#	Solution	Total energy saving achieved				
		Ton of coal/year	Ton of oil/year	Mwh/year	Ton of gas	Ton of biomass
1	EnMS	0	177	29,810	5	150
2	SSO	3,913	3,813	0	37	2,994
3	CASO			5,786		
Total		**3,913**	**3,990**	**35,596**	**42**	**3,144**

Table 15.2 - Enterprises group implemented EnMS, SSO and CASO with consultation provided by trained national experts

#	Solution	Total energy saving achieved				
		Ton of coal/year	Ton of oil/year	Mwh/year	Ton of gas	Ton of biomass
1	EnMS	22	1,412	17,863	170	0
2	SSO	9,031	3,423		2,471	125
3	CASO			2,575		
Total		9,053	4,835	20,438	2,641	125

The results of amounts of energy savings above converted to amount of GJ and TOE and CO_2 emission reductions are presented in the Table 16 below.

Table 16. Annual energy saving and CO2 emissions reduction divided into training contents

Solution	TOE/Yr.	GJ/Yr.	CO2 (Ton)/Yr.
EnMS	5,951	250,517	33,341
SSO	19,883	838,772	68,237
CASO	719	30,099	4,816
Total	26,553	1,119,388	106,394

If we are to consider the enterprise group who initiated implementing the solutions by themselves after attending the project training (former group) and the enterprise group who also initiated the solutions by receiving consultation provided trained national experts (latter group), the former group has lower total energy saving than the latter. Specifically total TOE reduction of the former is 10,840 TOE/year while the latter is 15,712 TOE/year. Please see tables 16.1 and 16.2 below.

Table 16.1. Annual Energy saving and CO2 reductions of the former group

Solution	TOE/year	GJ/year	CO2 (Ton)/year
EnMS	2,798	117,325	17,971
SSO	7,544	319,171	26,690
CASO	497	20,830	3,333
Total	10,840	457,325	47,994

Table 16. 2. Annual Energy saving and CO2 reductions of the latter group

Solution	TOE/year	GJ/year	CO2 (Ton)/year
EnMS	3,152	133,192	15,370
SSO	12,339	519,601	41,548
CASO	221	9,270	1,483
Total	**15,712**	**662,063**	**58,401**

By the training content, the highest amount of energy savings about 19,883 TOE is achieved from SSO solution implementation, the next energy saving of 5,951 TOE achieved from EnMS solution implementation and 719 TOE achieved from CASO solutions implementation.

By the industrial sectors, the highest annual energy savings of 11,741 TOE is achieved from EE solutions implemented in food-processing, next 5,216 TOE achieved from EE solutions implemented in textile-garment and the lowest 769 TOE achieved from EE solution implementation in rubber.

Table 17: Energy saving amount by industrial sectors

Subsector	Converted Energy and CO2		
	TOE/yr.	GJ/yr.	CO2 (Ton)/yr.
Paper	4,080	170,852	15,627
Rubber	769	32,661	3,282
Textile-Garment	5,216	218,479	22,795
Food-processing	11,741	496,930	42,914
Building materials	1,473	61,693	7,231
Others	3,272	138,767	14,542
Total	**26,552**	**1,119,383**	**106,392**

As presented above, there is estimated 65% of respondent enterprises (enterprises participated in EnMS is 64%, SSO is 71%, CASO is 60%) which implemented EE solutions after receiving training or national expert's consultation however they do no provide information on energy saving figures. As result in fact the actual energy savings will be higher than the reported results above. This means energy saving and GHG emissions have been reduced significantly in comparison to the statistic data shown in this report.

8   INVESTMENT COSTS

Summary from data given by enterprises who have supplied figures on investment costs for the implementation of solutions after receiving training and consultation shows that the total capital of investment is more than VND 207,080 million. For EnMS solutions investment cost is VND 53,263 million, SSO is VND 143,911 million, CASO is VND 9,917 million. Please see table 18 below.

Table 18. Investment for energy efficiency solution Groups

#	Solution	Total investment (million)
1	EnMS	53,252
2	SSO	143,911
3	CASO	9,917
4	Total (million VND)	**207,080**
5	Total USD	9,587,083

Note: Exchange rate: 1 USD=21,600 VND

Again, if we are to consider the enterprise group who initiated implementing the solutions by themselves after attending the project trainings (former group) and the enterprise group who also initiated the solutions implementation by receiving consultation provided by trained national experts (latter group), the latter group has put more investments than the former the amount of VND 119,544 million. Detailed analysis of investment for each solution in both groups also shows differences: the latter group has the highest investment on SSO solutions with VND 56,651 million where as the former group has the highest investment on EnMS solutions with VND 87,260 million. Please see tables 18.1 and 18.2 below.

