DANIDA

DEPARTMENT OF ENVIRONMENTAL
AFFAIRS AND TOURISM

Report Number: 12/9/6

ANNEXURE G

NATIONAL WASTE MANAGEMENT STRATEGY IMPLEMENTATION SOUTH AFRICA

RECYCLING

REVIEW OF INDUSTRIAL WASTE EXCHANGE

4 April 2005

EXECUTIVE SUMMARY

The Recycling Component of the National Waste Management Strategy Implementation (NWMSI) Project aims to develop a realistic and practical approach to increase and extend recycling in South Africa. Provision is made within this component for the investigation and possible pilot implementation of an industrial waste exchange initiative, as a mechanism for bringing about waste reduction in South Africa, through the reuse and recycling of industrial waste. As a first step toward developing such an initiative a review of the status quo of industrial waste exchange internationally and locally was undertaken and is documented in this report.

Three approaches were used for the collection of information for this review, i.e. a literature review was undertaken of industrial waste exchange internationally and in South Africa; stakeholders currently involved in industrial waste exchange in South Africa were interviewed; and, additional input was obtained through consultation with stakeholders at the NWMSI Project Initiation Workshop and the Provincial Recycling Workshops held during the period - October 2004 to January 2005.

The report briefly reviews the history of industrial waste exchange, also known as 'resource exchange', 'by-product exchange', 'waste interchange' and 'waste trading'. It gives an overview of formal waste exchanges worldwide, e.g. in the United Kingdom, Europe, the United States of America, Canada, South America, Australia and New Zeeland, Africa and South Africa. It lists examples of the materials exchanged, e.g. alkalis, construction and demolition waste, electronics and equipment, food and vegetation, glass, machinery, metals and metal sludges, oils and waxes, wood products, paints and coatings, pallets and containers, paper and cardboard, plastics, rubber, solvents, textiles, leather and timber.

South Africa's first formal Integrated Waste Exchange was launched in 2000 as a pilot project by the Cape Metropolitan Council, using an internet based exchange platform. The CMC's experience over the last four years is reviewed, and indicated that this approach has only had limited success to date. The CMC waste exchange's market potential has not yet been fully realised and since its implementation still in an initial phase, it will require further pioneering strategies to increase its success.

The study has identified and explored five approaches which could be utilised to promote and enhance industrial waste exchange in South Africa, i.e.:

- Working through public-private-partnerships, e.g. between *local authorities* who operate landfill sites, *industries* who discharge problematic waste to these sites and *waste companies* who specialise in waste re-use and recycling.
- Using the South African Cleaner Production centres to develop and assist with the implementation of appropriate technologies for industrial waste exchange;
- Use of trading platforms, such as the Cape Metropolitan Council platform, to link waste generators and waste re-users and recyclers;
- Linking waste minimisation clubs, industrial ecological parks and waste exchanges;
- Introducing funding mechanisms, particularly to enhance and support the exchange of low value commodities.

A separate proposal has been developed for a pilot project / investigation to address industrial waste exchange.

Table of Contents

ABBREVIATIONS AND ACRONYMS

AFR	African Recycler's Exchange
CID	Commercial Industrial Districts
CMC	Cape Metropolitan Council
CBOs	Community-based Organisations
CSIR	Council for Scientific and Industrial Research
DEAT	Department of Environmental Affairs and Tourism
EOL	End of Line (recycling)
EPR	Extended Producer Responsibility
IWEX	Integrated Waste Exchange
MDP	Municipal Development Program
NCPC	National Cleaner Production Centre
NGOs	Non-Governmental Organisations
NWMSI	National Waste Management Strategy Implementation
OWME	Ontario Waste Materials Exchange
the dti	Department of Trade and Industry
UK	United Kingdom
UNIDO	United Nations Industrial Development Organisation
US	United States (of America)
WIS	Waste Information System
WMC	Waste Minimisation Club

1 INTRODUCTION AND BACKGROUND

The programme for the National Waste Management Strategy Implementation Project, Recycling Component, makes provision for the investigation of and possible pilot implementation of an industrial waste exchange initiative as a mechanism for bringing about waste reduction in South Africa. As a first step toward developing such an initiative a brief review of the status quo of industrial waste exchange internationally and locally has been undertaken and is set out in this report. Based on this review recommendations are made on possible mechanisms to take the initiative forward.

1.1 Definition of Industrial Waste Exchange

Industrial waste exchange is an internationally recognised waste reduction concept. It is a mechanism for recycling and reusing industrial waste. This form of waste exchange attempts to link industrial waste generators with waste recyclers or companies that can use 'waste' as a raw material input to their product(s).

1.2 Early International Industrial Waste Exchange Initiatives

The exchange of 'wastes' between industrial companies has been taking place for over a century, simply because it makes good business sense.[1] During World War II, waste exchange was established as a mechanism to conserve valuable resources and equipment. The British established the earliest documented industrial waste exchange institution, the National Industrial Materials Recovery Association, in 1942. Unfortunately, at the end of the war, most exchanges had met their resource conservation goals and ceased to exist.[2]

In 1972, the concept of promoting transfers of industrial 'wastes' was re-introduced in Europe. In that year, the two European chemical industry organisations introduced waste exchange, i.e. the Federation of Belgian Chemical Industries and the Association of Netherlands Chemicals Industries. The approach adopted by both these organisations was to create information clearinghouses that listed wastes which were available and sought after. Neither of these organisations actively facilitated the transfers between potentially interested parties, but left it to the companies concerned. Between 1972 and 1976, a further 10 waste exchange organisations were established in Europe, including Austria, Finland, Germany, Italy, Norway, Sweden and Switzerland. An international waste exchange was established in 1975 by a federation of industries in Scandinavia (i.e. Denmark, Finland, Norway and Sweden). By 1978, France also established a waste exchange organisation.

---

[1] Peck, website

[2] *Analysis and Evaluation of Existing Integrated Waste Exchange of the City of Cape Town with regards to its Economic Efficiency and its Possible Social and Ecological Consequences*, Diploma Thesis by Christian Nissing, University of Cape Town, November 2002

During the late 1970s, nations outside of Europe also began to consider establishing waste exchange organisations to help conserve resources and reduce the volume of wastes requiring disposal. Numerous waste exchange organisations were established in New Zealand and Australia. The first North American Waste Exchange was established in 1973. By the mid to late 1970s, waste exchange organisations started proliferating in the United States.

Most of the early waste exchange organisations served as information exchanges and did not actively pursue matches of industrial waste generators and users. While some of the early exchanges operated for profit, most were non-profit organisations. Most waste exchanges dealt primarily with hazardous wastes. Waste exchanges were generally limited to trading on a regional rather than a national basis. Funding for the early exchanges came from several sources: government (federal, state and local), private donations, listing fees, and subscription fees. In general, waste exchanges that specialised in higher value materials survived without government funding; exchanges working to create transaction with contaminated, low value, or hard-to-exchange materials required ongoing government support.

