RENEWABLE ENERGY POLICY, PLANNING AND PRACTICE IN CITIES AND CITY REGIONS

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Contents

UNESCO – EOLSS SAMPLE CHAPTERS

Summary

Contemporary urbanization dynamics are fossil fuel driven, both locally and globally. This is a historical condition, the explosive result of a past technological revolution that has helped shape twentieth century societal paradigms, particularly those expressed in mass consumerism and urban modernism. This chapter traces the link between the fossil fuel revolution, urban physical change, and major design movements. The historical conditions—even if the power regime constitutes only a proximate force—are so powerful that they determine all major decisions, perceptions, and plans for the future. They are also responsible for a fundamental cognitive dissonance arising from the divergent values experienced in a world of contradictions: the contradiction of wishing to live and work "sustainably" in a world that is fundamentally not sustainable. Given that they were conceived during and for a different era, administrative urban planning, design and development systems will require restructuring to meet the inexorable

demands of a post-fossil-fuel era. However, much of the technological potential, as well as the environmental protection argument, have so far met powerful resistance. This resistance has been seen in pricing, policy making, and in the institutional policy and strategy apparatuses of government, industry and end users, as well as in existing and ever-accumulating, massive and ubiquitous infrastructure investments. This chapter describes promising programs and projects to counter this historically constructed inertia.

1. Introduction

Two daunting challenges confront the world's cities and city regions well within this coming generation, affecting the global urban system and human civilization as a whole: fossil fuel depletion and man-made catastrophic climate change. If these are not swiftly and effectively met their impacts will deeply affect all industrial, world, and mega-city systems—and hit hard the fast-growing, major urban agglomerations of the developing world, along with their economies.

Since the 1970s and 1980s the prospects of fuel depletion have only slowly begun to enter general urban planning and development frameworks, largely as energy efficiency and conservation issues. In terms of climate change, communities only during the 1990s began to recognize that all greenhouse gas (GHG) emissions are directly or indirectly generated locally, through acts of agency, production, or consumption. This provided a boost to the role of local places in the debate since GHGs can be allocated, made, understood locally, and hence form the basis for specific policies, programs, plans, and projects.

A number of organizational and cultural barriers mitigate against swifter, wider change. Among these barriers is the subsidiary regard in which cities are held in the traditional hierarchical frames of international arrangements dealing with globally encountered challenges. Another is posed by the short planning horizons and political uncertainties that prevail on the local level. In terms of policy development, measurement techniques and planning reality, an extraordinary, even paradoxical gulf exists between the global nature of greenhouse gas impacts and fuel depletion prospects, and the local reality that represents both the final impact and original source of globally experienced changes.

Despite the significant hurdles, energy issues have begun to take center stage in the reality of an increasing number of cities and towns around the world. The leaders of these pioneering communities realize that because of the central significance of cities in national economies, and their utter dependence on relatively short-term fossil fuel supplies—and the devastating effect of their burning on human health and the global climate—the speed and magnitude in which renewable energy strategies are introduced will be of crucial importance to the future of global civilization and local cultural settings alike. As socially, politically, economically, and culturally significant settings, cities face increasingly intense local action in their communities' search for improvement of the local environment, and in a rising movement to combat global warming. Business, industry, science, technology, and governments are being challenged to respond and deliver solutions. It is here where a growing number of new urban action and development initiatives are being readied to link local agendas and national frameworks to international challenges and resources.

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The challenges confronting a rapidly urbanizing human civilization are unprecedented. As long as the current path is pursued there is the dilemma of a massive investment in obsolete infrastructures, since any urban area or long-term urban systems element that is intrinsically dependent on fossil fuel will be rendered dysfunctional within only a few decades. All basic urban communication infrastructures, both traditional—such as roads, rail, and air and sea ports—and advanced have been nurtured in a world of total fossil fuel dependency. Indeed, the internet, an increasingly vital global and largely urban network of networks, relies largely on fossil-fuel operated hardware, conduit-based webs, and wireless communication carrying media. If global communications are to be sustained beyond the middle of this century, they must be powered by distributed, ubiquitous, and redundant renewable power supply systems.

