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SUSTAINABLE CONSUMPTION AND PRODUCTION:

ENERGY AND INDUSTRY

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BACKGROUND PAPER NO. 3

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I. INTRODUCTION

1. The Johannesburg Summit noted that fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development. It agreed that all countries should promote sustainable consumption and production patterns, with the developed countries taking the lead and with all countries benefiting from the process. For this purpose, the Johannesburg Plan of Implementation (JPOI) called for the development of a 10-year framework of programmes in support of national and regional initiatives to accelerate the shift towards sustainable consumption and production to promote social and economic development.[1]

2. The CSD, in its post-Johannesburg programme of work, identified changing unsustainable patterns of consumption and production as a cross-cutting issue to be considered in the context of the themes for each of its sessions. The Commission also decided to include the 10-year framework of programmes on sustainable consumption and production in the thematic cluster for detailed consideration at CSD 18/19 (2010/2011).

3. As part of the implementation of the JPOI, two International Expert Meetings on the 10-Year Framework of Programmes for Sustainable Consumption and Production have been held, in Marrakech, Morocco, 16-19 June 2003, and in San José, Costa Rica, 5-8 September 2005.[2] A third meeting is planned in Sweden in 2007.

4. Background Papers were submitted to CSD-12 and 13 reviewing activities and policies in various countries for making consumption and production patterns more sustainable with respect to the 2004-2005 thematic cluster, in particular human settlements and water.

5. The present paper, building on initiatives at the national and local level, identifies a variety of programmes and policies for improving the sustainability of consumption and production patterns relating to industrial development, energy for sustainable development, air pollution/atmosphere and climate change.

6. The present paper is intended to complement the report of the Secretary-General on energy for sustainable development, industrial development, air pollution/ atmosphere and climate change,[3] as well as the publication on Trends in Sustainable Development.[4] This paper will therefore focus on aspects of the themes of energy for sustainable development and industrial development that relate specifically to consumption and production patterns and that are not addressed in detail in the other documents.

7. Issues relating to cleaner production in industry, which are an important element of programmes for sustainable consumption and production, are addressed in both the Secretary-General's report and in another CSD-14 Background Paper submitted by the United Nations Environmental Management Group, on "Review of Selected Industrial

Environmental Initiatives of the United Nations System, Regional Development Banks and Other International Organizations (Background Paper #4, DESA/DSD/2006/4).

8. The policies and actions considered here do not constitute a comprehensive survey of the field, but are intended to highlight some of the successful approaches and practices for changing unsustainable patterns of consumption and production. They are also selected taking into account their potential applicability to other countries or regions. The paper is intended to stimulate international cooperation and exchange of experience and information. The policies and actions considered are accompanied by references to sources of further information.

II. ENERGY CONSUMPTION

Trends and Patterns

9. Increases in energy and resource efficiency, together with cleaner technologies and improved products, have resulted in reduced energy and resource consumption and pollution per unit of production and consumption. However, the increased efficiency has generally been offset by even greater increases in overall production and consumption, resulting in continuing increases in the total consumption of energy and natural resources. The increase is largely due to economic growth and population growth, but also, in some part, to a "rebound effect" in which increased efficiency of resource use has reduced demand and prices of energy and raw materials – at least relative to what they otherwise would have been – encouraging increased consumption. Sustainable development therefore requires increased efforts, using a wide range of policies and programmes addressing all aspects of production and consumption, to improve energy and resource efficiency and conservation.

10. In considering energy, this paper will focus on energy consumption by households, commerce, public institutions and industry. It will not generally address energy production, transformation, distribution and access, which are addressed in detail in the Secretary-General's report and in a large and growing body of literature. The use of traditional biomass for household energy, particularly in Africa and Asia, is also addressed in the Secretary-General's report and will not be considered here.

11. Final energy consumption (excluding primary energy used to generate electricity) is commonly divided for analytical purposes into three major sectors: industry, transport, and other sectors, the last including residential, commercial, public services and agriculture. In the OECD countries and in Latin America, these three sectors each account for about one-third of final energy consumption. In other developing regions and in the countries with economies in transition, the residential sector is generally the largest energy consumer, followed by the industrial sector.[5]

12. In OECD countries, energy consumption per capita is 4 to 10 times the consumption in most developing countries and continues to grow, although at a lower rate than economic growth. The most rapid growth in energy consumption has been in the transport sector, with consumption almost doubling over the last 30 years, while energy consumption in the industrial, residential and other sectors has grown slowly. In Latin America, energy consumption has increased rapidly in both the industry and

transport sectors, while in developing Asia, energy consumption has grown most rapidly in the residential sector.

13. In all regions except for sub-Saharan Africa, most final energy is consumed in the form of petroleum products and natural gas for transportation and industrial heat. In rural areas of Sub-Saharan Africa and developing Asia, traditional biomass remains the predominant source of energy in the residential sector, used mostly for cooking but also for heating, often causing serious indoor air pollution. In sub-Saharan Africa, despite relatively rapid growth in modern energy consumption, traditional biomass consumption has been steadily growing along with population, with biomass consumption ranging from 55% to over 90% of total national energy consumption.[6].

14. Efficiency in energy consumption, particularly by individual consumers and households, depends to a large extent on the availability and affordability of energy-efficient products and services and existing transport systems and other infrastructure. Sustainable consumption thus requires action by industry and by governments as well as by consumers.

15. In order to promote sustainable development, the Johannesburg Plan of Implementation calls on countries to "establish domestic programmes for energy efficiency". The G8 meeting in 2005, at Gleneagles, reiterated that "Improvements to energy efficiency have benefits for economic growth and the environment, as well as co-benefits such as reducing greenhouse gas emissions, preventing pollution, alleviating poverty, improving security of energy supply, increasing competitiveness and improving health and employment".

16. Energy efficiency efforts have been more successful when there is a supportive policy framework and regulatory environment. This framework may include the following elements: overall energy policy; power sector reform; energy efficiency policies, laws and regulations; agencies charged with improving energy efficiency; utility demand-side management programmes; voluntary agreements with industry; promotion and support of energy audits; and energy efficiency standards, codes, testing, certification and labeling.