Table 18.1 Investment costs of former group

#	Solution	Total capital (million VND)
1	EnMS	23,241
2	SSO	56,651

#		Total capital (million VND)
3	CASO	7,645
4	Total (million VND)	87,537
5	Total (USD)	4,052,639

Table 18.2 Investment costs of latter group

#	Solution	Total capital (million VND)
1	EnMS	30,012
2	SSO	87,260
3	CASO	2,272
4	Total (million VND)	119,544
5	Total (USD)	5,534,444

Sector wide, the sector with highest investment on energy efficiency solutions is food processing and beverages with the total investment of more than 108 billion VND and the lowest investment is paper with total investment of 2.8 billion VND. Please see table 19 below.

Table 19. Sector based investment cost

Sector	Paper and pulp	Rubber	Textile - Leather footwear	Food - Beverage	Building materials	Others	Total
Total investment (million VND)	2,828	3,453	40,171	108,918	12,477	39,232	207,080
%	1.4%	1.7%	19.4%	52.6%	6.0%	18.9%	100.0%

As noted, although number of enterprises which have implemented trained EE solutions is relatively high, many enterprises have invested funds to implement these solutions, and however there is a large percentage of enterprises (71%) which do not provide information on investment figures for the implemented solutions. Therefore, the total investment for EE solution implementation in practice may be higher than the figures provided in this report.

According to the questionnaires collected, most enterprises now believe that the application of the EE solutions/best operating practices presented in the training courses provided by UNIDO IEE project are effective, which helps businesses to reduce large amount of annual energy consumption, costs and limit environmental pollution. The payback period for the invested solutions is quite short; some solutions have a 1-year payback time. Especially many businesses also said that they have adopted many measures with insignificant investment costs, because these solutions just focus on solutions related to management and operation. Then there are also other businesses which have invested large amounts to replace old equipment with high energy consumption and harmful to the environment by high efficient equipment (energy efficient boilers & compressors, etc...), less energy consumption and harmless to the environment.

9 CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. The percentage of enterprises which applied the solutions after the training or consultation is relatively high, in average about 70%. The highest solution application is SSO with 81% of trained enterprises, and then comes CASO which is 75% and EnMS which is 61%.

2. Both of the trainee groups (enterprises and national experts) have been readily implementing/applying the acquired knowledge/contents, 100% with the national expert group, 81% with the enterprises trained on SSO, 75% with the enterprises trained on CASO and 61% with the enterprises trained on EnMS. This proves that trainees were well selected that enabled the optimization of training effectiveness and fulfilment of training objectives.

3. The total investment capital for the implementation of solutions is significantly high, about VND 207,080 million, in which VND 53,253 million is used for EnMS solution implementation, VND 143,911 million VND for SSO and VND 9,917 million for CASO ones.

4. The annual energy savings achieved as a result of the implementation of the 3 solution groups on EE solutions is so significant, about 26,533 TOE. This energy savings have helped enterprises to reduce their energy cost and reduce 106,394 tonne of CO_2 emissions.

5. All enterprises and expert trainees highly value the practicality and necessity of the training contents. Although there is a small percentage of enterprises which have not applied any solution after the training, this is mainly due to a slump in their production or their financial condition is yet to be stable.

6. The survey results also showed that the objectives of the training program on EnMS, SSO and CASO were achieved in practice. They are: a cadre of professionals equipped with the knowledge, skills and tools needed from the training were able to support the industrial enterprises application and implementation of energy management systems according to ISO 50001, CASO and SSO. Experts have promoted and provided consultation on the EnMS in line with ISO 50001 to industrial enterprises to improve energy efficiency and support businesses to establish and operate EnMS; Promote and

provide advices and consultancy on optimizing compressed air and steam systems for industrial enterprises to improve their energy efficiency; Technical support for businesses and coaching enterprise's personnel on assessment and implementation of system optimization projects.