The initial waste exchange organisations established during the 1970s have all closed down, primarily as a result of declining financial support from governments, or changes in solid waste disposal regulations that severely restricted transactions involving hazardous wastes.

1.3 Recent / Current International Industrial Waste Exchange Initiatives

Waste and Materials Exchanges are markets for buying and selling reusable and recyclable commodities. Some are physical warehouses that advertise available commodities through printed catalogues, while others are simply websites that connect buyers and sellers. Some are coordinated by state and local governments, while others are wholly private, businesses operated for profit. The exchanges also vary in terms of area of service and the types of commodities exchanged. In general, waste exchanges tend to handle hazardous materials and industrial process waste while materials exchanges handle non-hazardous items[3].

Typically, the exchanges allow subscribers to post materials available or wanted on a webpage listing. Organisations interested in trading posted commodities then contact each other directly. As more and more individuals recognise the power of this unique tool, the number of internet-accessible materials exchanges continues to grow, particularly in the area of national commodity-specific exchanges[3].

Wherever possible, the materials exchange presented contain a brief description of the services offered, including the materials available for exchange, how to contact the exchange, and other pertinent information[3].

Waste exchanges have been established in almost every country, including:

[3] USEPA, www.epa.gov/epaoswer/osw/index.htm

- *Brazil, Chile and Peru:* Brazil appears to be the most active waste exchanger in South America with waste exchanges operational in all its provinces. All the websites relating to waste exchanges in South America are either in Portuguese or Spanish.
- *Wales, Northern Ireland, Ireland, Scotland and England* all have more than one waste exchange. Ireland and England appear to be the forerunners with regards to efficient waste exchanges. Most of the waste exchanges are run by government, government funded organisations, or commercially active waste traders.
- *Belgium, Germany, France, Russia, Poland, Belarus, and even Malta* have waste exchanges or similarly operating systems.
- In *Portugal* the LIPOR Sorting Centre offers a service of facilitating waste exchange, and has created a market for waste materials.
- The "Reststoffenbeurs" of *The Netherlands* is a commercial waste exchange that charges 45 Euros per waste on offer, or 259 Euros per annum for inclusion of up to 5 waste products per month on the website.
- *Spain* has a By-Product Exchange where wastes that have been declared as by-products by a Waste Board that may be exchanged. The By-Product Exchange of Catalonia (Borsa de Subproductes de Catalunya - BSC) is a free service aimed at boosting the re-use of waste as far as possible, promoting recycling, and providing companies with a tool for cutting their costs and improving their competitiveness by reducing their expenditure on raw materials and on waste management. For this purpose, the BSC runs a database with particulars of BSC-registered companies offering or looking for waste for re-use as raw materials in production processes.
- Various waste exchanges operate in *New Zealand and Australia*, both run and funded by government or run by non-profit organisations.
- The aim of the waste exchange in *New Zealand* is to conserve energy, minimise resource use and reduce the need for landfill space. Products that have been successfully diverted from landfill include plastic, material, timber, computers, organic wastes, and unused chlorine. Other products have proved to be a considerable challenge, for example non-absorbent blue cloth and a concrete/wood residue. Over 900 companies have joined the Waste Exchange Service to assist in their waste management and many have had results which have saved them money.
- In *Australia*, a software programme has been developed with regards to waste exchanges. The software programme provides complete online administration for regional exchange and corporate operators whilst operating within a national framework. The programme is a multi-lingual service which currently supports English and Japanese, while other languages can be added on demand.
- In the *United States of America*, each state has its own waste exchange. 34 waste exchanges have been established that operate on a regional and international basis, and cover the following products: plastics, automobile parts, paper, non-ferrous and ferrous scrap metals, cotton, rubber, corrugated metals, pulp and paper fibre, electronic equipment, steel products, glass, and building and construction materials. Most are free of charge, while others offer memberships from US$15 to US$49, or donations of for example US$10.
- In *Canada* a number of waste exchanges exist. The Canadianenvironment.com Waste Exchange is only a discussion board and not a real exchange where waste products can be exchanged, such as the European waste exchanges. The Ontario

Waste Materials Exchange (OWME) is a service designed to facilitate the reuse and recycling of industrial by-product materials.

The modern waste exchanges provide guidance, information and practical assistance on environmental and waste management issues to businesses throughout their country or region and promote continual improvement and the adoption of best practice.

The following materials are available for exchange on waste exchanges worldwide: alkalis, construction and demolition waste, electronics and equipment, food and vegetation, glass, machinery, metals and metal sludges, oils and waxes, wood products, paints and coatings, pallets and containers, paper and cardboard, plastics, rubber, solvents, textiles and leather and timber.

Other terms used interchangeably with 'waste exchange' are:

- resource exchange,
- by-products exchange,
- waste interchange,
- waste trading service,
- residual waste exchange (reststoffen), and
- waste materials exchange.

2 Waste Exchange in Africa

2.1 African Waste Net[4]

During a seminar in Abidjan organised in February 1996 by the Municipal Development Program (MDP), the Groupe Régional pour l'Eau et l'Assainissement en Afrique de l'Ouest (GREA/AO, World Bank) and the Institut Africain de Gestion Urbaine (IAGU), the community of locally elected officials and of African experts noted that waste management policies and practices applied so far in African cities not only did not reach the objectives, but could not ensure renewal of the system. Inappropriate decisions concerning financing, technical choices, or the organisation plans pertaining to the modes of management adopted by local officials, were taken with no consideration for the specific context in which the African cities develop and for their urban, socio-economic and political characteristics. Following these observations, basic principles were formulated and included in the Abidjan Declaration of 16 February 1996. These principles proposed new approaches to waste management. In order to apply these new principles, the participants decided to create a sub-regional professional network called "African Waste Net". The MDP was called upon to help set up African Waste Net and give it legal status.

The purpose of the network is to facilitate discussions and action on the part of African stakeholders so as to formulate and implement a realistic policy for

[4] http://www.pdm-net.org/english/wastnet/wastnet.htm

sustainable waste management in African cities, following the principles set in the Abidjan Declaration. By definition, African Waste Net concerns every African stakeholder involved in the management of wastes in African cities, i.e. municipalities; private sector, communities and associations, as well as waste experts and researchers.

