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**CHANGING UNSUSTAINABLE PATTERNS OF
CONSUMPTION AND PRODUCTION**

EXPERIENCES IN HUMAN SETTLEMENTS AND WATER

BACKGROUND PAPER NO. 11

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CHANGING UNSUSTAINABLE PATTERNS OF CONSUMPTION AND PRODUCTION:

EXPERIENCES IN HUMAN SETTLEMENTS AND WATER

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. As part of the implementation of the JPOI, an International Expert Meeting on the 10-Year Framework of Programmes for Sustainable Consumption and Production was organized in Marrakech, Morocco, on 16-19 June 2003. In view of the themes to be discussed at CSD-12 and 13, the meeting requested the United Nations Department of Economic and Social Affairs, together with UN-HABITAT, and in collaboration with UNEP and other relevant organizations, to prepare a report on the actions needed at the international level to support national action in the waste, transportation, construction, and water and sanitation sectors, relating to sustainable consumption and production.² The report is to be an input to the 2004-2005 sessions of the Commission on Sustainable Development (CSD-12 and 13).

3. As a first step toward that report, the present paper has been prepared to review efforts toward making consumption and production patterns more sustainable with respect to the 2004-2005 thematic cluster, in particular human settlements and water. The paper is intended to complement the reports of the Secretary-General to CSD-12 on the three thematic issues,³ with a specific focus on changing unsustainable patterns of consumption and production, identified by the Commission as a cross-cutting issue to be considered in the context of each of the themes. As the 2004 session of the Commission (CSD-12) is a "review session", this paper, like the reports of the Secretary-General for this session, reviews practical actions that have been taken in implementation of Agenda 21 and the Johannesburg Plan of Implementation.

4. The examples of implementation actions included here do not constitute a comprehensive survey of the field, but are intended as illustrative of achievements and lessons learned in changing unsustainable patterns of consumption and production, as well as identifying continuing challenges and emerging issues. They are also selected taking into account their relevance to other countries or regions. The paper is intended to stimulate ideas and exchange of experience and information on ways to change unsustainable patterns of consumption and production. Most of the examples are accompanied by references to sources or further information on these and other examples.

5. The paper does not generally cover sanitation issues, other than wastewater treatment, as other aspects have been covered in the SG report on sanitation. On the issue of water, the paper focuses on water consumption and water efficiency in the household and industrial sector, as water consumption and efficiency in agriculture are covered in the SG report on water.

6. As the 2006-2007 sessions of the Commission (CSD-14 and 15) will focus on energy for sustainable development, industrial development, air pollution/atmosphere, and climate change, those issues are not addressed in this paper, but will be addressed in the preparations for those sessions.

7. Based in part on the present paper, the report requested by the Marrakech International Expert Meeting on actions needed at the international level to support national action in the specified sectors, will be prepared for the 2005 "policy session" of the Commission (CSD-13) on human settlements, water and sanitation. That report would also be submitted to the next International Expert Meeting, tentatively planned for mid-to-late 2005.

Housing and urban planning

8. The housing sector, including residential housing, commercial offices and stores, and the construction of industrial facilities, consumes about 25-40% of total final energy consumption in OECD countries and generates a roughly similar share of total waste, mostly as debris from demolition and reconstruction.⁴ At a broader level, the general structure of the city, neighbourhoods, highways, streets and infrastructure do much to determine how people live, work, travel and spend their leisure time.

9. As most consumers do not build their own homes, or businesses their offices or stores, people have limited ability to control their household energy consumption, much of which is used for heating and cooling. Household energy consumption therefore depends in part on government regulations and building standards for insulation, tightness of windows and doors, lighting efficiency, and heating and air conditioning efficiency. Since the oil shocks of the 1970s, most OECD countries have established regulations concerning the energy efficiency of buildings. In the United States, the state of California has been a leader, updating its state building code and appliance efficiency standards regularly on the basis of current technologies. As a result, residential electricity consumption per capita in California has remained steady since 1992, while it has increased by 20% in the United States as a whole.⁵

10. In high-income countries, urban areas with high population densities use substantially less land, energy and water per capita than suburban areas with large and widely spaced individual houses. The spatial development of cities, whether compact and high-density or sprawling and low-density, depends in part on fiscal structures and economic incentives. In the United States, government tax incentives and subsidized mortgages for house building and home ownership have tended to promote the development of suburbs with separate private homes with parking space for cars, which are often the only feasible means of transportation. Rental apartments in high-density urban areas are rarely granted tax breaks or other economic incentives. Zoning that separates residential areas from commercial areas, rather than mixing the two, also

promotes the use of cars rather than walking or other non-motorized transport and increases average trip length. Public spending on transportation infrastructure that goes disproportionately to road building, sometimes derived from earmarked taxes on fuel, also promotes and subsidizes the use of cars.

11. Improving urban planning to make cities more sustainable, and increasing the quality of urban life generally, requires integrated urban planning and management, involving cooperation among agencies responsible for land use, environment and transportation, agencies which have different and often competing priorities. Studies have found, in particular, that transportation policies commonly contradict environmental policies. In addition, many metropolitan areas consist of a number of independent towns with their own planning processes and priorities, and central cities and suburbs often have some directly competing interests. Denmark and the Netherlands have addressed this problem through national spatial planning agencies: the Netherlands Ministry of Spatial Planning, Housing and the Environment; and the Danish Spatial Planning Department within the Ministry of the Environment.

12. In Toronto, Canada, the Metro agency was established to coordinate roads, transportation systems, land use planning, schools and water supply for the metropolitan area. Similarly, in Portland, Oregon, United States, the metropolitan area includes Portland and 23 surrounding towns. To coordinate transportation, an independent and directly-elected regional agency was created. In some cases, such as in France and the United States, the political difficulties of creating a new level of policy-making have led national governments to use incentives such as making central government funding to local authorities dependent on regional coordination. In other cases, as with Mayors Jaime Lerner in Curitiba and Enrique Peñalosa in Bogotá, a strong political leader can push agencies into coordinating their efforts.⁶

13. To help ensure that urban planning met the needs of all, Porto Alegre, Brazil, in the 1990s, developed a "participatory budget" process involving public debates on municipal programmes and priorities. The process is organized in five themes: transportation; education, leisure and culture; health and social welfare; economic welfare and taxation; and city organization and urban development. As part of each annual budget process, discussions on these themes are organized in each of 16 districts of the city, and priorities are developed, with higher priority given to under-served areas. The districts then elect representatives to a Council to work with the city planning office and the mayor in the preparation of the budget. The process has contributed to urban development, including expanding access to water services from 80% of households in 1989 to 98% 1996, expanding coverage of the sewage system from 46% to 85%, doubling the number of children in public schools, and substantially increasing public tax revenues by increasing the willingness of citizens to pay. Public participation in the process has steadily expanded, and the urban political culture has changed from one of dispute and protest to one of dialogue and negotiation. Participatory budgeting has subsequently spread more than 100 other communities in Brazil.⁷