2. Major Urban Energy Issues

2.1. Fossil Fuel Depletion and Cities

The world depends on fossil fuel. Fossil fuel use increased five-fold over the past half century, from 1.7 billion tons of oil equivalent in 1950 to 8 billion tons in 1999, providing 85% of the world's commercial energy. The majority of this energy is used either within cities, or for transport to and from cities.

Most contemporary fuel sources, as widely available and relatively peacefully contested sources, are due to expire well within this century. Much of this reality will become globally pervasive within the next thirty to fifty years (see Figure 1).

Even conservative industry, national and international governmental sources estimate that oil will expire by 2050—the depletion of the more easily accessible supply sources is likely to take place already in the 2020-2030 time frame. Given rising use rate scenarios, natural gas is likely to evaporate by 2040. The logistically and environmentally most problematic source of global fuel supply—coal—is expected to expire well before 2100, provided that no large-scale efforts of energy fuel substitution are pursued to stretch its deposits.

Uranium is expected to be depleted by the mid-2030s, even if the daunting cost, security, safety, disposal, and public acceptance dilemmas were not to weigh so heavily against its application. Significant growth rates in uranium use are not anticipated, given the risks involved and a waning willingness among many governments to pursue nuclear fission further. Nuclear fusion, more than half a century after its arrival as a great modern dream, still struggles with enormous conceptual and technical flaws, and the problems associated with huge financial, environmental, and political costs. These include the specter of widespread public resistance to a new generation of nuclear super-reactors.

This outlook for fossil fuel depletion is even more troubling as it is under-emphasized in its public significance. Fossil fuel is the very source of modern economies and their petrochemical, transport and industrial production systems—and hence also sustains the spatial centers of global civilization: cities and city regions. The modern city, its history, forms, and growth dynamics, is entirely inconceivable without it. Yet a persuasive agenda to deal with the prospects equitably, humanely and positively still eludes global

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and local planners alike.

