Pengeluaran Bersih

Ke Arah Industri yang Mesra Alam

Cleaner Production

Towards Environment Friendly Industries

Volume 2 No 1
July 2012
ISSN 2232-0466
http://www.doe.gov.my
Cetakan ke-2 (2014)

MM VITAOILS

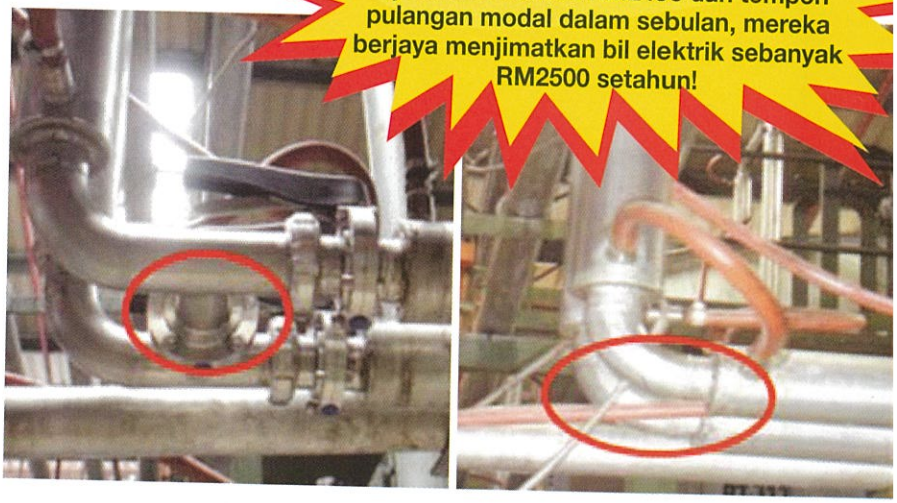
Kisah Kejayaan Pengeluaran Bersih

MM VITAOILS
Makers of quality edible oil products
www.mmvitaoils.com.my

Pengeluar produk minyak masak berkualiti menyahut cabaran melaksanakan teknologi bersih di dalam proses pengeluaran mereka dan berjaya mengurangkan kos ke atas tenaga kerja serta bil elektrik. MM Vitaoils model kejayaan IKS di Malaysia.

Baca selanjutnya di ms 2, 3 & 4

Dengan memasang paip pintasan bagi mengawal keperluan penggunaan *crystallizer* berkos RM2450 dan tempoh pulangan modal dalam sebulan, mereka berjaya menjimatkan bil elektrik sebanyak RM2500 setahun!



MENARIK DI DALAM

Konsep mengenai perubahan proses linear kepada proses kitaran di mana sisa buangan dari industri dijadikan bahan mentah untuk industri yang lain.

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LCA provides an inventory of relevant inputs and outputs of a production system and evaluates their potential environmental impact.

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ISSN 2232-0466

Dari Meja Pengarang

Assalamualaikum dan salam sejahtera,
Syukur Alhamdulillah dapat kita bertemu kembali dalam Buletin Pengeluaran Bersih Edisi Kedua.

Artikel utama memaparkan success story sebuah syarikat IKS tempatan, MM Vitaoils Sdn. Bhd sebagai projek demonstrasi yang telah berjaya melaksanakan amalan Pengeluaran Bersih di dalam proses pengeluarannya. Projek ini memberi gambaran sebenar mengenai keberkesanan pelaksanaan Pengeluaran Bersih oleh industri.

Artikel-artikel lain yang dipaparkan mengetengahkan pendekatan Pengeluaran Bersih bagi mengurangkan penjanaan Carbon Footprint atau Jejak Karbon serta kepentingannya di dalam Cleaner Production to Reduce the Carbon Footprint dan Importance of Cleaner Production Methods in a Carbon Constrained World. Selain itu, terdapat topik seperti Ekologi Perindustrian yang menjamin kelestarian sumber alam, pengurusan alam sekitar yang efisien melalui amalan Life Cycle Assessment, cabaran Malaysia dalam menghadapi kemelut Carbon Tax yang sedang hangat diperkatakan serta tips kecekapan penggunaan tenaga dalam artikel Energy Use and Carbon Footprint.

Pada keluaran kali ini juga, kita dapat mempelajari sesuatu yang baru mengenai kempen Pengeluaran Bersih, iaitu ECOPROFIT® yang telah dilaksanakan dengan jayanya di Austria selama 20 tahun. Pengalaman pihak berkenaan boleh dijadikan panduan dan dorongan kepada kita dalam melaksanakan program CP outreach di Malaysia.

Sementara itu, runagan ulasan buku pula mengetengahkan buku 'Storms of My Grand Children' hasil karya Dr. James Hansen, pakar perubahan iklim dari Amerika Syarikat. Buku ini mendedahkan fenomena perubahan iklim serta impaknya kepada generasi akan datang.

Sektor industri memainkan peranan penting dalam pembangunan ekonomi Negara dan mejadi pemacu kepada pertumbuhan hijau. Sebagai antara pengguna elektrik dan perkhidmatan logistik yang terbesar, pihak industri akan dapat membantu mengurangkan pelepasan gas rumah hijau melalui penjimatan penggunaan tenaga dan melakukan langkah-langkah pengurangan karbon.

Akhir kata, semoga maklumat yang diperolehi melalui buletin ini sedikit sebanyak dapat membuka minda pihak industri khasnya dan masyarakat umumnya mengenai peranan dan inisiatif yang boleh dilakukan dalam menangani isu perubahan iklim yang kian mengancam dunia.

MM Vita Oils Kajian Kisah Kejayaan Pelaksanaan Pendekatan Pengeluaran Bersih (CP) di Industri Kecil & Sederhana

Razuana Rahim Emel: reese.razuana@gmail.com

Profil Premis Demonstrasi

MM Vitaoils Sdn. Bhd. telah ditubuhkan pada tahun 1999, bertempat di zon perindustrian Shah Alam, Selangor. Syarikat ini merupakan *Master Brand* yang mempunyai portfolio jenama produk berkualiti tinggi berasaskan minyak sawit seperti minyak masak, minyak sapi, marjerin dan lelemak. Syarikat ini menghasilkan dan mengeksport 24 jenis produk minyak sawit berjenama ke pasaran 'niche' seperti Korea Selatan, China, India, Eropah, USA, Uzbekistan, Afrika dan Jepun.

Latar Belakang Projek

Projek Demonstrasi Pelaksanaan Pengeluaran Bersih telah dijalankan pada tahun 2009, yang merupakan program perintis JAS (agensi kerajaan) dan dilaksanakan bersama dengan Unit Perunding Universiti Malaya (Universiti) dan MM Vitaoils (industri). Jalinan kerjasama di antara pihak yang terlibat ini telah mewujudkan situasi 'win-win' dan seterusnya telah menarik minat pihak-pihak berkepentingan yang lain. Projek ini dijalankan dengan matlamat utama untuk mewujudkan sebuah premis demonstrasi contoh yang melaksanakan pendekatan dan elemen-elemen Pengeluaran Bersih secara menyeluruh di premis, khasnya terhadap proses, servis dan produk. Pencapaian yang diperolehi bagi setiap aspek pelaksanaan di premis seperti peningkatan kecekapan bagi proses dan aktiviti, pengurangan risiko keselamatan dan kesihatan, serta pengurangan impak terhadap alam sekitar telah didokumentasikan, di mana kelak premis ini berfungsi untuk ditonjolkan sebagai 'showcase' bagi industri-industri lain khasnya IKS Malaysia.

Penerapan Konsep Pengeluaran Bersih

Penerapan amalan CP di premis telah dimulai dengan penubuhan kumpulan CP yang dianggotai oleh pelbagai peringkat staf di premis. Pelbagai aktiviti telah dijalankan iaitu aktiviti audit dan penjanaan opsyen, pelaksanaan opsyen dan pemantauan, bengkel dan latihan kesedaran, aktiviti promosi, dokumentasi video dan audio, penganugerahan staf paling komited serta sebaran maklumat melalui buletin aktiviti CP.

Inisiatif Pengeluaran Bersih

Sejumlah lebih 200 opsyen CP telah dijana berdasarkan kepada isu-isu utama yang dikenalpasti semasa aktiviti audit. Opsyen-opsyen yang dijana merangkumi kategori modifikasi rekabentuk proses dan tatasusun premis, serta memfokuskan kepada kesan yang diperolehi dari segi aspek pengurangan atau pencegahan pembaziran penggunaan air, tenaga elektrik, bahan mentah dan utiliti lain, pengurangan penghasilan sisa proses pembuatan dan produk *off spec*, pengurangan risiko, serta peningkatan produktiviti. Syarikat telah berjaya melaksanakan 78 opsyen kategori tatasusun premis yang tidak memerlukan kos. Berdasarkan kepada penilaian dari segi implikasi kewangan dan impak pelaksanaan, sejumlah 5 opsyen kategori modifikasi rekabentuk dan proses telah dilaksanakan dan dinilai keberkesanannya seperti berikut:

1 Pemasangan Paip Pintasan Bagi Unit Penghablur

PERINCIAN

Semasa proses pembuatan produk minyak sapi halus, lelemak dan marjerin, aliran produk perlu melalui proses penghabluran di mana unit *crystallizer* diperlukan. Walaubagaimanapun, keperluan unit operasi ini adalah tidak relevan bagi produk minyak sapi berbutir di mana proses penghabluran tidak diperlukan. Produk hanya perlu dialirkan terus ke bahagian pembungkusan. Syarikat menghadapi kerugian dari segi penggunaan tenaga elektrik di mana suis unit operasi ini masih perlu dihidupkan walaupun tiada keperluan.

INISIATIF PEMBAIKAN

Pemasangan paip pintasan dilakukan bagi mengawal penggunaan unit *crystallizer* mengikut keperluan sewajarnya.

Sebelum Tindakan Pembaikan

Suis unit *crystallizer* masih perlu dihidupkan tanpa keperluan proses mengakibatkan penggunaan tenaga elektrik yang tidak efisien.

