## SUSTAINABLE DEVELOPMENT, ENERGY AND the CITY



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# SUSTAINABLE DEVELOPMENT, ENERGY AND THE CITY

## A CIVILISATION OF VISIONS AND ACTIONS

by VOULA MEGA Bruxelles, Belgium



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## With gratitude For all those who taught me the greatness, integrity and beauty of our world

To all those who sow the seeds of civilisations and strive to extend the limits of the possible...

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#### ACRONYMS

ACRR: Association of Cities and Regions for Recycling **CEEC:** Central and Eastern European Country **CEMR:** Council of European Municipalities and Regions CERES: Coalition of Environmentally Responsible Economies and Societies CHP: Combined Heat and Power COMEST: UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology CSD: Commission on Sustainable Development ECCP: European Climate Change Programme ECMT: European Conference of Ministers of Transport ECSC: European Coal and Steel Community EEA: European Environment Agency EEA / EFTA: European Economic Area / European Free Trade Association (Iceland, Liechtenstein, Norway, Switzerland) EFDA: European Fusion Development Agreement EFUS: European Forum for Urban Safety EMAS: Eco-Management and Audit Scheme (The integration of energy efficiency in EMAS led to the E2MAS) ESCT: European Sustainable Cities and Towns EU: European Union EU-15 European Union of 15 member States EU-25 European Union of 25 member States (since 1.5.2004) EURATOM: European Atomic Energy Community EUREC: European Renewable Energy Centres EWEA: European Wind Energy Association FMCU-UTO: World Federation of United Cities **GDP:** Gross Domestic Product **GEF:** Global Environmental Facility GHG: Greenhouse Gases (carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O)) HIV/AIDS: Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome IAEA: International Atomic Energy Agency ICLEI: International Council for Local Environmental Initiatives IEA: International Energy Agency IFHP: International Federation of Housing and Planning **IPCC:** Intergovernmental Panel on Climate Change ISOCARP: International Association for City and Regional Planners

ITER: International Thermonuclear Experimental Reactor

IPCC: Intergovernmental Panel on Climate Change

ISOCARP: International Association for City and Regional Planners

ITER: International Thermonuclear Experimental Reactor

JET: Joint European Torus

NGO: Non-Governmental Organisation

OECD: Organisation for Economic Co-operation and Development

OPEC: Organization of the Petroleum Exporting Countries (Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela)

**RES:** Renewable Energy Systems

RES-E: Electricity from Renewable Energy Sources

SME: Small and Medium-sized Enterprise

UNCED: UN Conference on Environment and Development (Rio de Janeiro, 1992)

UNDP: UN Development Programme

UNECE: UN Economic Commission for Europe

UNEP: UN Environmental Programme

UNESCO: UN Educational, Scientific and Cultural Organisation

UNFCCC: UN Framework Convention on Climate Change

UNPF: UN Population Fund

WBCSD: World Business Council for Sustainable Development

WHO: World Health Organisation

WMO: World Meteorological Organisation

WSSD: World Summit on Sustainable Development

WTO: World Trade Organisation

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#### PREFACE

#### **By Professor Sir Peter Hall**

It is a huge pleasure to be invited to contribute a preface to Voula Mega's remarkable new book. Many millions of words must have been written on the subject of sustainable development since its coinage in the historic Brundtland report of 1987, but very few of them address the theme of sustainable urban development so directly and so centrally as this work.

For the first time, the interested reader – whether beginning student or mature specialist – will find, within one set of covers, the essence of the challenge that faces urban professionals worldwide, and the essential knowledge needed to confront it.

Of particular merit is the fact that, drawing on her unusually wide experience in different professional agencies, Voula Mega has produced a book full of vital scientific and technical data, but has done so in a way that makes it immediately accessible to the non-scientist. But she goes with equal authority into the economic and social spheres, and then into specific physical planning actions with case studies taken from cities worldwide.

This book will instantly become a standard text – surely the standard text on the subject. But it deserves to be read by a much wider audience of concerned citizens in cities the world over. It is a brilliant achievement.