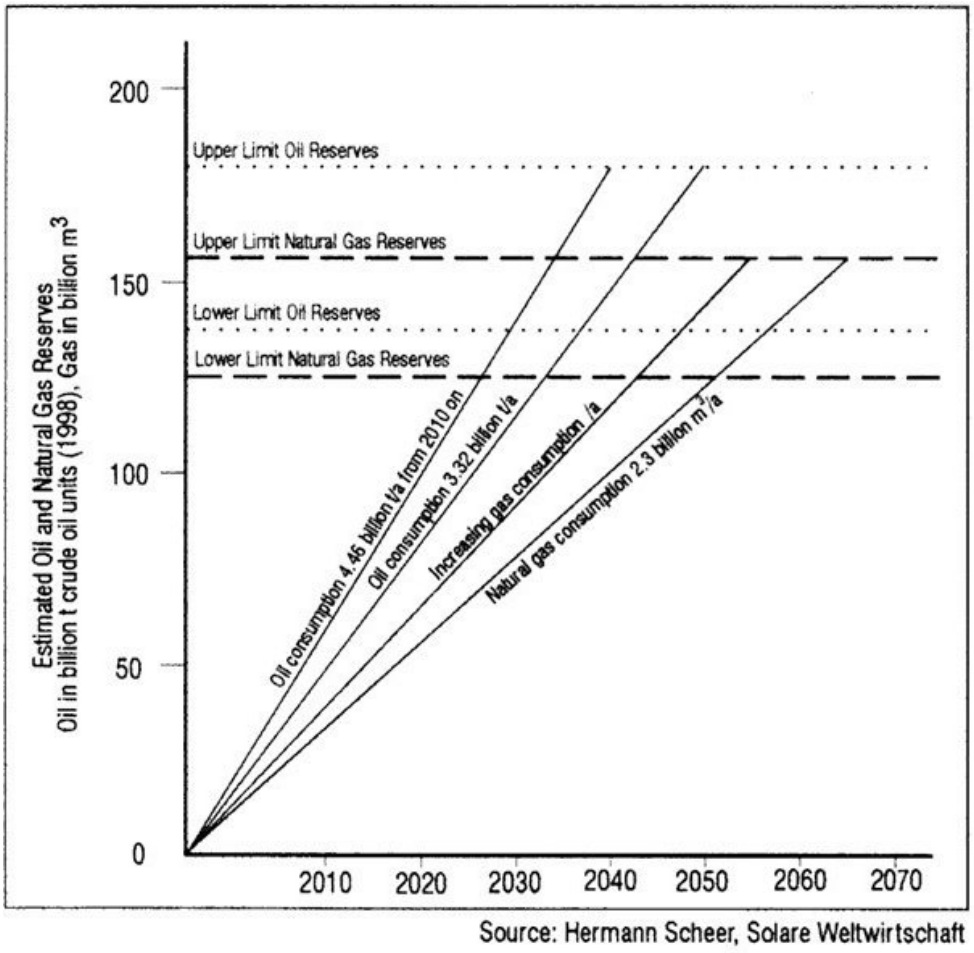

Figure 1. The prospects of fossil fuel depletion under a range of scenarios

Modern cities have mushroomed on their rich fossil nutrient supply, and especially voracious and dependent are the largest, most rapidly growing urban agglomerations. The very logic of their global rise and regional spread is founded on the availability of powerful, centralized, and inexpensive fuels: coal, petroleum, and natural gas—yielding fossil urban structures and patterns based on fossil transport, fossil construction machinery and fossil industrial systems and manufacturing processes. Intensive economies and labor markets clustered around the centralized and networked city regions and were anchored by heavy investments in infrastructure: power, transport and communications. This increasingly bolstered cities' primacy over non-urban hinterlands. The new cities of the nineteenth and twentieth centuries—and the very cultures they engendered—were a product of combustion: London exploded with coal-fired power, and pre- and post-World War II modern city innovations in the Soviet Union, the United States, Europe and across Asia alike were literally jump-started by the electrifying jolt of the new energy technologies. Los Angeles, as urban system, carrier of cultural content and global paradigm, is the proverbial petroleum city.

It is appropriate to refer to contemporary urban areas as fossil cities. The logic of global urbanization becomes transparent when considering the broad availability of

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inexpensive power for all urban infrastructures: building construction, lighting, air conditioning, computing and telecommunications and massive freight and human transport systems on surface, sea and air. These new bundles of infrastructure at once link cities globally and drain their regions. As a consequence, globalized urban systems are inherently more vulnerable to a serious—and inexorable—decline of global fossil fuel supplies than those that rely more on their local and regional human and land resources.

While some local urban systems theoretically are relatively safe from a terminal fossil fuel shock through their reliance on hydro-electric, nuclear or bio-energetic power, no currently utilized alternative energy source alone can help the vast majority of cities world-wide. Also, the interconnectedness of the global system makes it impossible seriously to contemplate the survivability of regional pockets of self-sufficiency. The only viable option to secure the continuity of urban civilization in this century is a system-wide turn to a broad portfolio of renewable energy sources, based on an overwhelming availability of solar, wind, wave, and geothermal energy. The alternative to this path lies in a massive military build-up as it is already being prepared by some leading economies. A global and open escalation of the simmering war over regional fossil resources, currently contained largely in local and regional conflicts, is inevitable without a broad and world-wide introduction of renewable energy sources. Cities and city dwellers would bear the brunt of such conflicts.