RECOMMENDATIONS

In general, the trainees highly valued the training courses provided by the Vietnam IEE project and hope to participate in other courses with similar program. The proposed recommendations are as follows:

1. Organization of in-depth training courses on energy management system in line with ISO 50001, CASO, SSO for each specific sector in order to help enterprises to have a systems approach on energy management model.

2. Other trainings related to the optimization of other systems that consume energy significantly at the production facilities.

3. Sharing of best operating practices on energy management system in a number of industrial enterprises in Vietnam and in the world. For other training courses, site visits to enterprises with successful implementation of energy efficiency solutions should be integrated.

4. Expanded training scope so that more enterprises from various sectors and trainees can participate in, especially key enterprise leaders/persons so that each and every enterprise can understand the goals and objectives of systems optimization in the production line.

5. Training interpreters should acquire more technical knowledge related to the training program so that the interpretation can be delivered more smoothly, effectively that will result in better training.

6. Training duration should be lengthened for better and deeper understanding.

ANNEXES

Annex 1. Energy conversion factors and emission CO$_2$ factors

ID	Type of energy	Unit	CO2(kg)	MJ/Kg	TOE
1	Electricity	kWh	0.576	3.60	0.00008598
2	DO oil	Litter	3.175	43.33	0.0088
		kg	3.175	43.33	0.00102
3	FO oil	Litter	3.264	42.65	0.00094
		kg	3.20	42.65	0.000998184
4	Coal	kg	2.550	28.22	0.000674
5	LPG	kg	2.970	47.31	0.001130
6	Petroleum	kg	3.063	44.80	0.00107
7	Sugar can bagasse	kg	0.343	7.50	0.000179
8	Rice husk/firewood	kg	1.460	14.82	0.0003539016

ANNEX 2: ANNUAL ENERGY SAVINGS AND INVESTMENT BY ENTERPRISE, EE MEASURES GROUP AND SECTOR

Table 2.1: Annual Energy Savings and Investment Cost by Enterprise and EE Group Measures

Code	Source of Data	Sector	Name of Company	Energy Management System — Achieved Annual Savings					Total investment to date (million VND)	Steam System Optimization — Annual Energy Savings				Total investment to date (million VND)	Compressed Air System Optimization	
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr	Tons of biomass/yr		Savings (kWh/yr)	Total investment to date (million VND)
1	Ex	Other	CT CP Bóng đèn Phích nước Rạng Đông												25,600	92
	Ex	Other	CT CP Phụ tùng xe máy số 1			2,700,000									13,608	55
	Ex	Building materials	CT CP Xi măng Cẩm Phả- CN Phía Nam												15,858	64
	Ex	Building materials	CT TNHH Hoya Glass Disk VN II												46,656	150
2	Ex	Textile - Garment	CT CP Dệt may Hòa Thọ	10		300,000			650						276,791	378
	Ex	Textile - Garment	CT TNHH May Minh Hoàng II												23,314	49
	Ex	Other	CT TNHH Nhựa Quang Thanh												21,082	44
	Ex	Other	CT CP Cơ điện Miền Trung			123,663			646						23,953	50
4	Ex	Other	Công ty TNHH Noble												70,000	85
8	Ex	Building materials	Sadico Cần Thơ												120,000	
12	Ex	Other	DN tư nhân Nga Thế												120	0.5
20	Ex	Rubber	CT CP CN Cao su Miền Nam Hóc Môn												343,238	300
	Ex	Rubber	CT CP CN Cao su Miền Nam Casumina												490,310	150
31	Ex	Textile - Garment	Công ty Aurora Hải Phòng												5,000	168
	Ex	Other	Công ty TNHH Brother hải Dương												242,900	311
	Ex	Textile - Garment	Công ty TNHH Dệt Kim Đông Xuân							2,000				6427	80,000	75
44	Ex	Other	CT Spindex HN													
6	Ex	Building materials	CT TNHH Posco Viet Nam									212		963		