Selepas Tindakan Pembaikan

Pemasangan paip pintasan bagi mengawal keperluan penggunaan unit *crystallizer*. Suis unit ini hanya perlu dihidupkan bagi proses yang memerlukannya sahaja.

PULANGAN KEWANGAN

Kos pemasangan = RM 2450
Tempoh pulangan modal = 1 bulan
Sebelum: Penggunaan elektrik = RM 44,305 (setahun)
Selepas: Penggunaan elektrik = RM 0

2 Penukaran Saiz Diameter Paip

PERINCIAN

Proses pengadukan minyak dan bahan-bahan yang berbeza komposisi di dalam tangki pengadukan mengambil masa selama 45 minit untuk mencapai tahap homogen.

INISIATIF PEMBAIKAN

Pemasangan paip berdiameter 2.0 inci menggantikan paip berdiameter 1.5 inci bagi memendekkan masa campuran bahan mencapai tahap homogen di samping mengurangkan kos penggunaan tenaga elektrik.

Sebelum Tindakan Pembaikan

Paip berdiameter 1.5 inci

Selepas Tindakan Pembaikan

Pemasangan paip berdiameter 2.0 inci

PULANGAN KEWANGAN

Kos pemasangan = RM 3150
Tempoh pulangan modal = 16 bulan
Sebelum: Masa pengadukan = 4212 jam (setahun)
Penggunaan elektrik: RM595 (setahun)
Selepas: Masa pengadukan = 2808 jam (setahun)
Penggunaan elektrik: RM 393 (setahun)

3 Pemasangan Injap Kawalan Pneumatik

PERINCIAN

Proses pengadukkan menggunakan sistem kawalan secara manual di mana sistem ini memerlukan tenaga pekerja tambahan dan tenaga elektrik.

INISIATIF PEMBAIKAN

Pemasangan injap kawalan pneumatik bagi menggantikan penggunaan sistem kawalan manual, di mana dapat menjimatkan kos penggunaan tenaga elektrik, tenaga pekerja serta meningkatkan keselamatan pekerja.

Pemasangan Injap Kawalan Pneumatik

PULANGAN KEWANGAN

Kos pemasangan = RM8250
Tempoh pulangan modal = 8 bulan
Sebelum : Penggunaan elektrik bagi motor = RM 1000 (setahun)
Selepas : Bil Elektrik = RM 0

4 Penggunaan Motor Pam Berefisiensi Tinggi

PERINCIAN

Semasa proses pengadukkan, pam digunakan untuk memutarkan shaf. Walau bagaimanapun, efisiensi pam yang digunakan ini sangat rendah dan menyebabkan penggunaan tenaga elektrik yang tinggi.

INISIATIF PEMBAIKAN

Pemasangan pam berefisiensi tinggi bagi meningkatkan tahap kecekapan proses.

Penggunaan motor pam berefisiensi tinggi

PULANGAN KEWANGAN

Kos pemasangan = RM 16098
Tempoh pulangan modal = 8 bulan
Penjimatan Elektrik: RM 1000 (setahun)

5 Penggunaan Mesin Semi Auto Pengkedap

PERINCIAN

Proses pembungkusan memerlukan tenaga pekerja seramai tiga orang di mana pengendalian mesin pengkedap adalah secara manual.

Penggunaan mesin semi auto pengkedap

INISIATIF PEMBAIKAN

Penggunaan mesin semi auto pengkedap dapat mengurangkan bilangan tiga orang pekerja kepada dua orang sahaja.

PULANGAN KEWANGAN

Kos pemasangan = RM 6700
Tempoh pulangan modal = 8 bulan
Sebelum : Pembaziran pita OPP = RM 122 (setahun)
Tenaga kerja: RM 18 000 (setahun)
Selepas : Pembaziran pita OPP = RM 0
Tenaga kerja : RM 0

KESIMPULAN

Projek demonstrasi ini telah berjaya mencapai matlamatnya hasil kerjasama semua pihak yang terlibat, terutama syarikat MM Vitaoils Sdn. Bhd. yang telah menunjukkan kesungguhan dalam menyumbangkan idea yang positif dan bekerjasama bersama kesemua ahli projek. Diharapkan kejayaan projek demonstrasi ini dapat dijadikan model dan rujukan kepada syarikat lain dan seterusnya mencapai sasaran pihak Jabatan Alam Sekitar dalam mempromosikan pelaksanaan pendekatan Pengeluaran Bersih di premis IKS Malaysia.

Ulasan Buku

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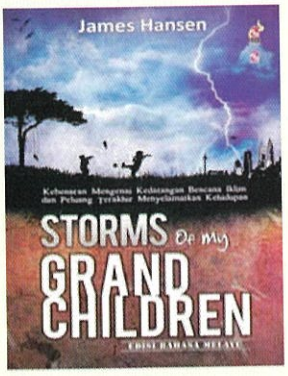

James Hansen, Storms of my Grand Children – Fenomena Pemanasan Global. 2012

USA: Bloomsburg Publishing plc.

Buku ini bermanfaat kepada mereka yang ingin memahami dan mendalami isu pemanasan global yang melanda dunia hari ini seperti faktor- faktor penyebab, senario masa kini dan permasalahan dalam menanganinya. Ia mengisahkan perjuangan seorang pengkaji iklim dunia terkemuka, Dr James Hansen yang dikenali sebagai individu yang menarik perhatian dunia kepada isu pemanasan globa. Beliau dilantik sebagai ahli Pasukan Petugas Iklim (Climate Task Force) bagi kabinet Amerika Syarikat, di mana beliau telah membentangkan kertas kerja bertajuk 'The Forcing Agents Underlying Climate Change' dalam mesyuarat yang diadakan pada 29 Mac 2001. Beliau mendedahkan bagaimana agen paksaan seperti CO_2 di atmosfera menjejaskan keseimbangan tenaga dan suhu bumi. Antara ancaman perubahan iklim yang utama ialah penghasilan gas rumah hijau yang dihasilkan oleh aktiviti manusia. Beliau turut mencadangkan pengurangan CO_2 dari paras 387 ppm (tahun 2009) kepada sekurang-kurangnya 350 ppm bagi mengawal pemanasan global.

Dalam buku ini, Dr. James Hansen telah menunjukkan bukti-bukti saintifik yang menyokong berlakunya perubahan iklim terutama *climate forcing* antara tahun 1750 dan 2000 di mana terdapat 7 punca yang terhasil daripada aktiviti manusia, iaitu CO_2,gas rumah hijau lain (N_2O, CFC, CH_4), ozon /aerosol karbon hitam, aerosol pantulan, perubahan awan dan perubahan litupan tanah. Beliau juga mendedahkan terdapatnya ahli sains yang dipanggil 'Contrarian' yang berpendapat isu pemanasan global adalah sesuatu yang tidak pasti dan sengaja diperbesar-besarkan. Perbezaan pendapat sebegini telah menimbulkan kemelut di kalangan ahli sains di mana pendapat pihak 'Contrarian' banyak mempengaruhi pemikiran dan tindakan ahli politik yang mengambil langkah berhati-hati dan tidak komited dalam menangani isu pemanasan global. Keadaan ini menyebabkan tiadanya suatu pendekatan strategik yang diambil oleh ahli politik bagi mengatasi masalah perubahan iklim yang melanda dunia sekarang ini.

Dr.James Hansen, iaitu bekas kakitangan NASA turut mencadangkan senario alternatif dan tindakan dasar utama yang perlu diambil bagi menangani pemanasan global iaitu:

1. Mengurangkan pelepasan CO_2 dalam masa 50 tahun akan datang supaya tambahan (paksaan) hanya menjadi 1 watt. Antara tindakan utama yang perlu diambil ialah meningkatkan kecekapan tenaga dan menggunakan tenaga yang boleh diperbaharui atau pun tenaga yang tidak melepaskan CO_2.
2. Menurunkan punca selain daripada CO_2 kepada sifar. Antara tindakan utama ialah mengurangkan pelepasan bahan pencemar seperti jelaga hitam,ozon dan metana bagi mengimbangi Nitrus Oksida (N_2O) yang dijangka bertambah akibat penggunaan baja dan aerosol yang dikurangkan kesan daripada aktiviti pembersihan udara.

Buku ini seharusnya membuka mata semua orang mengenai seriusnya isu pemanasan global pada masa kini dan seterusnya, bersama-sama menyuarakan pendapat dan bantahan kepada mereka yang bertanggungjawab supaya menangani isu global ini demi kesejahteraan generasi akan datang. Sekiranya tiada langkah jitu diambil bermula sekarang, pemanasan global adalah ibarat ribut yang dahsyat yang akan melanda anak cucu kita pada masa akan datang.

Cleaner Production to Reduce the CARBON FOOTPRINT

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The United Nations Development Programme (UNDP) defines "organisational carbon footprint" as the amount of greenhouse gas emissions an organisation produces in its daily operations. It is traditionally expressed in equivalent tonnes of carbon dioxide (CO2). CO2 emission sources include emissions from energy, industry, transport, fuel combustion in industry, services, households, etc. and industrial processes.

Understanding Carbon Footprint in Production

There are two ways that burning fossil fuel puts carbon into the air - direct and indirect. Let us look at burning one gallon of gas in a manufacturing industry. The direct manner it produces carbon is obvious: the engine burns gas and carbon is emitted from the exhaust. That is simple and easy to measure. But a whole lot of carbon was produced indirectly to enable us to burn that gallon of gas. Oil had to be pumped up out of the ground, transported to a refinery, refined and finally transported to the gas station where it is then delivered to the petrol station. That entire process produces a lot of carbon. Further, an enormous amount of fossil fuel was burned to even set up the petrol station!

As a developing nation, let us see how much have we contributed to the carbon footprint? (see Table 1).