Professor Sir Peter Hall Bartlett Professor of Planning University College London

## **INTRODUCTION**

## SUSTAINABLE DEVELOPMENT, ENERGY AND THE CITY: THE ESSENCE OF A CIVILISATION

Since the beginnings of time, cities and energy are linked to the rise and fall of civilisations. Nurtured with Promethean visions, they always offered the foundations for new worlds and eras. At the dawn of the civilisation of sustainability, they are on the forefront of visions and actions. They have crucial links with the creation of a healthy environment, social cohesion and economic development, in harmonious co-evolution and through processes of democratic participation. Old models are being rejected and innovations open up the range of opportunities. Technological progress is essential, but institutional change and socio-economic innovation are equally crucial to meet the challenges of a prosperous, healthy and rewarding future.

The active participation of informed and aware citizens is a condition for advancing towards sustainable development. The main aim of this publication is to provide the unspecialized decision-makers and interested citizens, but also experts and leaders of the future, with significant information and insight in a nutshell about the civilisation of sustainability and the role of energy (flows, technologies and dynamics) and cities (spaces, economies, societies and cultures). Policy choices and investments of the next years will be most decisive. The cost of inaction, technological dependencies and unsustainable cultural patterns may be unbearable.

Defined as a call for inter- and intra-generation equity, an eternal spring with permanent efflorescence, or business's and communities' investment in the future, the concept of sustainable development evolved significantly from a strictly ecological concept into a journey towards an economically robust, socially equitable and environmentally sound future, promoted by active citizen participation. Sustainability largely extends traditional environmental policies. It widens the scope to cover socioeconomic and cultural criteria and it demands new ethics, models and patterns. Dynamic integration and balance are key principles. Energy is crucially linked to all parts of the equation, while urban performances are critical for global progress.

Sustainability sheds light on the interrelated quantitative and qualitative aspects of development. Globalization projects communities and businesses onto the world; sustainability projects them onto the future. The road towards sustainable development could be construed as an Odyssey towards Ithaca. The ultimate goal is not only the destination but also the wisdom gained during the struggle against the Sirens of environmental deterioration and over-consumption.

The trajectory towards sustainable development asks for new policy approaches, including optimal portfolios of regulation and enforcement, economic instruments, voluntary measures, information and awareness raising. Diagnosis of the market and government failures, resulting in unsustainable patterns and hindering progress, should be followed by a prognosis of the adequate measures and their implementation. Alliances can bring together stockholders, stakeholders, shareholders and citizens and play a critical role in the implementation of sustainable policies.

Energy, the very fuel of all human activities, is synonymous to life and vitality. It is ubiquitous and concerns everybody, everywhere. It supports all socio-economic progress and has profound links with the environment. Its generation and use involve the irreversible use of precious natural endowments or the costly harnessing of inexhaustible renewable assets. Global warming, prominent issue in geopolitical strategic agendas, is mainly due to energy production and consumption. It is also the end result of decisions taken everyday in local environments.

Energy is a precondition and a catalyst of development. Two billion world citizens still have no access to modern electricity services. During the

20<sup>th</sup> century, the number of people on earth increased four-fold, while energy consumption was multiplied by sixteen. The degree of electrification has always served as an indicator of development. Fundamental unsustainable divides can be crystallized by the ratio of annual electricity consumption per capita in the least developed and developed world: 100 kWh versus 10,000 kWh.

In 2004, the first oil price crisis of the millennium is particularly worrying and can cast a shadow on the global economic landscape. Over a three year period, sustained high oil prices could reduce world economic growth by 1 percentage point.

The-UN Conference on Environment and Development in Rio de Janeiro in 1992 was instrumental in mapping out opportunities for sustainable development. Ten years later, the Johannesburg World Summit on Sustainable Development highlighted the urgency for more sustainable urban patterns and for a substantial increase of the share of renewable energy in the total energy supply. Progress will largely depend on the rationalization of consumption patterns, particularly transport, often impinging on deeply held cultural values. Policies and actions, targeted at changing citizen behaviour, should also address the socio-economic and political context within which consumption decisions are shaped. Long-lived investments in energy and transport infrastructures, industry, and urban and regional planning, may lock individual and collective action into unsustainable patterns.

