

Chapter 6. 3R Policy and Related Activities in Thailand

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I. Introduction

Although 3R polices are still in the initial phase in Thailand, several initiatives have been undertaken to promote 3R, including the activities under the name of Cleaner Production (CP). From the perspective of enhancing competitiveness and economic incentive, CP is recognized as a successful tool. There has been rapid expansion in the applications of CP from industry to other sectors, especially education and research. In addition, cement industries started to utilize waste as alternative fuel and raw materials.

This paper reviews some efforts to promote 3R, including Cleaner Production programs and the usage of waste in cement industries and waste to energy facility.

II. 3R Related National Policies

Thai government has implemented some policies related to 3R in this decade. In January 2002, the government endorsed “National Master Plan on Cleaner Production”. “Government Green Procurement Plan” was also endorsed in January 2008.

In order to tackle problem of resource depletion, pollution, hazardous waste, lack of land fill sites, global warming and others, the government has taken some efforts to preserve environment and natural resource and to improve green competitiveness of industries. Tools are cleaner production or cleaner technology, Life Cycle Assessment (LCA), Eco-design and Environmental Labeling (listed in ISO 14000). Government green procurement also pushes activities for greening the industry from the demand side. Not only the Ministry of Natural Resource and Environment, but also Ministry of Industry, and National Metal and Materials Technology Center have been interested in this filed and have conducted some programs. Thailand Environment Institute, Federation of Thai Industry and some universities have collaboration with these ministries.

One of latest initiative by the government is Government Green Procurement Plan. The Green Procurement Plan has some targets, in terms of percent of units (department level) implementing Green Procurement and percent to budget for each product purchase (see table 1).

Table 1. Target of Government Green Procurement Plan

Year \ Item	2008	2009	2010	2011
Percent of Units	25	50	75	100
Percent of Budget	25	30	40	60

Source: Green Procurement National Plan

III. Cleaner Production in Thailand

III-1. Background

The activities to promote Cleaner Production were started in 1990. Backgrounds of the concern on cleaner production are as follows.

- Rapid expansion of the manufacturing industry is reflected not only by the increase in GDP, but also by the rapidly increasing rate of air, surface water, and soil pollution.
- “Command and control” (CAC) approach, based on European & American pollution control models, relying on laws and regulations establishing emission limits and the subsequent enforcement.
- The success of CAC approach has been limited due to the stringent environmental standards which are beyond the capacity of existing industries or certain industrial sectors in Thailand.
- The situation is further worsened by a generally incompetent monitoring and enforcement measures, resulting from insufficient manpower and training in the government sector.

In response to the continuing environmental degradation and the perceived limitations of the CAC approach, Thailand has included “CP” in the 8th National Economic and Social Development Plan (starting 1999). The plan promotes cooperation among government agencies, private organizations, local communities and individuals for environmental conservation by *preventing* generation of pollution at the source (commonly known as Cleaner Technology or CT) and finding solutions for existing pollution loads. See Table 2 for the list of important CP and related projects.

In order to share the knowledge of experts on CP, in 1998 Cleaner Technology Education and Research Consortium was established. It was initiated by NSTDA. Thai National Pollution Prevention Roundtable (TNPPR) was also set up in 1999 and has meeting every 2-3 months hosted by members such as NSTDA, Tourism Authority of Thailand (TAT), TISTR, PCD, DIW and others. The first annual meeting of TNEC was held at PCD on Dec 2001. The CP working groups on Education and R&D, Agriculture and Tourism, Industry and Government have been formulated.