17. Market transformation policies and programmes for energy efficiency have been widely employed by industrialized countries and in recent years are being rapidly adopted by developing countries and economies in transition. Market transformation programmes for energy efficiency are intended to: (a) intervene strategically in the market; (b) create long-lasting changes in the structure or functioning of the market; and (c) lead to widespread adoption of energy efficient products, services and practices. Market transformation efforts that have been used to "push" technology innovation include a range of measures such as promoting technology transfer for domestic manufacturing, adopting minimum energy performance standards for energy consuming equipment, developing voluntary agreements with manufacturers, developing new lines of distribution of energy efficient products through electric utilities or retailers, and arranging soft financing terms for manufacturers. Other efforts have been designed to "pull" the market, including helping consumers to make informed purchasing decisions through media campaigns or point-of-purchase aids such as energy efficiency labeling,

reducing prices through subsidies or rebates, encouraging bulk purchase/procurement, establishing buy-back or recycling programmes, and providing financing of purchases through micro-credit, banks or utility bills. To date, a host of market transformation initiatives have been implemented by countries that have targeted residential appliances (e.g., lighting, refrigerators, and air conditioners), commercial buildings, industrial sectors, and government facilities.

18. Consumers often find it difficult to identify when a more energy efficient product or service is cost-effective. Life-cycle analysis is a tool which can help consumers compare the total costs associated with electrical appliances over their useful lives. A consumer information programme using life-cycle cost analysis will indicate when the purchase of energy-efficient products, such as lighting and appliances, will result in rapid payback through lower operating costs. Surveys have often found that purchasing decisions are based primarily on the initial cost and do not adequately take account of operating costs. Periods of rising energy costs provide an opportunity to raise consumer awareness of energy costs and savings and to improve energy efficiency standards. Such improvements are generally maintained even when energy prices decline.

19. It should be noted that some of the policy instruments for promoting energy efficiency, notably general energy taxes, provide incentives for increasing energy efficiency at all phases of production and consumption, with various degrees of effectiveness, depending on price sensitivity and the availability, convenience and price of alternative technologies for particular producers and consumers.[7]

20. The remainder of this section will consider four major areas relating to non-industrial energy consumption: the building sector, household and office appliances, sustainable transport, and renewable energy. The section on sustainable transport will consider air pollution as well as energy consumption. Industrial energy efficiency will be considered in the following section.

Energy efficiency: The Building Sector

21. Buildings, including residences and offices and the equipment and appliances used in them, consume about 35-40% of final energy consumption in most OECD countries, and the share has generally been increasing. Space heating is generally the largest component of this energy consumption, particularly in residential buildings, where it accounts for 66% of household energy consumption in the European Union and 51% in the United States. Energy is also consumed in buildings for air conditioning, hot water heating, lighting, appliances and equipment. Smaller amounts of energy are used in building construction.

22. Following the oil price shocks of the 1970s, most OECD countries introduced mandatory energy efficiency building codes to supplement older codes for structural strength and fire safety. In addition, countries have offered tax incentives, subsidies and low-interest loans for builders who go beyond the regulatory standards, as well as information and technical assistance to encourage builders and buyers to adopt more energy-efficient practices.

23. Studies of consumer choice indicate that buyers of buildings are mainly concerned with the purchase cost and are only prepared to pay extra for energy-efficient buildings if the investment is paid back very quickly. Builders therefore have little market incentive to invest in energy-saving features. Policies for increasing the energy efficiency of buildings have generally been regulations, such as construction codes, and to a lesser extent economic incentives. Another complication is the large numbers of small-scale builders and the diversity of buildings and their elements, where there is little standardization. In the European Union, 93% of enterprises in the construction sector have fewer than 10 employees and have little capacity for keeping up with new or specialized technical innovations.

24. OECD countries generally began by introducing energy-efficiency codes for each building element, including windows, walls, roofs, and systems for space heating, water heating, ventilation and air conditioning. Some countries have since introduced overall building performance standards, taking into account the components and other factors, such as passive solar heating from building orientation and design. Regular review and updating of building codes on the basis of current technologies and best practices can ensure a steady and cost-effective strengthening of regulations, as exemplified by California state regulations in the United States.

25. In the United Kingdom, electricity and gas suppliers are required to assist customers in improving energy efficiency through low-cost methods, with a particular focus on low-income households. In Denmark, the United States and other countries, building owners have been able to request free energy audits with recommendations for cost-effective energy efficiency measures. Surveys indicate that the majority of households participating in such programmes have undertaken at least some of the energy conservation measures recommended.

26. In the United States, some states and communities have passed Residential Energy Conservation Ordinances (RECOs) requiring existing buildings, when sold or renovated, to have some basic low-cost energy-efficiency measures such as insulation, weather stripping and caulking. Germany, in 2002, began to require energy efficiency measures in existing buildings, including replacement of old boilers, insulation of attics, and insulation of pipes in unheated rooms.

27. Some countries have introduced incentives for buildings that perform better than regulatory standards. In Canada, for example, the Commercial Buildings Incentive Program offers subsidies for investments in energy efficiency based on projected annual energy saving. In other countries, tax credits have been used for the same purpose. Analysis of such approaches suggests that subsidies at the design and construction stage have substantially greater impact on building performance than incentives based on operating costs, such as energy taxes. Some countries, such as the United Kingdom and Denmark, have introduced mandatory labelling of the energy efficiency of buildings.

Energy Efficiency: Appliances

28. For improving the efficiency of appliances, the most effective measures have generally been mandatory energy-efficiency standards applied to manufacturers. Many countries, notably Canada, China, Mexico, the United States, Republic of Korea, Australia, Viet Nam, Indonesia, Colombia and Thailand, have established mandatory standards for a variety of appliances, most commonly refrigerators and air conditioners.[8] Other countries have voluntary standards. Developing countries and smaller developed countries have often drawn on the established standards of other countries in developing their national standards. As a result of such measures, in OECD countries even the least efficient refrigerator on the market today consumes about half of the energy of the least efficient product eight years ago. It is estimated that, in the EU, further measures of this sort applied to a range of products could reduce total energy consumption by 10% by 2020.

29. Energy labeling has been widely used to encourage the adoption of energy-efficient products. These labels are of two types: either information labeling identifying the energy consumption of all products within a particular category; or endorsement labeling identifying the most energy-efficient products. Studies indicate that information labeling is more effective as it allows consumers to compare all products and consider energy efficiency along with other characteristics in their purchasing decisions. Information labeling often provides information not only on energy consumption, but also on the estimated operating costs of different models, allowing consumers to identify cost savings and compare them with price differentials.