Eighty per cent of EU citizens live in cities, which consume seventy five per cent of final energy demand. "Habitat II", the last UN Summit of the 20<sup>th</sup> century, highlighted the opportunities and threats and the strengths and weaknesses of urban agglomerations in advancing towards sustainable development. Cities are complex and dynamic ecosystems that underpin socio-economic activity and cultural efflorescence. They mobilize large flows of people, raw materials, energy, products, waste and emissions, and have enormous ecological footprints.

Sustainability asks for urban metabolisms, which are the processes that lead from inputs of materials, energy and labour to flows of products and services, to become circular rather than linear and offer the optimal value with the least impact on the environment. Eco-efficiency, eco-design and eco-auditing are most important for businesses and local authorities wishing to offer better, efficient, effective, citizen and environment friendly, products and services.

Environmental deterioration and social exclusion go hand in hand in many cities. Urban arteries often get blocked by traffic, pollution and waste. This may result in urban thrombosis and asphyxia. Sustainable regeneration and urban renaissance are major objectives for cities wishing to enhance their energy flows and quality of life. Cities are the only places where people and resources congregate at a point beyond which synergetic effects become more important than the simply additive ones. They also constitute laboratories of the future, places where most innovations are introduced and where cultural patterns are shaped. Last but not least, cities have always promoted open democracies. Citizen participation is the common denominator of all paradigm shifts introducing the civilization of sustainability.

The Johannesburg World Summit on Sustainable Development agreed on a comprehensive agenda to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound services and resources. Renewable energy flows are very large in comparison with commercial energy demand. Technologies to realise the potential of renewable energy flows exist to a large extent. Renewable technologies could be competitive with the conventional ones if the full costs and benefits of all energy options are taken into account. Government frameworks should help level the playing field and create a more favourable climate for the integration of renewable options in planning processes. The next decades will be critical, since more developed countries have to replace their ageing systems and developing countries get access to modern energy services.

Agenda 21, the Rio blueprint of action for the twenty first century, provided an international benchmark for urban performance. The preparation of local agendas for the twenty first century created a global momentum for the analysis and the enhancement of the urban environment. Energy is highlighted as an influential parameter for advancing towards the resourceful sustainable city. The Charter of European Sustainable Cities describes sustainability as a creative, balance-seeking process, extending into all areas of local decision-making. To succeed a sustainable city has to achieve a dynamic balance among economic, environmental and socio-cultural development goals, underpinned by an active citizen participation.

Knowledge embedded in products and services drives growth and employment and may be beneficial for the environment. Cities have to develop and adopt cleaner energy technologies and resource-saving innovations. They have to promote low-emission standards, to improve resource (and waste) management cycles and enhance the role of new and renewable energy technologies. Investments in research and technology have to be coupled with structural changes including restructure of public expenditure, fiscal incentives, guarantee schemes and public support for risk capital. Moreover, the knowledge-based eco-city not only requires advanced environmental technologies, but also education and change in behaviour and lifestyles. Technical and social innovation can reinforce each other and extend dramatically the limits of the possible.

At the beginning of the millennium, cities and the energy field are on the verge of dramatic changes. Urban and energy systems are capital intensive and have long lives. Immediate change is difficult and innovation is crucial for inefficient patterns to be transformed into more intelligent systems. Strongly entrenched ideas start to vacillate and new investments challenge the inertia of old infrastructures. New concepts, values and technological breakthroughs emerge, linked to policy and market initiatives, public expectations and scientific developments. A great proliferation of events and conferences, dissemination of the best practices and declarations of principles are characteristic of ground-breaking epochs.

In the European Union, energy and urban policy issues are at the crossroads of key economic, social and environmental policies, interests and concerns. Two of the three treaties establishing the European Communities (the European Coal and Steel Community and the European Atomic Energy Community) are about energy. The Strategy for Sustainable Development, launched in 2001, considers sustainable development to be a long term global objective grounded on common values and aspirations shared by the member States. The strategy completes and builds on the Lisbon strategy for the EU to become the most competitive and dynamic knowledge-based economy of the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. Agriculture, fisheries, transport, energy and cohesion are instrumental EU policy areas.