Urban mobility

14. Mobility in cities depends largely on the transportation options available. In large sprawling cities with limited public transit or possibilities for walking or bicycling, people with enough money use cars or motorcycles. In some cities of the United States, 95% of

people commute to work in private cars. In many European cities, on the other hand, with higher population densities, efficient and attractive public transit, and arrangements for convenient and safe walking and cycling, a majority of people commute to work by public transit or non-motorized transport. In Tokyo, nearly 92% of commuters to the downtown area travel by rail. The average distance per trip is about the same in Europe and the United States, about 13-15 km, but Europeans make only about half the number of trips by car, due to the availability of other options. In some major cities in middle-income countries, such as Bangkok and Kuala Lumpur, the majority of people commute to work in private cars despite the financial cost, due to the lack of attractive alternatives.⁸

15. In the United States, free parking space provided by employers and excluded from income tax also has also constituted a public subsidy that has encouraged the use of cars. The 1998 Transportation Equity Act for the 21st Century extended the same tax break to compensation for using public transit, up to \$100 per month as of 2002. While the large majority of federal funding still goes to highways, the Act modestly increases the share of federal funding to public transit and provides funding assistance to transit operators for the purchase of low-emissions buses, construction of alternative-fuel fuelling facilities, modification of garage facilities to accommodate clean-fuel vehicles, and use of bio-diesel fuel (from vegetable oil).⁹

16. While cars offer convenient, flexible and rapid transport in rural areas and smaller cities, for the growing number of megacities, travel by car is commonly slow, expensive and unhealthy, due to congestion, the costs of car ownership and parking, and air pollution. In Bangkok, Manila and Jakarta, rush hour speeds are down to 6 to 8 km/hr in core areas, not much faster than a brisk walk, and much slower than a bicycle. In those cities, less than 10% of the land is devoted to roads, less than half of the share in most European and North American cities. The megacities of the developing world thus need efficient mass transit systems and other alternatives to cars even more than cities of the developed world.¹⁰

17. Curitiba, under Mayor Jaime Lerner in the 1970s and 1980s, developed an innovative urban rapid transit system with a specially designed bus system operated by private operators using dedicated bus lanes along radial routes from the city centre. To speed loading, passengers paid their fares in advance in shelters at the stops. This system provided efficient rapid transit for less than 1% of what a subway would have cost, with much of the investment cost borne by the private bus operators. During the planning process, the city purchased land along the planned routes to build affordable housing for low-income households. Land along rivers in the city was preserved as park land with foot and bicycle paths, providing flood protection at the same time. Many downtown streets have been made into pedestrian streets, 150 km of bicycle paths have been established, and many parks have been built.

18. The "finger plan" approach to urban development can help promote public transit and reduce the need for cars. High-density housing combined with retail stores are concentrated on a few axes (fingers) extending out from the centre of the city, and these axes are well served with rapid transit systems, whether subways, light rail or dedicated bus lanes. The land in between the fingers can be used for parks or other low-density uses. This approach has been very successful in reducing vehicle traffic and improving the quality of urban life in such cities as Copenhagen and Curitiba, Brazil.¹¹

19. In Santiago, Chile, in 1995, in response to a proposed toll highway through the downtown area, a coalition of 25 community organizations was formed to protest the design of the project, demand an environmental impact assessment as required under the 1994 Environmental Law, and propose other ways to improve transportation and protect communities. The group was supported by other citizens groups, including architects, transportation engineers, environmentalists and a group of cyclists called "Ciclistas Furiosos" which organized monthly mass rides to demand bicycle lanes on existing roads, new bicycle paths and racks for bicycle parking. The protest movement, drawing on expertise from similar groups in Canada, the United States and Europe, stimulated a broad public debate on the project and related issues. In 2001, the highway project was revised to address many of the concerns and reduce its disruptive effects. The protest movement then became the permanent Ciudad Viva organization, with a broader focus on urban development, community participation, transportation and waste management. The organization contributed to the debates on the 2003 transportation plan for Santiago and other issues, and has been invited by the government to participate in a national urban reform taskforce. The movement also influenced the establishment, in 2001, of dedicated bus lanes, and limiting the largest streets to public transit on high pollution days. As a result, public transit use has risen considerably.¹²

20. In 2003, The Global Environment Fund approved a project to improve transportation in Santiago, including reducing air pollution and greenhouse gas emissions, making public transit more efficient and maintaining its current 60% share of urban trips, developing land use plans to reduce average trip length, and increasing use of bicycles. The project was prepared with the participation of Ciudad Viva, Ciclistas Furiosos and other stakeholders.¹³

21. In Bogotá, Colombia, from 1998 to 2000, Mayor Enrique Peñalosa led a campaign to improve the quality of urban life. The relatively inexpensive but effective TransMilenio bus rapid transit system was developed using existing buses with dedicated bus lanes. The city also promoted bicycle use and walking, developing 300 kilometres of bicycle paths and improved sidewalks and pedestrian-only streets. As a result, pollution levels have declined and commuting times during rush hours have been cut in half. In addition to the improvements in transportation, 1200 public parks were built or rebuilt, new schools and public libraries were built, and schools and libraries were linked through a network of 14,000 computers. Among the achievements were a 34% increase in public school enrolment over 4 years, and a substantial reduction in the crime rate. Bogotá has also been experimenting with selectively banning cars at certain times, and the experiments have proven popular.¹⁴

22. Jakarta, Indonesia, in January 2004, inaugurated the Bogotá-style TransJakarta bus rapid transit system with a 13 km dedicated bus lane, air-conditioned buses, and Curitiba-style bus shelters with fare pre-payment. The city plans to expand the system to 14 additional main transportation corridors.¹⁵

23. In the United States, Portland, Oregon, has been working to prevent urban sprawl and improve the quality of urban life. Space previously devoted to cars has been converted to use for walking and cycling, bikeways have been built, new buildings are required to have bicycle parking, central streets have been made more attractive for walking, traffic has been slowed, car parking space has been reduced, light rail lines are

being built, and development is concentrated around transit stations. Partly as a result of these measures, Portland has had population and economic growth while reducing property taxes, average commuting time, energy consumption and air pollution, and improving the perceived quality of life.¹⁶