The African Waste Net applies three basic principles:

- To carry out the *waste initiatives for and exchanges by African stakeholders*. The partners who support the network did not initiate it.
- A *continuous and dynamic exchange of ideas* throughout the sub-region between all the stakeholders involved in the management of waste in Africa. The African Waste Net functions like a continuous seminar where the participants constantly contribute ideas drawn from their own experiences, so as to receive feedback from other participants concerning their methods, modify their strategies accordingly and test the latter in a real environment.
- A *flexible network based on voluntary contributions* from all the members of the network and their partners**.** Exchanges no matter the subject, must be encouraged among all the stakeholders involved in waste management in Africa; open discussions and professional skills must take the place of such concepts as bureaucracy and hierarchy.

Meetings are organised between stakeholders from the various countries in the sub-region or from different cities within national networks. These meetings which gather different groups are the best way to compare experiences, assess one another's knowledge, exchange ideas and perspectives, all this with a view to come up with new policies and methods to manage wastes. Another advantage for the participants is that they can try to replicate experiences which have worked elsewhere and avoid repeating failed policies. These activities may be financed by several donors on the basis of project, possibly through African Waste Net's national offices (country correspondents) and sub-regional office (at MDP's headquarters).

The first element of the network includes the initiatives taken by the local stakeholders in the member countries, pertaining to exchange, research, evaluation and development projects. Their exchanges make up country networks under the supervision of a correspondent whose duties include, to:

- maintain the connection between the country network and the sub-regional office, especially to receive and process all the data pertaining to the participant;
- promote and support the conception and implementation of country; and
- assist the sub-regional office together with the other correspondents and the coordinator,

At the sub-regional level, central co-ordination is performed by a co-ordinator who is a member of the network located at the MDP. The co-ordinator works closely with the national co-ordinators and is more particularly mandated to:

- help the various country correspondents contact one another;
- to process and distribute all the data related to the observatory; and
- to maintain contact with network partners.

Although these relations and activities are most important in maintaining the network, African Waste Net does not ignore potential benefits from informal discussions. The purpose of this network is primarily to facilitate and promote waste exchanges.

2.2 African Recycler's Exchange[5]

The African Recycler's Exchange (AFR) is a membership based (at US$25 per month) worldwide information exchange for those companies and individuals who buy, sell or trade commodities, materials, goods and services relevant to the recycling industry. There is no charge for posting to the Exchange; however to reply to listings one must be a subscriber to the AFR.

The following categories and relevant South African companies are listed on the AFR:

- Trader / Recycler of Used and Baled Waste Paper: Waste Trade SA based in Port Elizabeth;
- Tire and Rubber Recycling: Texprojekt based in Sandton;
- Used Computer Items: Internet Shoppe (Pty) Ltd based in Laudium, Pretoria; and
- Trading in used and retreadable tires and casings: Motorserve Randburg.

3 South Africa's Integrated Waste Exchange

In South Africa an Integrated Waste Exchange (IWEX) was launched in May 2000 as a pilot project by the Waste Management Department of the Cape Metropolitan Council (CMC) as a part of its action plan towards and integrated waste management. Nissing[2] critically analysed the actual state of the exchange with regards to its economic efficiency and its possible environmental and social consequences, to identify its success and to propose ways to optimise its functionality in the future.

Nissing[2] shows that most of the material listings offer or request common and relatively low valuable materials, such as paper and plastics. The initially targeted market has not been reached with the desired impact; material listings cover a broader range of material classes than initially planned. Producing companies list most of the material offers, wanting to make a profit of their waste materials by selling them instead of paying for their disposal. On the other hand, existing recycling companies, looking for new input streams, have made most of the material requests.

Nissing[2] developed a tool to evaluate the impact and economic efficiency of the waste exchange. A preliminary indicator of the waste exchange's impact is the activity assessment, comparing the number of successful exchanges to the number of non-successful exchanges. The waste disposal reduction rate evaluation compares the quantity of exchanged materials to the total quantity of disposed materials. The South African Industrial Waste Exchange has exchanged between 0.16 and 1.26% of the total generated waste stream in the Cape Metropolitan Area. Nissing concluded that

[5] http://africa.recycle.net/web/link.html

the waste exchange's market potential is not yet fully realised and that it is still in its introduction phase, requiring further pioneering strategies.

Nissing[2] also found that the waste exchange currently excludes certain people in participating in waste exchange either because of their limited access to the system or their lack of skills in using the system.

Cape Town's Industrial Waste Exchange has been launched because of an environmental need, implicating by definition an ecological improvement directly related to its success. The waste exchange does not necessarily decrease transport distances, neither related emissions. A possible approach to addressing these problems is provided by the industrial ecosystem concept, which promotes local material exchange partnerships.

Waste exchanges are "virtual eco-industrial parks" in that they promote the same type of material exchanges among entities, but in this case they are not physically located adjacent to each other. Instead, using web-based databases and brokers, agreements are made between participants to transport and exchange materials at different physical locations. In this case, distance and transportation issues will play a significant role in determining how practical an exchange could be.

4 Industrial Ecology and Industrial Ecosystems

4.1 Introduction

One of the more radical approaches to achieving greater levels of material and energy resource use efficiency involves the concept of *industrial ecology*. 'Industrial ecology' refers to the exchange of materials between different industrial sectors where the 'waste' output of one industry becomes the 'feedstock' of another. For example, the excess steam from an electrical generating facility can be used as a heat source for a nearby chemical manufacturer; and, the fly ash from a coal fired generating station can be used as an input for the cement industry.

'Industrial ecosystems' refer to situations in which a number of different companies, usually in close proximity to each other, exchange various 'waste' outputs. Industrial ecology represents a relatively new and leading edge paradigm for business. It emphasizes the establishment of public policies, technologies and managerial systems which facilitate and promote production in a more co-operative manner. Implementing industrial ecology involves utilising tools and mechanisms such as: life cycle analysis, closed loop processing, reusing and recycling, design for environment and waste exchange. Technologies and processes that maximize economic and environmental efficiency are referred to as eco-efficient.

Natural ecosystems do not generate waste since the wastes produced by one organism forms the food source for another. Natural systems do not create an abundance of persistent toxic compounds that cannot be utilized by other organisms in the system. Hypothetically, in a completely efficient economy functioning in harmony with ecosystems, there would be no waste.