The EU strategy asks for the integration of principles of sustainability in all policies and suggests an array of enriched and strengthened policy instruments, to engage decisively on the trajectory towards sustainable development. The enlightening debate on urban sustainability promoted by the European Commission created new prospects for concerted action by European cities. The high dependence of the European Union on both fossil fuels and imported energy products is considered to be a prominent problem highlighting the urgency for EU research and policy agendas to promote the realisation of the enormous potential of renewable energy resources and invest in cleaner technologies. The Kyoto commitments are a powerful driving force. The entry into force of the protocol on 16 February 2005 is expected to inaugurate a new era of international cooperation for sustainable development.

This publication focuses on concepts and actions linked to cities and energy at the dawn of the civilisation of sustainability. It suggests that this civilisation cannot be the results of linear evolution and business as usual scenarios but of qualitative leaps and innovations. This often implies a radical shift to the creation of something new at the expense of something conventional.

Particular attention is being given to key European Union developments and innovations that can provide models and lessons for the world. This publication is based largely on research and studies managed by the author. It draws from articles published during the last ten years, after the author's experience with the related policies in the EU and the OECD. It embraces the broad horizon of issues and wishes to strike a balance among coverage and depth. It strongly advises to go further and deeper into each of the themes.

The first chapter examines the broad panorama of cities and the world demographic dynamics and focuses on European urban developments and the efforts of European cities to meet the challenges of sustainability. It highlights the importance of innovations and best practices for breaking new ground and the use of indicators as a yardstick of progress. The second chapter focuses on key elements of the urban environment and the principles and actions inaugurating new models and patterns. Eco-efficiency and improvement of the urban metabolism are crucial. Resource and waste management, energy and transport, quality of air, and contribution to climate change are of extreme importance to cities that become laboratories of ecological innovation and provide inspiring examples. The third chapter offers an insight into energy production and consumption models. It examines cleaner energy options and technologies, and renewable energy sources. It presents the contribution of nuclear energy and the ethical questions linked to access and use of energy. The new member States of the European Union and the developing countries have to meet particular challenges. The fourth chapter addresses the issues of energy policy, security and markets, mainly in the EU. It concludes with the specific problems of renewable energies trying to penetrate the market and the actions devised to overcome obstacles. The fifth chapter sheds light on the potential of all energy options, from the traditional fuels to nuclear fusion and renewable energy sources, which can form part of a less unsustainable energy future.

The sixth and seventh chapters shed light on the socio-economic vitality and the cultural energy of cities. Issues of competitiveness and employment, equity and social justice, living conditions and public health touch the very heart of cities and impact their potential for sustainability. Heritage and culture define urban identity. Citizens project their hopes and desires into the urban reality and legend. Public spaces can promote collective life and local democracy and bring added value to places. The final chapter examines paths to brighter urban futures. From strategic planning and sustainable regeneration, to citizenship and institutional and civic alliances, the horizon of instruments and initiatives is rich and instructive.

The postface offers information about the EU research agenda on Sustainable Development and the main axes of the current Framework Programme on Research and Technological Development on global change and ecosystems, sustainable energy and transport systems. The European and international selected literature and websites, included at the end of the book, should respond in a more complete way to specific questions in relation to the issues. Last but not least, a set of sustainability indicators in the annex aims at inspiring cities in search of significant yardsticks of progress.

This publication is illustrated with some of the best practices and exemplary cases. They constitute a kaleidoscope of innovations at the forefront of urban and energy developments. One should be reminded that there are no "accreditation systems of best practices" at the European or international level and this overview should be seen under the prism of relativity, intrinsically linked to the very notion of innovation, born to be surpassed.

The power of example may be decisive in navigating forward. The panorama of innovative urban sites and energy projects which breed noble emulation and continuous surpassing can inspire and encourage leaders, experts, and citizens. From urban paradigm shifts to nuclear fusion, innovations demonstrate that the most inexhaustible resources are not only renewable assets, but also knowledge and innovation.

Sustainability means, first and foremost, sustain ability to innovate and progress. The end of the petrol era will certainly come before the world runs out of oil. The end of divided and deteriorated cities will unquestionably come before they drown in their problems. Everything depends on human ingenuity to reinvent the world. This is the true and pure power, in every sense of the word.