Table 1. Top 20 nations that contributed to the global CO2 emissions in 2009

Rank	Country	CO2 emissions(mio. tonnes)
1.	China	6 538.37
2.	United States	6 094.39
3.	India	1 610.00
4.	Russian Federation	1 579.82
5.	Japan	1 303.78
6.	Germany	841.15
7.	Canada	590.2
8.	United Kingdom	546.43
9.	Korea, Republic of	503.32
10.	Iran (Islamic Republic of)	495.99
11.	Italy	475.3
12.	Mexico	471.46
13.	South Africa	433.53
14.	Saudi Arabia	402.45
15.	France	401.01
16.	Indonesia	397
17.	Australia	396.28
18.	Brazil	368.32
19.	Spain	366
20.	Ukraine	340.15
	.....	
27.	Malaysia	194.48

Source: UNSD Millennium Development Goals Indicators database, 2009

Nonetheless, the per capita contribution is another important statistics that needs to be considered (see Table 2).

Table 2: Top 20 nations contributed to the global CO2 emissions per capita

Rank	Country	CO2 emissions per capita
1.	Qatar	55.43
2.	Netherlands Antilles	32.47
3.	United Arab Emirates	31.06
4.	Kuwait	30.21
5.	Bahrain	29.58
6.	Trinidad and Tobago	27.88
7.	Luxembourg	24.93
8.	Aruba	23.02
9.	Brunei Darussalam	19.80
10.	United States	19.74
11.	Falkland Islands (Malvinas)	19.68
12.	Australia	19.00
13.	Canada	17.91
14.	Saudi Arabia	16.31
15.	Kazakhstan	14.76
16.	Estonia	14.22
17.	Faeroe Islands	14.12
18.	Nauru	14.09
19.	Oman	13.69
20.	Gibraltar	13.13
	.....	.....
61.	Malaysia	7.32

Source: UNSD Millennium Development Goals Indicators database, 2009

Comparing the countries with high CO2 emission and high CO2 emission per capita (see Table 3), it is obvious that countries like USA, Russia, Japan, Germany, Canada and UK are creating more damage to the environment, than countries like China, India and Brazil. That explains why the latter countries protested for being unfairly treated by the more developed countries in all the recent environmental summits.

In all these countries, the main driver of the economy is the SMEs. SMEs in Malaysia make up close to 99 % of all the establishments in the manufacturing, services and agricultural sector, and also provide around 65 % of total employment. On average, SMEs contribute more than 30% to the GDP. Hence, if all SMEs in these countries move towards clean production, the impact on the carbon footprint is likely to be significant.

Table 3: CO2 Emissions versus CO2 Emissions per Capita

Country	CO2 emissions (mio. tonnes)	Rank	CO2 emissions per capita	Rank
China	6 538.37	**1**	4.92	**82**
United States	6 094.39	**2**	19.74	**10**
India	1 610.00	**3**	1.38	**143**
Russian Federation	1 579.82	**4**	11.13	**26**
Japan	1 303.78	**5**	10.23	**34**
Germany	841.15	**6**	10.22	**35**
Canada	590.2	**7**	17.91	**13**
United Kingdom	546.43	**8**	8.97	**45**
Korea, Republic of	503.32	**9**	10.49	**31**
Iran (Islamic Republic of)	495.99	**10**	6.85	**61**
Italy	475.3	**11**	8.01	**52**
Mexico	471.46	**12**	4.39	**89**
South Africa	433.53	**13**	8.82	**47**
Saudi Arabia	402.45	**14**	16.31	**14**
France	401.01	**15**	6.5	**63**
Indonesia	397	**16**	1.77	**131**
Australia	396.28	**17**	19	**12**
Brazil	368.32	**18**	1.94	**125**
Spain	366	**19**	8.32	**51**
Ukraine	340.15	**20**	7.35	**58**

Cleaner Production and GDP

Cleaner production that increases the productive use of natural resources, minimises generation of waste and emissions, and fosters safe and responsible production is the way to reduce our carbon footprint. It has been reported that around 8 % of GDP per year is used to counter environmental degradation due to unclean production costs globally.

In the future, governments may need to force cleaner production for all manufacturing processes. Measuring carbon is the first step to managing the greenhouse gases that cause global warming. Estimating our production costs while hiding greenhouse gas emissions will contribute towards an unsustainable economy. Companies need to reduce their harmful emissions for the benefit of the planet. It saves companies money on energy bills, improves their reputation with customers and helps them to manage their long-term costs.

Carbon Tax: Are Malaysian Industries Prepared?

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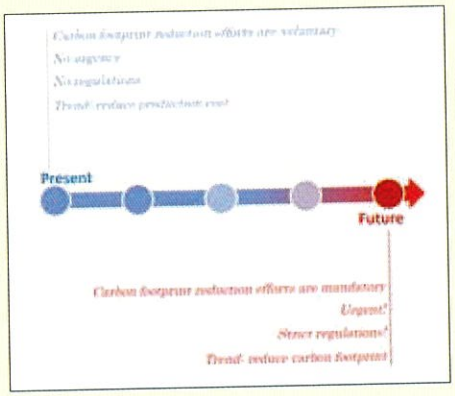
Over the last two decades, various parties have made numerous efforts to educate the general public on GHGs and how changes in its concentration in the atmosphere affect the solar radiation transfer, causing global warming. The Kyoto Protocol (KP) was adopted in 1997 resulting in a complex ratification process to stabilize GHG emissions. To date, 194 countries and the European Union are Party to the Convention and 195 Convention Parties are party to the KP. In general terms, three basic approaches can be used to reduce net GHG emission: (1) incentives for reducing; or, (2) "punishing" for emitting; or,(3) a combination of both. Many nations have adopted these strategies with various levels of success.



Incentives

Malaysia's Feed-in Tariff (FiT) is an example of incentives where power producers are given added tariff to generate sustainable power (solar, biomass, etc.). Similarly, polluters can also be made to pay for their emissions as the major 500 emitters in Australia are made to pay per tonne of carbon they release into the atmosphere. This cost was initially set at AU$23, and is said to increase gradually until 2015. Another known model is through introduction of taxes through fuel amount and types consumed or directly taxing the amount of carbon dioxide emitted through consumption of fuels. India imposes a carbon tax of 50 Rupees (US$1.07) per metric tonne of coal, which is used as fuel for half of the nation's electricity. In many nations worldwide, the concept of paying for the carbon dioxide emission directly or indirectly is rapidly gaining acceptance as a means to reduce global warming. Malaysia may well be in similar circumstances in the not-so-distant future.

In fact, during the COP15 in 2009, Malaysia announced to the international community that it would voluntarily reduce its carbon dioxide emission by 40% in terms of emissions intensity of gross domestic product (GDP) by the year 2020 compared to 2005 levels (Figure 1). Based on this commitment, Malaysia needs to reduce about 40-60 million tons of its annual carbon dioxide emissions by 2020 from its 'business as usual' figures. These reductions can come from greening the transportation sector, optimisation of electricity consumption by industries, public infrastructure and households, and generation of sustainable renewable energy.

The government must be lauded for introducing the Feed-in Tariff (FiT) through The Sustainable Energy Development Authority of Malaysia (SEDA Malaysia) and low carbon initiatives though efforts like the Green Technology Financing Scheme, which can significantly contribute to the overall reduction.

'Punishing' Emitters

Generally, national efforts to reduce emissions are done either by imposing a tax on the consumption of fuel or by imposing a tax based on emission levels. However currently in Malaysia, industries are not subjected to any of these taxes; to the contrary, industries are even receiving fuel subsidies at various levels depending on the types and amounts of fuels used. However, this situation may not be sustainable forever. Remember that pledge in COP15 mentioned earlier? That already calculates to SMIs having to reduce their emissions by 20 million tonnes yearly!

To strive in a globalised world and where global trades of goods and services are ascribed to the World Trade Organization (WTO), Malaysia needs to evolve with the global economy to remain competitive. Being a member to WTO puts all nations on an equal footing. For various reasons, the removal of subsides will take place in the future. It is also not impossible that there will be situation where nations may be imposed with a carbon emission quota. This will lead to a scenario where nations will impose a tax or a cap to industries in their capacity to produce goods and services in terms of their carbon emissions. So, whether we like it or not, this scenario is bound to happen, sooner than we might imagine.

When (and not 'If',) this finally happens, the prices of goods and services will undoubtedly increase and our current version of competitive edge on a global level may diminish. Even though the cost can ultimately be channelled to the consumers, competitors who have implemented green initiatives elsewhere will benefit from the ability to offer lower prices.

The Future Challenge

Which leads to the next question: are Malaysian industries ready for the future challenge? The big challenge for the nation is to develop into a green economy or carbon economy! If we are sincere in our responses, then the answer is *most probably not!* So the greening evolution (or revolution) of Malaysian industries should be taken seriously to maintain the economic competitive edge. It is no longer a question of thriving but a question of survival! Industries and SMIs should be able *(and willing!)* to compete in a scenario where emissions are taxed whether directly or indirectly and subsidies are removed!

The Department of Environment, Malaysia (DOE) through its Green Industry Unit has been promoting cleaner production strategies as a means to develop green industries in Malaysia. This concept integrates various strategies that can be used to reduce energy consumption, reduce material losses and optimise processes, sometimes even without any type of investment. Even though the initiatives are still in its infancy, responses from the industries have been encouraging. DOE is in the midst of building its capacity to service the industry to become greener.

In summary, industries in Malaysia need to prepare for the future for their survival. Let the initiative start NOW!