30. Information labeling programmes may be mandatory or voluntary. Studies have shown that mandatory programmes have a greater impact, as they allow all products to be compared. However, countries often begin with a voluntary programme, then change to a mandatory programme as standards improve and producers and consumers become familiar with the system. Public information campaigns, as a complement to product labeling, can encourage consumers to look for the labels and help them to interpret the information and recognize the financial savings that can be achieved through energy efficiency.

Changing Production and Consumption – Refrigerators in China

A project implemented by China's Environmental Protection Agency, with the support of the GEF, UNDP, the UN Department of Economic and Social Affairs, the Collaborative Labeling and Appliance Standards Programme (CLASP), the UN Foundation and the Energy Foundation has transformed the refrigerator market in China. New energy performance standards will drive manufacturers to increase energy efficiency of refrigerators by 20% by 2008. A national consumer education programme, linked with a manufacturer incentive program requiring manufacturers to use at least 10% of their advertising budget to promote energy efficiency, has succeeded in influencing consumer preferences toward increased energy efficiency. At the same time, a new energy information label was developed for refrigerators and retailers were trained in how to market the benefits of energy efficiency to increase the impact at the point of sale.[9]

31. Many endorsement labels, such as the Energy Star, which began in the United States and has become an international standard, address a single aspect (energy efficiency) or life-cycle phase of a product, which gives them a narrowly focused impact, making them simple to understand. It is estimated that Energy Star products resulted in $12 billion in savings in 2005 in the United States alone.[10]

32. Some countries have required electric utilities actively to promote energy efficiency, for example by giving away energy-efficient compact fluorescent light bulbs to introduce them to consumers, as a cost-effective means of meeting growing demand for energy services while avoiding the costs of building new power plants and controlling air pollution.

33. The Efficient Lighting Initiative (ELI), supported by the International Finance Corporation (World Bank Group) and the Global Environment Facility (GEF), has developed a testing method and certification/labeling system to promote high quality, energy efficient fluorescent lights. In 2005, the China Standard Certification Center was designated to develop and expand the ELI certification and branding system globally.[11]

34. Public procurement and consumption can be effectively used to promote energy efficiency, as exemplified by Energy Star computers in the United States. After the Energy Star label was introduced in the United States in 1992 as a voluntary label for computers meeting energy-efficiency criteria, all federal government agencies, beginning in 1993, were required to procure personal computers, monitors, and printers meeting the Energy Star criteria. The United States Government spends nearly $4.6 billion annually to buy about 1 million computers, about 3 per cent of the total market. As a result of the Energy Star procurement requirement, the number of manufacturers in the United States and elsewhere making Energy Star labeled computers and peripherals rose from 10 in 1992 to 600 by 1998, and sales of such computers accounted for a majority of the total market for personal computers. The standard for public procurement thus became a general standard for the entire market.[12] After the initial focus on computers, the Energy Star programme was extended to other products, including major appliances, office equipment, lighting, consumer electronics, residential heating and cooling equipment, and new homes and other buildings.[13]

35. Many modern appliances consume energy not only when they are used, but also when they are in “stand-by” mode, most often to operate a clock or remote control system. A microwave oven that is only used occasionally, for example, may use more energy in stand-by mode than for heating food. It has been estimated that, in the United States, about 5-10% of residential energy consumption is for stand-by power, costing more than $3 billion per year and consuming the output of 18 power stations[14]. Studies in Europe have estimated that stand-by power accounts for as much as 7-13% of residential energy consumption[15].

36. The energy consumption of stand-by functions in appliances varies considerably. The United States study concluded that use of the most efficient and cost-effective stand-by technologies could provide stand-by functions while reducing average power consumption by 72%. In 2001, the United States adopted standards for government purchases. In 2002, Australia adopted a national voluntary standard for stand-by power

consumption, and in 2006 the state of California in the United States introduced the first mandatory standards for stand-by power consumption by various appliances. In addition, public information campaigns have encouraged consumers to fully turn off appliances when the stand-by functions are not needed.[16]

Sustainable Transport

37. Air pollution from motor vehicles has been reduced dramatically in the developed countries since the 1960s by means of regulatory controls imposed on vehicle manufactures and fuel refiners, despite increasing numbers of vehicles and distance driven. Mandatory emission standards for new cars were introduced in the United States in the state of California in 1965 and were subsequently introduced nationwide, covering hydrocarbons, carbon monoxide (CO) and nitrogen oxides (NO_x). Stricter standards have been phased in over the years since then. Japan introduced similar standards beginning in 1986. The European Union introduced the Euro 1 standards in 1992, followed by the stricter Euro 2, 3 and 4 standards. The most recent standards have reduced emissions by about 98% compared to typical vehicles of the 1950s and 1960s.[17]

38. A number of developing countries have addressed the problem of growing urban air pollution due to motor vehicles by adopting developed country standards, sometimes first in major cities, then nationwide. The Republic of Korea in 1993 introduced standards similar to those of the United States and the EU. China and India in 2000 adopted the European Union's 1992 Euro-1 emission standards for new vehicles, and more recently the 1997 Euro-2 standards, with Euro 3 and 4 scheduled to be applied in the future. Argentina, Brazil, Chile, Singapore and Thailand have also introduced emissions standards based on EU or United States standards.[18]

39. In addition to air pollution standards, the United States, in 1975, adopted fuel efficiency requirements. The United States Corporate Average Fuel Efficiency (CAFE) standards were strengthened between 1975 and 1985, almost doubling average fuel efficiency compared to before 1975, saving 55 billion gallons of fuel annually and reducing CO_2 emissions by about 10%. The standards have not been strengthened since 1985, however, and the increased use of sports utility vehicles (SUVs), which are not covered by the CAFE standards for cars, has reduced average fuel efficiency. China has introduced mandatory fuel efficiency standards stricter than those in the United States, taking effect in 2005, with stricter standards to take effect in 2008. In Europe, which has higher average fuel efficiency than the United States due to voluntary actions by producers and consumers, the European Commission is negotiating voluntary standards with the auto industry.