Code	Source of Data	Sector	Name of Company	Energy Management System						Steam System Optimization					Compressed Air System Optimization	
				Achieved Annual Savings					Total investment to date (million VND)	Annual Energy Savings				Total investment to date (million VND)	Savings (kWh/yr)	Total investment to date (million VND)
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr.	Tons of biomass/yr			
	Ex	Food-Processing	CT CP Dầu thực vật Tân Bình								3.22			100		
	Ex	Other	CT CP Sài Gòn Food								1.8			193		
11	Ex	Paper	CT Giấy Thành Đạt							57				75		
	Ex	Paper	CT Giấy Việt Đức Anh							42				68		
	Ex	Paper	CT Giấy Mỹ Hương							89				125		
17	Ex	Food-Processing	NM sữa Dielac									2,259		420		
18	Ex	Paper	CT CP Giấy Sài Gòn-Miền Trung										66.88	120		
	Ex	Food-Processing	CT TNHH TM &DV Việt Á										58.2	105		
19	Ex	Other	Công ty CP Huy Long Đà Nẵng													
	Ex	Paper	Công ty Giấy Tân Long Đà Nẵng													
	Ex	Textile - Garment	Công ty CP Vinatex Đà Nẵng													
22	Ex	Food-Processing	Công ty TNHH URC Việt Nam								160			3,500		
	Ex	Other	Công ty CP 26							75				650		
	Ex	Building materials	NM Gạch ốp lát Việt Ý							450				3,100		
31	Ex	Other	Công ty Yamaha VN								48.5			4150		
	Ex	Textile - Garment	Công ty CP May XK Hà Phong							564				1200		
32	Ex	Paper	TCT Giấy VN							5,754				1,650	450,000	300
38	Ex	Food-Processing	Các NM Bia SG (VBL, SG)								2,970			53,723		
38	Ex	Food-Processing	Các NM Vinamilk (Thống Nhất, Trường Thọ)								239.2			10,691		
45	Ex	Food-Processing	Công ty CP Đường Kon Tum													
24	Ex	Other	NM tinh chế gỗ XK Satimex			267,960			525.5							

Code	Source of Data	Sector	Name of Company	Energy Management System					Total investment to date (million VND)	Steam System Optimization				Total investment to date (million VND)	Compressed Air System Optimization	
				Achieved Annual Savings						Annual Energy Savings					Savings (kWh/yr)	Total investment to date (million VND)
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr.	Tons of biomass/yr			
	Ex	Food-Processing	Công ty CP Đầu tư TM Thủy sản Incomfish		1.3	323,871			248.5							
	Ex	Food-Processing	Công ty CP Lương thực TP Colusa-Miliket			76,292			194.74							
	Ex	Other	Công ty CP Nhựa Rạng Đông			768,588			4,210							
	Ex	Food-Processing	Công ty Bột mỳ Bình Đông			18,714			74							
	Ex	Textile - Garment	Công ty TNHH Dệt Kim Đông Quang			77,868			100							
	Ex	Other	Công ty CP SX TM Kỳ phát			262,800			2,000							
	Ex	Building materials	Trạm nghiền Phú Hữu			2,152,078			6,320							
	Ex	Other	Công ty Nhựa Tân Hiệp Hưng			49,176			175							
27	Ex	Other	CT TNHH NN MTV Diezen Công Công	12.2	11	1,710,311			1,165							
	Ex	Other	CT CP Viễn Thông FPT			204,317			1,135							
	Ex	Other	Savico Megamall			380,000			1,600							
	Ex	Building materials	TOTO Vietnam Ltd.			5,860,000		170	1,340							
33	Ex	Food-Processing	Công ty Bia SG- HN		1,400	70,000										
35	Ex	Rubber	Công ty CP Cao su Đà Nẵng			1,469,922			1,583							
	Ex	Other	Khách sạn Furama Đà Nẵng			581,805			3,046							
43	Ex	Other	CT DISOCO			510										
43	Ex	Other	Cong ty Din Sen			212,334										
43	Ex	Food-Processing	Cty CP Duong malt (DN)			40,000			5,000							
43	Ex	Textile - Garment	CT TNHH Jia Hsin			212,334										
46	Ex	Rubber	Casumina Dong Nai												326,341	