24. Singapore, since the 1980s, has used road tolls that depend on the time of day and traffic conditions on urban roads to manage traffic congestion and promote use of the bus and light rail mass transit system. Since 1998, charges are automatically deducted at toll points from an electronic card in the vehicle, so there are no toll booths to slow traffic. The charges are adjusted to changing patterns and have proven very effective in optimizing traffic flows. Singapore also limits the overall number of cars in the city through auctions for a limited number of license plates. As a result, Singapore achieves average rush hour speeds of 45-65 kph on expressways and 20-30 kph on city roads.¹⁷

25. London, UK, in February 2003, introduced a congestion charge of \$9 for cars entering central London between 7am and 6:30pm, using monitoring cameras with automatic license number recognition. As a result, many commuters have switched to public transit, traffic delays have been reduced by one-third, average speeds in the charging zone have increased by 40%, and bus delays are well down. Surveys indicate that a large majority of Londoners find the scheme effective, the 100,000 drivers each day who pay the charge express satisfaction with the system, and business is generally supportive. The success of the scheme has contributed to the popularity of Mayor Ken Livingstone, who championed it. Central city congestion charges have also been used successfully for years in Trondheim, Norway, and have recently been introduced in Toronto, Canada, and Melbourne, Australia. Zermatt, Switzerland, uses its car-free status as a tourist attraction.¹⁸

26. In most large cities of the developing world, the informal transportation sector provides essential transport services, especially for informal settlements, as well as making a major contribution to employment. Pedicabs, mopeds, motorized tricycles and motorcycles are often the only vehicles that can penetrate the narrow alleys in informal settlements, which are often unserved by municipal transport. Private vans, such as Manila's Jeepneys, Mexico's colectivos, Nairobi's matatus and Jakarta's mikrolets, serve larger streets for longer trips. In Bangkok, São Paulo and other cities, growing demand from middle class commuters has given rise to unlicensed vans that provide air-conditioned express commuter services at premium prices. Informal transport often complements municipal services, serving areas not served by municipal services and providing feeder services to the large buses on main routes, or to subway or rail services. Late at night, informal services may be the only means of transport for people without their own cars. In some cases, the "informal" services are actually regulated private transport services, while in other cases they are strictly informal and officially illegal but unofficially tolerated. The informal transport sector is often highly organized through route associations, informal codes of conduct, and even vehicle dispatchers. The informal transport sector provides up to 15% of urban employment – with sales and services providing additional employment – and is a particularly important source of employment for recent migrants to the city. For users, a diverse supply of formal and informal transportation modes provides people, particularly low-income people, with reasonably reliable and affordable transportation and delivery services.¹⁹

27. The informal transport sector in many large cities of the developing world has grown very rapidly to meet the growing demand as well as responding to emerging demands for services not provided by the formal system, while the municipal transport systems have generally not kept up with urban growth. This rapid growth, while meeting essential needs and contributing to economic growth and poverty reduction, has also posed major challenges to sustainable urban development, in part because of lack of regulation. The vehicles are often old, highly polluting and unsafe, and operators usually have no insurance to cover injuries or damage. In many cases, informal transport vehicles are old used buses, vans or cars imported from developed countries. Because there are no official and protected stopping places for informal vehicles, they often load and unload passengers in the middle of traffic, usually in the busiest locations. Intense competition in the unregulated market may cause aggressive driving, and competition with formal public transit may reduce the economic viability of the formal system. Some cities are addressing these problems by licensing and regulating the informal sector, setting vehicle standards and insurance requirements, excluding pedicabs or other small, slow vehicles from major streets, limiting the number of vehicles, and establishing waiting and loading points off the busiest streets.²⁰

28. Population density is a critical factor determining the financial viability of public transportation systems. Research in Australia indicates that public transit is economically viable only with a population density greater than about 30 people per hectare. Many cities in the United States average about 14 people per hectare, while European cities commonly have about 50.²¹

29. Air pollution from traffic can be reduced through the use of clean vehicles and fuels. There has been a steady growth in sales of cars with hybrid gasoline-electric engines since the Toyota Prius was introduced in 1997. Honda has since introduced cars with hybrid engines, and Ford has announced that it will introduce a hybrid sports utility vehicle in 2004. As of early 2004, consumers have bought almost 200,000 such cars, which consume fuel at about half the rate of comparable cars with conventional internal combustion engines. While these cars are somewhat more expensive than conventional cars, the savings on fuel over the lifetime of the car cover the extra cost. A survey of consumers conducted by the US Consumers Union rated the Toyota Prius and Honda Civic Hybrid as two of the three small cars with the highest customer satisfaction, as well as being highly reliable.²²

30. In some cases, governments and local authorities, as major consumers of goods and services, have used their large purchasing power to take a leading role in changing consumption patterns. Public green purchasing is part of a broad traffic programme of the City of Malmö initiated in 1995, including pilot projects such as purchasing electric-powered vehicles. A strategic feature of the programme is technical and policy cooperation between Malmö, its surrounding municipalities, and Stockholm and Göteborg, the two biggest cities in Sweden. 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 use of such vehicles, to demonstrate their practical use, and to stimulate public demand for such vehicles. Other elements of the programme were 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, 23 per cent of the municipal vehicle fleet was powered by electricity, compressed natural gas or bio-diesel, and 75 per cent of municipal buses were powered

by natural gas. The coordinated introduction of these policies and programmes in the biggest cities of Sweden facilitated the process and enhanced its impact, and the large number of electric vehicles ordered together increased the interest of suppliers. The municipal programmes have also had an impact on the development of Swedish national legislation and guidelines.²³

31. New York City has an Alternative Fuels Program, implemented by the City's Department of Transportation 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. There are currently 17 CNG fueling sites within New York City, mostly owned and operated by the two New York City utilities, KeySpan and Con Edison, and all offer service to the public. New York also provides financial incentives for taxis that use CNG. 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 new vehicle operations by 3 miles per gallon (mpg) by 2005 compared to 1999.²⁴

32. Bicycles can be an effective means of reducing traffic congestion and air pollution. Four to eight bicycles can use the road space occupied by one car, and 20 bicycles can park in the space occupied by each car. Cycling is also much less expensive than public transit, not to mention private car travel. Lima, Peru, is promoting bicycle use, including through a revolving fund supported by the World Bank providing credit vouchers usable in bicycle shops. In Kenya, a luxury tax on bicycles at the rate of 80% until 1986 was gradually reduced, and finally eliminated in 2002, resulting in a large increase in bicycle sales. Most African countries still tax bicycle imports as luxury items, limiting access by poor people to low-cost and environmentally sound transportation.²⁵