Table 2. List of Important Cleaner Production and Related Projects

	Program	Donor and implementing organization	Activities
1990-1995	Industrial Environmental Management Program	USAID, IEM-FTI	CT in 38 factories (12 textile, 8 pulp & paper, 5 food, 5 iron & steel, 8 chemical factories)
1994-2001	Environmental Advisory Assistance for the Industry	GTZ, DIW	CT in leather tanneries, palm oil mills, fish processing, starch & derivatives, metal finishing
1996-2001	Network for Industrial & Environmental Management (NIEM)	UNEP, TISTR	CT in Pulp & Paper factories
1996-1998	Promotion of Cleaner Technology in Thai Industry	DANCED, TEI, and IEM-FTI	CT audit for Food/Metal Finishing and textile Industries. Set up CT information Center (CTIC) at TEI.
1997-1998	Participatory Approach to Environmental Management and Clean-up in Samut Prakarn Province	EU and TEI	Set up Participatory Environmental Management Committee. CT Audit for Auto parts and Agrochemical Industries.
1996-present	CT Internship Program	NSTDA, Universities and Industries (GUI concept)	Education and Research Program (Internship Program, courses on CT, LCA and Eco-design at universities)
1998-2000	Industrial Pollution Prevention and Cleaner Technology Transfer in Samut Prakarn	ADB and PCD	Project on Cleaner Production for Industrial Efficiency (CPIE)
1999-present	Sector Specific COP CT-manuals	CT unit at DIW	Make Sector Specific Code of Practice (COP) or CT-manuals
1999-2000	CT in Industry (Miyazawa Project)	DIW, TEI, FTI etc.	
1999-2001	CT in Industry and Farming	DANCED, TEI	
2000-2002	CT in Municipalities: Rachaburi & Bangpong	PCD & TEI	
2001-2002	CT & Benchmarking in Schools	DGE, TEI, NEPO	
2001-2004	Cleaner Technology Transfer Program	ADB and DEQP	
2005-2007	3R National Strategy Project in Model Countries	IGES, Ministry of Environment, Japan	Model countries: Thailand, Philippines, Malaysia, Cambodia

Note: ADB: Asian Development Bank

DANCED: Danish Cooperation for Environment and Development

DEQP: Department of Environmental Quality Promotion

DIW: Department of Industrial Works

DGE: Department of General Education EU: European Union

IEM-FTI: Industrial Environmental Management Office in Federation of Thai Industries

IGES: Institute for Global Environmental Strategies

GTZ: German Technical Cooperation GUI: Government-University-Industry

NEPO: National Energy Policy Office

NSTDA: National Science and Technology Development Agency

PCD: Pollution Control Department

TISTR: Thailand Institute of Science and Technological Research
TEI: Thai Environment Institute
USAID: United States Agency for International Development
UNEP: United Nations Environmental Programme

III-2. Some Programs for Cleaner Production

Thai government started Cleaner Production activities in 1990s. Based on various projects, experts of CP have been formulated. The Department of Industrial Works (DIW) in Ministry of Industry has promoted CP to Thai industry since 1998. They organized the experts to make Code of Practices on CP. The purpose of “Code of Practices” (COP) is to be used as guidance for specific industry in order to enhance competitiveness and reduce wastes (preserve natural resources). COP covers several CP measures, Environmental Performance Indicators (EPI) for benchmarking, and case studies. Up to February 2009, there are 12 CP Code of Practice (COP) for following industries: Dairy (Milk), Natural rubber, Pineapple canning, Frozen seafood, rice noodles, tapioca starch, fish canning, electroplating, Thai vermicelli, Wooden furniture, rice mill and Meat processing.

Pollution Control Department (PCD), MONRE has promoted CP to community and service sector since 1996. There are several projects (and manuals) for Schools, Hotels, Pig farm, Dyeing, Food, Sauce, Fruit drink, Cold storage, etc.

CP Internship Program in Thailand is operated by government, universities and industries (Figure 1). National Metal and Materials Technology Center under Ministry of Science and Technology is the program coordinator and the funding agency. Industry is on-site coordinator. Industries also bear the cost of per diem to student interns. CP experts and researchers in universities are mentors for student interns. The program has started since 1996, eight universities across the country are now participating the program: Chiangmai University, Khon Kaen University, Thammasart University, Chulalongkorn University, Kasetsart University, Mahidol University, King Mongkut University of Technology and Prince of Songkla University. Outputs of the project are human resource development of student interns and factory staffs, CP technology transfer to industry, pollution reduction and economic benefits. The first step of the CP internship program is recruitment of factories, students and faculties. Three day training workshops for factory coordinators, student interns and faculty members are organized. In the next step, CP audit is performed and the initial proposal is presented by student interns. After that, CT detail audit is performed, while low/no cost CT measures are implemented. Progress report is also presented. Final proposal is presented, after third CT audit is conducted.

