

Green Industry

for a Low-Carbon Future



A greener footprint for industry

Opportunities and challenges
of sustainable industrial
development



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

A greener footprint for industry

Opportunities and challenges of sustainable industrial development



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna, 2009

This publication has not been formally edited.

CONTENTS

1. Introduction	1
2. The Context	3
<i>A. Climate Change and other Global Environmental Threats</i>	3
<i>B. Trade and Environment</i>	5
<i>C. The Environmental Services Industry</i>	7
<i>D. The Current Financial and Economic Crises</i>	10
3. The Response: Greening Industry in Developing Countries	12
<i>A. Decoupling resource consumption from production</i>	12
<i>B. Reducing industry's impacts on the local environment</i>	15
<i>C. Confronting and profiting from environmentally-related standards in the global market</i>	16
4. The Role of the Development Aid Community	18
5. Conclusions	22

1. Introduction

These are challenging times for enterprises the world over. Not so long ago, enterprises were finding themselves faced with rapidly escalating prices for many of their major raw materials. The soaring prices of oil was the most prominent example of this phenomenon, but the same upward price pressures was seen for a number of raw materials fundamental to industry: coal and natural gas, iron ore, copper, aluminium, to name a few. Then as the financial and economic crisis hit, prices tumbled, but only because banks stopped lending, consumers stopped buying, and world trade dried up. As a result, enterprises went bankrupt or closed, and job losses mounted. The bad news will continue to come in for some time to come. If enterprises are to survive such troubled times, they will need to strengthen their capacity to compete, to increase productivity, to reduce production costs, and to take advantage of new opportunities.

But underlying this economic turbulence are far more troubling trends for the long-term health of our economies. At the global level, we have adopted patterns of material and energy consumption that are simply unsustainable. The amount of materials and energy we are consuming are such that we are rapidly outstripping the world's available resources. At the same time, this consumption is leading to increasing amounts of waste and pollution, which in its quantity as well as toxicity is overwhelming the assimilative capacity of the world's ecosystems. At the country level, the situation is more nuanced. Material and energy consumption patterns are highly unequal across countries. The least developed countries are still not consuming enough to satisfy their basic needs, while the most developed countries are consuming far beyond these needs. What is urgently required is that the more developed countries change their patterns of consumption; they must decouple their material and energy consumption from their economic growth, so that they can continue to create wealth but not at the price of increasing consumption. At the same time, it is imperative that the less developed countries do not emulate these unsustainable growth pathways, but choose instead paths of economic growth that are fundamentally less material and energy consuming.

In all of this, as the prime manufacturer of the goods and services societies consume, industry has a critical role to play. And one can only conclude that industry's production systems are fundamentally unsustainable: they do not allow the needs of present generations to be met without jeopardizing the ability of future generations to meet theirs. Only if production systems can decouple their consumption of materials and energy from their production ("produce more with less") will they become sustainable. They are that much more unsustainable because many enterprises use more materials and

energy than their production processes require, because they continue to use obsolete and inefficient technologies and fail to adopt proper management systems. This is particularly true of industry in the developing countries.

While these unsustainable patterns of industrial development may not have been appreciated until quite recently, it has been recognized since the start of the industrial revolution that enterprises can have obvious, visible, and sometimes highly noxious impacts on their local communities and environments. As a response to these manifest health and environmental impacts, the last forty years have seen an unparalleled growth in environmental legislation aimed at getting industry to “clean up its act”. This legislation has created many new opportunities for entrepreneurs, as it has created a demand for environmental goods and services that will allow enterprises to bring their environmental impacts under control. As a result, a new industrial sector, the environmental services sector, has come into being in the developed countries, growing rapidly and creating many new jobs. Because enforcement of environmental legislation has been more modest in the developing countries, the same sector is only slowly forming there.

In parallel, there has been a growing determination by different stakeholders in the developed countries to use the environmental and social performance of enterprises as a factor in deciding to do business with them. Individual consumers through their purchasing decisions, major lending institutions and investors through their lending and investment decisions, Government agencies through their procurement decisions, are all making environmental demands on enterprises. The first to feel this pressure have often been the transnational corporations and other large companies, but they in turn are now exerting similar pressure on their suppliers. With globalization of trade, many of these are now located in the developing countries.

This paper explores in more detail these challenges and opportunities. In keeping with UNIDO’s mandate, the focus is on industry in the developing countries. How can enterprises in these countries become greener and lessen their environmental footprint while at the same time continuing to grow and deliver goods, services and jobs to their populations? What role should the Governments of developing countries play in this process? Answers to these questions must take into account one overriding imperative: that industry in developing countries needs to grow. Industrial development is the only mechanism that will enable developing countries to reduce the level of poverty and hardship they face. The conclusion offers a strategy for the development aid community, designed to help developing countries bridge the gap between the present and the future.