40. Following the lead of California's 2002 Vehicle Global Warming Law, eight other states in the United States now require that future cars sold in those states reduce their emissions of greenhouse gases by about 22% by 2012 and 30% by 2016. It is estimated that the higher costs of the vehicles – $300-$1000 – will be paid for by reduced fuel costs in 1.5–3.5 years. In Canada, the government has negotiated an agreement with car-makers to reduce vehicular greenhouse gas emissions by 17% by 2010.[19]

41. Since the Toyota Prius was introduced in 1997, there has been a steady growth in sales of cars with hybrid gasoline-electric engines that are both more fuel-efficient and less polluting. Honda has since introduced cars with hybrid engines, Ford introduced a hybrid sports utility vehicle in 2004, and other car-makers are planning to introduce hybrid models. As of mid-2005, consumers have bought almost 500,000 such cars, the most efficient of which consume fuel at about half the rate of comparable cars with conventional internal combustion engines. While the Prius costs about $3000 more than comparable conventional cars, the savings on fuel over the lifetime of the car cover the extra cost. The United States offers a deduction of up to $2000 from taxable income for the purchase of a hybrid or other "clean fuel" vehicle, including vehicles powered by natural gas, 85% ethanol (E85) or electric vehicles.[20] In some cases, however, car-makers are using hybrid engines to increase power relative to comparable conventional models, rather than to improve fuel efficiency.

42. In Brazil, and to some extent in the United States, drivers have a choice of fuel between gasoline and ethanol, which reduces both air pollution and CO_2 emissions, as well as reducing dependence on imported oil. In Brazil, most vehicles are now produced with "flex-fuel" engines, introduced in 2003 at no extra cost and capable of using gasoline, ethanol or any mixture of the two. Many service stations offer both gasoline and ethanol, allowing consumers to choose their fuel based on availability, price and environmental considerations. The flex-fuel approach has overcome consumer resistance to ethanol-only engines, which lost popularity in the late 1980s when ethanol availability decreased with increasing sugar prices and gasoline became cheaper with declining world oil prices. Brazilian producers estimate that ethanol from sugar cane is cheaper than gasoline when oil is above $30 a barrel. In addition, costs of ethanol production are expected to decline further with improvements in production technology and co-generation and sale of electricity generated by burning sugar-cane residue (bagasse).[21]

43. Currently, ethanol production in developed countries with temperate climates is based on corn or grain, which have higher production costs and provide less net fossil fuel savings and CO_2 emission reductions than sugar cane. However, new technologies under development allow ethanol production using plant cellulose from agricultural or forestry wastes or fast-growing grass or trees grown specifically for the purpose. This would also offer new economic opportunities in rural areas and reduce pressure to clear forest land or switch agricultural land to ethanol production, as cellulose for ethanol production can be grown on otherwise unproductive land. The first cellulose-ethanol pilot production facility, using agricultural residues, is now operating in Canada, selling ethanol to the Canadian government for its fleet. Flex-fuel cars and trucks are sold by Daimler-Chrysler, Ford, General Motors, Peugeot and Volkswagen.[22]

44. An alternative fuel being developed in Europe, and to a lesser extent in North America, to replace petroleum-based diesel fuel is biodiesel, produced from vegetable oil, most commonly rapeseed (canola) oil. Biodiesel reduces CO_2 emissions and dependence on petroleum, but has been more expensive than gasoline and competes with other agricultural crops for land. It is becoming more competitive with current high oil prices. Used vegetable oil from food processing can also be used and is more

economical than new oil, but the supply is too limited to have a substantial impact on fossil fuel consumption.

45. Governments, local authorities and large institutions, as major consumers of vehicles and fuels, can use their purchasing power to take a leading role in changing consumption patterns. Public green purchasing is part of a broad traffic programme initiated by a number of cities in Sweden in 1995, including the introduction of cleaner vehicles. The project is intended not only to reduce the environmental impacts of public vehicles, but also to serve as a model for the public, to inform them about the benefits of such vehicles, to demonstrate their practical use, and to stimulate public demand. Other elements of the programme have been a municipal bicycle fleet and a requirement that road construction contractors comply with environmental criteria and have an environmental management system (e.g. EMAS, ISO 14001). By 1999, 75 per cent of municipal buses were powered by natural gas, and 23 per cent of the overall municipal vehicle fleet in the participating Swedish cities was powered by electricity, compressed natural gas or biodiesel. The municipal programmes have also had an impact on the development of Swedish national legislation and guidelines.[23]

46. New York City has had an Alternative Fuels Program since 1993. The main objectives of the programme are reducing air pollution and promoting the use of alternative fuels by both public and private vehicles. Under this programme, public fleets in New York are being replaced with alternative fuel vehicles, currently including over 6000 natural gas, hybrid, E85 (ethanol) and electric vehicles. The main alternative fuel at present is compressed natural gas (CNG). Natural gas buses produce an average of 97% less particulate matter, 84% less carbon monoxide and 58% less nitrogen oxide compared with conventional diesel engines. The CNG fueling sites for the public vehicles also offer service to other consumers. At the United States federal level, an Executive Order issued in 2000 requires any federal agency operating 20 or more motor vehicles to reduce petroleum fuel consumption by 20 per cent by 2005 compared to 1999. To meet the objective, agencies are required to acquire alternative fuel vehicles and to increase the average fuel economy of vehicle operations by 3 miles per gallon (mpg) by 2005 compared to 1999.[24]

Renewable Energy

47. In OECD countries, renewable energy sources, including large hydropower, account for about 5% of total energy production and consumption. Most renewable energy (excluding biomass) is derived from hydropower and geothermal energy and is used by energy utilities for generating electricity, which is distributed via the grid together with electricity generated from fossil-fuel sources. The generation and use of energy from renewable sources directly by consumers (including industry, commerce, households and public institutions) is small and is mostly for residential use. Residences, which consume about 20% of total energy, account for over 75% of non-utility renewable energy generation. For modern biomass, on the other hand, the main user in OECD countries is the pulp and paper industry, which burns residues for process heat.

48. Policies for promoting increased use of renewable energy by utilities have included requirements and/or incentives for utilities to increase their share of energy from renewable sources. There are also mechanisms that allow consumers, for a modest premium, to specify that the energy they consume should come from renewable sources, at least in the sense that their consumption is matched by increased renewable energy generation or purchase by the utilities delivering the electricity.

49. A number of countries have introduced requirements for utilities to include a specified share of renewable energy in their supplies. In California, a "Renewables Portfolio Standard" (RPS) that took effect in 2003 requires investor-owned utilities to obtain 20% of their power from renewable sources by 2017, with a phase-in requirement of 1% per year.[25] About 18 other states in the United States have RPS requirements, and a national requirement is under consideration.