The Importance of Cleaner Production Methods in a Carbon-Constrained World

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Cleaner Production (CP) is a concept that has been acknowledged and practiced for at least the last 25 years. In order to implement CP effectively, one will in fact need to implement a whole suite of interrelated 'cleaner' processes. These processes constitute the entire production chain and range all the way from cleaner procurement and purchasing, cleaner manufacturing, packaging, distribution, retail and consumption, and finally, cleaner waste management or disposal. As such, a holistic approach coupled with comprehensive management of all aspects of production, together with a healthy dose of due diligence constitute the necessary prerequisites to corporate implementation of CP

CP means Healthier Bottom Lines

A large part of CP is directly tied to production efficiency, and therefore, in turn, to savings in production costs. Efficient production, when applied comprehensively to the entire production process, can add up to a host of savings. The first area this involves is usually procurement. Sustainable, or green procurement, as it is now commonly known, involves the selection and purchasing of production inputs based, not only on price at the purchase point, but based on the costs that the use of that input will entail throughout, and even after the production process. It is possible, therefore, that an input that is lower-priced at the purchase point might actually result in higher costs due to the need to pre-process the input, to dispose of by-products, to manage higher levels of generated waste, or to deal with higher toxicity of waste. Green procurement could also involve the selection of inputs with a lower carbon history such as recycled materials or waste material from other industries. In many cases, these will lower procurement costs, sometimes even driving them negative as other industries might even be willing to pay someone to take their 'waste' off their hands.

CP involves more efficient utilisation of resources involved in the production process. This includes everything ranging from raw materials used, to materials such as catalysts, to environmental inputs, such as water, to consumables such as energy, either in the form of electricity or fossil fuels. In each case, the less you use, the less you pay for and the healthier the bottom line. It therefore pays to re-examine the entire production process to determine where and how resources can be more efficiently utilised. Catalysts, for example, can be recovered and re-utilized. Water can be recycled by using it initially where highest purity is required (e.g. steam turbines), and successively in processes where more impurities can be tolerated, and ending where grey water can be used, for example, for flushing. Energy sources like waste heat can also be captured through heat exchangers and used. The ultimate objective of efficiency exercises is to optimise resource use and minimise waste.

This brings us to the area of sustainable waste management. Waste management and disposal is virtually accepted as a fixed cost for many industries. This is particularly so for scheduled wastes that must be managed in accordance with strict environmental regulations. For this reason, many corporations are exploring methods of reducing the quantity and changing the quality of their waste into more inert and benign forms. In fact, with the growing awareness that many by-products previously considered wastes such as fly ash and bio sludge are actually valuable to other industries, many corporations are finding ways to make their by-products marketable, thereby expanding their profit margins, through implementation of their zero-waste policies.

CP means More Sales

At the retail level, consumers are becoming increasingly informed and aware about the impact of their own consumption habits on the environment and are more selective about the products and services that they consume. This rapidly growing class of consumers is calling more stringent labelling guidelines through which they will be able to distinguish environmentally friendly products from the rest in order to make informed buying decisions. In this regard, products and corporations that are perceived as transparent from a consumer safety and environmental impact standpoint are finding more acceptance and loyalty from consumers. This trend is even more evident in developed countries where mechanisms such as carbon taxes and product carbon footprint labelling are already in effect. From this standpoint, the marketability and competitiveness of imported products hinges not only on emissions from use of the product, but also emissions from the manufacture as well as disposal of the product, and in some cases, may involve a carbon tax or other forms of border carbon adjustment.

Although many still believe that carbon taxes and border carbon adjustments are something that we might have deal with in the distant future, the facts speak for themselves. The European Union (EU) has already implemented a carbon tax on all airlines originating in and arriving at all EU destinations. France has also unilaterally declared that it could impose carbon tariffs. In the US, on the other hand, the Waxman Markey Bill, a law that would have introduced climate protectionism for strategic low-emission technologies and trade measures targeted at imports from other countries, was actually passed by the House of Representatives before losing steam and not being considered by the Senate. We have every reason to anticipate that the issue will arise again in the future.

Carbon intensity considerations are relevant today. CP not only strengthens bottom lines, but results in products and services for which there is growing demand both locally and internationally. Finally, and most importantly, developments in international border carbon governance is pointing toward heightened negative sensitivity to imports, products and services that are carbon intensive, which will render them less competitive than their low-carbon intensity equivalents designed, produced and delivered through the implementation of CP.

Ekologi Perindustrian

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Ekologi perindustrian atau ekosistem perindustrian adalah kajian pemahaman hubungkait aliran bahan dan tenaga melalui satu sistem industri. Ia melibatkan perubahan proses linear kepada proses kitaran di mana sisa buangan dari industri dijadikan bahan mentah (*feedstock*) untuk industri yang lain.

Pelaksanaan konsep ekologi perindustrian amat perlu bagi mengatasi masalah produktiviti sumber alam seperti hutan, ladang dan lautan yang semakin merosot, peningkatan pencemaran disebabkan oleh pestisid, herbisid dan logam berat yang menjejaskan alam sekitar dan pertambahan populasi penduduk dunia. Ekologi perindustrian menggalakkan pertumbuhan hijau (*green growth*) di samping memastikan kelestarian alam untuk diwariskan kepada generasi akan datang.

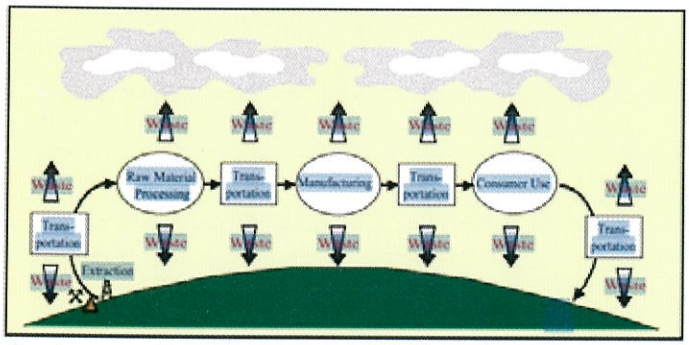
Masalah yang biasa dihadapi oleh negara maju dan negara membangun ialah kekurangan amalan kelestarian yang menjamin sumber-sumber digunakan dengan cara yang paling ekonomik. Penekanan perlu diberikan terhadap penggunaan tenaga yang cekap dan mengurangkan pembaziran sumber untuk menampung kualiti hidup yang tinggi.

Ekologi perindustrian menyasarkan keseimbangan di antara pembangunan industri dengan penggunaan sumber asli yang lestari termasuk tenaga dan bahan serta meminimakan impak ke atas alam sekitar melalui pengurangan buangan dan emisi yang sekaligus dapat menangani isu kekangan sumber dan ancaman perubahan iklim.

Ekologi perindustrian juga menerapkan budaya mencegah lebih baik dari mengawal pencemaran oleh pihak industri dan Pihak Berkuasa Tempatan contohnya melalui amalan *waste minimisation*.

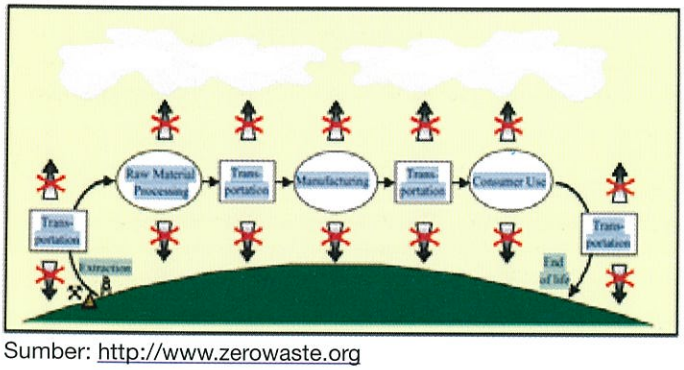
Rajah 1

Hari Ini



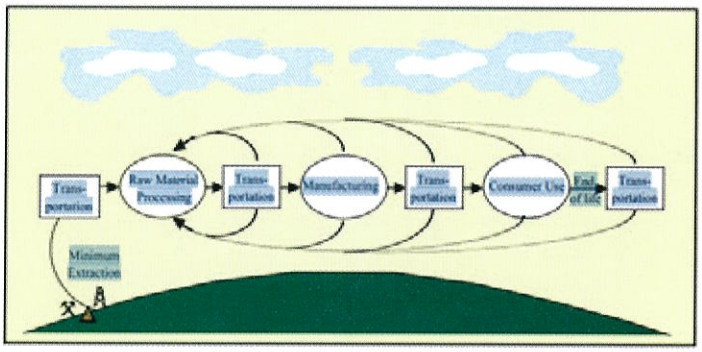
Sumber: http://www.zerowaste.org

Proses Terlibat



Sumber: http://www.zerowaste.org

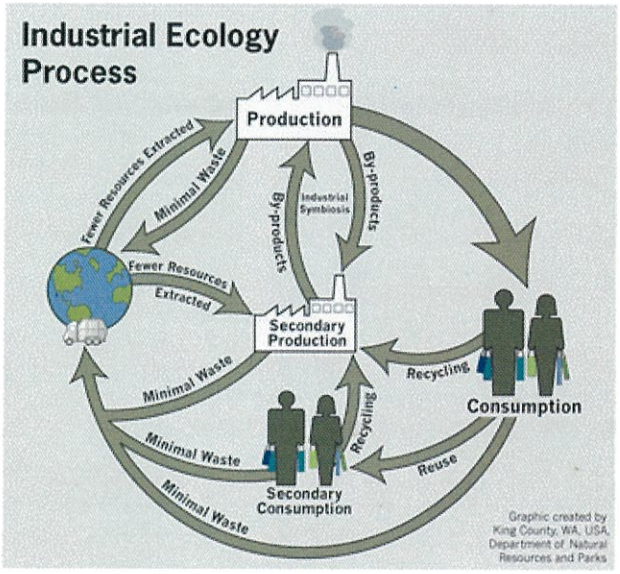
Amalan Ideal



Sumber: http://www.zerowaste.org

Rajah 2 menunjukkan konsep ekologi perindustrian yang menggalakkan kecekapan penggunaan bahan dan kitaran hayat produk yang meminimakan penjanaan buangan.