2. The Context

A. Climate Change and other Global Environmental Threats

Ever since the beginning of the industrial revolution, it has been recognized that enterprises have impacts – sometimes severe impacts – on their local environments: local rivers and groundwater, local air quality, and local land use¹. Broadly speaking, it can be argued that with the start of the modern environmental movement in the 1960's, the developed countries have brought this class of industry-related environmental impacts under control². The picture is less rosy in the developing countries, where enforcement of legislation is lagging behind industrial growth and is resulting in pockets of severe local pollution caused by industry. Nevertheless, the example of the developed countries shows that this is a solvable problem, and solving it could be a source of major business opportunities for enterprising companies. This issue is taken up again below.

Of much greater long-term impact are global environmental threats, which reflect the natural environment's growing inability to absorb the wastes that are the side-product of world economic growth. By their nature, these are much more difficult threats to tackle, being multi-country and multi-stakeholder, and they are of much great concern since failure to tackle them can result in broad eco-system, and consequent economic, collapse.

Climate change is the most prominent example of such threats. It is so dramatic because it has truly worldwide impacts and because it will require us to make fundamental changes to our economies, turning them from the high-carbon economies they have been for the last two hundred years – completely dependent on fossil fuels – into low-carbon economies. But there are other signs that the world's absorption capacity is being stretched to breaking point and requires changes in our production and consumption patterns. Depletion of the ozone layer is one such example, and recognition of the problem more than 20 years ago finally brought the international community, through the Vienna Convention to Protect the Ozone Layer and its Montreal Protocol, to adopt mechanisms to phase out chlorofluorocarbons and other ozone depleting substances.

¹ The impacts of industrial operations on workers were also recognized early on, and the growth of controls on these impacts has mirrored those on industry's environmental impacts.

² However, while a good part of this success can be attributed to the implementation of cleaner production, recycling/reuse, and end-of-pipe treatment, and environmentally sound disposal practices, it should be recognized that some part of it is also due to the environmentally-worst industries shutting down – but only to lead to increased production in the developing countries.

Other families of chemicals have been recognized as posing global, and not just local, threats. The recent Stockholm Convention was set up to tackle the growing problem of persistent organic pollutants, chemicals that are so foreign to eco-systems that these cannot break them down, thus allowing them to spread worldwide. There are growing concerns about the continuing disposal into the environment of heavy metals, such as mercury, cadmium, chromium and lead, which by their very nature are indestructible and can be very toxic to eco-systems. In general, the last 40 years have seen a growing concern about the vast number of synthetic chemical substances that are being brought onto the market, that are internationally traded, and whose potential effects on eco-systems are in many cases little known. Far-reaching national and regional legislations have been put into place to control chemicals, and through the Strategic Approach to International Chemicals Management (SAICM), adopted in 2006, there is the start of an international process to control them. Even plastics, that great symbol of prosperity, are being viewed with increasing alarm; their virtual indestructibility, their ubiquity, and their ability to interfere with environmental mechanisms, are seen as posing an increasingly important threat to the global commons.

Recently overshadowed by climate change but nevertheless of growing concern is the coming global crisis in water. Population growth, economic development, and urbanization are each leading to increased water consumption. When all three occur simultaneously, as is currently the case, the result is very rapid increases in water consumption: while the world's population tripled in the 20th century, the use of renewable water resources grew six-fold. The World Water Council estimates that on average the world has a level of water stress of 40%³, with a highly variable distribution – the arid parts and most heavily populated parts of the world have water stress levels above 80%. Adding to current water stress is the fact that one of the more significant impacts of climate change is that regions that already receive little water will receive even less.

Industry is related to a greater or lesser degree to all these environmental impacts. Global ecosystems are intimately intertwined with our economies; through the feedback loops so established, the degradations of the ecosystems will also have growing impacts on industry. Already, the efforts by the international community to reverse ozone depletion intimately involved industry, since it was both the producer of ozone depleting substances and the prime consumer of them. For the same reasons, any attempts to control the manufacture and commercialisation of chemicals will impact industry strongly. As for efforts by the international community to

³ A measure of the proportion of water withdrawals with respect to total renewable resources of water available

minimize climate change, these can be expected to have a very large impact on industry. Enterprises will almost certainly be required to find ways of drastically reducing their use of fossil fuels, or drastically reducing their use of electricity generated from fossil fuels. But climate change's impact on industry will not stop there. Like all other components of society, it will be impacted by the changes in climate that will inevitably occur – indeed, are already occurring – and will need to adapt to these changes, by relocating out of newly flood-prone zones, making do with less water (see below), adapting to higher temperatures, and so on. And it can be expected that industry will get involved in making available the technologies and other goods and services that society will require to adapt to climate change. As for water, globally it is estimated that already 15% of worldwide water use is industrial, and that is set to grow with industrial development. It can be expected that industry will have to “run drier” than it has historically, especially since in many areas of the world climate change will impact water availability.