2.2. Urban Greenhouse Gas Emissions

Global climate change is perhaps the most long-term and devastating effect of the massive, recent and rapid world-wide burning of much of the global Carbon Age heritage: the organic carbon stores, deposited and sequestered, for example, in coal sediment layers over the past 330 million years. The powerful release of stored carbon dioxide, and other gases of similar atmospheric impacts, destabilizes the planetary climate system through a strengthening of the positive radiation feedback mechanism known as the greenhouse effect. The results of a warming earth surface include rising ocean levels, affected food crops, shifting regional weather patterns and the advance of tropical diseases. There is also the distinctive prospect of catastrophic feedback systems, such as volcanic eruptions in glacial areas, disturbed oceanic methane strata and the thawing of methane-rich tundras.

As primary energy consumers, cities and other urban systems are the largest single sources of CO_2 equivalent greenhouse gas emissions. As hypertrophic urban growth is being fueled by the fossil-fed economy, the new agglomerations also become the worst offenders in carbon emissions, and the most difficult to retrofit to a renewables-based, zero-emissions behavior.

The protocol resulting from the 1997 Kyoto United Nations Framework Convention on Climate Change saw most industrialized nations agree to a 5% cut in carbon-dioxide-equivalent emissions by 2010, although it is commonly agreed that a 60% cut is required to actually halt global warming. As a global target based in international development equity principles, a figure of 3.3 tons of carbon dioxide-equivalent emissions per person per year (based on the customary 1990 figures) is also being proposed as a total sustainability measure to reflect the actual oceanic and forest sink

UNESCO – EOLSS SAMPLE CHAPTERS

capacity of the earth. The United States today produces nearly 26 tons annually per person, while India still lies well below this level, at 1.8 tons (see Figure 2). The result of the large imbalance between nations—the world average lies at seven tons—is the emerging reality of a global carbon trading system, heralded by some as an effective mechanism of overall reductions by some, decried as a rich nation's "license to pollute" by others.

The global need to work towards large-scale savings in fossil-based energy consumption, as well as greenhouse gas (GHG) emissions, calls for a systematic integration of renewable energy products, systems and processes in cities and regions. However, in industrialized countries mitigating action today is still seen to be largely a challenge of energy efficiency and conservation measures: many countries, such as those of the European Union and North America, expect most savings to be made in electricity consumption in residential and commercial building sectors as well as in altered transport and land-use patterns.