Rajah 2



Sumber: http://www.is4ie.org

Matlamat

- Mengurangkan dan menyingkirkan penggunaan bahan yang tidak boleh diubah kepada bentuk yang tidak berbahaya *(benign)* melalui biodegradasi atau digunakan sebagai bahan api.
- Mengoptimum proses untuk mengitar semula bahan supaya dapat mengurangkan penggunaan bahan mentah

Mekanisma

- Kajian aliran bahan dan tenaga (industrial metabolism)
- *Dematerialisation and Decarbonisation*
- *Extended Producer Responsibility (EPR)*
- *Eco-efficiency*
- Sistem Pengurusan Alam Sekitar atau Environmental Management System (14001)
- Analisis Kitaran Hayat atau *Life Cycle Analysis (LCA)*

- *Design for the Environment*
- Pengurusan rantaian bekalan
- Kimia alam sekitar

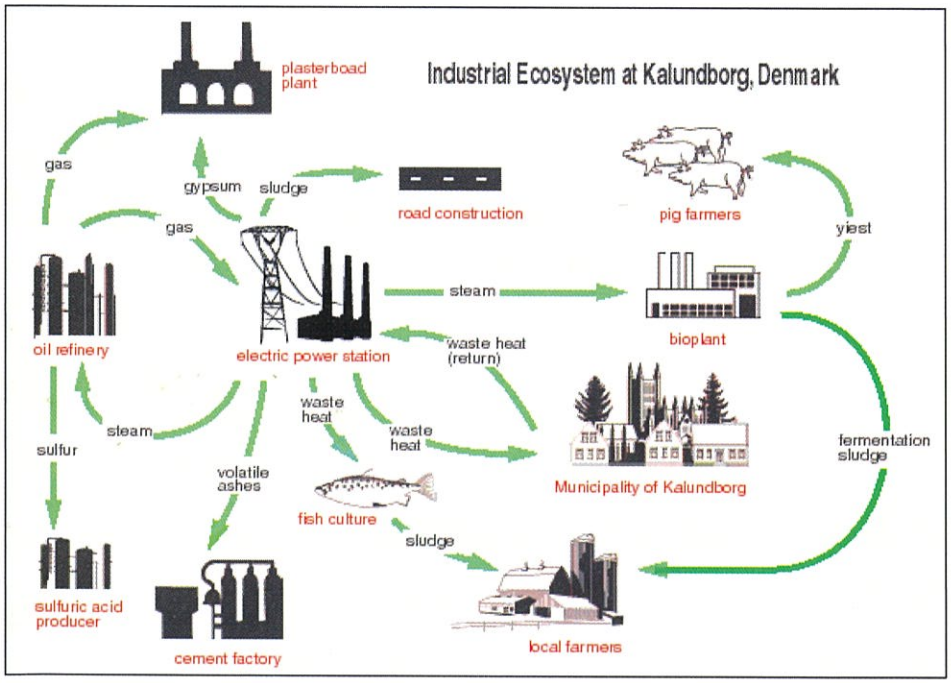
Kepentingan

1. **Industri**
   Peluang untuk mengurangkan kos pengeluaran melalui kecekapan pengitaran semula bahan dan tenaga serta mengelakkan amalan yang boleh dikenakan penalti undang-undang.

2. **Alam Sekitar**
   Pemulihan ekosistem yang telah musnah, pengurangan punca buangan dan pencemaran, penurunan permintaan terhadap sumber asli dan demonstrasi prinsip pembangunan lestari.

3. **Masyarakat**
   Meningkatkan prestasi ekonomi dan pembangunan serta mengurangkan penjanaan sisa pepejal dan effluen seterusnya menurunkan permintaan terhadap infrastruktur kerajaan dan peruntukan untuk melupuskan sisa.

Rajah 3



Sumber: *Ecodecision*, Spring 1996: 20

Pelaksanaan Ekosistem Perindustrian Di Kalundborg, Denmark

Model ekologi perindustrian yang efisien adalah seperti yang telah dilaksanakan di Kalundborg, Denmark. Ekosistem perindustrian yang dibangunkan di sini melibatkan kilang penapisan minyak, kolam penternakan ikan, kilang *plasterboard*, loji janakuasa elektrik arang batu, firma farmaseutikal dan majlis perbandaran Kalundborg.

Loji janakuasa elektrik menjual stim kepada kilang penapisan minyak dan menerima bahan api serta *cooling water* dari kilang tersebut. Sulfur yang merupakan sisa buangan dari kilang penapisan minyak dihantar ke kilang asid sulfurik. Haba yang merupakan produk sampingan dari penjanaan tenaga digunakan untuk sistem pemanasan di rumah-rumah dan pusat komersial di sekitar selain digunakan untuk pengoperasian kolam penternakan ikan. Stim dari loji janakuasa elektrik juga digunakan oleh firma farmaseutikal (*bioplant*) yang menghasilkan enapcemar biologi untuk digunakan sebagai baja oleh petani tempatan. Kalsium sulfat yang dihasilkan sebagai produk sampingan dari penyingkiran sulfur di loji janakuasa elektrik menjadi bahan mentah kepada kilang *plasterboard* untuk membuat *wallboard* manakala enapcemar yang terhasil digunakan di dalam pembinaan jalan. Abu terbang (*fly ash*) dari pembakaran arang dihantar ke kilang simen. Selain itu, penggunaan bahan yang efisien dapat dilihat melalui pencampuran lebihan yis dari pembuatan insulin oleh firma farmaseutikal yang menjadi suplemen tambahan kepada pemakanan khinzir.

Kejayaan pelaksanaan ekologi perindustrian di Kalundborg adalah disebabkan oleh hubungan sosial yang baik dan jaringan profesional di antara pengurus-pengurus fasiliti di dalam ekosistem tersebut serta sokongan padu dari Pihak Berkuasa Tempatan.

Elemen yang boleh dipertimbangkan apabila merancang sistem ekologi perindustrian ialah *social capital* yang mengandungi interaksi yang terancang, komunikasi dan kerjasama di antara syarikat-syarikat yang terlibat. Penggunaan program komputer yang canggih bagi permodelan sistem ekologi perindustrian sebelum ianya dibina dapat menghasilkan sistem yang baik dan efisien.

Adaptasi Di Malaysia

Walaupun ekologi perindustrian dianggap fenomena baru di Malaysia, namun dengan perancangan yang teliti serta mengambilkira sumber yang boleh diguna/di kitar semula di dalam sesuatu ekosistem industri, ianya pasti boleh dilaksanakan. Cabaran dalam melaksanakan ekologi perindustrian di Malaysia merangkumi kepakaran, pengetahuan, teknologi, kewangan dan *green planning*. Peranan Pihak Berkuasa Tempatan (PBT) di Malaysia amat penting memandangkan mereka merupakan agensi yang terlibat secara langsung di dalam perancangan dan pembangunan kawasan industri. Selain itu, input dari persatuan industri dan ahli akademik juga diperlukan bagi menilai kesesuaian jenis-jenis industri yang boleh digabungkan di dalam sesuatu ekologi perindustrian.

Amalan yang diterapkan di dalam ekologi perindustrian seperti *waste minimisation*, kajian kitaran hayat produk, guna semula dan kitar semula boleh mengurangkan penjanaan *Carbon Footprint* atau Kesan Karbon seterusnya mengurangkan perubahan iklim.

Rujukan

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LIFE CYCLE ASSESSMENT
An Environmental Management Tool

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The importance of Life Cycle Assessment (LCA) as an environmental management tool can be demonstrated by the number of International Standards (ISO) developed, approved and widely utilised by LCA practitioners over the years. The standards include:

- ISO 14040:2006
  Environmental management -- Life cycle assessment -- Principles and framework ISO 14044:2006
  Environmental management -- Life cycle assessment -- Requirements and guidelines
- ISO 14045:2012
  Environmental management -- Eco-efficiency assessment of product systems -- Principles, requirements and guidelines
- ISO/TR 14047:2003
  Environmental management -- Life cycle impact assessment -- Examples of application of ISO 14042
- ISO/TS 14048:2002
  Environmental management -- Life cycle assessment -- Data documentation format
- ISO/TR 14049:2000
  Environmental management -- Life cycle assessment -- Examples of application of ISO 14041 to goal and scope definition and inventory analysis
- ISO 14067: DIS
  Carbon footprint of products — Requirements and guidelines for quantification and communication

ISO 14040: 2006 defines the term LCA as follows:

LCA is a technique for assessing the environmental aspects and potential impacts associated with a product by:

- Compiling an inventory of relevant inputs and outputs of a product system.
- Evaluating the potential environmental impacts associated with those inputs and outputs.
- Interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the study.

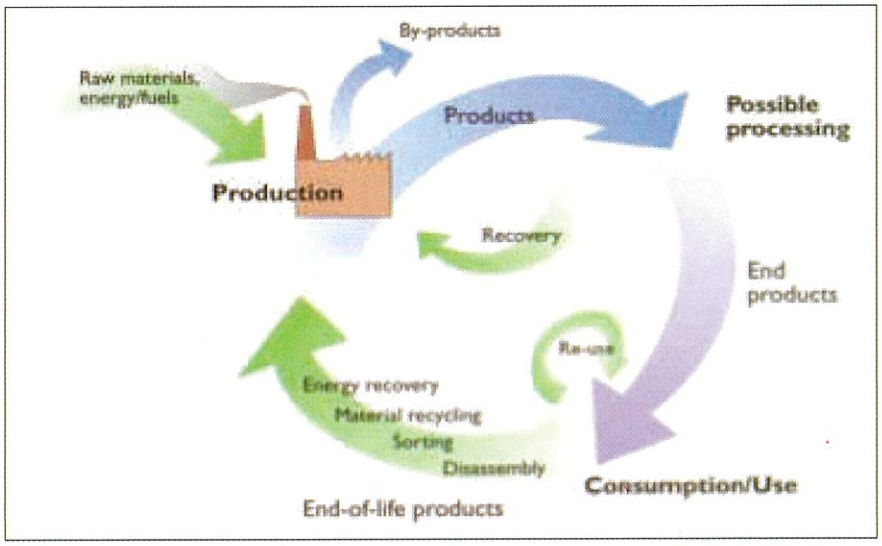

Figure 1: Environmental performance of products from 'cradle to grave'

Since the early 1970s, LCA has been used as an environmental management tool to systematically identify and evaluate the environmental impacts associated with a product, process or activity over its whole life cycle. LCA is a method and a tool to compute, categorise and assess the environmental burdens of a product, process or activity by identifying and quantifying energy consumption, materials usage and waste discharges, assessing the impacts of the resource usage and wastes on the environment to determine the damage to human health, eco-system and resource depletion, and evaluating opportunities for environmental improvements over the whole life cycle.