Of less direct and obvious concern to industry are the international community's continuing efforts to slow down the world's increasingly rapid loss of biodiversity, the increasing pace of land degradation and desertification, the growing “desertification” of continental shelves as fish stocks collapse, the accelerating disappearance of wetlands, and so on. Yet industry is actually being impacted by these changes. Like the rest of our economies, it needs the eco-system services the natural environment offers us – clean water, clean air, the mineralization of wastes – if it is to continue functioning, and the ability of nature to go on offering us these services depends on the existence of a healthy, stable, biodiverse environment. To the extent that containing these risks will require changes in production and consumption patterns, industry will find itself involved.

B. Trade and Environment

Already since the early 1990's multilateral environmental agreements (MEAs) have been established to control some element of international trade for environmental reasons. The Basel Convention, ratified in 1992, controls the international trade of hazardous wastes, the Cartagena Protocol of the Convention on Biological Diversity, ratified in 2003, controls the international trade in living modified organisms, the Rotterdam Convention, ratified in 2004, controls the international trade in certain chemicals that nationally have been banned or severely restricted for health or environmental reasons.

In many ways, these MEAs were put in place to protect the developing countries from inappropriate trading practices by the developed countries.

However, recent trends suggest that in the future it is the trade from the developing to the developed countries that will increasingly be subject to hurdles of an environmental nature. The earliest such hurdles flowed from the movement in the developed countries in the 1990s to adopt environmental management systems. This was undeniably a good move, since it recognizes that enterprises cannot properly control their environmental impacts unless they have in place formalized management systems for doing so. However, following in the path of the very successful ISO 9000 series of standards, it was further decided to establish various certifiable environmental management standards, ISO 14000 being the best known of these. During the same period, other certifiable management standards were created in the related field of worker health and safety. This work continues: ISO has just started the development of a new standard – ISO 50000 – in the field of energy management. All this has quickly got caught up in a generalized demand by civil society organizations that industry, especially multinational companies, become more socially and environmentally responsible, culminating in the growth of the Corporate Social Responsibility (CSR) movement, which covers all of industry's potential environmental impacts. In turn, this is now spinning off an international management standard on social responsibility, ISO 26000.

This growth in management standards in the environmental and related fields has been paralleled by a similar growth in environmentally-driven product manufacturing standards – energy efficiency standards, for instance, or standards banning the use in products of certain environmentally hazardous substances – as well as product standards in related fields such as consumer protection and food safety. Environmentally-related product labelling requirements are also becoming popular, the latest move being to start requiring carbon footprint data (“embedded carbon”) on products (a measure of how much energy went into the manufacture and transport of a product). Rather special forms of such product standards are those connected to fair trade, organic food, and the like.

The popularity of environmental and related standards can clearly be ascribed to a desire on the part of enterprises to publicize more believably their “environmental credentials” through their certification against such standards. However, as in the case of ISO 9000, they also have become a means for companies, especially multinational companies, to control their suppliers and lessen the risks to them from actions taken by these suppliers (this concern became especially acute after Nike's public-relations disaster deriving from questionable labour practices by some of its suppliers). The net result is that enterprises in the developing countries wishing to enter international trade through global value chains find themselves being required to conform to a thicker and thicker web of management and product

standards, a growing number of which are of an environmental or related nature.

It should be stressed that although these standards, especially the management standards, have a strong appeal – particularly in the developed countries where consumers tend to be more environmentally conscious – their application can undoubtedly bring great benefits to enterprises in developing countries, since the management discipline they impose can assist enterprises in running themselves more efficiently and therefore more profitably and competitively.

Much of what has been discussed in the last few paragraphs can be considered to be “private standards”, i.e. standards that are not required by law but required by enterprises if suppliers want their business. However, there is a growing body of “public standards”, i.e. national or regional laws and regulations, of an environmental nature that are impacting international trade. Because of concerns about public safety, many of the consumer and food safety product standards mentioned above take the form of public standards, but more and more of the environmentally-related product standards are also public standards. A number of countries have had energy efficiency requirements for products for at least a decade. A newer trend, especially in the EU, is to place a legal responsibility on manufacturers to ensure that their products, once they become waste, are recycled and reused: packaging was the first such product type to be targeted, although there are now similar requirements for waste electrical and electronic equipment and automobiles at the end of their lives. The commercialisation of chemicals has also been the subject of some far-reaching legislation in the EU. In today’s global economy, where thousands of kilometres separate the point of a product’s consumption from the points – often in the developing countries – of its production, such legislation can have very large ripple effects beyond national or regional boundaries.