Figure 1 illustrates changing nature of industrialization culminating in full industrial ecology, whereby "all process systems and equipment, and plant and factor design, will eventually be fully compatible with existing industrial ecosystems as a matter of course."[6]

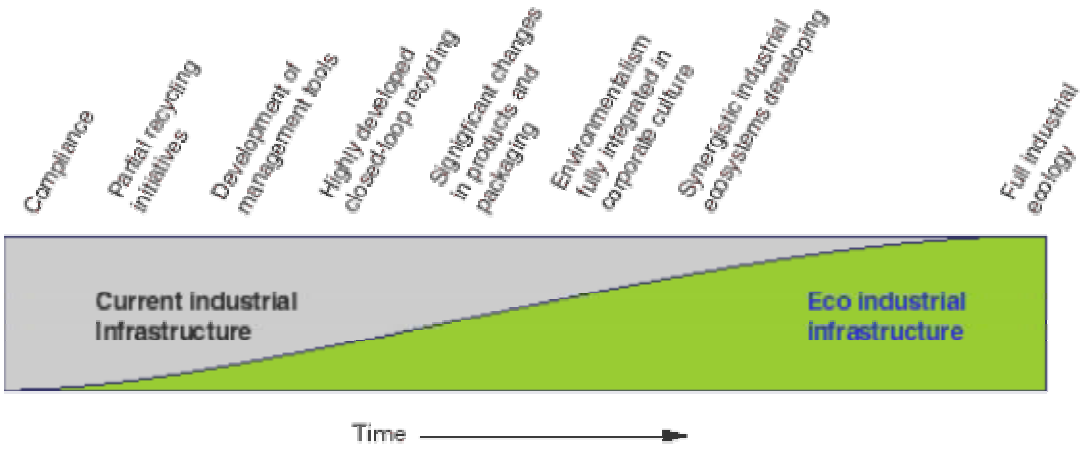

Figure 1: The Emergence of an Eco-Industrial Infrastructure
(Source: Arthur D. Little)

4.2 Environmental Technology Development

In order to move towards an 'eco-industrial infrastructure' significant technological advances will be required. Four generations of environmental technology have been identified by the International Institute for Sustainable Development, i.e. remediation, abatement, pollution prevention and sustainable technologies. The latter two types of technology, which are the least developed, have an important role to play in facilitating industrial ecology linkages and helping society move towards industrial systems that achieve the goal of 'Zero - waste' or 100 percent efficiency. The four types of environmental technologies are briefly described in the table below.

[6] Arthur D. Little (1994) *Industrial Ecology: An Environmental Agenda for Industry*, Industrial Ecology Workshop*:* Making Business More Competitive. Toronto: Ministry of Environment and Energy, February 1994

Technology	Point of Application	Characteristics	Examples
Remediation Technologies	• symptoms • damaged resources or environments	• after the fact • costly • range from low tech to high tech	• soil remediation • toxic site clean-ups • water treatment
Abatement Technologies	• pollutant capture or treatment at end-of-pipe	• captures or treats pollutants before release • consumes capital, energy and resources • generates waste steam • fairly costly	• flue gas desulfurization • sewage treatment plants • catalytic mufflers
Pollution Prevention Technologies	• industrial process design • product design or composition	• changes product or process or reduce or prevent pollution • more cost effective that abatement • reduced waste steam	• chlorine-free paper • cyanide-free electroplating • lead-free gasoline • industrial process design
Sustainable Technologies	• alternate product or service	• multiple benefits: environmental, economic, social, resource efficiency	• efficient lighting • recycled paper • renewable energy • bio-cosmetics and drugs

(Source: Thompson Gow and Associates, *1995 Environmental Scan*. Winnipeg: Canadian Council of Ministers on the Environment, 1995).

The majority of environmental technology firms in Canada manufacture technologies that fall into the remediation and abatement categories. Given the relative infancy of pollution prevention and sustainable technologies, there is tremendous growth potential in these areas. The anticipated annual growth rate of Canada's environmental industry is roughly 6 percent.

Industry Canada estimates that the growth in pollution prevention, also known as cleaner production technologies, will be roughly 30 percent per year. Pollution prevention and sustainable technologies, when combined with industrial ecology concepts, hold the promise of dramatically reducing the amount of 'waste' resulting from industrial production and consumption. Significant improvements in the efficiency of production are possible. The key question remaining is, how to move from theory to practice as fast as possible.

4.3 Industrial Ecology in Practice in Kalundborg, Denmark

The exchange of 'wastes'/commodities between independent firms in some sectors has been taking place for over a century, simply because it makes good business sense. The establishment of 'industrial ecosystems,' however, is a relatively new

phenomenon, with one of the best known example being located in Kalundborg, Denmark. An industrial ecosystem has been established in this town, which involves an oil refinery, a gypsum factory, a pharmaceutical firm, a fish farm, a coal-fired electrical power station and the municipality of Kalundborg, among others.

At Kalundborg, steam and various raw materials such as sulphur, fly ash and sludge are exchanged in what is the world's most elaborate industrial ecosystem. The participating firms each benefit economically from reduced costs for waste disposal, improved efficiencies of resource use and improved environmental performance. For example, gas captured from the oil refinery, which had previously been flared off, is now sent to the electrical power station which expects to save the equivalent of 30,000 tonnes of coal a year. Figure 2 demonstrates the industrial ecology system in Kalundborg.

