

CLEANER TECHNOLOGY CAPACITY BUILDING FOR RELEVANT STAKEHOLDERS FOR THAI INDUSTRY SMALL AND MEDIUM ENTERPRISES (SMEs)

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Previously, the management of an industrial environment was particularly focused on the end of pipe approaches. These made the industries faced with the rising cost of treatment due to stringent performance standards. Meanwhile, it was the burden on the government in regulating industries in order to make them complied with designated standards. To date, the trends of environmental management approaches have been changed. In an effort to maximize the reduction of pollution with cost effective, the concept of reductions of pollution at point sources or cleaner technology (CT) has gained widespread acceptance as appropriate strategies in resolving pollution problems for sustainable development.

The Department of Industrial Work (DIW), Ministry of Industry. Which is directly responsible for regulating industrial pollution and issuing permits for industrial operations in the country. DIW considered that it is important to collaborate among industrial 11 sectors to compose with Textile, Food, Pulp and Paper, Cassava, Iron and Package, Noodle Ago-Chemicals, Palm-Oil, Tannery, Metal-Finishing and Non- Ferrous in performing cleaner technology activities for management of industrial environment . The DIW assigned Thailand Environment Institute (TEI), Chulalongkorn University (CU) and The Environmental Industry Institute in the Federation of Thai Industries (FTI) to conduct the "Cleaner Technology Capacity Building for Relevant Stakeholders for Thai Industry, Small and Medium Enterprises (SMEs)". Under " Measures to Increase Governmental Expenditure, to Stimulate the Economy". These report was focused on 4 target industries; those were, food products industry, textile industry, pulp and paper industry, cassava industry, with the total of 70 factories by The Environmental Industry Institute in the Federation of Thai Industries (FTI). Firstly, the numbers of factories from aforementioned industries were less than the requirements. The Environmental Industry Institute, then, invited other industries either the membership or non-membership on the institute to participate in the project. As a result, there were 70 factories participated in which can be categorize into 5 groups, 32 factories of food products industry, 15 factories of textiles industry, 8 factories of pulp and papers Industry, and 4 factories of cassava industry and others 11 factories.

Considering the size of factories participated in the project, it could possibly be classified into 2 groups by size: a large enterprise (46 factories) and a small and medium enterprises (24 factories), under the draft of the Small and Medium Enterprise Act. These 70 factories were located in 17 provinces in different regions as the following detailed.

Central region	44	factories
Western region	12	factories
Eastern region	7	factories

North eastern region	6	factories
Southern region	1	factory

With the information collected during the preliminary assessment phase and the detailed assessment phase from 70 factories, there were totally of 1,081 opportunities or in an average of 16 opportunities per factory for performing clean technology activities. These opportunities, then; were classified into three different groups. In case of classify by the methods used in an operation for conducting cleaner technology activities, there were 605 opportunities (56 percent) using management and 476 opportunities (44 percent) using technique. In case of classify by the status or potential of factory to conduct cleaner technology activities, there were 701 opportunities (65 percent) that could proceed activities immediately. The remaining, 380 opportunities needed to be further study before conducting activities. In case of classify by the factors involved in activities performing in factories, the opportunities could be present in descending order from most to least as the following; water 33 %, energy 24 %, raw material 14 %, products 11 %, safety 6 %, chemical 5 %, occupational 4 %, training 2 % and waste values added 1 %.

The total of possibility of cost saving occurring from conducting cleaner technology activities in the project was about 163, 930, 659 Baht or in an average of 2.4 Million Baht per factories. This information did not include the adjusted of unknown data, which needed to be compared before conducting the activities. In addition, considering the energy conservation by minimizing the consumption, it showed that the possibility in reducing the heavy fuel oil in the process was 3,000,000 liters per year. As a result, air pollution such as SO₂, NO₂, CO₂, could be reduced about 118 tons, 8 tons and 11,857 tons per year respectively, if these 70 factories still continued conducting cleaner technology activities.