C. The Environmental Services Industry

In the developed countries, the elaboration of environmental legislation and its implementation over the last forty years have led to the creation of a new industrial sector, the environmental services sector, which assists enterprises to assess, measure and manage their environmental impacts as well as to manage and dispose of in an environmentally sound way the pollution and waste they generate. Specialized engineering companies have come into existence to design, install and operate environmentally sound technologies – from windmills to wastewater treatment plants, from biodigesters to incinerators – as have a host of environmental consulting firms specializing in an array of management or technical skills. Recent

statistics suggest that the industry is worth around 300 billion US\$/year in the developed countries alone⁴. The size of the sector in the developing countries is unknown but is definitely much less.

The key behind the phenomenal growth of the environmental services sector in the developed countries has been the rapid and continuing increase in the body of environmental legislation in these countries, but even more important is the consistent enforcement of this legislation. This legislation is driven by the Polluter Pays Principle, that is, it internalizes into enterprises the environmental costs that previously they were externalizing onto local communities and the environment. By definition, internalization increases costs for the enterprises and therefore there is a continuing incentive for companies to avoid or attenuate implementation of environmental legislation. Only proper enforcement of legislation, or on a more positive note the creation of adequate incentives, can keep implementation on track and therefore maintain an economically viable environmental services sector. Precisely because both enforcement and the incentives package are generally weak in the developing countries (it is normally not laws and regulations that are lacking), the level of implementation of environmental laws is low. Therefore, an environmental services sector has not been able to develop there to the extent that it has in the developed countries.

This being said, there are certain environmental services which can thrive even in the absence of proper enforcement or incentives packages because they actually create value for companies rather than just force them to bear a cost, even under current economic conditions. An obvious example is cleaner production services, an area where UNIDO has been offering countries technical assistance for nearly 15 years. By definition, cleaner production creates value for a company by reducing its operational costs through the elimination of inefficiencies in material and energy use, which in turn happens to have environmental benefits. As UNIDO's experience has shown, it is possible for an environmental service provider (in this case National Cleaner Production Centres) to make a business of offering cleaner production services to enterprises. Another example is in the area of environmentally-related barriers to global trade. More and more, enterprises in the developing countries wishing to enter into global value chains, or to retain their position in them, are recognizing that they must adapt to the environmental demands made of their products or of their manufacturing procedures, and to do this they need companies in their country that can offer specialized services relating to the development and certification of various management systems (environment, energy, health and safety,

⁴ "The Global Environmental Goods and Services Industry", OECD. Data refers to 2000.

labour, food safety, ...), as well as to the development and certification of products.

Another example of environmental services with an intrinsic value is waste recycling. Often, a waste without value to its generator can have value to a third party, which can use it as a raw material or can recondition it for reuse. The use of waste oil as a fuel is an example of the former, Waste solvent recycling is a good example of the latter. There are many opportunities here for companies to offer recycling-related services to enterprises, whether it be simply as a “match maker” (in the form of a waste exchange, for instance), or as a recycler proper (which includes sophisticated business models like chemical leasing), or as a manufacturer of recycling equipment, or simply as a transporter of recyclable wastes.

It is also the case that the rising costs of primary inputs can create new business opportunities, for the developing countries as much as for the developed countries. Energy is a case in point, with renewable energy being a good example; market demand for affordable renewable energy is growing very rapidly, under the twin pressures of increasing energy prices and increasingly pressing concerns about climate change. An oft-quoted example is that of Suzlon Energy, an Indian company founded in 1995, which is now the world’s fifth-largest wind turbine manufacturer. China also has plans to enter this market. Biofuels is also an area where the developing countries see themselves as having a global comparative advantage. Brazil in particular, which has been developing its bioethanol industry for the last 30 years, is pursuing a strategy to promote this industry worldwide. For its part, Malaysia, which has invested heavily in palm oil over the last decades, sees biodiesel as a new market for its palm oil. Biofuel from algae is also being heavily researched, with some plants already coming on line. Developing countries as well as developed countries are involved in this race. It is clear that many developing countries see themselves having global comparative advantage over the higher latitude developed countries in biomass production and therefore potential for biofuels and bioenergy in general.

A host of opportunities exist for the alert entrepreneur with respect to many other types of products with an environmental “brand”. Staying with renewable energy, there are potential markets for solar water heaters, for instance, for commercial or residential use, or for solar cookers for use in rural areas. Many products are already available for water purification in the home. Small-scale digesters for producing biogas are available for commercialisation. Opportunities also exist for providing products already on the market but redesigned to be more efficient in their use of material and energy: compact fluorescent bulbs, more energy-efficient cars and

appliances, more efficient water-using devices, and so on. Products catering to new needs generated by adaptation to climate change and other environmental change is yet another.