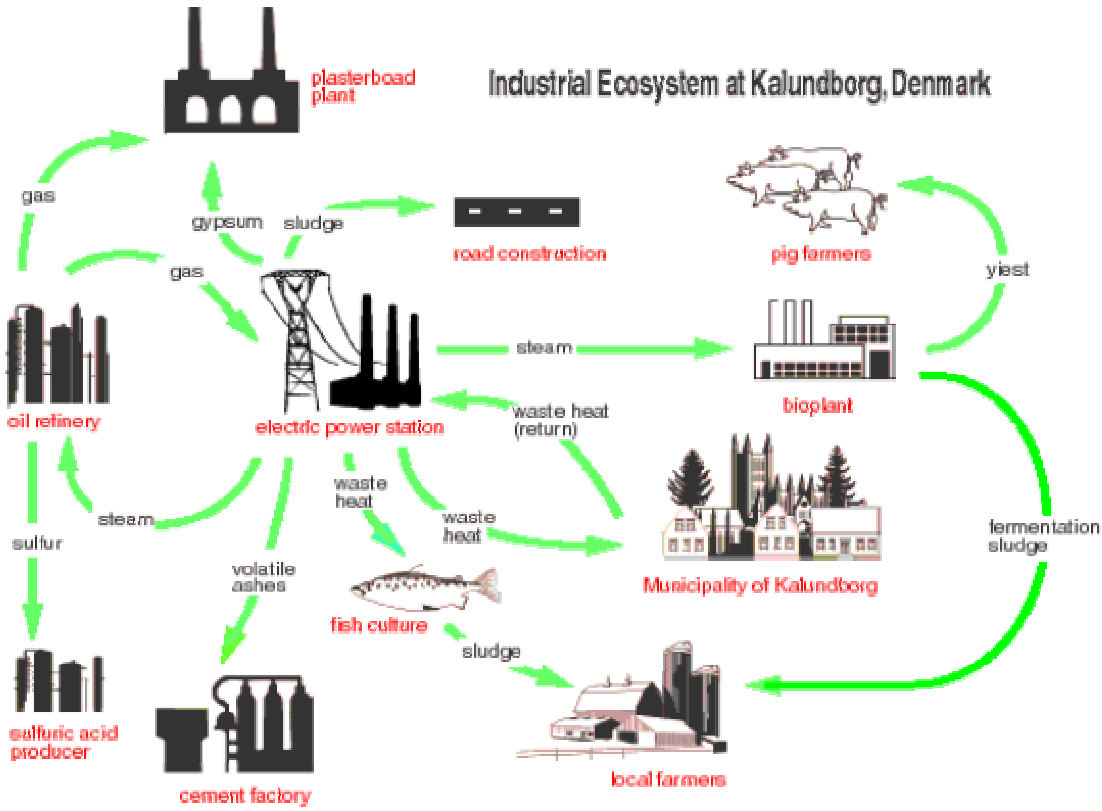

Figure 2: Industrial Ecosystem at Kalundborg
(Source: *Ecodecision*, Spring 1996)

The successful establishment of industrial ecology linkages requires continuing implementation of projects that identify industrial ecology opportunities. Work is required to clearly identify the regulatory and other policy barriers in order that they may be removed. Policy-based incentives - such as ecological tax reform and other practical techniques - need to be identified and implemented to help stimulate the market to drive industrial ecology. On the ground institutions, such as the National Cleaner Production Centre, can help to facilitate such linkages in larger industrial parks. For sites with a smaller number of firms, as in the case of the Parrow Industrial

Site in Cape Town, the preferred strategy may be to utilize existing institutions and networks, with a focus on promoting the economic benefits attainable through co-operation.

Government, industry, academics and other organizations which focus on establishing the right institutional, fiscal and policy environment for the practical implementation of pollution prevention technologies, sustainable technologies and industrial ecology, can help to ensure prosperity for their citizens and secure an important role for South Africa in global efforts to achieve sustainable development.

5 Waste Minimisation Clubs

5.1 Introduction

Waste minimisation is the application of a systematic approach to reducing waste at source. The basic concept is one of preventing the waste generation rather than having to install end-of-pipe treatment systems to solve the problem. Waste minimisation is an activity that relates to all inputs and outputs from an industry, business, site or process. Any raw material input to a process that does not become part of the product, is termed waste. This can be in the form of emissions to air, land and water and rejects. Waste is not simply material excess to requirements, but represents a loss in profits and can reflect as much as between 1% and 4% of a company's turnover. Waste minimisation involves investigating all methods of reducing material/utility use at source and improving process efficiency, thereby reducing emissions to the environment and saving money.

Waste minimisation is achieved through the implementation of a number of steps. The first steps include obtaining commitment to the programme from senior management, appointing a project champion to manage the programme and selecting a project team to assist in data collection. All processes within the factory are then investigated and data collected on all inputs and outputs in terms of quantity and value. At the end of this phase, the project team should target those processes, operations or waste streams that require more detailed assessment. Targeted processes can be based on the hazardous nature of the waste, the value of the waste, the large volumes of water consumed or the use of excessive energy. These areas can then be assessed in more detail and options for improvement identified. A feasibility analysis is then conducted to determine if the option is economically, technically and environmentally feasible. Those options that are found to be feasible can then be implemented. It must be remembered that waste minimisation is not a once off activity and the programme should be continuously monitored and targets reassessed and reset at regular intervals.

The concept of a waste minimisation club (WMC) was first developed in The Netherlands in the early 1990's to encourage industries to reduce pollution. It involves a small number of companies, generally within the same geographical area, working together to exchange ideas and information on waste minimisation, and in this way, encourage one another to improve process efficiency, save money and reduce their environmental impact. It has been shown to be a successful concept with

over 100 Clubs established in the UK, with similar initiatives in New Zealand and India.

5.2 Status of Waste Minimisation Clubs in South Africa

WMCs have been introduced in South Africa in a number of the larger cities, e.g. the WMC for Large Companies in the Western Cape. Having been in operation for only one year, its member organisations have identified combined potential for annual savings of up to R8 million. This is largely through preventative measures which create energy and raw materials savings, and reduce wastes, effluent and air-emissions. Determined to continue with the initiative to learn yet more and to maximise potential benefits, the member organisations (Caltex, Milnerton; Namakwa Sands, Vredenburg; Simba, Parow; SANS Fibres, Bellville South; KWV, Paarl; British American Tobacco, Paarl; South African Breweries, Newlands) have not only embarked on a second year of WMC operation, but have agreed to enlarge their membership base. Thus the circle of competence and the potential to reduce local environmental impacts is expected to further improve.

Having experienced first-hand the environmental, financial and efficiency benefits of actively pursuing waste and pollution reduction at source, BMW's Rosslyn facility approached the BECO-Institute for Sustainable Business, in an initiative aimed at addressing the Rosslyn industrial area's waste and pollution. Member companies of Waste Minimisation Clubs (WMCs) nominate an appropriate person to attend WMC meetings every alternate month. Amongst other benefits, members receive training in Cleaner Production techniques, updated information regarding relevant regulations and legislation, and the opportunity to share experiences in pollution prevention. The combined fees paid by member companies, enable BECO-ISB to deliver this information and training, together with technical Waste Minimisation Opportunity Assessments of member facilities, at a cost-effective membership rate.

BMW SA is committed to environmental protection and to playing a role in reducing the impacts of Rosslyn's industrial activities. The WMCs are a first step towards an Environmental Forum for the Rosslyn area. This forum will serve as a Centre of Competence for the area and will be made up of representatives from the Rosslyn WMCs and representatives from national, provincial and local government. The WMCs are also a tool to assist the companies' supply chain in embarking on environmental improvements.

One of BMW's waste minimisation projects resulted in a reduction in water usage of more than 80 percent per unit produced: totalling 459 240m^3 per year (enough water to supply 76 540 households with one month of their free water allocation of 6*kl*). A second reduction project reduced Chrome 6+ in the effluent to below 0,005 mg/ℓ. This significant reduction in Chrome 6+ (about 83% over the last 4 years) constitutes a major step in reducing the environmental and health impacts emanating from the industry and sets a benchmark for other players to emulate. In financial terms, these two projects alone resulted in an annual financial saving to BMW of US$ 617 076, with a return on investment of more than 6000%. From initial responses received, indications are that one to two WMCs are likely to result from the launch meeting, with participating companies standing to be the first in Rosslyn to benefit from the

initiative. BECO will apply for support from **the dti**'s Sector Partnership Fund thus potentially reducing company membership fees to below R8 000 per annum.
The table blow presents the status of waste minimisation clubs in South Africa in 2003.