| Code | Source of Data | Sector | Name of Company | Energy Management System | | | | | | Steam System Optimization | | | | | Compressed Air System Optimization | |
| | | | | Achieved Annual Savings | | | | | Total investment to date (million VND) | Annual Energy Savings | | | | Total investment to date (million VND) | Savings (kWh/yr) | Total investment to date (million VND) |
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass /yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr	Tons of biomass / yr			
1	Enter.	Food-Processing	CT TNHH Co May Lai Vung										624	950	1,500	
2	Enter.	Other	CT TNHH Điện Stanley			1,649,800			3,500							
3	Enter.	Food-Processing	C.P. Vietnam Corporation - Bàu Xeo			1,521,831			500	161			876	200	15,000	
4	Enter.	Food-Processing	CT CP Thủy sản & XNK Côn Đảo (COIMEX)							7				12		
6	Enter.	Building materials	CT CP Xi-măng Hà Tiên 1												86,400	165
7	Enter.	Other	Cty CP XNK Y tế DOMESCO			530,000			6,500							
9	Enter.	Food-Processing	Công ty CP Chăn nuôi VN- CN KD thức ăn Thủy sản Bến Tre			141,474	150		152				822			
8	Enter.	Food-Processing	Công ty CP chăn nuôi VN-CN SXKD Thức ăn thủy sản Cần Thơ			1,200,000			300				600	3000		
31	Enter.	Food-Processing	CT CP Acecook Việt Nam - CN Hưng Yên												90,000	100
35	Enter.	Food-Processing	Công ty đường malt bắc ninh												14,332	50
37	Enter.	Textile - Garment	CT TNHH Giày ADORA Việt Nam							300						
43	Enter.	Textile - Garment	CT CP Taekwang Vina Industrial												1,613,603	2,346.5
47	Enter.	Textile - Garment	CT CP Dệt may Đầu tư Thương mại Thành Công							2,400				22,000	500	2,000
55	Enter.	Food-Processing	CT Bia Sài Gòn Bình Tây												12,800	50
59	Enter.	Other	CT CP Hóa chất Cơ bản Miền Nam								2,000			7,000		
60	Enter.	Food-Processing	Cty CP Sữa VN		177											
62	Enter.	Food-Processing	Nhà máy bia sg nguyen chi thanh - DN								1,100			20,000		
63	Enter.	Food-Processing	Nhà máy Sữa Sài Gòn - CT CP Sữa			14,468,000			7,400		131	36.6		1,000		

Code	Source of Data	Sector	Name of Company	Energy Management System						Steam System Optimization					Compressed Air System Optimization	
				Achieved Annual Savings					Total investment to date (million VND)	Annual Energy Savings				Total investment to date (million VND)	Savings (kWh/yr)	Total investment to date (million VND)
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr.	Tons of biomass/yr			
			Việt Nam													
71	Enter.	Textile - Garment	CT TNHH Liên doanh Vĩnh Hưng (IMT)												76,032	50
74	Enter.	Food-Processing	CT CP Acecook Việt Nam - CN Bắc Ninh												10,038	191
75	Enter.	Paper	CT CP Giấy Việt Trì												44,000	40
77	Enter.	Paper	CT CP Tiến Thành												110,880	450
79	Enter.	Food-Processing	CT TNHH Friesland Campina Hà Nam												376,710	375
81	Enter.	Food-Processing	CT TNHH Bia Châu Á - Thái Bình Dương												85,000	450
85	Enter.	Other	CT TNHH MTV Đạm Ninh Bình												1,728,000	
86	Enter.	Rubber	Công ty Cao su sao vang								536.48			1,200	87,000	220
87	Enter.	Building materials	Công ty CP Xi măng Vicem Hoàng Mai												50,000	50
88	Enter.	Building materials	CT TNHH MTV Xi-măng Vicem Tam Điệp												876,000	500
89	Enter.	Garment	CT TNHH Tai Ryong VN							400				300	20,000	100
97	Enter.	Thực phẩm	CT CP Tràng An							200						
99	Enter.	Textile - Garment	CT TNHH Minh Trí							25						
101	Enter.	Building materials	CT TNHH Toto Việt Nam												180,000	150
103	Enter.	Building materials	CT CP Xi-măng Tân Phú Xuân												2,000	150
106	Enter.	Building materials	CT CP Xi-măng Cẩm Phả													
107	Enter.	Other	CT Liên doanh TNHH Crown Hà Nội			158,000		5	900						125,000	50
109	Enter.	Other	CT TNHH Nissei Electric Hà Nội			729,600			650							
111	Enter.	Building materials	CT TNHH FCC Việt Nam												10,216	25