Even when products become waste, they can generate business opportunities. For instance, the high costs of waste management in the developed countries are producing business opportunities for enterprises in the developing countries. In many cases, it is more economic for waste collectors in developed countries to ship their waste to developing countries for reuse there rather than to manage the waste at home. For instance, there is already a very large trade from the developed countries to the emerging economies in scrap metals, which the latter use to manufacture the goods they then export back to the developed countries.⁵ Even more humble waste products are the subject of global trade. For instance, one of the largest export products from the port of New York is waste paper, much of it going to China. There is also a growing trade in used computers and other waste electrical and electronic goods from the developed to the developing countries. There is a positive aspect to these developments: developing countries obtain raw materials at cheaper prices than might otherwise be the case, developed countries keep their waste management costs in check, the environment is not loaded with as much waste as it might otherwise, and ecologically disruptive extraction of raw materials is minimized. However, it is important to note that there is also a darker side: the dumping of what is essentially waste by the developed countries in the developing countries under the pretence that it is recyclable. Stories abound, for instance, of containers full of used computers being unloaded in developing countries with the claim that they can be refurbished and reused when in actual fact very few of them can. A more subtle problem is the fact that the recycling of these wastes generates side-streams of toxic waste, which the recipient countries are not in a position to manage properly: certain components in computers, for instance, are not recyclable and contain toxic materials; the inks removed from waste paper create a toxic waste stream. It was to control this kind of pernicious behaviour that the international community adopted the Basel Convention, alluded to earlier.

D. The Current Financial and Economic Crises

The current financial and economic crises that have swept through the global economy have come to overlay the deeper malaise in the economy-environment relationship and the subsidiary industry-environment relationship that have been described above. There has been some discussion about whether or not the sudden and dramatic financial-economic

⁵ This is an interesting development, since in effect it “closes the loops” on global manufacturing.

crisis is in some way actually linked to the longer-term malaise, specifically whether the sharp increase in financial instruments being wielded in the markets prior to the collapse were actually also fuelling a dramatic increase in the unsustainability of our patterns of consumption.

Be that as it may, it has been suggested by many that the large public spending programmes being touted as a means to revive our economies are also a golden opportunity to place our economies on more sustainable pathways of growth. It is true to say that many of the global and local environmental impacts described earlier are a reflection of incorrect or improper investment decisions by the private sector, but these may be themselves simply a reflection of poor or inappropriate public policies or investment strategies. It follows that undertaken now – as part of broader stimulus packages – needed green public investments, as well as implementing necessary changes in policy that will encourage green private investments, could well “jump-start” our economies onto more sustainable paths of economic growth.

3. The Response: Greening Industry in Developing Countries

In the face of all these environmental challenges, but also keeping in mind the more immediate global economic crisis that industry is having to cope with, how are the enterprises in the developing countries to respond? How can they become greener and lessen their environmental footprint while at the same time continuing to grow and deliver goods and services, as well as jobs, to their societies? And how then should the Governments of developing countries be responding?

The response must be two-pronged. On the one hand, recognizing the fundamental unsustainability of today's consumption patterns, industry in the developing countries must decouple its material and energy consumption from its production, to allow its output to continue to grow while minimizing growth in its material and energy inputs. On the other hand, recognizing that even the best run enterprise will still generate wastes and pollution, enterprises in the developing countries need to reduce their environmental impacts on the local environments in which they are located.

A. Decoupling resource consumption from production

Considering first the **production systems**, enterprises should adopt business strategies where they look to maximize resource efficiency and cleaner production. More simply, they should adopt "3 R's" strategies – Reduce, Recycle, Reuse. This requires them to first maximize the efficiency with which they use their energy and raw materials, using cleaner production, pollution prevention, green productivity or similar approaches. Experience gained through UNIDO's National Cleaner Production Centres (NCPCs) as well as the broader literature suggests that enterprises in the developing countries are often using three or more times more materials and energy than their equivalents in the developed countries. Therefore, not only is this a necessary strategy to adopt from an environmental point of view, there is also a pressing economic case for enterprises to do so, especially in the current economic downturn, since greater material and energy efficiency will reduce their operating costs. Material and energy costs account for 40-60% of the operating costs of enterprises in the developing countries⁶.

Governments can assist enterprises by supporting awareness-raising, capacity-building, the development and transfer of more efficient production technologies, and the creation of specialized industry support institutions such as the NCPCs. It can also reduce if not eliminate subsidies that might

⁶ Herrndorf, "Greening SMEs in Developing Countries", 2006

exist on energy, water and other raw materials; the existence of these subsidies artificially reduces industry's input costs, making it more difficult for enterprises to make the economic case for efficiency.