33. Thailand's Energy Policy and Planning Office, in 2002, awarded 14 municipalities \$12,000 for feasibility studies of bicycle lanes. The town of Muang Lamphun in northern Thailand has proposed a 33 km network of bicycle routes as part of an effort to put cycling at the center of its transportation system. Currently, municipal police use bicycles on their patrol routes, and students are able to exchange recycled garbage for free bicycles at their schools. Some 44% of residents bicycle to work, according to a study conducted by the municipality last year, and a surprising 95% of car drivers said they would leave their cars at home if safe cycling lanes were provided. The bicycle lane network would follow 24 streets around temples and tourist attractions, while 25 major roads would get a separate bicycle path.²⁶

34. A major deterrent to cycling as a means of urban transport is concern about safety. Construction of bicycle paths or separate bicycle lanes can be very effective in promoting cycling. Denmark and the Netherlands have extensive systems of bicycle paths and lanes, and many Chinese cities reserves traffic lanes exclusively for bicycles. Mexico City, in February 2004, inaugurated the first 5 km section of a planned 90 km

bike-way network. Allowing and facilitating the transport of bicycles in subways and trains and providing safe and convenient bicycle parking at train stations allows a combination of local cycling and longer distance rail travel for trips that are too long for cycling and inconvenient by rail alone. Some cities, however, as vehicle traffic has increased, have discouraged or even banned bicycles from some streets.

Solid waste management and recycling

35. Solid waste is a growing problem in cities all over the world. While developed countries have reduced the environmental impact of solid waste through sanitary landfills and high-temperature incineration, the volume of waste is steadily growing. In the developing world, few cities have adequate waste collection and disposal systems, and the accumulating waste threatens health, damages the environment, and detracts from the quality of urban life.

36. In OECD countries, municipal waste averages 540 kg per person per year, ranging from 354 kg per person in Norway to about 800 kg per person in the United States. During the 1990s, total waste generation in OECD countries increased by about 14%, about half attributable to population growth and half to an increase in per capita waste generation. Most of the solid waste in OECD countries goes to landfills, but there is a growing trend toward incineration with energy recovery, with large differences between countries due in part to different geographical conditions and population densities.²⁷

37. In the United States, which relies on landfills for about 86% of waste disposal (excluding recycled waste), the number of landfills has declined from about 8000 in the late 1980s to about 2500 in the late 1990s, while the total capacity has increased, as small local "dumps" have been replaced by large regional "sanitary landfills". This trend is largely due to the 1976 Resource Conservation and Recovery Act, which requires landfills to have plastic linings several inches thick for the base, underground piping systems for collecting and treating toxic liquid draining from the waste, a system for monitoring groundwater to ensure against contamination, and soil to cover garbage within hours after disposal to reduce odor, pests and health hazards. Many of the landfills also recover methane generated by decaying organic waste, thus providing a source of energy and reducing greenhouse gas emissions. Incineration is substantially more expensive than landfill disposal in the United States due to the low cost of land for landfill (landfill fees average \$26 per ton), the cost of disposal of incinerator ash in expensive toxic waste landfills, and the declining volume of combustible waste due to recycling.²⁸

38. In the European Union, pollution emissions from incinerators have been reduced since 1990 through the closing of many old small incinerators, the introduction of emission cleaning systems, and higher temperature incineration, which reduces the emission of toxic products such as dioxins and furans.²⁹

39. In Canada, the city of Toronto launched a programme on "Governments Incorporating Procurement Policies to Eliminate Refuse" (G.I.P.P.E.R.) to coordinate efforts by various levels of government to incorporate environmental considerations into public purchasing procedures, with a focus on waste reduction. The programme produced G.I.P.P.E.R.'s Guide to Environmental Procurement, the third edition of which was published in 2002. The procurement guidelines are intended to reduce waste

generated by government activities, build markets that promote waste reduction, reuse, recycling and recovery, and promote joint purchasing by public agencies to increase their impact.³⁰

40. In OECD countries, the average share of recycled waste has reached about half. Recycling rates are increasing and now average over 80% for metals, 35-40% for glass, and 40-55% for paper and cardboard. Recycling rates vary substantially among countries: for example, in Ireland, 10% of paper and cardboard is recycled, whereas the figure for Germany is 70%. In general, the Scandinavian countries, Belgium, Switzerland, Austria and Germany have very high recycling rates. Mediterranean countries still have the lowest recycling rates, although they are increasing rapidly.³¹

41. In the United States, recycling increased from less than 10% of household waste in 1989 to 30% in 1997, largely due to municipal curbside collection programmes, which increased from 1000 to 9000 over the same period. Recycling, however, does not pay for itself, as the prices of recycled materials are relatively low and volatile. This is due in part to low costs of virgin material and production technologies designed for virgin materials, such as pulpwood rather than recycled paper. Uncertainty as to the supply and price of recycled material has discouraged investment in technologies to use it. In some cases, local authorities have set targets to increase recycling, but these have generally not been effective as they have not provided the incentives or enforcement measures necessary. Where municipalities have passed laws making household recycling mandatory, they have not been prepared to search garbage and impose fines for non-compliance. Nonetheless, most households have been willing, even happy, to recycle in the spirit of civic duty and environmentalism, even in the absence of incentives or enforcement.³²

42. In an attempt to induce households to reduce waste disposal and increase recycling, about 4000 communities in the United States have introduced charges per bag of household waste. The effectiveness of such programmes in encouraging recycling and reducing waste generation is unclear, although the amount of waste in each bag clearly increases. Furthermore, such programmes may increase illicit dumping, with substantially greater environmental damage than proper landfill disposal.³³

43. To increase demand, and hence prices, for recycled material, and to encourage the introduction of technologies using recycled material as input, some communities have passed laws requiring government offices, and in some cases even private business, to buy products such as paper with a certain proportion of recycled material. These measures, however, have been difficult to administer and enforce. Economic analyses of recycling indicate that it is generally substantially more expensive than landfill disposal, particularly where land is inexpensive. The economic benefits of recycling are greatest for aluminum, other metals and paper, and least for plastic and glass.