Objectives of LCA

Given its holistic approach, LCA is becoming an increasingly important decision-making tool in environmental management, particularly as a tool for Cleaner Production.

As an effective environmental management tool, LCA has two main objectives. The first is to quantify and evaluate the environmental performance of a product or a process from "cradle to grave", as shown in Figure 1. This helps decision-makers to choose between alternative products and processes which suit the organisation's business and environmental strategies. Another objective of LCA is to provide a basis for assessing potential improvements in the environmental performance of a product system.

LCA as a Tool for Decision Support

LCA also serves as a field of study, as a technique and a tool for decision-support. One of the key environmental impacts considered in LCA is global warming or climate change. There are six types of gases namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons CFC -11, CFC -12 and HCFC 22, which have been indentified and scientifically proven to have effects on global warming. These six types of gases have different global warming potentials (GWP). GWP is a

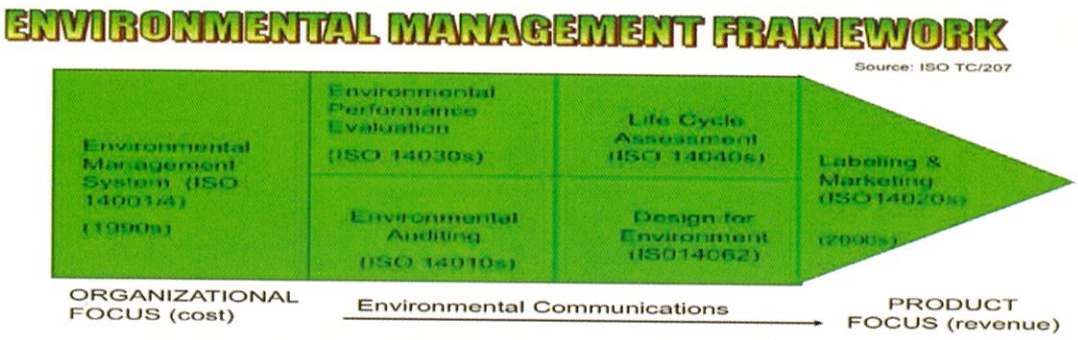

Figure 2: ISO Environmental Management Framework

measure for climate change in terms of radiative forcing of a mass-unit of greenhouse gas. As different gases contribute to global warming differently, thus a characterisation exercise is required to compare the GWP of each gas. In this respect, the characterisation factors of the United Nation's Intergovernmental Panel on Climate Change (IPCC) is used for computation of GWP, expressed in terms of carbon dioxide equivalents (CO_{2eqv}.). Hence, compilation of CO_{2eqv} or Carbon Footprint (CFP) is a life cycle inventory analysis confined to emissions that have an effect on climate change. CFP is usually expressed as kilograms or tons of CO_{2eqv}. per functional unit of product system.

Cleaner Production and the Carbon Footprint

Before Cleaner Production or more specifically, reduction in CFP can take place, it is important to systematically understand and evaluate the CFP of the product system and the manufacturing facilities using LCA as a tool so that the associated environmental impacts related to the products can be determined. In this respect, LCA can be used as a suitable tool to systematically identify and evaluate the significance of the hot spots or activities/areas where contributions to CFP of a product system are most significant. Depending on the outcome of CFP life cycle inventory analysis, steps can be taken to generate Cleaner Production options to reduce the associated CFP of the product, including product eco-design, re-formulation of products, changing to another production process, increasing recycle content of raw materials and increasing use of alternative/renewable energy, green supply chain management etc, to enable a more sustainable production in place. Thus LCA can be used holistically as a CP tool to reduce the carbon footprint as well as reduce the impact of climate change.

LCA Applications

Since the aim of Cleaner Production is to enhance profitability for companies while reducing waste and pollution, life cycle inventory is a more holistic approach since the methodology is well established and is scientifically proven to be more accurate than other approaches.

According to ISO 14040:2006 (E), the application of LCA can assist in:

- Identifying opportunities to improve the environmental performance of products at various points in their life cycle
- Informing decision-makers in the industry, government or non-government organizations (e.g. for the purpose of strategic planning, priority setting, product or process design or redesign)

Figure 2 provides a clear picture on Environmental Management development trend where cleaner production is actually embedded in the ISO 14001/4 Environmental Management System. It is very obvious that the focus for effective environmental management is shifting from production systems/processes-based management to management of eco products over the years. In terms of financial perspective, the focus is also shifting from cost savings to generation of more revenue.

LCA for Sustainable Consumption and Production

Moreover, the global development for environmental management is mainly geared towards sustainable consumption and production. Cleaner Production caters mainly for sustainable production. To help the manufacturing companies to increase sales revenue and increase profitability, marketing of sellable products is equally important. One of the effective ways is to market eco-products, as the world is undergoing a 'Green Revolution' due to the danger of adverse environmental impacts.

According to ISO 14020 series of standards, certification or labelling of eco products need to take LCA into consideration when establishing the product criteria for eco labelling. Thus for companies that use LCA tool for Cleaner Production have an added advantage in that the products would more likely to be eco-labelled, compared with companies using other non-LCA based Cleaner Production tools.

Eco-labelled products have a distinct advantage over other competing products as they provide a means of communicating the eco-friendliness of products, enhance marketing advantage to environmental conscious customers and consumers, promote company image to investors and general public. They also have an added advantage of winning contracts and sales by out-pacing other competitors through meeting the stringent green requirements of multi-national companies (MNC), where green purchasing is widely practised.

Conclusion

In addition, by practising cleaner production using LCA approach, an organisation's products would be more likely to be eco-labelled and be certified as eco-labelled products.

Energy Use and Carbon Footprint

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The use of heat, steam and electricity generation in power plants contributes to CO_2 emission. The amount of carbon emission depends on the carbon content in the fuel we burn to generate other forms of energy such as heat, steam or electricity. Use of coal leads to higher carbon emissions than oil but the use of gas results in lower carbon emissions than oil. Hence we constribute to CO_2 emissions whenever we use any electrical appliances or equipment , drive a car or operate any fuel fired equipment. In Malaysia per kWh electricity consumption contributes to 0.79 kg CO_2 emission.

Towards Low or Zero Carbon Economy

The trend is to reduce carbon emissions through the use of low carbon fuels such as natural gas, ethane and liquid petroleum gas and the use of zero carbon energy resources especially renewables such as wind, solar, hydro or the use of nuclear power.

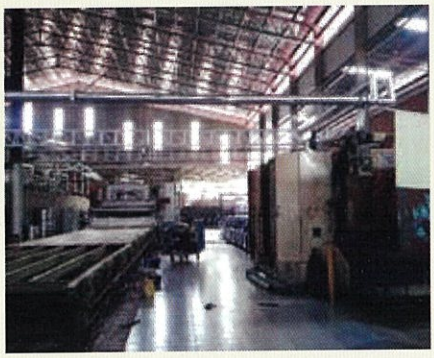
The use of renewables offers many challenges: the investment cost is high and the continuous availability of the resources itself is questionable because high investment cost. At present, the more effective way to reduce carbon footprint is to use energy efficient management of energy demand and use of alternative energy.

Reducing Carbon Footprint through Managing Energy Use

The carbon footprint of a manufacturing plant can be reduced by reducing energy use. We can reduce energy consumption at any place through best practices, smart purchasing and designing energy efficient products and services.

- Use natural and free energy where and when possible
- Switch off the electric light bulbs when daylight is sufficient
- Use stairs instead the lift or escalator where possible
- Walk or cycle instead of driving to nearby grocery stores, school or offices.

These practices will not only save energy cost but enable us to keep fit and healthy as well.



A transparent wall allows daylight into the factory and avoid the use of electric powered lamps during the day.

Maintenance is important to ensure the system operate efficiently

Understanding our own bio-sensor

- Being in a colder space can be uncomfortable and will require us to wear additional clothing. It is better to increase the room temperature to increase comfort and the same time reduce the electricity bill on air conditioning.
- Natural lighting offers better colour rendering than artificial lighting, and is good for our well being and productivity. So use natural lighting as much as possible at home or at the workplace.

Operation and mantenance

- Operational control is very critical because it has an impact on energy use. It is important to train the operators to ensure they operate the equipment at optimum efficiency. This will avoid bad practices such as leaving the equipment to operate on an idle mode or standby mode.
- Ignoring schedule maintenance can affect energy use significantly particularly in large air conditioning systems and steam generation and distribution systems. For example, failure to clean clogged filters of the airconditioning system forces the motors to work harder. While steam leaks if not repaired can cause unneccessary high fuel bills and more emission of carbon dioxide.

Purchasing energy efficient products

Here are some tips on purchasing and using energy efficient products

- Use light bulbs of similar brightness but with a lower watt rating.
- Purchase household appliances that are energy efficient and have the star rating
- Purchase energy efficient motors. This can initially represent a higher investment but it uses less energy over the life time of the motors.

Using bio materials such as a *nipah* roof only saves energy in manufacturing roof materials but it has low thermal conductivity and keeps the room cool.

Efficient use of boilers and steam distribution systems

Boilers are the heart of many food and textile industries. An alternative to consider is to replace the old and inefficient boiler with new and high thermal efficient boilers. Also steam pipes should be repaired as soon as possible to avoid unnecessary burning of fuel which causes carbon emission. Efficient combustion is important to get the most of the energy in fuel and to minimise smoke emission. Monitoring operation and maintenance is critical to efficiency and reducing carbon emission.

Future products and processes

For continuous improvements in effeciency, there is a need to keep developing better products, processes and services to improve the economy and our life with minimum impacts on the environment.

