

From Renewable Energy to Sustainability: The Challenge for Hong Kong

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Abstract

Renewable energy has an important role to play in meeting future energy needs and achieving sustainability. However, its diffusion and deployment is slow in the past decade due to low fossil fuel prices and barriers in the energy market. Rigorous methods are needed to accelerate the development and utilization of renewable energy, and to increase its contribution to the current energy supply mixes.

The need of developing countries to enhance their renewable energy applications will present economic opportunities for trading-based cities. The use of renewable energy in Hong Kong is at present very limited, although their potential is believed to be significant. It is essential for Hong Kong to develop a renewable energy market that will satisfy the local demands for green energy and enhance the renewable energy development together with the Mainland China. The development of a sustainable energy structure will present both challenges and opportunities to Hong Kong.

The concept of sustainability has gained widespread support over the last decade, with many organizations adopting it as an important goal. The cities in Asia is a major focus for global sustainable development since these cities have large population growth, fast economic development and increasingly large consumption of energy and resources [1, 2]. The energy sector, which supports our economies and contributes directly to our quality of life, is a critical area for achieving sustainability.

At present, the majority of energy resources in the world are derived from fossil fuels (such as coal and oil) which inevitably leads to the continuing depletion of energy resources and emerging of adverse environmental impacts. Development and deployment of clean, renewable energy is imperative in the economic and environmental interest for every country [3]. Like other cities in Asia, Hong Kong should be more careful about its energy portfolio and policy in order to cope with the needs of social and economic development in the long term. The development of a renewable energy market, and a sustainable energy structure, will present both challenges and opportunities to Hong Kong.

The Need to Put Sustainability into Practice

"Sustainability" and "sustainable development" have become the guiding principles of environmental policy and international development, but they are often misunderstood because the term is ill-defined [4]. Providing for the present without compromising the ability of future generations to provide for themselves is the common notion for sustainability [5]. However, to guide decision and policy makings, it is necessary to go beyond the generality and put it into practice at different disciplines. Figure 1 shows a conceptual diagram of three important segments of sustainability: social sustainability, economic sustainability and environmental sustainability [6]. The diagram can help us understand the objectives in different domains and the connection between them.

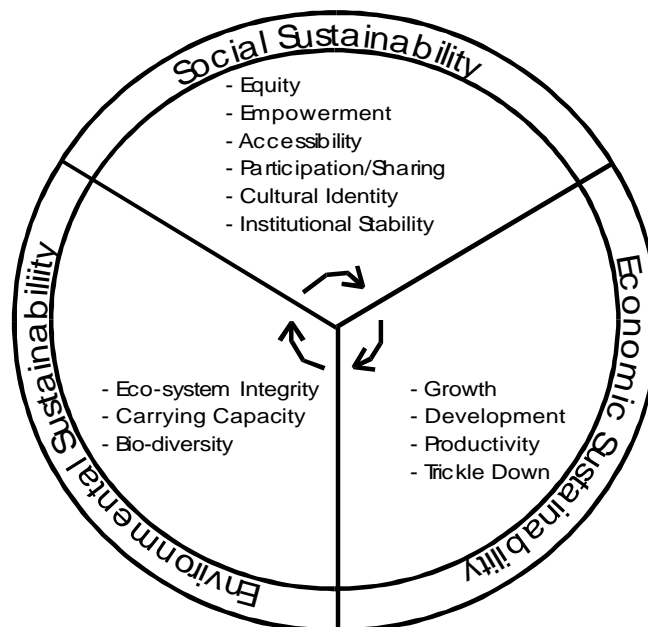


Figure 1 Three important segments of sustainability

Creating a sustainable structure in energy supply and use is a way to translate the sustainability concept into action. The linkage between energy and socio-economic development, environment, social and economic security must be understood in order to design effective strategies. Options for a future energy system compatible with sustainable development include [7]:

- (a) More efficient use of energy and energy-intensive materials;
- (b) Increased use of renewable sources of energy;
- (c) More efficient production and use of fossil fuels;
- (d) Fuel substitution, from high-carbon- to low-carbon- or no-carbon-based fuels.

Although renewable energy is often regarded as the critical element in building a sustainable energy future, the progress in its diffusion and deployment is slow. Moderate growth in the use of renewable energy resources is projected for the next 20 years, as the low fossil fuel prices continue to constrain their development [8]. Rigorous applications of relevant theory and technologies are needed to accelerate the development and utilization of renewable energy, and to increase its contribution to the current energy supply mixes.

The Potential of Renewable Energy

In the United Nations system, "renewable sources of energy" refer to large- and small-scale hydropower, modern and traditional biomass energy, solar energy, wind energy, ocean energy, urban and rural organic waste, and geothermal energy [7]. Large hydropower and traditional biomass are, by far, the most important among them. The new and emerging renewable energy technologies such as solar, wind, modern biomass and geothermal, contribute only a small portion at present. Table 1 shows the estimates of the contribution of renewable sources of energy in 1990.