44. In Brazil, 35 aluminum recyclers, supported by 6000 scrap-buying centres around the country, recycled 87% of the aluminum cans consumed in the country, worth almost \$300 million, generating 2000 jobs directly and an estimated 150,000 indirectly, and conserving 1700 GWh of energy.³⁴

45. Packaging makes up a growing share of the waste stream in most countries. Germany, in 1991, began a programme to reduce and recycle packaging waste,

including product and transport packaging, through a Packaging Ordinance that requires manufacturers to pay the cost of recycling the packaging from their products and to achieve a recycling rate of 60-75%, depending on the material. While some companies developed schemes to comply with the Ordinance on their own, many manufacturers joined forces with retail firms and waste collection companies in the German Dual System or Green Dot system in order to reduce costs through economies of scale. Participating manufacturers place a green dot on their packaging and pay the waste collection companies for the green dot packaging they collect for recycling. Packaging recycling in Germany is thus a national rather than a municipal programme as elsewhere. As a result, packaging in Germany declined from about 96 kg per person per year in 1991 to 77 kg in 2002, a reduction of about 20%. Of over 6 million tonnes of packaging waste collected, some 5.3 million tonnes were sent for recycling, an 84% recycling rate.³⁵

46. The Green Dot programme has been expanded to the European level in response to the 1994 European Packaging Directive and is now operational in 20 European countries with some 95,000 participating enterprises. Participating waste collection programmes are organized in the Packaging Recovery Organization Europe (PRO-Europe). For goods imported from outside Europe, the European importer is responsible for meeting the requirements.³⁶

47. Computers and other electronic equipment, which contain toxic elements including lead, barium, chromium, cadmium, beryllium, brominated flame retardants and PVCs, are of growing concern with respect to hazardous waste. About 70% of the heavy metals found in United States landfills come from electronic waste, and Silicon Valley in California has become seriously contaminated with toxic waste sites. A large amount of United States electronic waste is exported to Asia for recycling, often under unsafe conditions.³⁷

48. The European Union in 2003 adopted a Waste Electrical and Electronic Equipment Directive requiring producers, by 2005, to take responsibility for recovering and recycling electronic waste without charge to consumers. On old products, costs are to be shared by all producers, while on products marketed after 2005, producers will be responsible for their own products. The EU also adopted in 2003 a Directive on Restrictions on Hazardous Substances requiring electronics manufacturers to phase out, by 2006, the use of lead, mercury, cadmium, hexavalent chromium and two flame retardants used in plastics. In the Netherlands, Norway, Sweden and Switzerland, the purchase price of some electronic items includes an advance disposal fee to fund recycling. The EU has also adopted a Directive on end-of-life vehicles to reduce waste going to landfills. By 2007, 85% by weight of every new vehicle must be made from recyclable components, up from the 75% metal that is now recyclable.³⁸

49. Japan, as part of its Basic Plan for a Recycling Society, has been developing legal requirements for recycling. The 1998 Home Appliance Recycling Law came into effect in 2001. By 2003, collection of used air conditioners, TV sets, refrigerators and washing machines increased by about 20%, metals were recovered for recycling, and CFCs (greenhouse gases) were recovered for disposal. The Construction Recycling Act came into effect in 2002, requiring the sorting of debris from demolition to facilitate recycling of stone debris for road and building construction, and reuse of lumber for particle

board, paper or energy generation.³⁹ EPR policies have also been established in the Republic of Korea, and Brazil.

50. In 1995, the Danish government entered into an agreement with a number of organizations on a take-back scheme for used tires, with a goal of recycling 80% of scrap tires. Previously most scrap tires ended up in landfills. A consumer charge of about \$1 per tire on purchase is used to subsidize enterprises that collect tires and convert them into rubber granulate. In 1999, the take-back rate reached 87%.⁴⁰

51. For general municipal waste collection and management, there has been little success in transferring U.S. and European systems to developing countries, in particular to low-income neighborhoods where access for large vehicles is limited. There, scavenging and informal recycling have long been the norm, and government policy has begun to focus on how to make such systems work more effectively and safely, recognizing their importance not only to waste collection and recycling of useful materials, but also to employment of the unskilled. The World Bank estimated in 1995 that scavenging employed 7000 workers in Manila, 8000 in Jakarta, and 10,000 in Mexico City. In poor urban neighbourhoods in Egypt, India, Indonesia, and the Philippines, scavengers collect household waste door-to-door with handcarts. Support measures include legalizing scavenging activities, encouraging formation of scavenger cooperatives, awarding contracts for collection of mixed wastes and recyclables, and establishing public-private partnerships between local authorities and scavengers.⁴¹

52. A problem for individual scavengers is that industry often demands a minimum quantity from suppliers, so scavengers have to sell through middlemen. The middlemen can often take most of the profits as there are few of them and many scavengers. By forming their own cooperatives, scavengers can bypass the middlemen and increase their earnings. In a number of countries in Latin America (Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Peru, Venezuela) and Asia (India, Indonesia, Philippines), scavengers have formed cooperatives and become part of formal solid waste management programmes. Through such programmes, refuse collection has been expanded at relatively low cost, creating jobs and benefiting low-income communities. Instead of being a problem, scavengers can be part of the solution to the problem of solid waste collection and disposal in the cities of low-income countries.⁴²

53. Cairo, Egypt, has had for decades a large, well organized informal system of garbage collection that collects about one-third of the 9000 tons of solid waste generated every day, mostly from the more affluent neighbourhoods. The activity provides employment for about 40,000 people who collect, transport, sort, sell and remanufacture discarded material. About 80% of the waste is either recycled by the collectors or sold to others who reuse or recycle it, probably the highest municipal waste recycling rate in the world. A major problem for the system has been requirements by the city authorities to move the activities out of town in an attempt to clean up the urban neighbourhoods. The system is also now threatened by the new national policy to contract out waste collection to large "modern" waste management systems.⁴³

54. In Madras, India, there are almost 1000 civic groups called EXNORAs, each comprising about 70 families, with contributions varying from \$0.02 to \$0.40 per family. The groups hire "street beautifiers" who collect the garbage in the area. The garbage collected is separated and the reusable materials are sold to scrap dealers for recycling,

with the income augmenting the street beautifier's salary. The organic waste from several streets is taken to a common collection point for the municipal authorities to transport to the dumping yards, facilitating the collection work of the municipal authorities. Some 18 percent of the garbage of Madras is collected each day through this system, and 1500 jobs have been created.⁴⁴

55. In Dhaka, Bangladesh, the city provides waste collection services from collection points in middle and upper income areas. Household collection occurs in some areas on a small-scale, organized by residents, entrepreneurs or groups organized for other purposes offering waste collection as a public service, in some cases with support from local politicians. Waste collection is sometimes combined with street sweeping. A survey in 2000 identified 250 such local initiatives. One example is a youth club that collects waste from 300 households for \$0.40 per month. Another example is an entrepreneur who has two bicycle rickshaws and six workers to collect waste in a middle-income neighbourhood, with 700 households paying \$0.30 per month for daily waste collection. Some households pay the collectors an extra fee for door-to-door collection. The collectors separate paper, bottles and plastics for resale. A common problem in such arrangements is the collection of the household waste in a larger container for secondary collection by the municipal collection system for transport to a city disposal site. Households do not want a collection container near them due to the smell.⁴⁵