Code	Source of Data	Sector	Name of Company	Energy Management System						Steam System Optimization					Compressed Air System Optimization	
				Achieved Annual Savings					Total investment to date (million VND)	Annual Energy Savings				Total investment to date (million VND)	Savings (kWh/yr)	Total investment to date (million VND)
				Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr		Tonnes of coal/yr	Tonnes of oil/yr	Tons of Gas/yr.	Tons of biomass/yr			
115	Enter.	Textile - Garment	CT CP Dệt VĨnh Phú												80,000	90
116	Enter.	Textile - Garment	Cty Giayf Aurora Viet Nam							300						
120	Enter.	Textile - Garment	CT CP Dệt CN Hà Nội							120						
123	Enter.	Food-Processing	CT TNHH Đại Thành										72	89	91,600	43
127	Enter.	Textile - Garment	CT TNHH Changshin VN			9,412,101			3,339		46			900		
			Total	22	1,589	47,673,348	150	175	53,253	12,944	7,236	2,508	3,119	143,911	8,361,382	9,917
			Total from Expert Questionaires	22	1,412	17,862,542	-	170	30,012	9,031	3,423	2,471	125	87,260	2,574,771	2,272
			Total from Enterprises Questionaires	-	177	29,810,806	150	5	23,241	3,913	3,813	37	2,994	56,651	5,786,611	7,645

Actual Annual Savings Achieved					Total investment to date (million VND)
Tonnes of coal/yr	Tonnes of oil/yr	kWh/yr	Tons of Biomass/yr	Tons of Gas/yr	
12,966	8,825.6	56,034,730	3,269	2,683	207,080

Table 2.2 Annual Energy Savings and Investment by Sector

Energy Savings by Sector								
Types of Energy	Paper	Rubber	Textile-Garment	Food-processing	Building Materials	Other	Total Annual Energy Savings	Total Investment (million VND)
Tons of Coal/yr	5,942		6,119	368	450	87.2	12966.2	12,966
Tons of Oil/yr		536.48	46	6,182		2,061	8,825.56	8,826
kWh/Yr	604,880	2,716,811	12,177,543	18,557,162	8,598,208	13,380,127	56,034,730	56,034,730
Tons of Gas/yr				2,296	382	5	2682.6	2,683
Tons of Biomass/yr	66.88			3,202			3269.08	3,269
Total	**2,828**	**3,453**	**40,172.50**	**108,918**	**12,477**	**39,232**	**207,080**	**207,080**

ANNEX 3

SURVEY QUESTIONNAIRES FOR NATIONAL EXPERTS

Dear: **Trainees**

*Under the Project **"Promoting Industry Energy Efficiency through System Optimization and Energy Management Standards in Vietnam Project"**, the Project Management Unit (PMU) has conducted training courses on energy management system and system optimization for national experts.*

In order to help PMU to evaluate the impacts/outcomes of the conducted training courses as well the project implementation, it is highly appreciated if you could cooperate and provide information by answering the following questions.

We commit to hold in confidence and not disclose any provided information to third party.

We sincerely thank for your cooperation!

I.   GENERAL INFORMATION

1. Name:

………………………………………..……………………………………………………..

2. Position:

………………………………………….....……………………………………………...

3. Company/ Organization:

……………………………………………………………………...

4. Contact:

……………………………………………………………………………………………

5. Phone: …………………………**Email**:

…………………..……………………………….……………...

Please tick X in the chosen box by click in the box

6. You are:

☐   An Officer of the Energy Conservation Centre

☐   A Consultant of Certification Organization/body

☐   A Technical/ Financial Consultant of Consultation Organization

☐ University Lecturer

☐ Others (in details)...

7. Your Organization/ Company is:

☐ State Owned   ☐ Co. Ltd

☐ Joint Stock Company   ☐ Foreign Company

☐ Other (in details)

8. Education Level

☐ College   ☐ Post-graduated

☐ University   ☐ Other (in details)

9. Working experience in your current organization/ company:

☐ < 2 years   ☐ 5-10 years
☐ 2-5 years   ☐ > 10 years

10. Your responsibilities in the current organization/company (in details):

....

....

11. You have participated in Training Course:

☐ EnMS in line with ISO 50001

☐ SSO

☐ CASO

12. Do you move to other organization after participating in the project training course?

☐ Yes   ☐ No

13. If Yes, Do you move to another department within the organization/ company after participating in the training course?