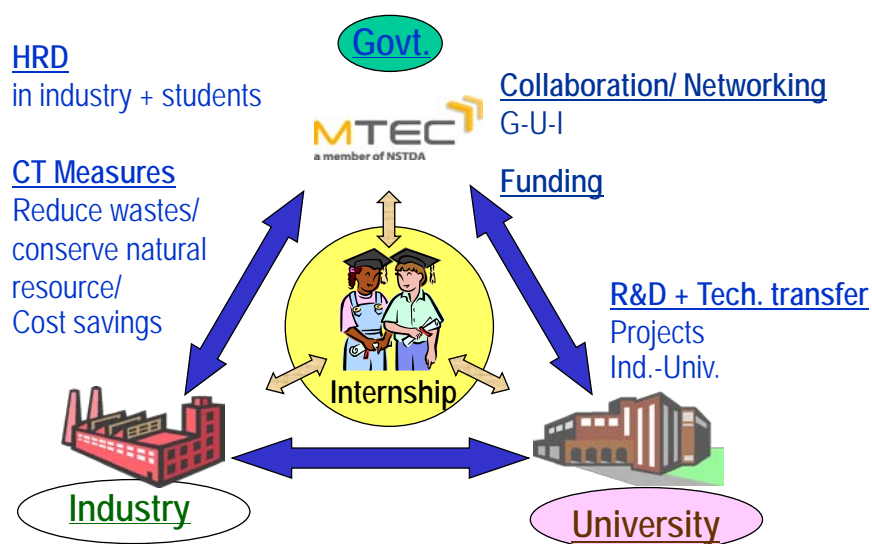
Questionnaire survey for participated industries and faculty members during 2003 to 2007 showed that 76% percent of proposals had been implemented. While the investment was about 17 million baht, the CT measures can save about 50 million baht per year. Student interns also got experiences to improve the production processes.

Table 3. Output of CP Internship Program (2005-2008)

Year	2005	2006	2007	2008
No. of university in the network	7	7	8	8
No. of Industrial Companies	102	106	111	67
No. of Students involved	204	222	238	142
No. of Faculty Members involved	165	153	153	100
No. of Coordinators from Industry	102	106	111	67
No. of CP-Options proposed	>102	>123	317	193
Expected Savings (Million Baht / year)	>153	>69	>125	>53
No. of Student's Research Projects	12	17	39	24

Figure 1.

CP Internship Program- Education (Tripartite Collaboration G-U-I)



35

III-3. Discussion for implementing Cleaner Production Program

Some success factors have been observed from various CP projects. Commitment of top management is an essential starting point to implement CP. CP expert team should have determination, creativity, ability and knowledge. Cooperation from all stakeholders including all employees is needed. Incentive mechanism for employee to participate CP, such as staff education, 2 ways communication and reward program should be carefully designed. Data on use of resource and generation of waste should be collected.

In addition, based on the experiences in Cleaner production activities, we learn following lessons. First, from the view point of capacity of target companies, CP

measures should be distinguished into two categories: good housekeeping (simple + no/low cost) for small and medium enterprises, and technology improvement (complicate + high cost) for large enterprises. Second, CP measures need both CP expert and industrial specific expert to work together. Third, it is important to highlight CP economic benefit. Fourth, cost of utilities (especially water/ wastewater treatment) should reflect the real cost (normally subsidized in developing countries). Fifth, Govt. should implement environmental tax/ polluter pay principle (assign all external cost related to environment.)

IV. Waste reduction and Recycling measures in Cleaner Production Program

Practical use of CP concept and practices for Thai industry cover both *simple options* as well as *sophisticated technology options* resulting in the reduction of production cost, reduction in pollution generation as well as improved environmental protection.

In the cleaner production pilot projects, some waste reduction and recycling measures were applied. For metal finishing industry, membrane filtration system to recover heavy metals and produce de-ionized water was installed. Spray rinse and static rinse after chromium handling and drag-out recovery tank were also applied. By these measures, water and chemical consumption can be reduced. Nickel was recovered by reverse osmosis system. Payback period was only 1.3 year.

Regarding rice noodle factory, by applying CT, starch, water and energy consumption were saved. Washing system was changed from mechanical (impeller) to pneumatic (compressed air) system. Continuous extrusion line package with automatic cutting machine was installed together with water reuse system and thermal insulation of steam equipment. Housekeeping practice was also improved. Economic costs and savings were estimated as Table 4.