The Campaign for Cleaner Production ECOPROFIT® A Success Story

The basic idea of ECOPROFIT® is a win-win-model, using integrated environmental technologies to strengthen businesses economically and simultaneously improve the local environment. Enterprises are enabled to cut their costs through investments into operational environmental protection and to increase their eco-efficiency. But there are some specific features which makes it different from other Cleaner Production programmes.

History

It was the year of 1991. The location was the city of Graz, the capital city of Styria, one of the nine provinces of the Federal Republic of Austria, Europe. It has 260,000 inhabitants and is an economic centre. It was the evening before the Rio Earth Summit of 1992 where a new programme of pollution prevention will be presented by United Nations Environmental Programme(UNEP) and United Nations Industrial Development Organization (UNIDO), and which is known today as Cleaner Production. The programme was meant to reduce the environmental impact of industry. It is built on ideas used by 3M in its 3P programme (pollution prevention pays). It has found more international support than all other comparable programmes. However, there were and still are justified concerns on how to engage business in this programme.

Even the Environmental Department of the Municipality of Graz and the University of Technology, Graz had expressed concerns though they had already in 1991 jointly recognized the potential of Cleaner Production for the environment and the economy as well. At this early time, a small number of pilot and demonstration projects had been conducted which basically showed the usefulness of the Cleaner Production methodology to improve environmental performance of enterprises and, additionally, to gain benefits in economic (e.g. cost savings) and social (e.g. working conditions) terms.

But limitations were recognized. The few existing demonstration projects had been driven by external consultants, today frequently called Cleaner Production auditors. Therefore integration into the management and daily business of companies was weak; as a consequence continuation of the programme after the consultants had left was doubtful. The number of experienced consultants was limited, therefore the number of cases was limited. The applied methodology was time consuming and costly. Only a few enterprises could see the profits in Cleaner Production; the majority were reluctant, because Cleaner Production was considered a burden in the first instance and a good will action at best. The city of Graz came up with an amazing solution to all these concerns. It was a defining moment for ECOPROFIT®.

The Main Features Of ECOPROFIT®

FIRST, ECOPROFIT® addresses businesses where it matters, namely to make profit.

SECOND, the methodology refers to the in-house capacity of a company and provides help to self-help instead of alienated external consulting.

THIRD, joint workshops with a group of companies enable efficient implementation instead of time consuming and costly case-by-case consulting.

FOURTH, ECOPROFIT® is sector neutral and works for all types of companies without specific extra efforts.

FIFTH, the organisation of the programme includes public appreciation of the participating entrepreneurs as an additional driver for businesses.

SIXTH, the programme is designed to start a continuous improvement process in businesses.

1 Addressing businesses where it matters

Generally, Cleaner Production is promoted as a win-win approach which benefits the environment, the economy, and the society. Although ECOPROFIT®, originally, is an acronym of "**ECO**logical **PRO**ject **F**or **I**ntegrated Environmental **T**echnology", ECOPROFIT is a catchy title which is addressing the main purpose of every business, which is to make profit. ECOPROFIT® is not hiding this intention, but puts it in the focus right from the beginning and even in the programme's name to attract entrepreneurs where it matters. Consequently, ECOPROFIT® is systematically enhancing the typical questions of Cleaner Production with economic arguments. E.g. the basic question, why we have so much waste and emissions, is completed by the question, why are we wasting so much money? Every waste or emission was originally costly purchased raw material which was not converted into qualified products or services; waste and emissions are reducing the profit margin, either directly (incomplete conversion of raw materials into products which can be sold) or indirectly because of waste and emission treatment costs. ECOPROFIT® turns the fundamental axiom of entrepreneurship into practice: Gain more with less! Maximise your output value by minimising your input costs. ECOPROFIT® is not just a good will action, but a smart approach to increase a company's profit.

2 Help for self-help

Innovation does not take place in expert councils, it happens every day on the ground in industry. Consultants can only facilitate the process of identifying problems and inefficiencies and can help to structure modes of creating solutions. Every company knows its business better than even the best consultant. ECOPROFIT® is assisting to make the maximum use of a company's capacity to become more efficient. Not the external consultant, but the company management is implementing Cleaner Production. The external consultant acts more like a trainer or coach. The team players are the company's staff members. It reminds of Socrates, the famous Greek philosopher, who guided his student to come to the same conclusion like the fabulous mathematician Pythagoras. Only by asking certain questions the student

found himself the famous equation $a2 + b^2 = c^2$. In a similar way ECOPROFIT® is providing guidance for self-help to companies. The programme provides an easy-going toolkit which guides entrepreneurs step by step to set up their own Cleaner Production system. Along a number of work sheets complemented by an explanatory text book, the companies dig into the methods of Cleaner Production and implement it gradually. The need for external consultants is minimised which is an important aspect in view of limited expert capacities in general.

3 Efficient implementation through group consulting

Probably the most interesting aspect of ECOPROFIT® is how messages are conveyed to the entrepreneurs. Typically, an ECOPROFIT® project provides a number of 10 workshops on different topics over a span of 12 months. The workshops are attended usually by the plant or production managers or the environmental managers of up to 15 companies. Typical workshop contents are:

- Cleaner production and waste minimisation, input/output analysis, strategies of minimisation: Overview of the project, presentation of participants, data collection, minimisation strategies, "Fun Factory" (an interactive game to learn the principles of CP).
- Setting up an environmental team and an environmental programme within the company: ECOPROFIT® arguments for the top management, motivation of employees.
- Material flow analysis: Most important steps on how to carry out a material flow analysis, examples, and practical exercises.
- Waste management, waste logistics: How to save costs, container systems, waste separation guidelines, motivation of employees on how to separate waste.
- Energy analysis: Analysis of the energy management, energy saving tips and tricks, peak load measurements, thermography measurements, energy consumption and carbon emissions.
- Laws and Regulations: Introduction into environmental law.
- Innovation and creativity techniques: Various innovation models are trained, specific real existing company problems are tackled by adopting the new methods.
- Ecological purchasing, handling of hazardous materials: Waste minimisation starts already at the purchasing phase; comparing different eco-labels; practical exercises for companies; safety data sheets, symbols of hazardous materials.
- Eco-Controlling, eco-indicators: Aspects of an environmental information system, selection of indicators, controls, and benchmarking.
- Preparation for the award, final report: Procedure for the award, discussing the award documents, presentation of the project results through the participants.

Each of the workshops is structured to cover the following aspects:

- Feed-back session: In this session every company briefly describes activities done since the last workshop. This guarantees continuous work and control of special topics and measures.
- Information block: An expert introduces the new main topic.
- Interactive phase: In order to foster the understanding of the new topic the participating companies are divided into smaller groups to adopt the just learned principles.
- Final discussion: The results are summarised and the relevance and improvement regarding the given topic for each company are discussed. In each workshop the companies receive training material and special working sheets which they have to prepare for the next meeting. In some of the workshops, special local experts or officials are invited to give short statements and to join the final discussion.

Additionally, the participating companies receive individual on-site consulting by the consultants, which is however limited to a maximum of five days per company over a period of 12 months. This ensures that ownership remains with the companies and the project is not outsourced to external consultants.

4 Sector neutral

The main target groups of ECOPROFIT® are small and mid-sized enterprises (SMEs) which constitute an important stakeholder group of sustainable production policies at local level whose cumulative contribution to pollution cannot be underestimated. With regard to the low degree of regulation, or the lack of statutory instruments, and in view of the great number and variety of SMEs, local governments need to adopt a co-operative policy style. ECOPROFIT® addresses production companies as well as hospitals, hotels, service companies, and vendors. Experience has shown that a group of companies from different sectors and of varying size participating in the same ECOPROFIT® programme are even better at taking up the messages than a homogenous group consisting only of one sector. One reason is that the attending members do not consider themselves as direct competitors and tend to have more open exchange. Another reason is that different backgrounds with similar challenges invite creativeness and thinking in analogies. The multi-sector approach has proven possible because of the intended mobilisation of in-house capacities of the companies.

5 Public appreciation

After the first year, the companies are audited (legal compliance, environmental performance, environmental programme) and receive an official award by the City. The award has to be applied for and renewed every year. To receive this award, a company has to fulfil several criteria which are then checked by an independent commission. The company must have:

- A waste management plan
- A legal (environmental) compliance check
- A company environmental policy
- Documentation of the environmental performance of the previous year
- An environmental program for the upcoming year (to ensure continuation)
- An environmental review along a checklists, which considers the major elements of ECOPROFIT® (organisational structure, etc.).

Usually the award is presented during a public ceremony in the presence of representatives of policy, economy and media. Additionally, most of the companies join the so called ECOPROFIT® CLUB. In regular workshop meetings, they receive

an exchange of experience and update their knowledge on environmental law and new organisational and technical development. This forum is growing annually because new companies join.

Replication Of ECOPROFIT®

Since its first initiation more than 20 years ago in the City of Graz, the ECOPROFIT® approach is used in more than 20 countries on 4 continents. Successful replication happened in several cities in Austria (Graz, Vienna, Vorarlberg, Klagenfurt), and in Germany (Munich, Berlin, Hamburg, Dortmund, Aachen, and 60 more cities), in Slovenia (Ljubljana, Maribor), in Italy (Modena), in Hungary (Pécs), in India (Gurgaon), in Colombia (Bucaramanga, Medellín), in Korea (Incheon, Busan), in Russia (St. Petersburg), in China (Panzhihua, Tianjin, and 11 further provinces), in Mongolia (Ulan Bator) and further more. More than 5,000 companies worldwide participate in ECOPROFIT® projects.