☐   Same organization   ☐   Different organization

14. Relativity level of the your current job with energy management system or system optimization fields that you have been trained

☐   Not related to the field

☐   Remotely related to the field

☐   Quite related to the field

☐   Mostly related to the field

☐   Totally related to the field

15. **After participating in the project training courses, have you ever been the trainer in the use trainings for industry (which were not organized by the Project). Please indicate the number of enterprises participated in?**

Content	Number of training course	Enterprise participate in
EnMS in line with ISO 50001		
SSO		
CASO		

Note: Please provide the name of organizer of these courses:

………

………

II. INFORMATION ON SUPPORTED AND IMPLEMENTED ENTERPRISES

16. Please provide information about the enterprises which you provided consultancy after your participation in the project training courses) (in details into Table below).

16.1. Consultation on EnMS development in line with ISO 50001

#	Company Name	Progress (from start up to now)	Actual annual savings achieved				Total investment up to date (million VND)
			Tonnes of coal/ yr	Tonnes of oil/ yr	kWh/yr	Others	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Note: if the consultation activities are not finished, only information needed to fill in are the Name of *Company and Progress columns. The Progress need to indicate: completion of energy review, development of implementation plan, checking...*

16.2. Consultation on SSO assessment

#	Company Name	Total annual energy savings (from implemented measures only)				Total investment to date (million VND)	Implemented Solutions
		Tonnes of coal/yr	Tonnes of oil/yr	Tonnes gas/yr	Tonnes of biomass /yr		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Note: For the Column "Implemented Solutions", it is necessary to write briefly as: ***Condensate Recovery, reduce blowdown, improve boiler efficiency ...***

16.3. Consultation on CASO assessment

#	Company Name	Electricity Savings (kWh/yr)	Total Investment up to date (million VND)	Implemented Solutions
(1)	(2)	(3)	(4)	(5)

Note: For the column "Implemented Solutions", it is necessary to write briefly as: ***reduce leakage, change pipes size...***

Please send the filled questionnaires before 15.10/2014 via contact:

The Office of Energy Conservation Centre of HCMC in Hanoi. Room 1, 2nd Floor, CEN ASSEST, Building 137 Nguyen Ngoc Vu, Cau Giay, Hanoi. Phone: 0943377123 (Ms. Nhan); 0462701435 (Ms. Nga).

Email: donhan@ecc-hcm.gov.vn or: N.Pham@unido.org

Sincerely thanks to your provided information.

ANNEX 4

SURVEY QUESTIONNAIRES FOR INDUSTRIAL ENTERPRISES

Dear: Sir/Madam

Under the Project ***"Promoting Industry Energy Efficiency through System Optimization and Energy Management Standards in Vietnam Project" implemented by the Ministry of Industry and Trade and UNIDO****, the Project Management Unit (PMU) have conducted user training courses on energy management and system optimization for energy managers and technician persons from industry..*

In order to help PMU to evaluate the impacts/outcomes of the conducted training courses as well the project implementation reporting to the project donor, PMU shall conduct a survey to collect information about the results/performance of all energy efficiency measures implemented by participating enterprises in the project training program.

It is highly appreciated if you could cooperate and provide information by answering the following questions. We commit to hold in confidence and not disclose any provided information to third party.

Sincerly Thank!

I.	**GENERAL INFORMATION**

1. Your enterprise is *(Please tick X in the chosen box by click in the box)*

☐ State-owned   ☐ Enterprise with foreign investment

☐ Private   ☐ Others (in details)

2. Mainly focus industry

☐ Paper & pulp   ☐ Textile

☐ Rubber   ☐ Food processing

☐ Others (in details)

3. **Which training courses that you participated in?**

☐   EnMS in line with ISO 50001

☐   SSO

☐   CASO

4. **After participating in those courses, which solutions have been implemted by your enterprise?**

☐   Development and Operation of Energy Management System

☐   SSO

☐   CASO

If not, please give the detail reasons why:……………………..

If solutions are implemented, please indicate the implementation results:

(*Note*: *Please provide only solutions learnt from the Project Training Courses*)

II. Development and Operation of Energy Management System in line with ISO 50001

5. **When your EnMS in line with ISO 50001 has been built**?..