56. In most urban areas in Africa, there is no public municipal waste collection. In some areas, waste collection is undertaken by neighbourhood organizations or small entrepreneurs. In the Sainte Rita community in Cotonou, Benin, some 2700 households and organizations pay monthly fees to a community programme that trains and employs youths to collect their waste. Recyclable paper and plastic is sold for reprocessing and organic material is composted for the programme's farming operations.⁴⁶

57. In Lusaka, Zambia, in 2000, the Sustainable Lusaka Programme of the Lusaka City Council organized a similar system, providing training and grants to community organizations in low-income neighbourhoods to form household waste collection enterprises serving 200-1300 houses. Trainees were given loans to buy vehicles, boots and safety clothes. Households and shops were informed of the services and fees and invited to subscribe for \$0.20-0.40 per house and \$1 per shop. While many did so, some of the organizations were not well run, had problems collecting fees, could not cover their costs, and the number of subscribers has declined. As in Dhaka, there were problems in transferring waste from the primary neighbourhood collectors to the secondary municipal collectors, which served only the middle- and upper-income neighbourhoods.⁴⁷

58. Dar-es-Salaam, Tanzania, has a population of 2.5 million, 75% of whom live in unplanned settlements. Waste accumulation there had reached a crisis point in 1992, with only about 2% of the waste collected by the municipal collection system, and the rest accumulating in streets, around market places and around drainage systems. In 1992, the city organized a consultation on the issue with public, private and community organizations. With international support, the municipal collection system was expanded, with household waste collected by hand-carts. Most of the formal city area is now covered by 20 private companies charging monthly fees of \$3 and employing a total of about 1500 workers. Some 24 community organizations and NGOs employing about 800 workers cover parts of the unplanned settlements, receiving municipal subsidies and

charging monthly fees of \$0.30. About 33% of the 2400 tonnes of waste generated is now collected, with about 9% of that being recycled.⁴⁸

Urban and industrial water conservation

59. While cities consume less than 10% of the total water used globally, the concentrated nature of that demand poses a heavy burden on limited local water supplies, both in terms of volume of demand and pollution from wastewater discharge. The high costs of water collection, treatment and distribution, as well as wastewater collection and treatment, are a major burden on public budgets and are beyond the capacity of most developing countries.

60. In the 1980s and 1990s, with growing demand for municipal water supplies facing the increasing cost and difficulty of developing new supplies of clean water, water agencies and utilities in many countries began to explore demand-side management approaches. This was based on the principle that consumers need effective water services such as showers, toilet flushing, clothes washing and dishwashing, rather than a particular quantity of water. In many cases, it was found to be more cost-effective to meet the growing demand for water services by increasing water efficiency rather than by increasing the volume of water delivered. For households, water efficiency improvements include low-flow showerheads, low-flush toilets, and water-efficient washing machines and dishwashers. For lawns, gardens and landscaping, they include perforated “soaker hoses” and soil moisture sensors to avoid wasting water, covering swimming pools in hot weather to reduce evaporation, and limiting water use for car washing. For industrial use, demand-side management approaches include reuse of cooling water and process water and reducing water consumption by evaporative coolers and boilers. Water audits can be a useful way of identifying cost-effective means of reducing water consumption.⁴⁹

61. South Australia, in 2003, applied legal restrictions on the outdoor use of water for households and public spaces. Watering of lawns and gardens must be done by hand, by drip irrigation, or in the evening. Paved areas, walls or roofs can only be washed if necessary for health or safety reasons. Cars and boats can only be washed by hand, with a high-pressure low-volume water cleaner, or with a hose with an automatic shut-off nozzle. Construction sites must also use hoses with a trigger nozzle.⁵⁰

62. In the United States, household indoor water use averages 262 litres per person per day. However, households that install the water-saving devices mentioned above and reduce leakage have reduced their use to about 160 litres per person per day. Since 1997, all toilets, faucets and showerheads installed in the United States must meet water efficiency standards established by law in 1992. These efficiency standards can lower indoor household water consumption by about one third, and studies of 16 cities indicate that they will save water utilities about \$200 million in investments over the next 20 years.⁵¹

63. In the United Kingdom, the Environment Agency of England and Wales makes an annual Water Efficiency Award to promote water efficiency. In 2003, the major award went to the building company Gusto Homes. Gusto has built houses and offices with automated rainwater harvesting systems which collect rainwater in underground storage tanks and use it for toilet flushing, washing machines and gardening. Houses were also

equipped with low-flow toilets, faucets and showers. The collected rainwater provided about 50% of the household water consumption. As a result of the success of this project, such systems are being installed in other houses, and an Association of Rainwater Harvesting Companies has been established to promote such systems and encourage high standards in their design and installation.⁵²

64. Most cities are located on rivers and are dependent on reuse of water that has been used upstream and discharged into the river, with or without treatment. Paris and its region are provided with water by the Seine River. After serious deterioration of water quality in the Seine in the 1960s due to discharge of untreated municipal wastewater and industrial pollution, water treatment measures were undertaken. As a result, dissolved oxygen content has steadily improved, microbial, phosphate, metal and PCB pollution has declined, accidental releases of toxic contaminants are now rare, and aquatic biodiversity is increasing. However, nitrate levels are still increasing and pesticides and other toxic chemicals remain serious problems. About 90% of the population of the river basin is now connected to sewers leading to a wastewater treatment plant, and the rest live in rural areas and have their own private sewage disposal systems. Most of the sludge from the treatment plants is used by farmers, although there are concerns over heavy metals in the sludge, largely from industrial effluent. In addition to over 2000 municipal wastewater treatment facilities in the Seine basin, twelve hazardous wastewater treatment plants have been built, reducing the impact of industrial pollution on aquatic environments.

65. While wastewater treatment is the responsibility of municipalities, starting in the 1960s, the French national Water Agency used a variety of incentives to induce the municipalities to improve water treatment, including financial support, technical support for operation, assessment and monitoring, pollution charges, and joint programmes. Environmental taxes have been imposed on pesticides and phosphate laundry detergents. In critical regions, higher pollution charges were combined with greater financial assistance. The pollution charges are inducing industry not only to install wastewater treatment facilities, but also to make production processes cleaner, in some cases with support from the Water Agency. Current efforts focus on improving the efficiency of wastewater treatment plants, particularly for nitrates, and developing low-cost, low-tech wastewater treatment systems for rural areas with low population density.⁵³