#### Chapter 1

## CITIES IN THE CIVILISATION OF SUSTAINABILITY

This chapter examines the broad panorama of cities and the world demographic dynamics and focuses on European urban developments and the efforts of European cities to meet the challenge of sustainability. It highlights the importance of innovations and best practices for the civilisation of sustainability and the use of indicators as a yardstick of progress.

#### 1. WORLD CITIES AND DEMOGRAPHIC DYNAMICS

At the dawn of the third millennium (also called the "urban" millennium), humanity stands at a very important crossroads. For the first time in history, urban dwellers are about to outnumber the rural ones. The global urban population, estimated at three billion in 2003, is projected to exceed the 50% mark by 2007 and to reach five billion in 2030, the year in which more than three fifths of the world population are expected to live in urban areas. Almost all of this growth is expected to be absorbed by the urban areas of the less developed world. Beyond the simple demographic growth, urbanization is a prime cultural process and a key issue for sustainable development. Cities embody the values of the civilisations which created and transformed them (UN/HABITAT 2002, UN 2004a).

#### VOULA MEGA

Everywhere in the world, cities are human nests, places of social interplay, confrontation and dialectics. They are theatres of civilization, schools of abilities and values, and temples of learning about life in society, citizen duties, and rights. They have been defined as places in which the human genius is expressed, a palette of possibilities, a melting pot of potential that has not yet been exploited. Alcaeus (7<sup>th</sup> century BC) suggested that "cities are not made from their roofs, stone walls, bridges and canals but from men able to grasp opportunities and make the most of them." According to Aristotle (4<sup>th</sup> century BC), the city is "built politics." Vitruvius (1<sup>st</sup> century BC) stated that "cities should be solid, beautiful and useful", built with order, eurhythmy, symmetry, propriety and economy.

Cities are both living organisms (ecopolises) and technical contrivances (technopolises). C. Levi-Strauss defined the city as nature and culture, individual and societal, a space of injected life and invested dreams. He called it the "human invention par excellence." L. Mumford spoke about the city as "the form and symbol of an integrated social relationship", and stated that "the test of a great city is the life it makes possible for its citizens." J. Jacobs defines cities as places that generate, in an ongoing way, their economic growth from their own resources and from the "disordered order" of human interactions. For L. Borges, "The city is also the other street, the one we never take, it is the secret centre of blocks, the ultimate courtyards, it is what facades conceal, it is my enemy if I have one, it is the person who doesn't like my verses, it is what is lost and what will be, it is the ulterior, the different, the lateral, the quarter that is not yours, neither unique, the one we ignore and we love." R. Sennet suggested that "a city is made out of difference, diversity and anonymity; it represents the possibility of meeting the unknown." Last but not least, according to P. Geddes "a city is a dramatic action."

Cities are hives of human activity, the only places where people concentrate at a point beyond which the dynamic synergetic effects become more important than the merely accumulative ones. C. Doxiadis characterized a typical small village as 250 red dots and one blue dot. The blue dot served as a metaphor for the one notably different person (e.g. a wise, a saint or a fool) distinctive from the population symbolised by the red dots. As the size of settlement increases to that of a small town, four or five blue dots appear floating around. In a still larger town, two blue dots may actually meet for the first time and, as the scale grows, blue dots may come together, reinforce each other and impact on the surrounding red dots. A city is, therefore, a matter of critical mass, which, once reached, has a self-engendering and fulfilling capacity (Doxiadis 1974, 1975a, b).

It seems that cities display the resilient, self-organising, dynamic balance of living organisms. Their growth evolves along cyclic lines that constitute the phenomenon of "urban transitions. Urban transitions depend on the geographical position of cities, the architecture of the national territories and the pace of economic growth. Urbanization is the first stage of the cycle, characterized by fastest growth in the city centre. The second phase is sub-urbanization, with fastest growth at the suburban ring. Next is counter-urbanization, characterized by a population decline, mainly in the urban core and often even in the surrounding suburbs. This phase is also called "rurbanization", when rural regions benefit from the loss of the urban population. Last but not least, re-urbanization indicates that the core grows again faster than the suburbs. Most developed cities are at the third or the fourth stage of the cycle. Some of them have even initiated a new cycle with migration waves towards regenerated city centres.