Conclusion and Overview of the Project

Industrial classification

According to the information of the DIW in March 2000, it was reported that there were 126,000 registered factories. The DIW classified these factories into 104 industrial categories. For this project, the DIW assigned the Environmental Industry Institute in the Federation of Thai Industries Institute to conduct cleaner technology activities in 70 factories of 4 target industries those are; food products industry, textiles industry, and cassava industry. Since, firstly, the number of factories in the target industries were less than 70 factories, other industries were invited to participate in the project. Later, there were 70 factories participated in the project that could be classified into five groups as the following.

Group of Industries

1. Food products industry.

There were 32 factories participated in this project. According to the statistic of DIW in March 2000, it reported that there were 5,800 factories in the manufacture of, animal which is not water animal, milk, water animal, vegetable or fruit, food from flour, sugar, confectionery, animal food, malt or beer. On the other word, the proportion of factories that participated in the project was 0.55 percent out of the total number of factories in this industry.

2. Textiles industry.

There were 15 factories that participated this project. According to the statistic of DIW in March 2000, it reported that there were 7,340 factories in the manufacture of textiles, thread or fiber, textile product which is not cloth, knit, lace, apparel with thread or fiber or dyeing, dressing apparel which is not shoes. On the other word, the proportion of factories that participated in the project was 0.2 percent of the total number of factories in this industry.

3. Pulp and paper industry.

There were 4 factories that participated in this project. According to the statistic of DIW, it was mentioned that the total numbers of pulp and paper industry were 114 factories. The proportion of factories that joined the project was 7 percent of the total number of factory in this industry.

4. Cassava industry

There were 4 factories that participated in this project. According to the statistic of DIW, it was mentioned that the total numbers of manufacture of cassava were 108 factories. The proportion of industries that joined the project was 3.7 percent of the total number of factories in this industry.

5. Others industry

There were 11 factories in this group such as cosmetic, cement, steel and wire.

Size of Factory; a factory can be classified by size as the following:

- Large enterprise is a factory, which has employee over 2,000 persons. There were 46 factories participated in this project.
- Small and Medium Enterprise (SMEs) is a industry which has employee not more than 200 persons. There were 24 factories participated in this project.

Detail of category and size of industries that joined the cleaner technology project are given in the following table.

Table 1 Category and size of industries participated in the project

Industry	SMEs	Large
Food	7	25
Textiles	5	10
Pulp and paper	3	5
Cassava	4	-
Others	2	6
Total	24	46

Table 2 Opportunities of industries classified by type of operation and status or potential of factories in conducting cleaner technology

Industry	Type of operation				Status of industry			
	Management		Technique		Suitable to conduct activities without needed further study		Needed further study	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Food	300	60.5	196	39.5	332	66.9	164	33.1
Textiles	114	52.5	103	47.5	122	56.2	95	43.8
Pulp & Paper	65	48.1	70	51.9	102	75.6	33	24.4
Cassava	42	57.5	31	42.5	50	68.5	23	31.5
Others	84	52.5	76	47.5	95	59.4	65	40.6
Sum/Average	605	56.0	476	44.0	701	64.8	380	35.2

Table 2 showed that opportunities to conduct cleaner technology could be classified by type of operation into the opportunity to use management and the opportunity to use technique. It was found that the proportion of an opportunity to use management was similar to the opportunity to use technique in all groups of industry. The opportunities that required the management operation for conduct cleaner technology activities were 605 opportunities or 56 percent. The opportunities required technique use in an operation was 476 opportunities or 44 percents.

Considering opportunity to conduct cleaner technology by status or potential of factories, it was found that all industrial groups had a similar proportion to conduct cleaner technology activities. In an average, the potential of factories to conduct the activities immediately was higher than those needed further studies before conducting the activities in the ration of 2 to 1. There were 701 opportunities or 64.8 percent that the factory could conduct activities immediately and there were 380 opportunities or 35.2 percent of all opportunities that the factories need further study before conducting activities.

Opportunities to conduct cleaner technology classified by factors involved in activities.