More than 20 years of ECOPROFIT® in Graz

In Graz, on an annual basis approximately 2 million Euros are saved. According to recent statistics provided by the City of Graz the programme has generated remarkable results due to the efforts of SMEs participating in annual ECOPROFIT® programmes of the city. They sum up the savings as follows:

- 16.87 million tonness of fuel (equal to 403 big tank lorries)
- 115.86 million cubic meters of natural gas (equal to the annual consumption of 143,500 households for heating purposes)
- 480,583 MWh electricity (equal to the annual electricity consumption of 8,000 households)
- 177,331 tonnes of solid waste (equal to the waste production of 14,700 individuals over 15 years)
- 17.72 million cubic meters of water (equal to 59 big tank ships)
- 2.2 million CO^2 emissions (equal to 346,000 automobiles each surrounding the globe)

Two-thirds of implemented measures are no or low cost measures, particularly attractive for SMEs.

Further developments

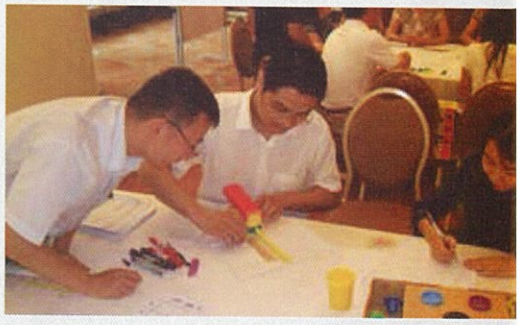
The establishment of an international ECOPROFIT® Network enables participating companies, consultants, local authorities and research institutions to benefit from synergies by sharing knowledge. The permanent further development of the project is a central concern of the ECOPROFIT® community. As a reaction to the wishes of project participants, special programs were developed for tourism as well as small businesses with less than 10 employees. ECOPROFIT® consultants are even offering training for school teachers on how to include Cleaner Production in their courses at high schools.

Establishing an ECOPROFIT® Programme?

Twenty years is a long period. Over this period a number of variations were tried to set up similar programmes, many of them unrecognised and forgotten again. The approach of ECOPROFIT® has survived and has prospered almost unchanged, which is the best proof of a best practice. The genuine ECOPROFIT® itself is an international registered and copyrighted trademark. Project managers are allowed to use the trademark and the associated programme (manuals, etc.) through a licence agreement at a low cost.

Successful ECOPROFIT® is a cooperative approach between local authorities and local companies with the goal of reducing costs for waste, raw materials, water, and energy. The local authority is usually the owner of the programme and commissions the implementation to an experienced consultant team. Frequently also business member organisations (e.g. local chambers of commerce) are involved which is very useful for the recruitment of participating companies. A typical programme will last about 12 months (from kick-off, through 10 workshops, until the awarding of successful companies). The optimum number of companies is around 15 SMEs. Under these assumptions, average costs (in Europe) for one annual programme with 15 companies are estimated to be a maximum 45,000 EURO (RM180,000), including workshops and on site consulting. The costs are usually shared by the local authority providing a subsidy and the participating companies. The ratio of co-financing by the local authority can be reduced after a programme is well established. There are also cases where initial funding is provided by the national government.

Gurgaon, India - January 14, 2003: 15 companies received their ECOPROFIT® certificate. They are the first in Asia to have achieved this standard.



Kunming, China – August 2008: Chinese Cleaner Production trainers experienced the challenges of the "Fun Factory", a close-to-real-life exercise to reduce waste through good housekeeping measures and careful work planning.

Dr. Gerhard Weihs holds a PhD in Philosophy and a diploma in Environmental Techniques. He has been involved in ECOPROFIT® since the beginning. In 1992 he organized on behalf of the City of Klagenfurt, Austria, the first replication of ECOPROFIT® outside Graz. Since 2000 he has also been promoting ECOPROFIT® on an international level. He organised the first ECOPROFIT® Programme outside the European Union borders in the Ukraine (2000), the first such programme in Asia, in India (2002) and further programmes in Mongolia (2007) and in China (Tianjin 2005, in eleven provinces of Western China 2008-2011).

Currently he is based at the Economic Planning Unit in Putrajaya as the team leader of the Malaysia-EU cooperation project "Sustainable Consumption and Production – Policy Support Malaysia (2012-2015)", which has the objective, amongst others, to strengthen the policy framework of Malaysia to better enable industry to adopt sustainable production practices.

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Program Pembangunan Kepakaran Pengeluaran Bersih CP

Kursus Pengenalan Pengeluaran Bersih

Unit Industri Hijau (UIH), Jabatan Alam Sekitar Putrajaya telah mengadakan Kursus Pengenalan Pengeluaran Bersih untuk memberi maklumat asas dan pengetahuan mengenai konsep dan pelaksanaan Pengeluaran Bersih. Kursus ini wajib dihadiri oleh pegawai JAS yang akan menjalani Program Kompetensi CP Jabatan Alam Sekitar pada tahun 2012. Kursus ini telah diadakan pada 26-30 Mac 2012 bertempat di Hotel Cititel, Kuala Lumpur. Seramai 23 pegawai dari JAS Ibu Pejabat dan Negeri telah mengambil bahagian dalam kursus tersebut. Kursus selama lima (5) hari ini bukan sahaja memberi peluang kepada semua peserta menambahkan pengetahuan khususnya berkaitan dengan Pengeluaran Bersih malah menjadi platfom yang paling sesuai untuk berbincang serta bertukar-tukar idea baru berkaitan Pengeluaran Bersih. Pembelajaran di dalam kelas dengan topik seperti Konsep Pencegahan Sisa dari Perspektif CP, Life Cycle Analysis, Ekologi perindustrian di samping lawatan ke kilang yang dipilih sebagai latihan untuk penjanaan dan pelaksanaan opsyen CP serta perbincangan berkumpulan membantu meningkatkan kefahaman peserta mengenai Pengeluaran Bersih dengan berkesan.

Kursus Audit Pengeluaran Bersih (Kompetensi Tahap 1)

Kursus Audit Pengeluaran Bersih (CP) telah diadakan pada 21-25 Mei 2012 di Hotel Quality, Shah Alam. Kursus tersebut merupakan lanjutan kepada Kursus Pengenalan Pengeluaran Bersih yang telah diadakan pada 26-30 Mac 2012. Objektif penganjuran kursus adalah untuk melatih pegawai-pegawai Jabatan Alam Sekitar (JAS) supaya berkebolehan menjalankan Audit CP di kilang-kilang bagi menilai peluang-peluang untuk melaksanakan CP, membantu pihak industri untuk membuat opsyen dan menilai kejayaan pelaksanaan opsyen-opsyen CP tersebut serta menasihati pihak kilang dalam aspek pelaksanaan CP. Sesi *hands-on* mengenai pelaksanaan Audit CP yang turut diadakan melibatkan lawatan ke premis industri. Latihan praktikal memberi peluang serta pengalaman kepada peserta untuk menjalankan Audit CP di industri dengan bimbingan tenaga pengajar.

Pusat Maya Industri Hijau (PMIH)

Sejak tahun 2009 Jabatan Alam Sekitar melalui Unit Industri Hijau telah membangunkan dan menyelengara Pusat Maya Industri Hijau (PMIH) atau *Green Industry Virtual Centre (GIVC).* Pusat Maya Industri Hijau adalah nama baru bagi mengantikan Pusat Maya Pengeluaran Bersih atau *Cleaner Production Virtual Centre (CPVC).* Pertukaran nama ini dibuat selaras dengan Program Transformasi Jabatan yang bertujuan untuk memantapkan lagi usaha-usaha penghijauan industri di Malaysia dengan melaksanakan inisiatif-inisiatif Industri Hijau termasuk program Pengeluaran Bersih kepada semua sektor industri dan bukan sahaja memberi tumpuan kepada Industri Kecil dan Sederhana (IKS) seperti sebelum ini.

PMIH adalah sistem aplikasi laman web yang direkabentuk untuk meyebarkan maklumat dan mendidik masyarakat umum, terutamanya sektor industri berkaitan peluang-peluang Pengeluaran Bersih yang wujud untuk dilaksanakan di dalam operasi harian syarikat. Pusat ini menyediakan maklumat umum Pengeluaran Bersih seperti definisi, sejarah, kebaikan dan metodologi Pengeluaran Bersih. Maklumat berkaitan

sumber sokongan kewangan dan latihan untuk melaksanakan Pengeluaran Bersih kepada IKS juga disediakan.

PMIH juga dimuatkan dengan contoh-contoh Laporan Audit Pengeluaran Bersih untuk premis industri yang dilaksanakan di bawah program Bantuan Audit Pengeluaran Bersih. Laporan tersebut antara lain menyenaraikan langkah-langkah Pengeluaran Bersih yang boleh dirujuk dan diadaptasi oleh pihak industri yang berkaitan. Disamping itu, pengunjung web PMIH boleh mendapatkan maklumat berkaitan kejayaan pelaksanaan (success stories) Pengeluaran Bersih di premis-premis industri.

Selain itu laman web PMIH juga merupakan saluran bagi menghubungkan pengunjung kepada aplikasi-aplikasi lain yang turut dibangunkan oleh Unit Industri Hijau sebagai contoh, Portal *CP Implementation Tool* (CPIT) dan *Malaysia Green Industry Database* (MGID). CPIT adalah aplikasi atas talian yang boleh digunakan oleh pihak industri yang berminat untuk melaksanakan audit Pengeluaran Bersih secara kendiri. Aplikasi ini adalah berdasarkan data yang dimasukkan oleh pengguna industri dan hasilnya adalah sistem akan memaparkan opsyen-opsyen Pengeluaran Bersih yang boleh diadaptasi di premis industri tersebut. Manakala web portal MGID adalah merupakan sistem aplikasi yang dibangunkan khusus untuk kegunaan Unit Industrui Hijau (UIH) bertujuan mengumpul dan menganalisis maklumat asas Pengeluaran Bersih di Malaysia seperti status pelaksanaan CP di premis- premis industri.

PMIH juga memaparkan maklumat dan program terkini seperti seminar, bengkel dan kursus yang telah dan akan dilaksanakan oleh Jabatan Alam Sekitar. Di masa hadapan, PMIH akan dimuatkan dengan lebih banyak maklumat berkaitan lain-lain inisiatif Industri Hijau, *Carbon Footprint* dan isu-isu berkenaan perubahan iklim dunia.