50. Stand-alone renewable energy systems, such as solar photovoltaic (PV) systems or wind generators not connected to the electrical grid, require batteries to store power for use when the resource is not available (e.g., at night for solar equipment), which increases the cost and reduces the environmental benefits. Investment in renewable energy in areas served by a grid is therefore more economic and sustainable if the generator/consumer can sell surplus consumer-generated renewable energy to the grid and buy energy from the grid when required, thus eliminating the need for batteries, as well as making full use of available wind, sunlight or other renewable energy sources.

51. Utilities have often refused to buy power from private sources in such situations, sometimes citing technical difficulties in accepting power that does not conform to their operating specifications. Germany, in 1991, in order to promote private investment in renewable energy systems, adopted a "feed-in law" requiring utilities to purchase all renewable energy offered to them at a minimum of 90% of the retail price. For wind energy, Germany guarantees a minimum purchase price of 8.5 euro cents ($0.11) per kWh for the first five years (12 years for offshore installations) and 5.4 euro cents ($0.07) for the rest of a 20-year period. These policies have made Germany the global leader in wind energy capacity. For private solar photovoltaic installations, Germany began in 1999 to offer interest-free 10-year loans and a guaranteed "feed-in" price of 8.5 euro cents per kWh. With the Renewable Energy Law in 2000, the guaranteed purchase price jumped to about 50 euro cents per kWh for 20 years, much above the price of conventional power, creating a strong incentive for private investments in solar power. Solar thermal water heaters are also subsidized.[26]

52. While the cost of generating electricity using solar PV systems is still substantially higher than the cost of fossil fuel generation, solar heating is more competitive and costs are expected to decline further. Globally, solar heating, mostly for water and space heating, is estimated to provide 25 times more power than PV systems and has been growing rapidly, China is the leading country in using solar heating; other major users include India, the United States, Japan, the European Union, Turkey, Israel and Australia. The importance of solar heating has often been neglected as it has not been included in energy databases due to lack of data.[27]

53. Biogas, derived from animal wastes and other biomass, also offers a cost-effective renewable energy source in rural areas, particularly for cooking and lighting. Initial efforts to promote biogas in China, India, Sri Lanka and other countries suffered from poor design and lack of maintenance. More recent designs are more reliable and convenient to maintain and better integrated into farming and household systems.[28]

54. India is a leader among developing countries in wind power development, with capacity currently growing at about 40% per year. Policies, which are developed and coordinated nationally by the Ministry of Non-Conventional Energy Sources, include tax incentives, expedited clearances of foreign investment, and requirements that utilities source a certain share of the electricity from renewable sources, providing opportunities for the private sector, including small-scale investment. More than 97% of the investment in wind energy in India is from the private sector.[29]

55. Public procurement can also be used to promote renewable energy through the market. In Canada, in 1996, the federal government announced plans for green power purchases, including electricity generated from new or expanded renewable energy sources with the EcoLogo certification, including wind, water, biomass and solar. In 1997, the ministries of Natural Resources Canada (NRCan) and Environment Canada made commitments to purchase 15% to 20% of their electricity in the form of green power by 2010, and began purchasing green power from the electric utility in Alberta to run their facilities in the province, with a commitment to 10 years of such purchases. In addition to providing renewable energy for government operations, the programme is also intended to promote the development of green power markets for other consumers.[30]

56. In 2005, China adopted a Renewable Energy Law that requires electric utilities to purchase renewable energy from other producers and offers discount loans and tax preferences for renewable energy projects. A target is to increase the share of renewable energy, including wind energy, solar heating and PV, geothermal, hydro and other renewable sources, to 10% of total energy consumption by 2020, up from 3% in 2003.[31]

III. ENERGY EFFICIENCY IN INDUSTRY

57. Approximately one-third of the energy consumed globally is used by the industrial sector.[32] A wide variety of energy efficiency policies, programmes, products, services and delivery mechanisms have been implemented in many countries in efforts to improve energy efficiency in industry, with some success. In OECD countries, for example, manufacturing output has doubled since the 1970s, while energy consumption in manufacturing has not changed. While most of those gains in energy efficiency were achieved between 1973 and 1986 in response to higher prices, opportunities for significant energy savings continue to exist. The current high prices for oil and natural gas are creating a new sense of urgency for improving energy efficiency in industry.

58. Industrial energy efficiency refers not only to the technological efficiency of production equipment, but encompasses all changes that result in reducing the energy used to produce one unit of output. Energy efficiency is associated with economic

efficiency and efficient use of raw materials and includes technological, behavioral and economic changes.[33]

59. Where grid electricity supply is unreliable, industries often have to install their own diesel generators in order to continue operations when the grid power supply is down. This reduces economic and energy efficiency because the diesel generators are less efficient than large central generation facilities and because of the capital investment in the diesel generators that are only used part-time.

Market-Based Measures for Improving Energy Efficiency

60. The current trend toward liberalizing energy markets around the world is stimulating new initiatives to increase energy efficiency and energy demand management in industry. In non-market economies, energy was often priced below international market levels and there were no incentives for industry to improve energy efficiency. Economic restructuring in such countries as Russia and China has resulted in substantial increases in overall industrial energy efficiency by eliminating the most inefficient enterprises, putting pressure on surviving enterprises to become more competitive, and reducing energy subsidies. Also, more stringent environmental measures have encouraged cleaner and more energy efficient production technologies.

61. Market economies are also introducing market-based measures to promote energy efficiency. In Italy, the United Kingdom and France a system of "white certificates" is being implemented, requiring electricity and gas utilities to promote energy efficiency among end users and to show that they have saved an amount of energy equal to a specified percentage of the energy they distribute. The energy savings are certified through "white certificates", which can be traded on the market among utilities. Utilities that do not achieve their required share of certificates are subject to financial penalties.[34]

62. Carbon dioxide emission trading schemes involving utilities and energy intensive industries are now in place both within the EU and among signatories of the Kyoto Protocol. While designed to reduce greenhouse gas emissions, these market mechanisms provide significant incentives for energy efficiency. The EU programme is aimed at energy efficiency in large industries, while the Kyoto Protocol does not specify the sectors or types of energy efficiency measures that can be pursued.