The world has been steadily urbanizing for centuries. Industrialised regions were always more urbanized than the less developed ones and had already reached the "urban age", half a century ago. The gap in urbanization levels increased between 1950 and 1975 and has narrowed since 1975 and it is expected to narrow further by 2020. Urban dwellers represented 50% of the total population in OECD regions in 1950, 70% in 1975 and 77% in 1995. Waves of intense urbanization have followed periods of economic growth in Northern Europe and subsequently in the United States, Japan, Australia and New Zealand.

In less developed regions, the urban population shares of the total populations were less than 20% in 1950, 27% in 1975 and 35% in 1995. Towards the end of the year 1970, the share of the urban population in the total population growth in the less developed regions exceeded for the first time the one in the developed regions. Since then, most urban growth has taken place in developing countries, fuelled by both rural-urban migration and natural population increase. The reclassification of some settlements as cities contributed significantly in increasing the urban share in many countries. If China or other populous nations modified the

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administrative boundaries of cities, estimates of the world urban population would change considerably (UN 2002a).

The annual rate of urbanization in the developed regions has almost remained unchanged from 1980 to date at about 0.3% per year. It is expected to remain relatively unchanged in the near future and to be at the same levels in 2020. The rate of urbanization in the developing regions was four times higher in 1980, when it started a downward trend expected to continue in the future. As a result, the world rate of urbanization was 1% during the decade 1990-2000 and it is expected to reach 0.8% in 2020.

The urban growth rate has been declining since the late eighties in both the developed and less developed regions. In spite of this decrease, the average absolute annual increment is steadily becoming larger. Paralleling the shift of the demographic centre of gravity towards the less developed regions, 90% of the global urban increment comes from the less developed regions. Their contribution is expected to reach 97% in 2020. Within the range of less developed regions, the least developed countries have both a lower rate of urbanization and a faster urban growth.

Europe's share in the world urban population is decreasing. In 1950, about two thirds of the urban population in the developed regions resided in Europe. Urban population growth rates reached their peaks during the period 1960-1965 and declined thereafter. Urbanization rates are higher in Northern and Western Europe. The growth rate of the rural population was already negative in Europe in 1950. The rural population in Europe is expected to be less than half the 1950 levels by the year 2020.

The process of economic development is closely linked to the phenomenon of demographic transitions. The causal mechanisms of a demographic transition include economic growth, education, health care, rural - urban shifts, family structures and employment patterns, especially linked to female labour, and public policies. Forms and speed of transitions vary greatly, but the general movement presents some broad characteristics.

Previous to the industrial revolution, all countries experienced high birth rates and high death rates resulting in slow or no population growth. In the era of industrialization, and as many world countries reached a high level of economic development, death rates fell drastically, due to breakthroughs in science, better social conditions and improved health and hygienic care. At the same time birth rates remained high (and increased after the wars), resulting in a very rapid population increase.

Since the early 1970s, a second transition has taken place in OECD countries, resulting from declining birth rates. As birth rates fall, the population stabilizes at a new higher level. This transition is now also taking place in many developing countries, but stabilization in the population could take decades, since these countries have very young populations and large number of females in the birth giving ages. Recently, the second demographic transition has resulted in ageing population in many countries. Population levels have more or less stabilized and the number of the elderly increases continuously. In some European countries, and in particular in the former republics of the Soviet Union, population levels are actually decreasing.

In 1999, the total world population reached 6 billion. It was 1 billion in 1804, 2 billion in 1927, 3 billion in 1960, 4 billion in 1974 and 5 billion in 1987. The UN Population Prospects indicate that, presently, the population growth rates fall faster, fertility declines are broader and deeper and migration flows larger than at the beginning of the last decade of the century. Eighty per cent (4.7 billion) of the world population live in less developed regions and 20% in the developed countries, which comprised 32% of the world population in 1950. Asia alone accounts for 61%, Africa 13%, Europe 12%, Latin America and the Caribbean 9%, and North America 5%.

