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ENERGY EFFICIENCY TOWARDS GREEN PRODUCTIVITY

By Lok Lee Lee, NPC

A Workshop on Green Productivity (GP) and **Benchmarking** was recently concluded with the objective of promoting the integration of GP and Energy Efficiency (EE). Representatives from 15 member countries of the Asian Productivity Organisation (APO) gathered at the workshop that was held in New Delhi, India from 12-16 January 2004. It was jointly hosted by the APO[1] Tokyo and the National Productivity Council of New Delhi.

In addition to the country paper presentations by the participants, the hosts appointed two APO resource speakers from Japan and Malaysia. Mr. Ikeuchi Yoshiharu deliberated on energy benchmarking in Japan with special focus on the steel making industry. He attributed the country's success to the extensive energy saving campaigns, mandatory audits and small group activities.

For Malaysia, I discussed how benchmarking could assist industries in bringing about higher productivity, energy cost savings and ultimately lower CO_2 emissions; hence positive impact on Green Productivity (GP).

Energy and Environment Issues Addressed Simultaneously

GP is about enhancing productivity, competitiveness and environmental performance for sustainable development through energy conservation i.e. energy efficiency and the use of renewable energy sources.

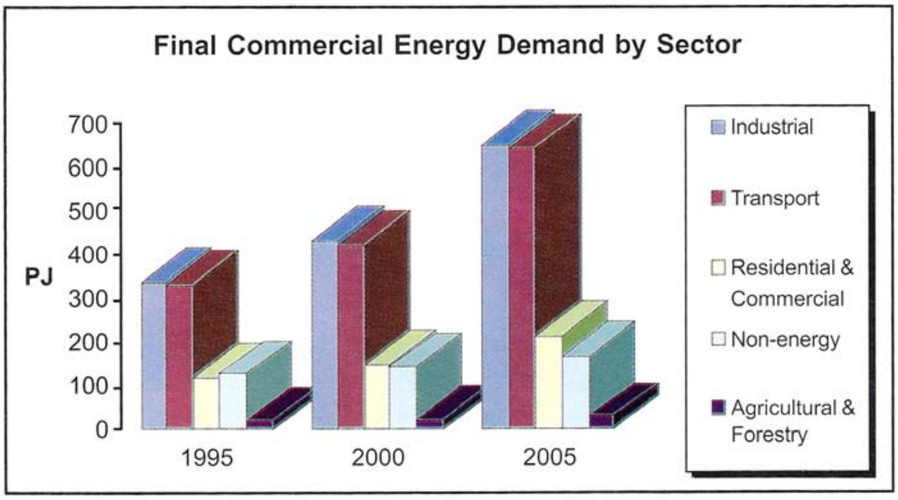
Malaysia has been a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) since 1993 and is committed to reducing Greenhouse Gas (GHG) emissions and mitigate climate change. Malaysia's energy policy focuses on:

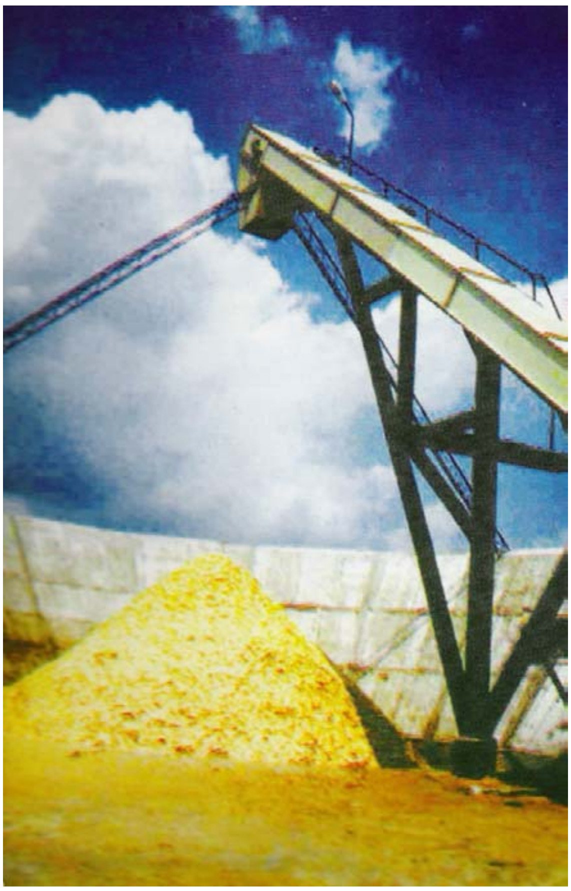
- ***Energy Supply*** **-** energy adequacy, reduce dependency on oil, alternative sources
- ***Energy Utilisation*** - promotion of EE and its encouragement, and elimination of wasteful energy and non-productive energy consumption patterns
- ***Environmental Consideration*** **-** minimisation of environmental degradation

1 The Environment Department 01' APO has five core areas: QP Promotion Mission, GP Demonstration Pro gram, GP Dissemination Assistance, GP Technical Information and Advisory Service and International Cooperation.