63. Fiscal and financial incentives for energy efficiency are being offered by governments and electric utilities. A main target for these incentives are energy-intensive industries, energy service companies (ESCOs) and makers of energy-intensive equipment. Such incentive programmes typically have short-term objectives of increasing energy efficiency by 10 percent and long-term objectives as high as 25 percent with respect to a base year. In China, for example, tax incentives favour low carbon energy and energy-efficient equipment. Investment in co-generation facilities, energy efficient buildings and the like are exempt from fixed asset taxes. Since 1998, energy conservation and pollution reduction equipment which is imported from abroad has been exempt from import taxes.

64. Carbon taxes are being used by a number of countries to reduce consumption of fossil fuels and emissions of CO_2. In the early 1990s, Finland, Sweden, Norway and Denmark imposed taxes on fossil fuels, although some energy-intensive industries were fully or partially exempted. The Netherlands, Italy and the United Kingdom have also introduced carbon taxes. Evaluation of the results indicate that the taxes have had significant effect in reducing CO_2 emissions through increased energy efficiency and fuel switching, although the effects have been limited due to the exemptions and the insensitivity to price of some forms of energy consumption. In Sweden, switching from fossil fuels to biomass was an important factor, while in Norway the most important switch was to hydroelectricity.[35]

65. While energy taxes provide general incentives for increasing energy efficiency, there has been concern in many countries that tax rates that are high enough to have a substantial effect will reduce the international competitiveness of national industry. To address this concern and increase the political acceptability of new or increased taxes, the revenues are sometimes "recycled" to industry, in some cases for investments in energy conservation or for reducing other costs such as payroll taxes.[36] In other cases, the revenues are recycled to households to reduce opposition to increased taxes.

66. Another market-based approach to energy efficiency being pursued by a number of countries is the development of energy service companies (ESCOs). ESCOs offer services in developing, financing and implementing performance-based projects to improve energy efficiency or reduce electricity loads of facilities owned or operated by customers. ESCOs are promoting energy efficiency around the world but particularly in countries experiencing increased competition and privatization among electric utilities, as well as in other sectors undergoing liberalization, e.g., heat production in Central and Eastern Europe. Since ESCO remuneration is often tied to the level of energy savings, they tend to target energy intensive industries.

Policies for Industrial Energy Efficiency

67. Negotiated agreements between government and industry to improve energy efficiency are playing a significant role in both developed and developing countries. (See Table 1 below) Typically, companies or industry associations set targets for reducing energy use or greenhouse gas emissions in exchange for government support, such as financial incentives, publicity, or relief from other environmental or tax obligations. Agreements that are completely voluntary, without substantial incentives for participation or penalties for non-participation, tend to have less participation by industry. Results have tended to be small improvements on business-as-usual. Some such agreements have implied threats of future regulation in case of non-participation or non-compliance, promises of easy environmental permitting or relief from regulations for participants, and avoidance of energy or GHG emissions taxes. These programmes have been more successful. The Netherlands, for example, has many such agreements and has achieved energy efficiency improvements of 22 percent between 1989 and 2000. Programmes using a mix of incentives along with penalties for non-compliance have achieved both wide participation and strong results.[37]

Table 1. Current Voluntary/Negotiated Agreements with Industry[38]

Country	Agreement	Program Years	Incentives								Penalties			
			Government and Public Recognition	Information	Assistance and Training	Energy Audits	Financial Assistance & Incentives	Emissions trading	Relief or Exemption from Regs & Taxes	Reduced/ Avoided Energy/ GHG Taxes	More Stringent Env. Permitting	Increased Reg's	Penalty/ Fee	Energy or CO_2 Tax
Completely Voluntary														
Australia	Greenhouse Challenge	1996-present	X	X	X									
China (Taipei)	Energy Auditing Programme	2002-2020	X	X	X	X								
Finland	Promotion of Energy Conservation in Industry	1997-present	X	X	X	X	X							
Korea, Rep. of	Energy Conservation & Reduction of GHG Emissions	1998-present	X	X	X		X							
United States	Climate Vision	2003-present	X	X	X	X								
With Threat of Regulations or Taxes														
France	AERES Negotiated Agreements	2002-present	X		X			X					X	
Germany	Agreement on Climate Protection	2000-2012							X	X				
Japan	Keidanren Voluntary Action Plan on the Environment	1997-present	X											
Netherlands	Benchmarking Covenants	2001-2012	X	X			X		X		X			
Energy/GHG T axes or Regulations														
Canada	Large Final Emitters Programme	2003-2012		X	X	X		X	X			X	X	
Denmark	Industrial Energy Efficiency	1993-present		X	X	X	X			X				X
New Zealand	Negotiated Greenhouse Agreements	2003-2012						X		X				X
Switzerland	CO_2 Law Voluntary Measures	2000-2012						X		X				X
UK	Climate Change Agreements	2001-2013	X	X	X	X	X	X		X				X

68. Energy performance standards and labels are becoming more common in both developed and developing countries. As the world becomes increasingly dependent on electrical equipment and appliances, electricity consumption is rising more rapidly than consumption of other forms of energy. In industry, electric motors power pumps, drives, compressors, fans and other equipment, figuring in most industrial processes. One of the most cost-effective and proven methods for increasing energy efficiency in industry is to establish energy efficiency standards for industrial motors.

Energy efficiency labels for motors from China, Colombia, Singapore and Thailand.

69. According to a study by the European Copper Institute, European industry could save over 200 billion kilowatt hours (kWh) of electricity per year by using more energy-efficient electrical motors. Research by the EU's motor challenge programme found that industry across the EU-25 could save €10 billion per year on its electricity bills plus a similar amount on reduced maintenance. Carbon dioxide emissions would be reduced by 100 million tonnes per year, equivalent to one quarter of the EU-15's Kyoto reduction commitment.[39]

70. Monitoring and targeting is a tool that provides useful information concerning the implementation of energy efficiency measures, allowing them to be made more effective. It provides feedback on performance improvement measures by assessing energy savings achieved. Monitoring and targeting has a long history in the United Kingdom, which launched a national program in 1980. Over 50 industry sector studies have demonstrated the benefits of monitoring and targeting. These benefits include:

- Energy savings of 5% to 15%, with similar reductions in emissions of CO_2 and other pollutants;
- Coordination of energy management policy, through targeting of initiatives that achieve the greatest benefits;
- Assisting with financing for energy efficiency projects, through determination of baseline energy use levels for energy efficiency project proposals, and verification of savings (critical for performance contracting by ESCOs);
- Improved product and service costing through better understanding of the energy content of products and services;

• Improved budgeting, through improved data for the accurate projection of future energy use.