Table 4. Economic Benefits of CP for a Rice Noodle Factory

CP Measures	Investment (Baht)	Savings (Baht/year)	Payback Period (Year)
1. Apply First in first out concept for rice storage	5,000	46,420	0.11
2. Install waste reuse system	91,000	48,710	1.87
3. Install washing rinsing system	75,800	79,730	0.95

Environmental Benefits are as follows.

Reduce starch loss (& solid waste, BOD in WW)	13,185 kg/yr
Reduce water consumption (& wastewater)	4,259 m ³ /yr

Service sector can also make waste reduction by applying CP measures. Regarding hotel, solid waste segregation and organic/food waste composting save annually 78,413 baht and 4,000 baht respectively. A hospital can save annually 25,000 baht by segregation of infected and general wastes, 84,000 baht by the use of bulk package of juice and sauce, and 60,000 baht by recycling program.

V. Utilization of Waste by Cement Kilns and Waste to Energy Facility

Department of Industrial Works has announced the list of licensed facilities for disposal of waste or unusable materials, and classified these facilities into 2 main groups (DIW, 2007). The first group divided into 4 types: disposal of waste by cement kiln (9 facilities), disposal of waste by industrial waste incinerators (3 facilities), disposal of waste (hazardous and non-hazardous) by landfill (3 facilities), and disposal of non-hazardous waste by landfill (3 facilities). In the second group, 53 factories are classified as separation and recycling facilities.

V-1. Cement Kilns

Industrial solid waste is incinerated in cement kiln as substitutes to fuel and raw material or unqualified wastes. Typical wastes for fuel substitution are biomass such as rice husk, paper and cloth. These wastes are going to the unit of cement kilns. Examples of co-material or raw material substitution are steel slag, fly ash and bottom ash. These wastes are going to raw material preparing unit. Unqualified wastes such as contaminated wastes are also incinerated in the cement kilns.

Right now, the three cement manufacturers, TPIPL, Siam City Cement (SCCC), and Siam Cement Group (SCG), have a total capacity of industrial waste incineration around 411,703 tons/year (2007). Table 5 shows the volume of waste used by SCCC and SCG. TPIPL accepted about 121 thousand ton of hazardous waste annually.

Table 5. Disposal and Utilization by Cement Kiln of SCCC and SCG (Unit: ton)

	Waste	Total	Alternative fuel	Alternative raw material	Incineration disposal
Siam City Cement (2006)	Hazardous	101,414.46	6,606.52	68,107.42	26,700.52
	Non-hazardous	244,226.49	54,906.09	184,442.93	4,877.47
Siam Cement Group (2007)	Hazardous	132,329.55	50,352.09	66,440.45	15,537.01
	Non-Hazardous	167,476.52	44,886.36	107,588.93	15,001.23

Source: based on manifest data to DIW.

V-2. Waste to Energy Facility

Currently, there are 3 waste-to-energy plants in Thailand that can handle the industrial waste (Table 6).

Table 6. Incinerator for Industrial Waste

Facilitators	Maximum capacity (ton/year)	Status	Technology
Department of Industrial Works	12,600	Waiting a tender	Waste to Energy
OM TECNOS Company	960	Operational	
Bangpoo Environmental	36,500	Operational	Waste to

Complex			Energy
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VI. Conclusion and Further Steps

Concept of 3R has not been fully adopted in national policy of Thailand, so far. But cleaner production programs cover waste reduction and recycling in manufacturers and service sectors. Such programs generate economic benefits and environmental benefits. In addition, some plants to utilize waste have been developed, such as waste to energy facility. Cement industries also utilize waste as alternative fuel and raw materials.

Based on the experiences of CP student intern program, human resource development on cleaner production is very important. With support of government, industries and universities should have collaboration program for Cleaner Production. Such programs can enhance human resources save resources. Industries also enjoy the cost savings.

One of the limitations of cleaner production is the fact that basic scope is limited to the production process in a factory. in order to reduce waste further in economical way, it may be necessary to work with other recycling factories. Although it is not mentioned in this paper, some other activities have been implemented in Thailand, such as Waste Information Exchange Programs and Eco-Town Programs, which will be reviewed in other papers.

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