Energy-use is a major cause of atmospheric pollution, particularly because energy is largely generated by burning fossil fuels. The extensive use of non-renewable sources to meet the industry's energy demand, spurred by the nation's rapid industrialisation, worsens the levels of GHG emissions.

Figure 1: Energy Consumption Trend in Malaysia *(Source: Eighth Malaysia Plan (8MP))*





- Industrial sector is the largest energy consumer. Its share of the total final commercial energy demand is expected to increase from 37.1 % in 2000 to 38.2% by the year 2005.
- Increase of 25.7% in consumption of final commercial energy, which grew at an average of 4.7% from 928.2 Petajoules (PJ) in 1995 to 1,167.1 PJ in 2000
- Industrial end-use energy inefficiency accounts for 30% of sector's demand
- Industrial energy wastage may reach 650 PJ (2005) annually. This wastage is equivalent to 783 million barrels of crude oil and costs the nation RM 7.76 million (USD 2 million)

Energy Efficiency Benchmarking: A Window for GP Intervention

One of the efforts in promoting Energy Efficiency (EE) is the Malaysia Industrial Energy Efficiency Improvement Project (MIEEIP), launched in 1999 and implemented by the Malaysia Energy Center/Pusat Tenaga Malaysia (PTM). This project aims to bring down energy consumption in the 8 energy-intensive industries (food, iron & steel, rubber, cement, ceramic, glass, paper and wood) by 10% by 2004.

Energy audits conducted by the MIEEIP team indicated that if Malaysia were to curb wasteful use of energy, it could contribute to national savings of RM 6 billion over a 5-year period with an investment of RM2.5 billion in energy saving projects. Given that EE technologies have an average. economic lifespan of 15 years, the actual savings realized could be higher.

Benchmarking is one of MIEEIP's eight components, the others being Energy Audit, Energy Technology Demonstration, Energy Efficiency ESCO Support and Financial Institution Participation. NPC acts as the Technical. Advisor for Component 1: Energy-use Benchmarking. Among the objectives of this component are:

- setting up of a data collection system for energy-use benchmarking
- establishing industrial energy-use benchmarks
- establishing a system for disseminating end-use energy benchmarking information to industries
- promoting benchmarking as a productivity enhancement tool together with PTM

e-Tool for Energy Efficiency Benchmarking

Benchmarking is used as a tool to measure and compare energy intensity at process level and overall plant level against peers/industries locally and internationally. A sample of the specific energy consumption table and graph is illustrated in Figure 2. NPC and PTM have developed an on-line e-benchmark system to enable industries to monitor their energy-use performance, and obtain real-time competitive scores and ranking. The Industrial Energy Efficiency Community of Practice has been established in the system and to date 63 factories are participating in this e-benchmarking system. More industries are encouraged to join in this community.

Figure 2: Sample of Specific Energy Consumption (SEC) at process and Overall Plant

SEC	Company A	Company B	Company C
Overall			
- electrical	9.53	3.74	7.89
- thermal	0.00	0.00	0.00
- sum	9.53	3.74	7.89
Melting			
- electrical	3.21	2.17	5.13
- thermal	0.00	0.00	0.00
- sum	3.21	2.17	5.13
Pouring			
- electrical	0.23	0.32	3.00
- thermal	0.00	0.00	0.00
- sum	0.23	0.32	3.00

Graph for overall SEC
Graph : SEC for melting process
Graph : SEC for pouring process

Best in class
Worst in class

Sharing Malaysia's Success Stories

Successful cases from Malaysia were presented at the workshop. These include the benchmarking initiatives and the energy audit recommendations of PTM in terms of energy saving measures which range from zero cost to low cost and high cost measures.

Zero Cost measures: use existing equipment efficiently, motivate and empower employees, proper control and maintenance at factory process; Low Cost measures concentrate on utilities and process improvement within factory, a move towards technology solutions (e.g. insulation, sub-metering, monitoring and targeting) and High Cost measures emphasize on investment in technology, new technologies, new process modification etc.