71. The World Bank has supported monitoring and targeting activities for improving energy efficiency in the industrial sector. It has set up institutional arrangements to promote and sustain energy savings in Brazil, Peru, Colombia, and Slovakia. A recent European Commission Green Paper on energy has set a target of reducing EU energy consumption by 20% compared to projections for 2020. In countries and industries where monitoring and targeting has been employed, measured energy cost savings relative to investment was typically 3:1.[40]

72. Benchmarking of energy consumption per unit of production provides a means to compare the energy efficiency of one company, facility or production line with similar facilities producing similar products. This approach has been effectively applied to compressed air systems, for example, in Germany's REN Strom programme. Benchmarks are typically employed as part of negotiated agreements and are disseminated to all participating companies. Companies may then agree, for example, to achieve the energy efficiency level of the top 10% of the plants.

73. Websites for information on industrial energy efficiency are proliferating rapidly, providing tools, guidebooks, technical information and links on energy efficiency programmes, policies, technologies, financing and technical assistance. The EU's CORDIS website[41] provides access to information on available support programmes, databases and reports, while its ManagEnergy website[42] has similar tools and includes links to over 400 energy agencies, events and partner searching capabilities.

Table 2. Overview of Industrial Sector Energy Efficiency Programme Products and Services in Industrialized Countries[43]

	Australia	Canada	Denmark	EU	France	Germany	Japan	Nether-lands	Norway	Sweden	Switz	UK	USA
Audits/assessments							X	X		X		X	X
Benchmarking			X			X		X	X			X	
Case studies	X	X		X			X	X	X	X		X	X
Demonstration: commercialized technologies			X		X	X	X	X			X	X	
Demonstration: emerging technologies		X		X	X			X		X			X
Energy awareness promotion materials	X	X	X		X		X		X	X	X	X	
Fact sheets	X			X						X	X	X	X
Industry profiles		X		X				X	X				X
Reports/guidebooks	X	X		X		X	X	X	X	X	X	X	X
Tools and software	X	X	X	X		X		X	X			X	X
Verification	X	X		X	X	X		X	X				X
Visions/roadmaps	X	X					X	X		X			X

Energy Efficiency in the Energy Industry

74. Both developed and developing countries have pursued regulatory reform and liberalization of the electric power industry, in the expectation that such reform and restructuring could improve efficiency, lower costs and consumer prices, and stimulate economic growth and competitiveness. These expectations have to some extent been realized. For example, in some formerly public-owned companies of OECD countries, labour productivity has improved by up to 60 per cent and generating costs in some cases have declined by 40 per cent. In other countries, availability of generating plants has improved significantly (from 60 per cent to 87 per cent), customer outages have been reduced, distribution productivity has improved, and electricity prices have been reduced, typically by 13-20%.[44] Wider economic benefits are also possible as electricity is an input to almost all productive activities. However, the impact of market liberalization on investments in long-term generating capacity is not yet fully clear, particularly in developing countries.

Case Study on Electricity Market Reform: Colombia

Colombia undertook a "middle of the road" approach to electricity sector reform beginning in 1994 and continuing today. In 1994, the electricity sector was 100% publicly owned, but suffered from inadequate capitalization and inability to attract investment. In 2005, 55 percent of the generating capacity and 50 percent of the distribution capacity is in private hands. The sector is more efficient and transparent, system availability and reliability have markedly improved, and electricity losses have been reduced. There still remains a challenge of rural electrification (30 percent of the population still has no access). The regulatory framework has significantly changed the "rules of the game" but utilities still have only limited independence. Privatization now involves 37 private companies with new capitalization of $3 billion. Tariffs are competitively priced, although there are cross-subsidies. Since 2003, operations have yielded a financial surplus.[45]

75. Improving end-user energy efficiency reduces energy demand, slowing the rate of needed investment in additional generating capacity. While electric utilities in developed countries have been implementing demand-side management (DSM) programmes aggressively during the past 25 years, the electricity sectors in developing countries have made little use of the approach. Until the early 1990's, subsidized energy prices, non-competitive markets, lack of sufficient knowledge and expertise of DSM, and a lack of adequate regulatory and institutional support were the primary factors limiting DSM activities in developing countries. However, as more countries move toward market economies and allow electricity prices to reflect costs, opportunities for energy savings and better use of capacity through DSM will increase.

Case Study on Demand Side Management: Thailand

In Thailand, the national utility's demand side management programme, supported by the Global Environment Facility, has exceeded targets, reducing peak demand by 383 MW and achieving annual energy savings of 1,868 GWh. The utility created a dedicated DSM office, now with a staff of 375 people, which is implementing 13 energy efficiency programmes for refrigerators, air conditioners, green buildings, industrial cost reduction, industrial ESCO development, motors, compact fluorescent lamps, street lighting, thermal storage, stand-by generation, interruptible loads, time-of-use tariffs, and public awareness campaigns. The utility works with manufacturers to promote development of new high-efficiency equipment and sales of efficient refrigerators and air conditioners, including through workshops with distributors and retailers.[46]

76. Combined heat and power, or co-generation, is another technology for improving energy efficiency in electricity generation, either in utilities or industry. After electricity is generated in a thermal power plant, the waste heat from the generators can be used for industrial process heat, space heating, product drying, air conditioning and water cooling. Co-generation can increase overall energy efficiency from 35% to 80%. In industry, electricity and heat are both generally used on-site, avoiding transmission losses, reducing energy costs, and improving power reliability, security and quality. While there is substantial potential for expanding co-generation, it is often constrained by outdated policies for the electricity sector and by electric utilities that perceive co-generation as a threat to their sales of electricity and, therefore, their revenues.

The Energy Sector is a Major Water User

Conventional electric power plants require large amounts of water for cooling. Typically, half of the water used is evaporated in the cooling process and the other half is often discharged into waterways at higher temperatures or in a degraded state. In the United States, for example, 39% of available freshwater is used in power generation, about the same as for agricultural irrigation, while only 14% is used for public water supplies and 6% for industry. Since combined heat and power co-generation systems do not consume water for cooling, they conserve water and avoid environmental impacts to rivers and lakes.[47]

77. The petroleum refining industry provides fuel and/or raw materials to practically every economic sector, with the largest shares going to the transport sector and the chemical industry. Refineries themselves are also large consumers of energy, with approximately 50 percent of operating costs attributable to energy needs. The United States accounts for about one quarter of all refinery capacity in the world, and the industry is the largest industrial energy user in the country. A number of refining companies have adopted energy management programmes that are yielding significant results. BP has implemented a greenhouse gas emission reduction program that has reduced its global emissions to 10 percent below 1990 levels after just five years. ExxonMobil identified over 200 best practices for processes and equipment that are reducing energy use by 15 percent. In The Netherlands, all refineries participated in Long-Term Voluntary Agreements with the Ministry of Economic Affairs covering the period from the early 1990s to 2000 and achieved total energy efficiency improvement

of 17%.[48] As a result, another series of agreements have been signed for the period 2001-2012.