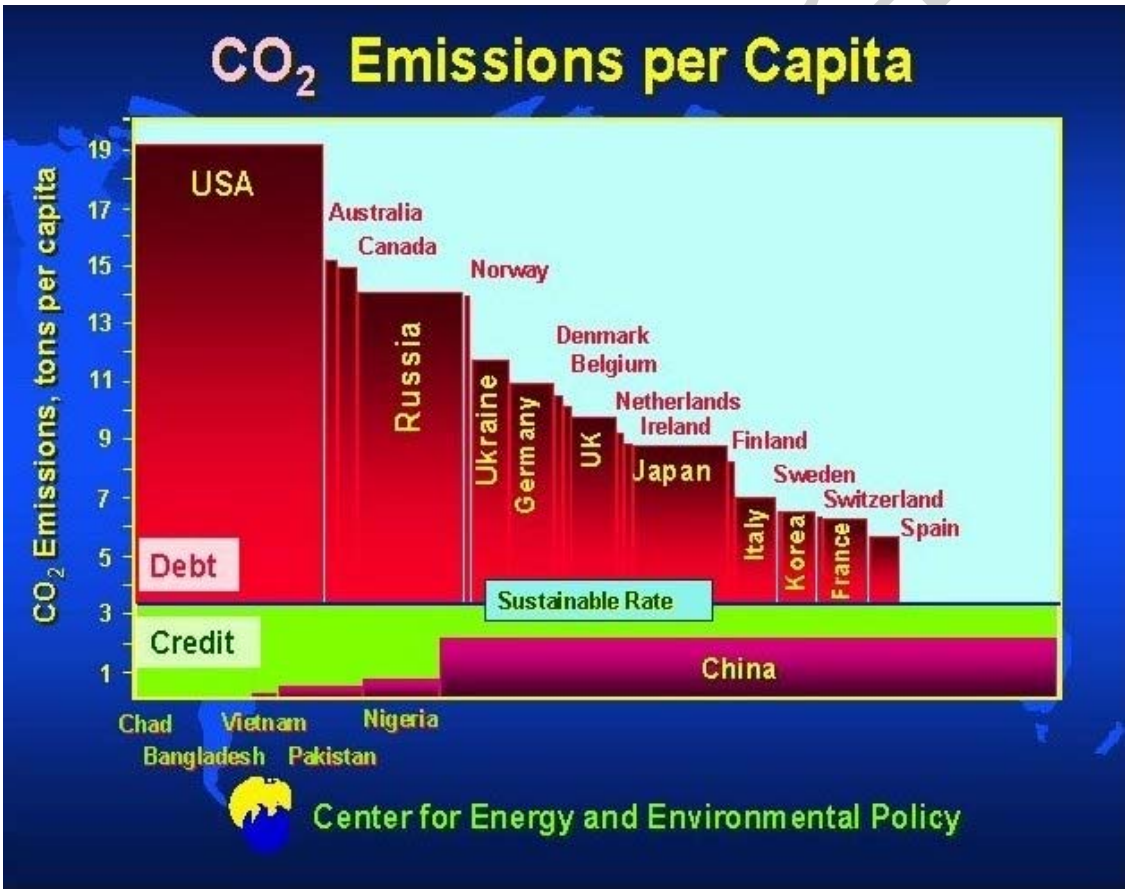

Figure 2. Relative national distribution of per-capita greenhouse gas emissions measured against sustainable levels

In the long run, however, efficiency and conservation measures have limited capacity effectively to reduce fossil fuel use and combat global warming, given the massive fuel requirements that will continue to grow well into this century, and particularly in the developing world. Renewable energy technologies have to be advanced immediately in

order to be available in time for a significant and relevant supplementing and replacement role half a century hence. While cities are increasingly seen as settings for local environmental action, as well as instruments of international and national greenhouse gas abatement, much of the prevailing urban energy agenda is still aimed either at issues of efficiency, or at isolated but highly visible renewable energy technology installations, without a sense of sustained and comprehensive action, or an understanding of the relative value of individual agenda items.

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Biographical Sketch

Professor Peter Droege is Asia Pacific Chair of the World Council for Renewable Energy, and prior to joining the University of Newcastle has directed the postgraduate Urban Design Program at Sydney University for a decade. His academic experience includes a period of more than twelve years in affiliation with the School of Architecture and Planning at MIT and other US educational institutions, and a 1992/1993 position at the University of Tokyo as Urban Development Endowed Chair holder. He was the chief editor of 'Intelligent Environments' an important publication on communications and urban development (Elsevier, 1997).

He served as a member of Prime Minister Paul Keating's Commonwealth Urban Design Task Force and is an adviser to the National Urban and Regional Development Review conducted by the Deputy Prime Minister, Mr. Brian Howe. He has extensive professional and academic experience with urban development and design in Australia, the United States, Europe, East Asia, the Middle East and Africa.

Recent public-sector work ranges from municipal-government assignments such as his posting as urban development and design advisor to the City of Amsterdam, to advisory services to Singapore's National Computer Board and urban development aspects of its IT 2000 Plan. In the private sector he has worked with public space and urban design firms such as that of Kevin Lynch, and as president of a design advisory firm which also developed plans for Boston's Financial Center. In Australia, he has served as urban form and concept design advisor to the initial feasibility study for the Japan-Australia new-city initiative of the "Multifunction Polis" (MFP), and currently performs advisory duties on other urban development projects, conference organizing committees, and design juries.

He has won several design awards, including two Grand Prizes in international urban concept competitions staged in Japan: on information technology and urban development, and on ecological "envelopment" strategies for a coastal region occupied by twelve cities and towns.

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