Opportunity for conducting cleaner technology was classified by factors involved in the manufacturing as shown in Table 3

Table 3 Opportunities of Industry in conducting cleaner technology classified by factors involved in manufacturing

Industry	Raw Material	Water	Chemical	Energy	Product	Waste Value Added	Safety	Health	Training	Total
Food	47	184	19	114	56	10	35	17	14	496
Textile	31	45	15	75	17	-	10	16	8	217
Pulp & paper	34	49	10	19	8	-	11	-	4	135
Cassava	6	26	1	8	19	-	10	2	1	73
Others	32	49	9	39	23	1	3	4	-	160
Total	150	353	54	255	123	11	69	39	27	1,081

Proportion of factors involved in cleaner technology activities of all industries were reported in descending order from most to least opportunities as the following; water 33 %, energy 24 %, raw material 14%, products 11% safety 6%, chemical 6%, occupational 4%, training 2% and waste value added 1%. At present, most of factories in Thailand are not much concerned to save the water. It might be that the cost of water supply is rather cheap and available. The factories, then, look over the consumption of water supply. However, opportunity to conduct cleaner technology concerned with water supply could be reduced much expenses.

The next important factor was the energy conservation. Mostly, this factor was related to the use of steam in the industries. It is one of many factors, which has been ignored also. This might be because the employees did not aware to the amount of energy loss from non-insulated steam pipe and blow down condensation which still had heat and rather clean

without utilization. Heat loss with an excess air from boiler as a result of the combustion or lacking of controlling of the blow down ration of and lacking of good maintenance were some example of an enormous energy loss.

The third important factors were raw material and products. Mostly it was well controlled due to these factors were the main expense and income of the factories. However, there were some points that could be reducing the use of raw material and product loss in the process. The pattern of reduction of raw material and products in each factory was different from others. This information could be study from the as assessment report of each factory.

Considering by industry, the factor of water or water consumption had the highest proportion. Except for the textiles industry, which had high opportunity involved in the energy. It might be that the textiles industry was the industry, which use much steam in the process. Therefore the possibility of opportunity for conducting cleaner technology was much concerned with energy conservation. In the process of an assessment for conducting cleaner technology, the detail of using boiler including steam pipes and reuse of condense waster would be studied.

Possibility in saving the money and a reduction of air pollution and CO₂

The total of possibility in saving occurring from conducting cleaner technology activities in the project was 163, 930, 659 Baht or in an average of 2.4 Million Baht per factories. In addition, considering energy conservation, it had possibility to minimize the use of heavy oil in the process 3,000,000 litres per year. This caused the reduction of air pollution such as SO₂ about 118 tons per year, NO₂ about 8 tons per year and CO₂ about 11,857 tons per year if these 70 factories still continued conducting activities.

Considering the details of each industry category as shown in table 4, though the pulp and paper industry had only 8 factories, it had a possibility in saving about 48 million Baht, or in an average of 6 million Baht per factory. It might be that most of them were large factories. Thus, the potential in conducting clean technology activities in each opportunity could possibly get highly cost saving. In addition, most of factories in this industry usually had committees and personals with high capability and expertise in this field.

Table 4 Possibility in cost saving and a reduction of air pollution and CO₂

Industry	Number of factory	Cost Saving	Reduction of air pollution and CO ₂ (Tons / year)		
			SO ₂	NO ₂	CO ₂
Food	32	72,513,386	87.52	6.02	9,038.9
Textile	15	22,375,243	20.43	1.15	1,707.25
Pulp & paper	8	48,722,682	-	0	0
Cassava	4	5,133,411	5.42	0.28	424.83
Others	11	15,185,937	4.7	0.7	686
Total	70	163,930,659	118.07	8.15	11,856.98

However, the possibilities of cost saving as mentioned above represented only the opportunity in factories that had completed information. Some cost saving did not include such as management activities. Most of factories could not get the record for comparing cost saving. Because the factories knew that if they conducted cleaner technology they would save the money from such activities. So they would do without planing to keep

record either before or after conducting activities. Furthermore; some activities had already done and for the remaining activities were undertaken. Therefore the certain benefits would be occurred or not, it depended on the motivation and steadily in continual performing cleaner technology activities of all 70 factories.

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