IV. CORPORATE SOCIAL RESPONSIBILITY

78. Corporate Social Responsibility (CSR), as a voluntary approach for enhancing the contribution of businesses, especially multinational corporations, to sustainable development, is steadily gaining ground. A number of private initiatives exist, some sponsored by specific industries or groups of industries, others by workers, NGOs and other stakeholders, still others as multi-stakeholder partnerships. The interest in CSR is to a considerable degree a response to the forces of globalization. Whereas a developed country corporation operating only in its home country could generally provide assurances to shareholders and other stakeholders of its corporate responsibility by meeting or exceeding national regulations, it is much more difficult to demonstrate responsible behaviour where operations, often through contractors and sub-contractors, are spread over many countries, some of whom have weak environmental and social legislation and regulation and/or ineffective enforcement.

79. International CSR initiatives include systems of voluntary norms, or codes, of corporate conduct, like the OECD Guidelines for Multinational Enterprises[49] and the UN Secretary-General's Global Compact[50], process standards like the ISO14001 standard for environmental management systems of the International Organization for Standardization (ISO), and reporting guidelines like those of the Global Reporting Initiative (GRI), which uses a multi-stakeholder process to develop and disseminate Sustainability Reporting Guidelines[51], and AccountAbility's AA1000 series.[52]

80. In the case of the ISO14001 standard, there has been rapid growth in certification of industrial facilities in some developing countries, although developed countries, particularly in Europe, still dominate total certifications. From 1997 through April 2005, the number of certifications in China rose from 22 to 8,865, in India from 28 to 1500, in Thailand from 61 to 974, and in Brazil from 63 to 1800.[53] In total, almost 100,000 enterprises or other entities in over 120 countries had ISO14001 certification by 2004. Among developing countries, there is an especially strong representation of export manufacturing economies in East Asia, while very few African enterprises are certified. A European survey of facilities with EMS indicates improvements in the efficiency of use of raw materials, water and energy, but not necessarily in regulatory compliance.[54]

81. Certain sets of norms are designed for specific sectors or types of industry, as for example with the Equator Principles[55], designed for the banking and financial industries, and the recently launched Principles of Responsible Investment[56], designed primarily for institutional investors. In labour-intensive industries like clothing, footwear and toys, there are certification schemes like Social Accountability International's SA8000[57], and the ISO is developing the ISO 26000 guidance standard on social responsibility for publication in 2008 as a voluntary and non-certified standard[58].

82. The EU has issued a Communication on CSR, entitled “A Business Contribution to Sustainable Development”. In addition, European businesses have adopted a common approach to “ethical sourcing” through the Business Social Compliance Initiative (BSCI),[59] based on the labour standards of the International Labour Organization (ILO), as well as on the UN Charter on Human Rights and national regulations. The initiative aims at continuously improving the social performance of suppliers, leading eventually to SA8000 certification or equivalent.[60]

83. A major challenge facing an international company concerned with CSR issues is ensuring compliance by all suppliers in its global supply chain with its environmental and social standards. Contracting out the monitoring and verification process to third parties is one option that can reduce costs for those companies not large enough to justify an independent process. Where there is a risk to the company’s reputation from adverse publicity, the loss of control from contracting out these services needs to be weighed against any potential cost savings. The Global Reporting Initiative (GRI) is currently working on expanding the coverage of its sustainability reporting guidelines to include suppliers.

84. While mostly voluntary, corporate social and environmental responsibility programmes have in some instances been initiated by governments. The Cambodian Government, for instance, in cooperation with the ILO, provides assurances to foreign buyers and investors that its textile and garment industry meets certain labour standards.[61] Similarly, the Government of Pakistan has approved a plan to support the implementation of global social accountability standards for 250 major export units. This could evolve into a sort of “race to the top” competition among countries to attract foreign investment, but it may be constrained by the willingness of developed-country customers to pay a higher price for the assurance of products that meet specified process standards.[62]

85. Governments of some developed countries have started to make aspects of corporate responsibility and accountability mandatory. In the United Kingdom, pension funds are required to disclose how they take into account social, environmental and ethical factors in their investment decisions. In Canada, banks and financial institutions with over $1 billion in equity must produce public accountability statements regarding their contribution to the national economy and society. In France, publicly traded companies are required to include auditable information on social and environmental performance in their annual reports.[63]

86. Within the investment community, socially responsible investment (SRI), including social and environmental components, is gaining currency, with a growing industry to support it. There are numerous funds specializing in SRI, SRI research and rating firms, and stock indices like FTSE4Good and the Dow Jones Sustainability Index (DJSI). There are negative and positive approaches to SRI: the negative approach avoiding companies that cause environmental or social harm, and the positive approach investing in companies that provide goods and services that contribute to sustainable development.

87. UNEP has launched a Finance Initiative, whose mission is to identify and promote the adoption of best environmental and sustainability practices in financial institution operations.[64] The Initiative involves some 200 financial institutions, including a number of leading banks and insurers which are concerned with the potential impact of environmental problems such as climate change and future environmental liabilities on their operations and profits.

88. Pollution registers have been used by a number of governments in both developed and developing countries to put public pressure on industry to improve their environmental performance. The European Pollution Release and Transfer Registries (PRTR), the United States Toxic Release Inventory (TRI) and the Indonesian PROKASIH programmes are examples of government requirements for public disclosure of industrial pollution emissions that allow the public and the media to put pressure on industry to improve environmental performance.

89. To assist governments and industry in meeting environmental objectives in the most cost-effective way, the United Nations has been working with governments, experts and industry to develop procedures for corporate environmental management accounting (EMA), with detailed physical and cost accounting of energy, raw materials and wastes. Publications on principles and practices for EMA have been developed, translated into various languages, and disseminated. Based on that work, a set of guidelines has been adopted by the International Federation of Accountants (IFAC) to guide the work of accountants.[65]

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