Status of Waste Minimisation Clubs in South Africa

Name	Place	Industry	Members	Funding	Facilitators	Status
KZN Metal Finishing Waste Minimisation Club (now Association)	Durban	Metal Finishing only	About 29 members when initiated, now 70-80 members in the association	Water Research Commission, THERMIE Program funds two consultants	Pollution Research Unit from University of Natal	Started June 1998. Project ended ultimo 2000 but continues as an conservancy.
Hammersdale Waste Minimisation Club	Durban	Cross sectoral	10 members	Water Research Commission, THERMIE Program funds two consultants	Pollution Research Unit from University of Natal	Started June 1998. Project closed but continues as an industry association.
Second KZN Metal Finishing Waste Minimisation Club	Durban	Metal Finishing	15 members, mainly electroplaters	Danced, DWAF	KZN Metal Finishing Association	Started January 2002
Gauteng Metal Finishing Waste Minimisation Club	Gauteng	Metal Finishing	10 members, metal finishers, chemical suppliers and a water company	Danced, DWAF	Gauteng Metal Finishing Association	First meeting October 2001
Cape Metal Finishing Waste Minimisation Club	Cape Town	Metal Finishing and Chemical Suppliers	26 members	Danced, DWAF, DTI Sector Partnership Fund	Cape Metal Finishing Association (CMFA)+ BECO - Institute for Sustainable Business	First meeting August 2000. 14 meetings so far
Waste Minimisation Club for Large Companies in the Western Cape	Cape Town	Cross sectoral	8 members, all large companies	DTI Sector Partnership Fund and NOVEM in Holland	BECO - Institute for Sustainable Business	First meeting November 2000. 13 meetings so far
The Pietermaritzburg Waste Minimisation Club	Pietermaritzburg	Cross sectoral	11 members from a variety of industries.	Water Research Commission through Pollution Research Group	University of Natal, Chemical Technology Group	Launched October 2000, 9 meetings so far.
Nelson Mandela Metropole Metal Finishers Waste Minimisation Club	Port Elizabeth	Metal Finishing, might become cross sectoral	12 members, who want to include other industries with effluent problems.	BHT Water Treatment funds newsletter	University of Port Elizabeth, institute of environmental and coastal management	First meeting March 2001, stopped end 2002 due to moving of members. New start up is planned.

Name	Place	Industry	Members	Funding	Facilitators	Status
City of Cape Town Waste Minimisation Club for the Plastics Industry	Cape Town	Plastics Industry	10 plastics companies	City of Cape Town and DTI Sector Partnership Fund	BECO - Institute for Sustainable Business	First meeting March 2002. 4 meetings so far
Gauteng Waste Minimisation Club for the Plastics Industry	Gauteng	Plastics Industry	App. 7-10 companies in the plastics industry in Gauteng	Plasfed (*)	BECO - Institute for Sustainable Business and Plasfed	Start up phase. First meeting expected mid 2003
City of Cape Town Waste Minimisation Club for the Convention Centre Construction	Cape Town	Construction industry	WBHO, Malan's quarries, Two Oceans	City of Cape Town	BECO - Institute for Sustainable Business	Initial start up failed due to lack of interest

Name	Place	Industry	Members	Funding	Facilitators	Status
City of Cape Town Waste Minimisation Club for Blue Route Shopping Centre	Cape Town	Retail and restaurants	7 tenants of the shopping centre	City of Cape Town	BECO - Institute for Sustainable Business	First meeting March 2002. 3 meetings so far
City of Cape Town Waste Minimisation Club for the Car Repair Industry	Cape Town	Garages	6 garages, including 2 fleet maintenance facilities of the City of Cape Town	City of Cape Town	BECO - Institute for Sustainable Business	First meeting March 2002. 3 meetings so far
City of Cape Town Waste Minimisation Club for the Cape Town Civic Centre	Cape Town	Office Departments	8 departments in the Cape Town Civic Centre	City of Cape Town	BECO - Institute for Sustainable Business	First meeting February 2002. 5 meetings so far
City of Cape Town Waste Minimisation Club for the Atlantis Industrial Area	Cape Town	Cross sectoral	7 companies in the Atlantis industrial area	City of Cape Town, DTI Sector Partnership Fund	BECO - Institute for Sustainable Business	First meeting February 2002. 5 meetings so far
Waste Minimisation Club for Wine farms in the Breede river valley	Robertson	Winemakers	9 wine makers in the same valley	Western Cape Provincial Government, DTI Sector Partnership Fund	BECO - Institute for Sustainable Business	First meeting January 2002. 5 meetings so far
Waste Minimisation Club for the food industry Cape Metropolitan Area and Boland	Cape Town	Food and Beverage industry	26 companies	DTI Sector Partnership Fund	BECO - Institute for Sustainable Business	First meeting July 2002, 6 meetings so far
Waste Minimisation Club for the Paarl region	Paarl	Cross Sectoral	7 industries in Paarl	n.a.	BECO - Institute for Sustainable Business	Start up failed due lack of interest and lack of support by municipality

Name	Place	Industry	Members	Funding	Facilitators	Status
Waste Minimisation Club for Delporte and Chamdor Industrial areas in Mogale City	Mogale City	Cross Sectoral	6-10 industries in Mogale, a.o. leather tanning, abattoirs and meat processing	Frysian Water Alliance (*), DTI Sector Partnership Fund (*)	BECO - Institute for Sustainable Business	Start up phase. First meeting expected early 2003
Waste Minimisation Club for Large Companies in the West rand area	West Rand, Greater Joh'burg	Cross Sectoral	6-8 companies in the West Rand area	Rand water (*), Mogale City (*)	BECO - Institute for Sustainable Business	Start up phase. First meeting expected mid 2003
Waste Minimisation Club for Rosslyn industrial area	Rosslyn, Tshwane	Cross Sectoral	6 industries in the Rosslyn industrial area (Tshwane)	DTI Sector Partnership Fund (*)	BECO - Institute for Sustainable Business	First meeting July 2002. 2 meetings so far
Waste Minimisation Club for Parow Industria industrial area	Cape Town	Cross Sectoral	6-8 companies in Parow Industria	Parow Industria City Improvement District (*)	BECO - Institute for Sustainable Business	Start up phase. First meeting expected mid 2003
Waste Minimisation Club at the Red Cross Childrens Hospital	Cape Town	Hospital (in house)	7 different departments	City of Cape Town / Western Cape Provincial Government	Fairest Cape Association, BECO - Institute for Sustainable Business	First meeting March 2002

Name	Place	Industry	Members	Funding	Facilitators	Status
Waste Minimisation Club for the Bellville industrial area	Cape Town	Cross Sectoral	7-10 Industries	City of Cape Town, Western Cape Provincial Government	BECO - Institute for Sustainable Business	First meeting March 2003
Sasol in house (**)	National	Petrochemical (in house)	27 business units within Sasol, a large petrochemical company	Sasol	Sasol	Meeting in February 2001, WMC integrated with existing structures.