The current population growth rate of approximately 1.3% per year is the lowest one since the Second World War, significantly less that the peak growth rate of 2.04% in 1960-70, less than the 1.72% rate of the following two decades and less than 1.42% between 1990 and 1995. Average annual population increments exhibited a time lag of about two decades. In fact, 1990 marks a historic reversal: the absolute population increments reached their highest of 87 million persons added every year and have been decreasing since then (UN 2002a).

During the years 1995-2000, the world population grew by 78 million per year. The world population continues to grow by 76 million

inhabitants per year. In 2050, the world will count 2.5 billion additional inhabitants.

The world average figures conceal large differences across countries and regions. During the period 1950-1998, the population of the less developed regions increased by 168% (1.8% per year), while the population of the developed countries increased only by 45% (0.4% per year). During the last decade, only 6% of the global annual increment originated in the developed regions, while 94% originated in the less developed regions. It is important also to highlight the increasing demographic weight of the 48 least developed countries, which account for 17% of the total world population growth. They experience higher fertility, higher mortality and higher population growth, almost a full percentage point greater than that of the other countries.

Europe is the only world region with a growth rate less than one per cent during the last twenty years. Population growth is still positive (0.03%), but natural increase starts to be negative in countries like Germany and Italy. Seventy five per cent of the population growth in the European Union is due to net migration gains. Central and Eastern Europe experience population decrease, due to out-migration, sharp fertility declines and rising or stagnant mortality.

The global average fertility level stands at 2.7 births per woman, almost half of the fertility rate of 5 births per woman in 1950. Birth rates are now declining in all regions of the world. Africa has the highest fertility rate of 5.1 births per woman. In practically all OECD countries, fertility is currently significantly below 2.1 births per women, which is the fertility rate necessary for the replacement of generations. The United States and Mexico exhibit currently the highest population growth in the developed world (1.99% and 2% respectively). In Spain, Czech Republic, Italy, Greece, Germany, Portugal and Hungary, Austria, Japan and Switzerland the fertility is under 1.5 births per woman. In the Nordic countries, in particular Sweden and Norway, fertility substantially increased in the late 1980s and the early 1990s and approached or even surpassed the replacement level, before declining again.

Fertility rates in less developed regions have always been about double than in the developed regions. The African level is estimated to be almost twice as high as that of other less developed regions. In the early 1980s, all the developed regions, except Eastern Europe, presented below replacement fertility levels ranging from 1.6 births per woman in Western Europe to 1.8-1.9 births per woman in North America and Australia, while fertility in Eastern Europe was at replacement level. In the early 1990s, fertility rates had increased in North America and fell sharply in Eastern and Southern Europe. Within the European Union, after years of steady decline, the total fertility indicator reached the bottom of 1.42 births per woman in 1995 and an upturn has been observed since then (UN 2002a).

Mortality is continuing to decline and, globally, life expectancy at birth increased by more than 6 years over the last twenty years. The estimated life expectancy at birth in the developed regions (74.2 years) is more than 12 years higher than in the less developed regions, which is, in turn, more than 12 years higher than the one in the least developed regions (49.7 years). OECD regions exhibit an average life expectancy of above 75 years. Japan has the highest life expectancy in the world (79.5 years), followed by Iceland and Canada. Among the world regions, North America (76.7 years) and Australia (72.9 years) exhibit the highest life expectancy rates. At the other end, Africa presents the lowest average life expectancy at birth (51.8 years) and the highest infant mortality. In Africa, 50% of all deaths occur below the age of 10, while in Europe and North America death occurring below the age of 10 is under 2 per cent.

In most world regions, there are gender differentials in life expectancy, favouring women, by four years on average. They tend to increase when overall mortality levels decrease and they score highest in Europe. Central and Eastern Europe were the only regions where life expectancy declined slightly over the last 20 years. This decrease is mainly the result of an increase in deaths from cardiovascular diseases.