66. In Jordan, municipal wastewater, treated and reused for irrigation, is an important part of the national water supply. Available water from renewable sources was 160 m³/capita/year in 1998 and is projected to fall, as a result of high population growth, to 91 m³/capita/year by the year 2025, far below the water scarcity threshold of 1000 m³/capita/year. The country has 19 wastewater treatment plants serving about two-thirds of the urban population. Treated wastewater amounts to about 10% of available freshwater resources, and plans are to increase the amount to about 30% by 2020. There is little industrial effluent, so pollution by heavy metals or toxic organic chemicals is low. Most of the water from the treatment plants meets WHO guidelines for use of water for restricted agricultural irrigation. Of the treated wastewater used directly for irrigation – including flood, furrow or drip, but not sprinkler irrigation – about half is used for tree plantations, while most of the rest is used for fodder production and olive orchards. Other treated wastewater is discharged to streams, mixed with streamflow and used further downstream for unrestricted agriculture. A small amount of the treated

wastewater is used for cooling in industry. In a few cases, farmers have been found irrigating vegetables with treated wastewater, and the vegetables have been destroyed.⁵⁴

67. Bulawayo, Zimbabwe, is located in a dry, drought-prone region with an average of 460 mm of rainfall per year. As there is limited potential for increasing the water supply to address recurring water shortages, the city has taken a number of water conservation measures, including reducing leakage from the municipal water distribution system, reusing treated but non-potable water from water treatment plants for irrigating trees and lawns, and reusing higher quality water from the largest and most advanced treatment plant for irrigating grain and pasture. An increasing block-tariff pricing structure has reduced average water consumption by 23% while ensuring that basic social needs are met. At times of severe drought, water rationing is applied and the use of watering hoses is banned, reducing water consumption from the normal average of 140 litres per capita per day to 100 litres. These measures have been supported by public information campaigns for water conservation.⁵⁵

68. Improving water efficiency and reducing water pollution from industry is one of the functions of National Cleaner Production Centres (NCPC) established in many developing countries and countries with economies in transition, in many cases with assistance from UNIDO and UNEP. In the Slovak Republic, the NCPC assisted a recycled paper processing plant to reduce water consumption in the production of cardboard from recycled paper by 48%, or almost 2 million cubic metres per year, with financial benefits of \$313,000 per year. In Costa Rica, the NCPC helped a fruit and vegetable processing plant to reduce its consumption of water for washing produce and equipment by 24%, providing savings of about \$10,000 per year for an investment of \$1000. The NCPC in India assisted an organic chemical factory to reduce water consumption by 22% through internal water recycling, with savings of \$33,000 per year on an investment of \$64,000. In the Republic of Korea, the NCPC helped a fabric dyeing company introduce a new enzymatic process for dyeing cotton, reducing water consumption by 33% and reducing the costs of water, chemicals and energy by \$9000 per year. In a Uganda fish processing plant, cleaner production methods reduced water consumption by 30%, with a savings of \$6000 per year.⁵⁶

69. In Concepción, Chile, fish processing companies that produced fishmeal were a major source of organic water pollution going into the sea. Faced with impending effluent regulations, the Fisheries Association of 16 companies sought technical advice from the University of Concepción, which determined that the fish wastes in the effluent could profitably be recovered, increasing fishmeal production, while reducing pollution and water consumption. With financial assistance from UNIDO and the Chilean FONDEF fund for technological development, the companies bought improved pumps that reduced losses in pumping fish from ship to shore, while substantially reducing water consumption and damage to the fish. Screens were then used to capture fish particles from the effluent and add them into the fish processing system, further reducing losses and pollution. Finally, new fishmeal dryers were installed which used energy more efficiently and improved fishmeal quality, which was particularly important for international markets. The new systems were first tested in one processing plant and then adopted by the others when proven effective. The new system reduced organic pollution (chemical oxygen demand) by 85% while increasing productivity such that the investment paid for itself within two years.⁵⁷

Conclusion

70. These examples of efforts towards making consumption and production patterns more sustainable, with a focus on human settlements and water, indicate a wide range of initiatives in many countries in all regions. They demonstrate a wide and growing recognition that current patterns of consumption and production are unsustainable. While the selection of examples for this paper favoured recent work, the review conducted in the preparation of the paper confirms that much of the activity in this field is quite recent, with a rapid growth in the 1990s and since.

71. Indeed, it could be concluded that Agenda 21, with its chapter 4 on "Changing consumption patterns", effectively put the issue of unsustainable patterns of consumption and production on the international agenda. The importance of the issue was reaffirmed by the Johannesburg Summit which dedicated chapter III of its Plan of Implementation to "changing unsustainable patterns of consumption and production" and called for "the development of a 10-year framework of programmes in support of regional and national initiatives to accelerate the shift towards sustainable consumption and production." This has provided a stimulus for greater work in this field, increased exchange of experience and information, and greater international cooperation.

72. In preparing this paper, an effort was made to include examples from all regions and from countries at all levels of development. The review indicated that most activities of the sort described here have taken place in developed countries, but that activities in developing countries have been increasing in recent years. The review also indicated that activities in developing countries often drew on the experience and technology of developed countries. This is in keeping with the call in the Johannesburg Plan of Implementation, reaffirming that in Agenda 21, for all countries to "promote sustainable consumption and production patterns, with the developed countries taking the lead and with all countries benefiting from the process."⁵⁸

73. While this paper has focused on achievements in making consumption and production patterns more sustainable, more general analyses of trends in sustainable development indicate that the efforts to change consumption and production patterns have generally been outweighed by increases in the volume of consumption and production. The success stories here can serve as a stimulus for efforts to broaden and deepen this work; they cannot be taken as an indication that sustainable consumption and production is being achieved.

74. Nonetheless there has been increasing commitment to changing unsustainable patterns throughout the world, much experience has been gained, and international cooperation and exchange of information and experience are increasing. The Marrakech Process for the development of the 10-year framework of programmes initiated by the Johannesburg Summit is both a response to that trend and an effort to increase further international cooperation toward making consumption and production more sustainable.