Table 1 Estimates of the contribution of renewable sources of energy in 1990

Energy resource	Estimated contribution in 1990 (Million tons of oil equivalent)
• Traditional biomass	930
• Large hydro	465
• Modern biomass	121
• Small-hydro	18
• Solar	12
• Geothermal	12
• Wind	1
Total renewables	1,559
Total energy	8,808
Renewables share of total energy (%)	17.7%
New renewables share of total energy (%)	1.6%

Notes: 1. Source: World Energy Council.
2. New renewables = total renewables minus traditional biomass and large and small hydros.

Technical developments over the past decade have made renewable energy more viable by increasing the conversion efficiency and greatly reducing the cost and material requirements [9]. Various renewable energy technologies have reached maturity and others promise to do so in the medium term. The economics of renewable energy can be justified more easily if the externalities of conventional fossil-energy generation are internalized in the accounting system. The social and environmental impact of renewables is of a different nature to that associated with fossil and nuclear technologies. Reduced greenhouse gas emissions and possible social benefits are major attractions of renewables [10].

In developing countries, energy issue is particularly important since energy demand is rising rapidly and acute energy shortage could be a bottleneck to economic and social development [2]. An adequate supply of energy is urgently needed, and renewable sources of energy are valuable for achieving energy security and supply diversity. Decentralized generation using renewables can facilitate rural electrification, stimulate economic development and employment opportunities in the rural areas, provide relief from excessive urbanization, and encourage a sustainable living pattern. Depleted land may also be restored through agricultural and forestry biomass. To enhance and exploit their indigenous capacities, developing countries will require technological and financial assistance from industrialized countries. This will present economic opportunities for trading-based cities, like Hong Kong, which have strong links with these economies.

Current Situation in Hong Kong

With virtually no indigenous fossil resources, Hong Kong is totally dependent on imported fuels for energy generation. The current energy scene in Hong Kong is dominated by coal and oil products imported from other countries. Coal and fuel oil used for electricity generation represent about 60% of the total primary energy requirements [11]. Diversification and cleanliness of generation technologies are becoming more and more important in the energy industry.

Unfortunately, no data is available to assess how much renewable energy is now being utilized in Hong Kong [12]. It is believed that only a few projects in Hong Kong have adopted any forms of renewable energy scheme, such as solar water heating systems. Land-use and space restrictions is an important constraint since Hong Kong has a high population and building density. Large hydropower, traditional biomass energy and geothermal energy are not feasible in Hong Kong because of the limited local conditions. The use of other renewable energy technologies, such as solar, wind and modern biomass, is few and far between, although their potential is believed to be significant [13, 14].

Major Barriers and Potential Technologies in Hong Kong

The lack of government support and incentives remains the key limiting factor in Hong Kong. Although sustainability is the theme of the Hong Kong Government's environmental review paper [15], extremely little has been mentioned and done for promoting renewable energy. It has been criticized that Hong Kong completely lacks legislation, strategies and incentives for the integration of renewable energy [13].

Existing institutional barriers are also limiting the commercial viability of the renewable energy technologies. Rigidities in the conventional energy sector, difficulty in grid connection and

private generation, lack of considerations in building and town planning regulations, complex planning submission process, are all making renewables difficult to grow in Hong Kong. As electricity in Hong Kong is not expensive, the public awareness of renewables is generally low. Lack of information, advice and training are additional factors hindering development of the renewable energy technologies.

Nevertheless, it is believed that some technologies which may be integrated into the urban environment could be used in Hong Kong, such as building-integrated photovoltaics (BIPV). Countryside and new towns in Hong Kong are potential candidates for small renewable energy systems, such as solar thermal, biomass and wind. Technologies involving the conversion of waste to energy may be used to help alleviate the problems associated with waste treatment and disposal while producing useful energy. Table 2 gives the renewable energy technologies that are applicable to Hong Kong [9].

Table 2 Renewable energy technologies applicable to Hong Kong

<p>1. <i>Technologies that can be readily applied</i></p> <ul style="list-style-type: none"> • Passive solar design (and energy efficient building design) • Solar photovoltaics (building-integrated and standalone on highways) • Solar thermal (for water heating and absorption air-conditioning) • Municipal waste to energy (incineration and digestion) • Landfill gas
<p>2. <i>Technologies requiring further investigation and study</i></p> <ul style="list-style-type: none"> • Small hydropower (river based) • Wind energy (onshore and on islands) • Wave, tidal and ocean thermal

Partnership between Hong Kong and Mainland China

Hong Kong has become the Special Administrative Region (SAR) of the People's Republic of China on 1 July 1997. As China has abundant sources of renewable energy and is very concerned about their development [12, 16], there are opportunities for developing renewables through partnerships between Hong Kong and Mainland China. Hong Kong may profit economically by creating new industrial activities, involving in financing and research, and promoting international collaborations for renewable energy technologies [3, 17].

With a highly efficient network of transport and communication, a sound legal and financial framework, a free market environment and a competent workforce, Hong Kong will be able to contribute effectively in technology transfer and development of renewable energy technologies in China. Possible activities that Hong Kong may be engaged in include:

- (a) Prepare and implement training programmes in the various specialized areas;
- (b) Strengthen or establish capacities for assembling, manufacturing, testing and controlling the quality of specialized equipment;
- (c) Develop related maintenance and management services;

- (d) Develop credit and marketing facilities designed to promote the development and use of promising technologies in the field;
- (e) Strengthen financial assistance with multilateral institutions;
- (f) Set up networks and centres of research and information in the field.