Enterprises can also promote decoupling by switching from non-renewable to renewable sources of energy and materials. In the case of renewable energy, decoupling will come about when the electricity production sector shifts to renewable sources of energy and offers the rest of industry green electricity. It will also come about when enterprises directly increase their use of renewable energy, for instance by substituting biomass for fossil fuels in boilers, using solar energy for certain forms of drying, and so on.

Governments have a very important role to play in creating the market conditions to allow the renewable energy industry to grow. It also has an important role to ensure that renewable materials – primarily biomass – are produced sustainably.

Enterprises must also maximize the recycling and reuse of any remaining wastes they generate; increased efficiency will not eliminate all wastage. In some cases, enterprises can recycle and reuse their wastes themselves, but often it will be others who recycle and/or reuse them.

Here, Governments have an important role to play, to create a vibrant market in recycled materials. Support for awareness-raising, capacity building, the development and transfer of recycling technology, as well as entrepreneurship development, will all be important Government activities, as will the creation of a proper regulatory structure regulating the storage, transport, and processing of recyclable wastes. The removal of subsidies mentioned above will also help recycling markets, removing unfair competition from virgin raw materials. Note that in recycling there will often be “crossover” between the industrial sector and other sectors of society, in the sense that waste paper collected from municipal waste, for example, can be used as raw material in paper manufacturing enterprises, while that certain types of industrial waste can be used in the agricultural sector as fertilizer.

Through environmentally sound **product design**, enterprises can assist in bringing about broader decoupling throughout societies. At one level, enterprises can redesign their products so that they contain fewer materials (dematerialization). At another level, they can redesign them so that they consume less energy, less water, less detergents, and so on, during their use. How important this is can be judged from the life cycles of certain classes of common products – automobiles, for instance, or many white goods – which consume far more materials and energy during their use than

was consumed during their production. In these cases, it is more important that enterprises design an energy efficient product than use an energy efficient production process. This being said, with regard specifically to enterprises in the developing countries, it is far from clear how much product design they actually carry out. In many instances they either have designs forced on them (if they are part of global value chains, for instance) or they simply adopt pre-existing product designs. There is very little capacity in many developing countries in product design, let alone environmentally responsible product design.

Governments have a very important role to play here to raise awareness within industry about the importance of product design and to create the necessary capacities and support institutions (in academia or elsewhere) to assist industry. As a major purchaser of goods and services, Governments can also play an important role through its procurement policies, favouring goods manufactured with the smallest environmental footprint.

Enterprises can bring about an even more fundamental form of decoupling by getting away from the idea of their being sellers of products and instead think of themselves as sellers of services. A moment's thought will show that in most cases we are not interested in the product we purchase per se, but in the service that the product renders for us. For instance, most of us are not interested in a washing machine per se but in the fact that it washes our clothes. An enterprise that purchases a solvent is not interested in the solvent per se but in its ability to clean metal surfaces. And so on. There are numerous cases where enterprises can build a solid business case for selling the services of their products rather than the products themselves. The environmental advantages of this approach is that it can diminish the number of products manufactured and the resource consumption during their use, and it can increase the amounts of the products that are recycled at the end of their useful lives. There are already a number of cases where companies have adopted this approach. One where UNIDO has been active these last years is in the field of chemical leasing, which as the name suggests has the chemical manufacturer leasing his chemical products rather than selling them.

Here, Governments have a vital role in building awareness in industry about this approach and being a champion for it. It could also use its procurement power to source services rather than products.

The use of **management systems** is the most effective means for any enterprise to ensure that it efficiently and continuously implements 3R strategies. Certification of that system by third-parties increases its value to the enterprise. Which of the various possible standards an enterprise should

adopt will depend on its specific business model. However, given the current trends in management system standards, adoption of a CSR approach, which broadly includes all aspects of environmental (and social) impacts, might be the best.

Governments have an important role in supporting awareness-raising, capacity building, the creation of industry support institutions that can assist enterprises implement management systems, as well as the creation of the necessary accreditation and certification bodies.

B. Reducing industry's impacts on the local environment

As alluded to earlier, even enterprises with very low material and energy inputs will still generate wastes and pollution that can harm the local environment – and the enterprises' workers. Industry must therefore reduce to acceptable levels its environmental impacts on the local environments in which it is located (as well as its impacts on the health and safety of its workers). Broadly speaking, enterprises should first try to minimize their excessive waste and pollution or otherwise neutralize their environmental impacts. Where this is not possible, enterprises should dispose of the wastes or release the pollutants in an environmentally sound manner.

Governments have always had a key role to play here, both in enacting the necessary laws and regulations and in enforcing them. In the developing countries, it is often not the legislative framework that is weak, it is the enforcement capabilities. Their continuing weakness has meant that an environmental services industry sector like the one now existing in the developed countries has failed to develop properly, and the new jobs that could thus be created have substantially failed to materialize. Greater effort is required to substantially improve enforcement.