6. **Self-realization or outsource in order to develop the EnMS's processess and procedures?**

☐   Self-realization   ☐   Out-source

if outsource, please provide the name of the consultancy organization

……

7. **Has your enterprise's EnMS been certified with ISO 50001 certification?**

☐   Certified

☐   In preparation process

☐   No intention to obtain certification

8. **If not, which steps have been implemented by your enterprise?**

☐ Energy audit/ energy review

☐ Issued energy policy and established the Energy Management Team

☐ Completed the energy planning

☐ Control operation and implementation

☐ Internal review

☐ Monitoring measurement and analysis

☐ Review of nonconformities and corrective actions

☐ Management review

☐ Invited outside organization to evaluate and certify

☐ Other activities (in details)

9. **If your enterprise applied and operated EnMS in line with ISO 50001, please indicate:**

9.1 Implemented solutions?...

....

....

9.2 After applying EnMS in line with ISO 50001, How many percentage of energy efficiency improvement as in the whole company is.............. %.

9.3 Total energy savings gained after applying EnMS in line with ISO 50001:2011

☐ Tons of oil/year

☐ Tons of coal/year

☐ kWh/year

☐ Tons of gas/year

☐ Tons of biomass/year (which type of biomass used :...........................)

9.4 Total investment cost for the monitoring & measurement system

☐ …………Million VND

9.5 Total investment cost for all implemented solutions

☐ …………Million VND

III.   STEAM SYSTEM OPTIMIZATIO (SSO)

10. Which SSO solutions have been applied in your enterprise?

☐ Take advantage of the high temperature of exhaust pipe to preheat the feeding water and air

☐ Reduce leakage

☐ Control of the excess air percentage

☐ Insulation of steam distribution pipes system and heat exchange devices (boiler, heaters, etc.)

☐ Reducing losses and soot deposits (clean boiler)

☐ Improving the condensate recovery system

☐ Replacing the old boiler with high efficiency boiler

☐ Checking and replacing all failure steam traps

☐ Swiching the boiler fuel (please indicate the type of used fuel at the moment and the alternatives)

☐ Others (in details)………………………………………………………

11. Total energy savings from applying steam system optimization solutions annually

☐ ………………Tons of oil/year

☐ ………………Tons of coal/year

☐ ……… ………Tons of biomass/year (Type of Biomass used :………………………)

☐ ………………Tons of natural gas/year

12. otal investment cost of all implemented SSO solutions

☐   ………………Million VND

13. **Which CASO solutions have been implemented in your enterprises?**

☐   Review and overcome of compressed air leakage

☐   Adjust the placement of compressors

☐   Resetting the operating pressure of compressors

☐   Avoid compressed air abusing

☐   Reduce the pressure at air filters

☐   Using mediate cooling devices and after compress

☐   Adjust/ decentralize the air pressure level

☐   Install auto condensate dischargers

☐   Controlling of usage

☐   Adjust compressors: Auto-off when unneccessary

☐   Reduce the intake air temperature

☐   Adjust compressor performance by inverter

☐   Use high efficiency compressors

☐   Check and adjust the size of compressed air distribution pipes

☐   Maintain manually

☐   Others (in details)

14. **Total energy savings from applying compressed air system optimization solutions**

☐   ………………kWh/year

15. **Total investment cost to apply compressed air system optimization solutions**

☐   ………………Million VND

PLEASE PROVIDE THE ENETERPRISE'S PROPOSALS AND RECOMMENDATION FOR NEXT OUR TRAINING COURSES

……………………………………………………………………..……………………………...

……………………………………………………………………………………………………...

……………………………………………………………………………………………………...

Please send the filled questionaires to the Energy Conservation Centre viathe below mail or email before 15/10/2014:

Northern areas and Da Nang City:

Nguyen Dinh Tuyen, the Office of the Energy Conservation Centre of HCMC in Hanoi.

Address: Room 1, 2nd Floor, CEN ASSET, Building 137 Nguyen Ngoc Vu, Trung Hoa, Cau Giay, Hanoi

Email: dinhtuyen@ecc-hcm.gov.vn or Vphanoi@ecc-hcm.gov.vn

Phone: 04.63278966   Fax: 04. 62814149   Mobile Phone: 0983.523.338

Southern areas:

Ms. Dzang Thi Luan, the Office of the Energy Conservation of HCMC

Address: 244 Dien Bien Phu, District 3, HCMC

Email: nguyenloan@ecc-hcm.gov.vn

Tel: 08.39322372 (etx:13)   Fax: 08.39322373 Mobile: 0988.436.488