How to Realize the Potential of Renewable Energy

To seize the opportunities, Hong Kong should establish a renewable energy market and gradually build up the experience with the technologies. The barriers and constraints to the diffusion of renewables should be removed. The legal, administrative and financing procedure should be established to facilitate planning and application of renewable energy projects. Government could play a useful role in promoting renewable energy technologies by initiating surveys and studies to establish their potential in both urban and rural areas. Figure 2 shows the major considerations for developing renewable energy technologies.

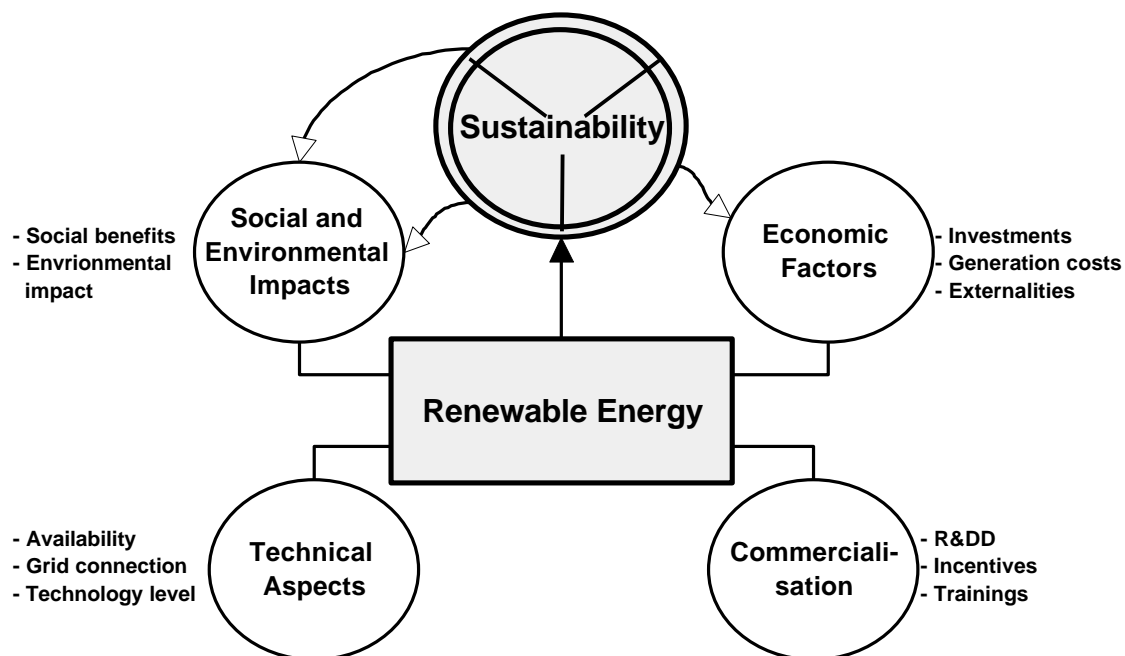


Figure 2 Major considerations for developing renewable energy technologies

As the existing energy utilities often play a key role in determining the adoption and contribution of renewable energy technologies, the utility structure and the strategy for integrating renewables should be reviewed and studied. Utility regulations should be framed to reflect the varying costs over the networks, increase competitiveness and facilitate the access of independent renewable energy production. As commented by Godfrey [18], the major challenge for renewables is to get them into a reliable market at a price which is competitive with energy derived from fossil fuel, and without disrupting the local economies.

Since the use of renewable energy often involves awareness of perceived needs and a change of life style and design approach, it is essential to develop effective information exchange, education and training programmes. Human resources for renewable energy technologies should be strengthened by establishing education and training programmes. Energy research,

development and demonstration should be encouraged to improve information and raise public awareness. The technology transfer and development process should be institutionalized through international exchanges and networking.

To overcome obstacles in initial implementation, programmes should be designed to stimulate a renewable energy market so that options can be exploited by industries as soon as they become cost-effective. Financial incentives should be provided to reduce up-front investment commitments and to encourage design innovation.

Conclusion

Renewable energy has an important role to play in meeting future energy needs in both the rural and urban areas. Their development and utilization should be given the highest priority, especially in the light of increased awareness of the adverse environmental impacts of fossil-based generation. The need for sustainable energy development is rising rapidly in the world. Widespread use of renewable energy is important for achieving sustainability in the energy sectors in both developing and industrialized countries.

It is essential for Hong Kong to develop a renewable energy market that will satisfy the local demands for green energy and enhance the renewable energy development together with the Mainland China. A regional approach to solving of the energy problems is more effective and will stimulate international collaborations and economic activities among different cities and countries. It is clear that the goal of sustainability cannot be realized without major changes in the present energy structure. The need to move towards a sustainable energy future by wider use of renewables will be a big challenge for the city of the Hong Kong SAR.

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