Governments can also invest directly in publicly owned waste management and pollution control infrastructure. The municipal wastewater treatment plants for cities and other urban centres is the most obvious example. Other examples are recycling centres, incinerators, or landfills for municipal wastes, which are often fully or partly owned by government entities. Such investments will often involve industry, either as the constructor of the infrastructure or as one user – municipal wastewater treatment plants will often treat industrial wastewaters along with those from households and commercial establishments; enterprises can use the infrastructure for municipal waste management for many of its non-hazardous waste streams. This infrastructure is often absent in the developing countries, with the lack of funds being a primary reason but lack of the necessary skilled personnel to run the infrastructure being another important reason.

Governments also have a role in creating the right market conditions to encourage entrepreneurs to create businesses in the environmental services sector. The need for Government to encourage business creation in the fields of renewable energy, recycling, construction, and consulting has already been alluded to, but there are a host of other business opportunities in the environmental services sector waiting to be created in the developing countries, with all the attendant employment opportunities this implies.

C. Confronting and profiting from environmentally-related standards in the global market

The basic steps laid out above for greening enterprises in the developing countries will stand them in good stead when faced with the immediate commercial challenge of attempting to enter – or remain in – world markets and having to meet an increasing number of environmentally-related standards to do so. These standards require enterprises to reconfigure their products and/or processes to meet the requirements of their international customers or the laws of the countries into which they wish to export, and to certify that they have done so. In other words, they must be able to:

- Redesign their products so that they meet any pertinent environment-related product standards;
- Reconfigure their processes so that they meet any pertinent environmentally-related process (technology and management) standards;
- Certify that their products and/or their manufacturing processes meet these standards.

In this case even more than the last, the introduction by enterprises of formal management systems, certified by external parties, will greatly aid them, first to meet requisite standards on a continuing basis, and second to produce the evidence – through the certification process – that this is indeed the case. This is particularly so for cases where enterprises are meeting process-related standards; indeed, meeting a general management system standard like ISO 14000 or (in the future) ISO 26000 may actually be what is required by buyers. However, management systems can also be extremely useful to meet product-related standards (as is primarily the case, for instance, with ISO 9000).

Those enterprises that manage to do this successfully will find it that much easier to break into, or maintain their position in, global markets. In so doing, they will tap into new sources of growth.

As alluded to earlier, Governments have an important role to play in supporting the establishment of the necessary industry support institutions that can assist enterprises to meet the standards and certify that they do so. They also have an important role to play in monitoring the development of environmentally-related standards affecting trade, using the relevant international fora to ensure that the impacts of new standards on their industry is minimized, informing their industry of new standards that could impact them, and assisting them to meet them.

4. The Role of the Development Aid Community

What role can the development aid community play to assist enterprises in the developing countries in adopting the strategies outlined above? The answer to this depends on an understanding of the barriers that are impeding enterprises in these countries from taking up these strategies. There are three major such barriers:

- Lack of knowledge and skills: Numerous enterprises are either not aware of the challenges ahead, or they do not have the necessary skills to deal with them. They are also not aware of the business opportunities that environmental issues afford them.
- Lack of an adequate external support system: Even where enterprises are aware of the challenges ahead, or of the business opportunities this opens up for them, they do not have at hand the necessary specialized industry support institutions to assist them.
- Lack of an inconsistent policy framework: Governmental policies are not creating sufficient incentives to allow enterprises to take on and overcome the challenges ahead, or to take advantage of the business opportunities available.

Governments have the primary responsibility for removing these barriers. However, they too often lack the skills, as well as the funds, that would enable them to discharge this responsibility effectively. So it is here that the development aid community can play an important role, first and foremost by supporting Governments eliminate gaps in the normative framework. Many individual activities are being undertaken by enterprises and by Governments (often supported by the development aid community), but all too often these do not lead to the necessary upscaling because the incentive structure is not there to drive the process.

The importance of environmental legislation has already been mentioned, to internalize costs that enterprises are currently externalizing on the local communities and the environment. Therefore, Governments need support to establish new environmental laws and regulations where gaps are identified. However, as noted earlier, it is often not the laws and regulations that are lacking in the developing countries but their proper enforcement. Thus, Governments need support to strengthen their capacities to enforce existing environmental laws and regulations.

Also important is the need to support Governments to create the necessary normative framework to encourage the growth of a recycling industry. It is often said that wastes are simply misallocated resources, and developing countries can ill afford to bear the financial burden of misallocating its

resources. As experience in the developed countries has shown, however, it is important to create a normative framework that distinguishes clearly between recycling activities and other, non-productive, waste management activities.