At the global scale, the acquired immune deficiency syndrome (AIDS) epidemic has been the main demographic plague at the turn of the century. In many countries, it led to a dramatic drop in life expectancy. Over 22 million people have already lost their lives and more than 42 million are currently living with HIV/AIDS. The United Nations and the World Health Organization revealed that the impact of HIV/AIDS is particularly devastating in Sub-Saharan Africa. During the last decade additional deaths due to the epidemic represented 90% of all additional deaths due to AIDS in the developing world. In the 38 hardest-hit African countries, the average life expectancy at birth is currently almost 10 years less than it would have been in the absence of AIDS. In Botswana one

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out of three adults is infected and life expectancy at birth is anticipated to fall from 61 years during the period 1990-1995 to 40 by 2005.

In 2003, three million people died of AIDS and an estimated five million were newly infected with HIV, half of them between ages 15 and 24. Yet only one person in five at high risk of infection has access to proven prevention actions. The HIV/AIDS epidemic has erased decades of progress in improving living conditions and advancing towards sustainability (UN 2004b). Studies by the UN Population Fund (UNPFA) suggest that if 15% of the population are infected with HIV, the GDP will decrease by 1% per year (UNFPA 2004).

The world geopolitical order has often resulted in significant population movements. Since the mid-1980s, international migration has rapidly gained importance and has been highlighted as a component of population change. The world stock of international migrants increased from 75 million in 1965 to 119 million in 1990 and attained 175 million in 2000, one out of every thirty five world citizens. International migration presents a greater importance for the developed world, where it amounted to 4.1% of the population, while only 1.6 per cent for the rest of the world. Europe and North America presented the highest numbers of international migration, while Japan and Korea have experienced low immigration. In Europe, the greatest flow during 1985-1990 was associated to the waning Cold War, and since 1990, the major source of migrants has been the former Yugoslavia.

The United Nations regularly present three variants of population projections based on past trends and possible future developments regarding fertility, mortality and migration. Medium variant represents the most likely to happen, while the high and low variants delimit the array of probable developments. According to the medium-fertility variant projection, the annual population growth rate will continue declining, from 1.33% in 1995-2000 to 0.34% in 2045-2050 (Figure 1). The absolute annual increment is expected to gradually decline to 64 million in 2015-2020 and then sharply to 30 million in 2045-2050. All variant projections yield similar results with respect to the distribution of the world population. The shares of the Asian and Latin American populations as a proportion of the world population are relatively stable at approximately 60% and 10% respectively, while one per cent decrease per decade of the share of European and North American populations is expected to compensate for the increase of the African population (UN 2004a).

The population of the developed regions of the world is expected to reach a peak of 1.6 billion in 2020, after which the population is expected to decline. Around 2028, there will be as many people in the currently least developed countries as in the developed ones. Until the year 2020 the highest growth rates will continue to be in Sub-Saharan Africa, Middle East and North Africa. This pattern will, however, continue to differ from the pattern of absolute increase in population. The largest increments are expected in South Asia, East Asia and Sub-Saharan Africa.



Figure 1. World population patterns and Outlook 2050. Source: UN

According to the World Bank, population momentum will be the most important contributor to population increase. Even if in many countries fertility rates have fallen below the replacement level, the population will continue to grow as large cohorts move through the reproductive ages, generating more births that are offset by death. Most OECD countries have population momentum between 1.0 and 1.6; however Japan, Finland and Germany seem to go towards population decline. The main increase of the OECD population is expected to occur in the USA (Figure 2).

Population density in the developed countries lies below the median world population density and is now around 33 inhabitants per km<sup>2</sup>. However, the average population density hides huge differences. The density patterns of Australia, followed by those of North America on one hand and the patterns of Japan and Korea on the other, occupy the two ends of the density spectrum. Europe occupies a broad central place, with Scandinavian density patterns overlapping with the ones of North American and the Dutch patterns ranging between those of Korea and Japan.

Population density is expected to remain relatively unchanged in the developed world, as the population stabilizes and national frontiers are well established. USA, Mexico, Australia and New Zealand will be the only regions to increase their population density. Europe has the densest network of cities in the world, with an average distance of 16 Km among urban areas, against 29 Km in Asia and 53 Km in North America.



Figure 2. Estimated and projected population in OECD regions, 1980-2020. Source: UN