(*) Application in preparation; (**) Last information from July 2001

6 MECHANISMS TO PROMOTE AND ENHANCE IWEX

Based on the outcome of the review presented above, a number of possible approaches to Industrial Waste Exchange in South Africa are proposed for consideration. These are illustrated by successes achieved with these approaches elsewhere in the world.

6.1 Public-Private-Partnerships

One of the promising mechanisms to encourage Industrial Waste Exchange (IWEX) is a public-private-partnership between a *municipality* and *industries* in its area of jurisdiction to jointly address industrial waste management problems. The public-

private-partnerships mechanism offers a means of addressing the following opportunities and challenges:

- Significantly reducing load of hazardous waste to landfills;
- Finding alternative uses for industrial waste generated in significant quantities with a high potential for environmental pollution;
- Significant financial savings;
- Effective coordination of an IWEX initiative;
- Capacitating the staff of the local and district municipalities to drive the process, both technical and management skill are required;
- Addressing the problem of the reluctance from the industrialists to disclose their hazardous waste streams and volumes; and
- Addressing various legal issues (e.g. liability) associated with waste exchange.

The Cape Metro Council is the only municipality in South Africa that is currently operating a formal IWEX system. An opportunity to establish another system in one of the other provinces was investigated. The Recycling Team undertook an investigation to identify a suitable local (or district) authority which is experiencing problems with the disposal of industrial waste at which the implementation of an IWEX system could possibly present a solution. A number of local authorities were approached with a view to identified as a potentially suitable candidate municipality for a pilot study for the implementation of an IWEX system. The team focussed on candidate areas which are highly industrialised and which are facing significant industrial waste disposal problems.

6.2 Cleaner Production Centres[7]

During the World Summit on Sustainable Development held in Johannesburg in September 2002, the Council for Scientific and Industrial Research (CSIR), the Department of Trade and Industry (**the dti**), the United Nations Industrial Development Organisation (UNIDO), the Austrian and the Swiss governments agreed to establish the South African *National Cleaner Production Centre (NCPC)*. NCPC programme was initiated in 2003 at the CSIR in Pretoria. The CSIR has a long record of providing solutions and assistance to processing and production industries for efficiency and environmental impact improvement projects, and provides an organizational structure and an information system on industry. The NCPC is well placed to develop and assist with the implementation of appropriate technologies for industrial waste exchange.

In addition to the NCPC, there are a number of other institutions throughout South Africa which are also active in the cleaner production field which could also provide technical assistance with industrial waste exchange, e.g. Water Research Commission, the Institute of Waste Management of Southern Africa, the University of Natal (Pollution Research Group) and the University of Cape Town (Environmental & Process Systems Engineering Research Group in the Department of Chemical

[7] National Cleaner Production Centre, www.ncpcsa.co.za

Engineering). An example of an international cleaner production centre providing this sort of technical support is set out below.

The *Burnside Cleaner Production Centre* was established in the Burnside Industrial Park in Nova Scotia, Canada, in 1995. The primary role of the Cleaner Production Centre is to promote and facilitate the 'greening' of the over 1,200 businesses located in Burnside. The services the Centre provides include: promoting materials and energy conservation through audits; searching for technologies to improve resource use efficiency for business clients; facilitating packaging waste reduction through waste audits; and identifying and facilitating waste and energy linkages between firms. The Centre promotes industrial ecology relationships, in part, by the creation of a waste exchange. The Burnside Cleaner Production Centre is an example of a very practical, 'on the ground' approach to promoting industrial ecology at an existing industrial park. Examples of actual and potential 'symbiotic' relationships in the park include:

- Recycling of corrugated cardboard which is collected by a company located in the park and sent outside for reprocessing into linerboard.
- The reuse of a computer company's excess polystyrene by a packaging firm.
- A variety of recycling and reuse firms dealing with toner cartridges, ribbon re-inking, tire re-treading and furniture refurbishing.
- Potential for a silver recovery program for the printing industry (25 printing firms are located in the park) by combining resources to purchase a silver recovery system.
- Potential for a paint exchange among the 21 firms that either use paint in their processes or distribute paint to customers. Roughly 5038 litters of paint are currently wasted each year with a total value of $52,000. Establishing a "paint swap" program could reduce this waste.
- Potential for a chemical exchange among the 19 firms that either manufacture, distribute or retail chemicals (Industrial Park as Ecosystem Project,' March 1996. Burnished, NS: Cleaner Production Centre).

6.3 Trading Platforms

The Cape Metropolitan Council web-based IWEX trading platform has indicated the potential and limitation of this mechanism to enhance industrial waste exchange. Consideration could be given to providing waste exchange website services (such as the Cape Town IWEX) at the provincial level, and linked to a national platform. A possible institutional home for such a web-based trading platform could be the National Cleaner Production Centre at the CSIR in Pretoria. Short distance material exchanges will be favoured for economic reasons. For this purpose, the website service should provide a search engine which could automatically generating and a proposal list of potential exchange partnerships primarily in the appropriately close geographical surroundings.

6.4 Linking Waste Minimisation Clubs, Industrial Ecological Parks & IWEXs

In South Africa, waste minimisation clubs involve a small number of companies, generally within the same geographical area, working together to exchange ideas and information on waste minimisation, and in this way, encourage one another to improve process efficiency, save money and reduce their environmental impact. In the UK, waste minimisation clubs have been established to achieve the same objectives as the South African clubs, but in addition to reduce their discharges, particularly to landfill sites.

The Leicestershire Waste Minimisation Association, was the UK's longest running waste minimisation club, and was set up in 1998 as the second phase of the highly successful Leicestershire Waste Minimisation Initiative. This demonstrated the benefits companies can achieve through adopting a policy of waste minimisation. The Leicestershire Waste Minimisation Association continued the work started by the Leicestershire Waste Minimisation Initiative, by providing companies with a focused, tailor made approach to waste minimisation through the work of Waste Minimisation Facilitators. These were environmentally qualified graduates, who worked with member companies for one day a week for a year helping to research and implement waste minimisation projects.

6.5 Funding Mechanisms

Industrial waste exchange systems generally operate with relatively restricted budgets. To assist with the development and maintenance of industrial waste exchanges, funding mechanism need to be investigated and could include:

- Fees for waste disposal at landfill sites;
- Percentage contribution from savings as a result of waste exchanged;
- Government funding, for example through **the dti's** Sector Partnership Fund (which is currently funding some waste minimisation clubs); and/or a national levy on waste disposal (similar to the national levy on water sales for funding water research managed by the Water Research Commission); and
- Funding or co-funding by private companies who benefit from the industrial waste exchange system.