One of the reasons why energy and material inefficiency exists is that their cost to enterprises is distorted by subsidies (electricity and water are especially frequently subsidized). Therefore, there is a need to support Governments in campaigns to remove as many as possible of these subsidies. Governments also need support to remove other financial disincentives to efficiency, in the form of tax or fiscal policies discouraging enterprises from adopting green investments or green patterns of operation.

It is easier for enterprises to green themselves if they are backed up by a science and technology framework that encourages green innovation as well as the transfer, development, adaptation of cleaner process technologies, recycling technologies, renewable energy technologies, and other environmentally sound technologies. Thus, there is a need to support Governments create this science and technology framework.

As has been noted already, the developing countries generally have poor product design capabilities. Yet it is critical for developing countries to be able to design green products that fit their needs. Thus, Governments need support to create the necessary normative framework that will encourage the growth of a product design community, with a focus on environmentally sound product design.

Enterprises can be encouraged to be greener in their operations if they are sited properly. Locating SMEs in industrial zones, for instance, means that there can be common wastewater treatment and waste management operations, which individual enterprises might not be able to afford. Proper siting can also allow groups of enterprises to undertake industrial ecology, where wastes from one enterprise are fed to another enterprise as raw materials. Governments can be supported to change zoning laws and other land management laws to encourage patterns of siting of enterprises that encourage green investments and green patterns of operation.

As has been noted, global trading will increasingly require enterprises in the developing countries to comply with environmental product or process standards and certify that they meet them. In this case, Governments need support to create the necessary normative framework to allow enterprises to locally obtain certifications against environmental standards. In addition, Governments need support to ensure national stakeholders can actively take

part in the development of these international standards so that the specific conditions of the developing countries are properly taken into account.

Getting the right normative framework in place will greatly help to create the incentives that will naturally drive enterprises to become greener. However, the elimination of other gaps can make the incentive structure work even better. These can be broadly classified as gaps in the support system enterprises need, gaps in the financial support structures and in public-sector investments, and gaps in the knowledge and skills sets industry needs. Here, too, the development aid community can support Governments.

With respect to gaps in the support system, the development aid community could support Governments in their efforts to make entrepreneurs aware of the opportunities that exist for new green businesses (responding to demands for technologies, infrastructure, or specialized consulting, laboratory, or other services). Depending on the specific issues, this could run from simple information campaigns to running demonstration or pilot projects. The next step would be for the development aid community to support Governments assist entrepreneurs to build up the technical and commercial skills they require to be able to take advantage of these opportunities. This could extend to assisting universities or other bodies of higher learning, or vocational training establishments, to establish new curricula. Where conditions require it, the need could be for the direct establishment of the necessary support institutions (e.g., accreditation bodies, or where markets are weak or small and a first-mover is required, or research facilities at universities to improve innovation and applied research).

As far as gaps in the financial support structure and public-sector investment are concerned, the development aid community could support Governments to put the banking sector in the position of being willing and able to support green investments by the private sector, or to invest itself directly in required infrastructure such as wastewater treatment plants and waste management plants (these can be the green investments in stimulus packages).

Finally there can be gaps in the industrial sector's knowledge and skills. Here, the development aid community can support Governments to build up the necessary technical, and just as importantly the necessary managerial, knowledge and skills in enterprises throughout the industrial sector.

Initially, the development aid community can focus on those areas where entrepreneurs can get an adequate financial return even when the normative framework is defective and is not giving the correct price signals. Cleaner

production is an obvious case, since implementing cleaner production reduces enterprises' operating costs. The ability to meet environmental standards in the global market is another since it opens (or keeps open) international markets. Recycling is a third, since entrepreneurs can make money recycling wastes. As the gaps in the normative framework are eliminated, it will make financial sense for enterprises to focus on the other aspects of greening themselves and the focus of development aid can correspondingly shift.

5. Conclusions

Enterprises in the developing countries find themselves at a critical juncture. The current financial and economic crisis is putting intense pressure on them to be more efficient and more responsive to market demands if they are to survive. At the same time, long-term environmental trends, particularly climate change but also other trends, will require some fundamental changes to the way enterprises do business. As one of the primary motors of development, it is critical that industry in the developing countries continues to grow, but at the same time Governments in the developing countries have to ensure (as do the developed countries, but in different ways) that this growth is sustainable.

The development aid community has an important role to play in supporting Governments to guide their industrial development into sustainable pathways. UNIDO itself, conscious of the growing importance of ensuring green industrial growth, has recently launched a Green Industries Initiative. The goal of this initiative is to work with Governments and industry support institutions so that they in turn can provide assistance to enterprises and entrepreneurs in all aspects relating to the greening of industry.

Printed in Austria
V.09-85821—August 2009



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org