Abstracts from PTM MIEEIP Newsletters:

- MIEEIP News 10 2003: Energy Savings for Cement Sector; How a corrugated paper packaging box: manufacturer realized an annual energy savings of RM: 68,464 from the energy efficient measures implemented; and also how another company, Newsprint Mill was able to achieve almost 14,770 Giga-Joules (GJ) in annual energy savings, RM 117,800 in annual savings in fuel costs and decreased energy losses resulting from boiler blowdown.

- MIEEIP News 2Q 2003: A Holistic Approach to Energy Efficiency at Pan Century Edible Oils through 4 projects of Steam System Optimization.

- 35,000 GJ in annual energy savings and reduced steam by 10%); Cooling Tower Modification (reduced power. demand at 4 cooling Towers by 8%); High Efficiency: Motors (total investment cost for replacement of all: existing standard motors to HEMs was RM 400,000, this investment was quickly recovered within four years); and finally the Energy Monitoring & Targeting Project detected abnormalities for immediate remedial actions which in turn resulted in energy savings.

- MIEEIP News 3Q 2003: Glass Container Factory undertook a series of low-cost and high-cost EE improvement measures totalling RM 7.5 million. Benefits: total energy savings of 57,300 Giga Joules/annum from its new furnace and 2,800 Giga Joules/annum from improvements lead to savings in fuel cost of more than 33 % from heat recovery system for glass furnace, reduction in water consumption by 25 cubic meters per day from recycling and annual savings of RM 1.8 million. In another successful case study, a cement company, through its fan system optimization improved production and saved 175,000 kilowatt-hours (kWh) annually, improved productivity and saved RM 22,8000 in annual energy costs and reduced annual maintenance costs by RM38,000.

Based on the findings of the MIEEIP energy audit team from 43 factories, the implementation of zero cost, low cost and high cost measures can reduce the combined energy consumption by 14%, 9% and 11.8% respectively. In addition, the efficiency of furnaces and boilers in the industrial sector can increase from 65 % to, 87%, thus resulting in a reduction of GHG emissions by 28%.

Figure 3 illustrates the results of the steam system optimization programme at a refining and soap noodle plant while Figure 4 the potential energy savings and CO_2 reduction in the 8 industrial sub-sectors.

Figure 3: Fuel Savings, Cost Savings and CO_2 Reduction

No	Energy Cost Reduction Measure	Type of Investment	Fuel Savings GJ/yr	CO_2 Reduction t/yr	Capital expenditure RM	Annual cost saving RM/yr	Payback time yr
1	Use of low pressure steam for tank farm heating	low cost	2,665	197	60,900	71,152	0.9
2	Pressure reduction vslve for distallation vacuum system	low cost	6,504	481	28,000	122,551	0.2
3	Insulation improvement	low cost	10,789	798	47,000	203,275	0.2
4	Steam trap maintenance	low cost	4,395	325	77,500	78,725	1.0
5	Condensate recovery	low cost	2,943	218	118,000	73,964	1.6
6	Temperature control for tank farm heating	low cost	1,896	140	23,600	34,648.0	0.7
7	Replacement of steam ejectors with vacuum pump in bleacher	low cost	5,188	384	45,000	96,166	0.5
			34,380	**2,544**	**400,000**	**680,481**	**0.6**

Figure 4: Potential Energy Savings and CO_2 Reduction in the 8 industrial Sub-sectors

INDUSTRIAL SUB-SECTOR	TYPICAL BASELINE ENERGY USAGE PER SUB-SECTOR	POTENTIAL ENERGY % TO ENERGY USAGE **	POTENTIAL ENERGY SAVING PER SUB-SECTOR	TOTAL POTENTIAL CO_2 REDUCTION
	*toe / year	%	toe / year	toe / year
Food	172,275	9.3	16,095	532,652
Iron & Steel	521,964	5.9	30,805	102,689
Rubber	281,820	10.1	28,420	94,739
Cement	101,490	8.0	8,127	27,092
Ceramic	39,079	8.8	3,442	11,473
Glass	124,354	2.6	3,295	10,983
Paper	93,682	6.5	6,063	20,210
Wood	3,872,921	23.0	890,812	2,969,488
TOTAL	**5,207,585**	**9.3**	**987,060**	**3,290,325**

* Toe : ton of oil equivalent (conversion factor, 1 toe = 41.84 GJ)
** Source : MIEEIP energy audit, year 2001

Conclusion

GP can thus integrate productivity improvement with environmental protection and is applicable across industries, firms and communities. The continuous implementation of GP and environmental programs by APO and its member countries has prompted a shift in mindset about the importance of GP. Tagged with that is the increasing attention to a holistic approach for sustainable development to minimize the adverse impacts of climate change and depletion of the ozone layer, and subsequently, raise the quality of human life.