7 INPUT FROM NWMSI PROJECT WORKSHOPS

Concerns about and suggestion to address IWEX were obtained through consultation with stakeholders at the NWMSI Project Initiation Workshop and the Provincial Recycling Workshops. The input obtained through this means is briefly outlined below.

7.1 NWMSI Project Inception Workshop

The NWMSI Project was designed in 2001 but due to various circumstances implementation only commenced during 2004. During the intervening period there were various significant developments that had to be taken into account in the final design of the project. The need for an update of the 2001 Project Document, including project objectives, outputs and activities, was identified and Department of Environmental Affairs and Tourism (DEAT) decided to consult with the relevant key stakeholders from the public and private sectors through an Inception Workshop.

The following concerns about Industrial Waste Exchange and related topics were raised for consideration by the NWMSI Project:

- Consider both recycling and waste minimization;
- Consider extended producer responsibility (EPR) as a means to emphasize waste minimization;
- Explore opportunities for energy recovery;
- Ban some waste streams from landfill sites;
- Create incentives to facilitate waste reuse and recycling;
- Develop legislation that promotes reuse and recycling; and
- Consider health and environmental risks and legal implications; and
- Do not limit the waste exchange initiative to private sector only.
- Address potential confidentiality of information problems associated with IWEX.

7.2 NWMSI Project Provincial Recycling Workshops

A series of Provincial Recycling Workshops for the NWMSI Project were held during the period - October 2004 to January 2005. These workshops were held to discuss and consult with stakeholders on the NWMSI Project Recycling Component, with the following specific objectives in mind, i.e. to: Raise awareness at provincial and local level of the NWMSI project; Report on progress thus far; Consult with provinces and local authorities to establish their recycling needs, requirements and priorities; Identify existing provincial and local recycling initiatives; and Identify potential projects which may be considered for incorporation as part of the NWMSI Recycling pilot projects, including a possible pilot project on Industrial Waste Exchange.

The workshops were aimed at the key role-players and stakeholders in the provinces and local authorities who are involved with waste recycling or who are affected or impacted by recycling. This included representatives from the following institutions: Provincial waste and pollution management departments; Local authority waste and pollution management departments; Commercial concerns and businesses dealing with waste management and recycling; Community-based Organisations (CBOs) and Non-Governmental Organisations (NGOs) involved with recycling initiatives; and Recycling companies (e.g. paper, cans, plastics, glass and tyres). The following suggestions were made and concerns were raised:

- The workshop participants identified IWEX as a means of addressing the lack of (or rapidly diminishing) airspace at landfill sites, and public-private-partnerships

were seen as a viable means to promote and implement the concept. There is a higher potential for applying IWEX within industrial districts because of close proximity of a variety of industries to one another.

- The workshop participants felt that IWEX should be encouraged and that it could assist local authorities and provide opportunities for waste management service entrepreneurial companies.
- Based on the Cape Metropolitan Council's (CMC) extensive experience with IWEX, the following was proposed, that:

  - Implementation of IWEX be needs driven.
  - IWEX should be implemented in commercial industrial districts (CID), since these lend themselves to the IWEX approach. Key success factors could include: short transportation distance between 'waste' generator and 'resource' user, CID managers that could champion the use of IWEX, and the integration of this function with other CID activities.
  - Problems associated with current CMC initiative include a lack of marketing and limited follow through. It was suggested that the approach could be further encouraged through regular e-mails/newsletter which are regularly updated.
  - Sappi has an initiative using paper pulp in brick making, however strict quality control is necessary.
  - It was proposed that the potential for re-use of general waste from industry by community groups be investigated.
  - The University of Cape Town is promoting IWEX, e.g. in Khayelitsha by the use of insulated materials for the construction of domestic dwellings using from materials from the Parow East IWEX; and assists CID manager working on IWEX.
  - Agricultural waste currently landfilled but could possibly be used in industry; the possibility of composting should also be investigated.
  - The system would require champions to drive the process – possibly an institute with good credentials.
  - Potential pitfalls included the fact that industrialists would not want to post inventories of hazardous waste on public web sites, due to the potential danger of bad publicity.
  - An intra-industry approach may be more successful, but care has to be taken not to fall foul of Competitions Act.

8 CONCLUSIONS

A review of the status quo of industrial waste exchange internationally and locally was undertaken and is documented in this report. Three approaches were used for the collection of information for this review, i.e. a literature review was undertaken of industrial waste exchange internationally and in South Africa; stakeholders currently involved in industrial waste exchange in South Africa were interviewed; and, additional input was obtained through consultation with stakeholders at a range of Provincial Recycling Workshops held during October 2004 to January 2005.

The report briefly reviews the history of industrial waste exchange, also known as 'resource exchange', 'by-product exchange', waste interchange' and 'waste trading'.

It gives an overview formal waste exchanges worldwide, e.g. in the United Kingdom, Europe, the United States of America, Canada, South America, Australia and New Zeeland, Africa and South Africa. It list the materials exchanged, e.g. alkalis, construction and demolition waste, electronics and equipment, food and vegetation, glass, machinery, metals and metal sludges, oils and waxes, wood products, paints and coatings, pallets and containers, paper and cardboard, plastics, rubber, solvents, textiles and leather and timber.

South Africa's first formal Integrated Waste Exchange was launched in 2000 as a pilot project by the Cape Metropolitan Council, using an internet based exchange platform. The CMC's experience over the last four years is reviewed, and indicated that this approach has only had limited success. This waste exchange's market potential has not yet been fully realised and since its implementation still in an initial phase, it will require further pioneering strategies to increase its success.

The study has identified and explored five approaches which could be utilised to promote and enhance industrial waste exchange in South Africa, i.e.:

- Working through public-private-partnerships, e.g. local authorities who operate landfill sites, industries who discharge problematic waste to these sites and waste companies who specialise in waste re-use and recycling.
- Using the South African Cleaner Production centres to develop and assist with the implementation of appropriate technologies for industrial waste exchange;
- Use of trading platforms, such Cape Metropolitan Council platform, to link waste generators and waste re-users and recyclers;
- Linking waste minimisation clubs, industrial ecological parks and waste exchanges;
- Introducing funding mechanisms, particularly for the exchange of low value commodities.

A separate proposal[8] has been developed for a pilot project / investigation to address industrial waste exchange.

[8] *Criteria for the selection of the Recycling Pilot Projects*, National Waste Management Strategy Implementation Project, Department of Environmental Affairs and Tourism, March 2005