NOTES

- ¹ www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm, chapter III, paras. 14, 15.
- ² www.un.org/esa/sustdev/sdissues/consumption/Marrakech/MarrakechReport.pdf
- ³ www.un.org/esa/sustdev/csd/csd12/csd12_docs.htm
- ⁴ OECD, Environmentally Sustainable Buildings: Challenges and Policies, 2003.
- ⁵ Calculated from data from US Energy Information Administration (www.eia.doe.gov/emeu/aer/enduse.html) and California Energy Commission (www.energy.ca.gov/electricity/consumption_by_sector.html).
- ⁶ Molly O'Meara Sheehan, City Limits: Putting the Brakes on Sprawl, WorldWatch Working Paper 156, 2001, pp. 52-53.
- ⁷ Sustainable Development Notes, March 2003, World Bank, www.worldbank.org/participation/sdn/snd71.pdf
- ⁸ WorldWatch Institute, State of the World 2004, p. 30; and Molly O'Meara Sheehan, City Limits: Putting the Brakes on Sprawl, WorldWatch Working Paper 156, 2001, pp. 10-11.
- ⁹ US Department of Transportation, www.fhwa.dot.gov/tea21/factsheets/index.htm, 12 April 2004.
- ¹⁰ Informal Transport in the Developing World, UN-HABITAT, Nairobi, 2000, p. 85.
- ¹¹ Molly O'Meara Sheehan, City Limits: Putting the Brakes on Sprawl, WorldWatch Working Paper 156, 2001, pp. 27, 33.
- ¹² Pablo Allard, "The Tough Road to Living City", in *ReVista: Harvard Review of Latin America*, Winter 2003, at <http://drclas.fas.harvard.edu/publications/revista/cities/allard.html>
- ¹³ [www.gefweb.org/Documents/Council_Documents/GEF_C21/CC - Chile - Executive_Summary.pdf](http://www.gefweb.org/Documents/Council_Documents/GEF_C21/CC_-_Chile_-_Executive_Summary.pdf)
- ¹⁴ Citynet: The Regional Network of Local Authorities for the Management of Human Settlements, News issue #12, Nov-Dev 2003, www.citynet-ap.org/en/Activities/SUTP/sutp3.htm
- ¹⁵ Institute for Transportation and Development Policy, Sustainable Transport e-update, February 2004, www.itdp.org
- ¹⁶ Molly O'Meara Sheehan, City Limits: Putting the Brakes on Sprawl, WorldWatch Working Paper 156, 2001, p. 29.
- ¹⁷ Asian Development Bank, www.adb.org/Documents/Events/2002/RETA5937/Manila/downloads/tp_15B_menon.PDF
- ¹⁸ Economist, 23 Aug. 2003.
- ¹⁹ Informal Transport in the Developing World, UN-HABITAT, Nairobi, 2000.
- ²⁰ Ibid.
- ²¹ P. Newman & J. Kenworthy, Sustainability and Cities, Island Press, 1999, pp. 55-57.
- ²² Consumer Reports, April 2004, p. 7.
- ²³ www.iclei.org/egpis/egpc-160.htm
- ²⁴ New York City Department of Transportation, www.nyc.gov/html/dot/html/motorist/alternativefuel.html.
- ²⁵ Institute for Transportation and Development Policy, Sustainable Transport e-update, February 2004, www.itdp.org
- ²⁶ Ibid.
- ²⁷ Waste Generation and Related Policies, Soizick de Tilly, in *The Economics of Waste*, OECD 2004. See also WorldWatch SOW 2004, p. 16.
- ²⁸ "The Economics of Residential Solid Waste Management", by Thomas Kinnaman and Don Fullerton, NBER Working Paper 7326, www.nber.org/papers/w7326
- ²⁹ OECD, Towards Sustainable Household Consumption: Trends and Policies in OECD Countries, 2002.
- ³⁰ Environment Canada, www.environmentalchoice.com/gipper.pdf
- ³¹ Waste Generation and related policies: Broad Trends over the last ten years, Soizick de Tilly, *The Economics of Waste*, OECD 2004.

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- ³² Don Fullerton & Amy Raub, "Economic Analysis of Solid Waste Management Policies", in Addressing the Economics of Waste, OECD, 2004.
- ³³ "The Economics of Residential Solid Waste Management", by Thomas Kinnaman and Don Fullerton, NBER Working Paper 7326, www.nber.org/papers/w7326
- ³⁴ Cempre News, #72, Jan. '04.
- ³⁵ The Green Dot, www.gruener-punkt.de
- ³⁶ Packaging Recovery Organization Europe, www.pro-e.org/indexeurope.htm
- ³⁷ WorldWatch Institute, State of the World 2004, pp. 44-45.
- ³⁸ europa.eu.int/scadplus/leg/en/s15002.htm
- ³⁹ Japan Ministry of the Environment, www.env.go.jp/en/
- ⁴⁰ Danish Ministry of Environment and Energy, <http://www.mst.dk/udgiv/Publications/1995/87-7944-324-9/html/8.htm>
- ⁴¹ "The Economics of Residential Solid Waste Management", by Thomas Kinnaman and Don Fullerton, NBER Working Paper 7326, p. 19, www.nber.org/papers/w7326, and "Waste generation and related policies: Broad trends over the last ten years, Soizick de Tilly, in The Economics of Waste, OECD 2004.
- ⁴² UNU/IAS Working Paper No. 24, Martin Medina, 1997, www.gdrc.org/uem/waste/swm-ias.pdf
- ⁴³ Laila Iskandar, "Integrating Local Community -based Waste Management into International Contracting", Report of the Workshop on Solid Waste Collection that Benefits the Urban Poor, Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries, 2003.
- ⁴⁴ MOST Clearing House Best Practices in Human Settlements, in cooperation with the Together Foundation and UN Habitat, www.unesco.org/most/asia3.htm
- ⁴⁵ Mansour Ali, "Community -based Enterprises: Constraints to scaling up and Sustainability", in Report of the Workshop on Solid Waste Collection that Benefits the Urban Poor, Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries, 2003.
- ⁴⁶ UN-HABITAT-Together Foundation Best Practices Database, www.bestpractices.org/cgi-bin/bp98.cgi?cmd=detail&id=21280
- ⁴⁷ Ibid.
- ⁴⁸ E.B.N. Chimano, "An Overview of Progress in Dar-es-Salaam", in Report of the Workshop on Solid Waste Collection that Benefits the Urban Poor, Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries, 2003.
- ⁴⁹ Water and Sanitation in the World's Cities, UN-HABITAT, Earthscan, 2003, p. 196.
- ⁵⁰ South Australia Water, www.sawater.com.au/Restrictions
- ⁵¹ WorldWatch Institute, State of the World 2004, pp. 55, 59.
- ⁵² www.environment-agency.gov.uk/subjects/waterres/286587/487004/487681/?version=1&lang=_e
- ⁵³ Water for People, Water for Life: The United Nations World Water Development Report, World Water Assessment Programme, p. 433-442, www.unesco.org/water/wwap
- ⁵⁴ "Wastewater Reuse: The Hashemite Kingdom of Jordan", by Fayez Bataineh, Mohamed Najjar and Saleh Malkawi, www.idrc.ca/waterdemand/docs/english/rfrnc_wstwtr.shtml
- ⁵⁵ ICLEI, Local Government Action on Water, Sanitation and Human Settlements: Case Summaries, Background Paper No. 5, CSD-12, 2004.
- ⁵⁶ UNEP Division of Technology, Industry and Economics, www.uneptie.org/pc
- ⁵⁷ Business and the UN: Partners on Sustainable Development, United Nations, New York, 1999, p. 34.
- ⁵⁸ Johannesburg Plan of Implementation, para. 15; Agenda 21, para. 4.8.