International Solar Cities Initiative

Importance of energy, cities, and Asia

Sustainable energy systems are central to current concerns about low-carbon or green development, affecting the global atmosphere and economic development. Environmental risks and technological and economic obsolescence are major challenges to current energy systems. The common denominator of most policy proposals to pursue a sustainable energy path is a shift from big, centralized, risky technologies to those relying increasingly on high-efficiency energy-using equipment and scaled-to-need renewable energy systems. In particular, greater efficiency can reduce the energy required by the transportation, construction, and industrial sectors, thereby reducing carbon emissions.

Since the early 1970s, Asian countries have registered the most rapid economic growth of any region, but with the lowest ecological carrying capacity. Due to rising energy demand, greenhouse gas (GHG) emissions (about 30% of GHG comes from Asia) are also increasing. PR China and India, in particular, are becoming the world's largest sources of "black" carbon emissions.

Modern cities have mushroomed based on a rich fossil fuel supply. The logic of their global rise and regional spread is founded on the availability of powerful, centralized, inexpensive fuels, like coal, petroleum, and natural gas-yielding fossil urban structures. Urban development depends on fossil fuel. Fossil fuels supply 85% of the world's commercial energy, and 75% of this is used to support cities. In this respect, the key question facing Asian countries is whether further urban development will occur in a sustainable manner, or whether it will reproduce the patterns that industrialized countries witnessed in the past. There is increasing evidence that the low-carbon development of cities hinges upon this choice.

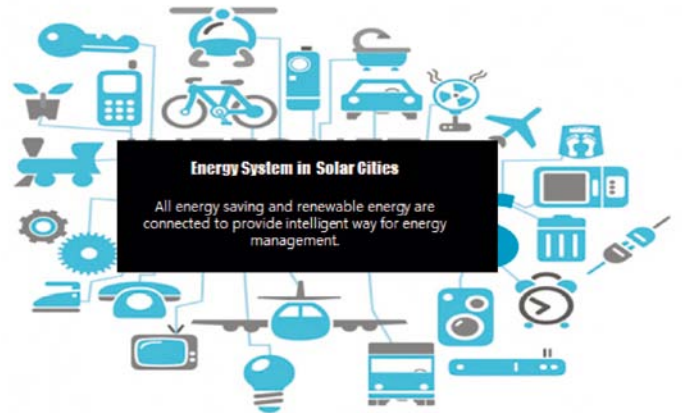

Figure 1. Interlinked energy systems in solar cities.

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The International Solar Cities Initiative (ISCI; www.iscicities.org) is an international nonprofit organization dedicated to promoting new urban policies and practices that reduce per capita GHG emissions by cities to levels consistent with long-term climate sustainability as estimated by the Intergovernmental Panel on Climate Change. Key contents of the solar city program can be found in the ISCI Declaration and can be summarized as follows.

1) Each city sets its own target for renewable energy adoption with a specific timetable appropriate for its geographical, economic, and political circumstances.
2) Partnerships are formed between institutes and centers for the mutual development of renewable energy implementation techniques, capacity building in cities, and shared expertise.
3) Sister-city relationships are encouraged in renewable energy implementation, end-use efficiency, and climate change policy.

The ISCI started as an International Energy Agency and International Solar Energy Society joint task force in 1999 and became independent in 2003. The ISCI has endeavored to bring scientists and policymakers together, sharing practical knowledge for the transition to sustainable societies where the main energy sources are efficient and renewable. The 1st ISCI Congress on Solar Cities for a Sustainable World was held in Daegu, ROK, in 2004, followed by the 2nd on Solar Cities: Reducing Carbon Emissions from Cities in Oxford, UK, in 2006; the 3rd on Visionary Voices Talk Sustainable Cities in Adelaide, Australia, in 2008; the 4th on Solar Energy Changes Life in Dezou, PR China, in 2010; the 5th on Energy in Cities: Innovation Facing Climate Change in Buenos Aires, Argentina, in 2014; and the planned 6th on Aerospace and Solar Cities (tentative title) in Noordwijk, the Netherlands, in 2016. Each congress comprises a mayors' summit, scientific conference, business forum, citizens' forum, and exhibition.

Policy and technology for solar cities

Major policy areas for solar city development can be divided into three: institutionalization (organization and policy); technology; and knowledge (public participation). The development and deployment of technologies, especially for energy efficiency and renewable energy, are the engines of solar city development. For example, energy-efficient technologies in end-use sectors such as light-emitting diode and fluorescent lighting, supported by appropriate smart monitor-

ing and control technologies and green building standards, will help in constructing smart buildings. Intelligent energy information and communication technology will allow the gathering of big, real-time data on energy consumption so that intelligent decisions can be made for savings. Such systems can be employed as part of building/factory energy management systems.

Renewable energy sources like super-efficient solar, offshore wind, ocean wave, and tidal power must also be considered. More efficient photovoltaic panels and offshore wind technologies will create a significant shift in the energy map. The required technology exists and is already being applied to harvest wave and tidal power in some parts of the world, including the Asia-Pacific. Renewable hybrid energy systems will multiply renewable energy sources by providing energy during most weather conditions and reinforce renewability by leveraging synergy among sources. Advanced biomass energy technologies can help realize the potential of millions of tons of available biomass to replace fossil fuels.

Alternative-fuel vehicles will effectively reduce petroleum dependence and pave the way for low-carbon transportation systems. Electric and/or hydrogen fuel cell vehicles are currently being produced by most major automobile companies. Hybrid vehicles can also continue to be utilized supplemented with, for example, solar energy collected on carport roofs or in car parking facilities to power electric vehicles and batteries. Service stations of the future will not only charge electric vehicle batteries but also lease batteries for quick change/charge.

Energy storage systems are an emerging industry with great relevance to renewable energy. Successful applications of this technology will contribute significantly to stabilizing renewable energy flows. In addition, smart grids have multiple benefits. They accelerate improvements in energy systems, increase grid reliability, help consumers save money, and reduce overall carbon footprints.

Water, waste, and land management, encompassing water reclamation, greywater and rainwater systems, low-water landscaping, and water purification and management, are important for cities. Recycling, municipal solid waste salvage, brownfield, and remediation are also areas for waste management. Organic agriculture, habitat conservation and restoration, and urban forestry and parks are closely linked with energy and environmental issues.

Conclusion: a multidimensional approach needed

To sustain solar city development policies, three actions are needed: a legislative foundation; long-term planning and consecutive implementation plans; and the creation and expansion of green budgets. In addition to an institutional base, a multidimensional approach can be effective in integrating energy, industry, and culture. Solar City Daegu can be an example (Figure 2). In Daegu, an innovative system for energy demand-side management and renewable energy will be intensively and systematically introduced. The new industrial dimension will create innovative industries and employment opportunities through promotion of the solar and hydrogen economy. The ecocultural dimension is the provision of clean nature and a healthy culture. This requires public awareness and participation. Thus, solar city programs need broad, deep support at both the highest policymaking and grassroots levels. Partnerships among local governments, businesses, experts, and social groups are vital in any solar city program.

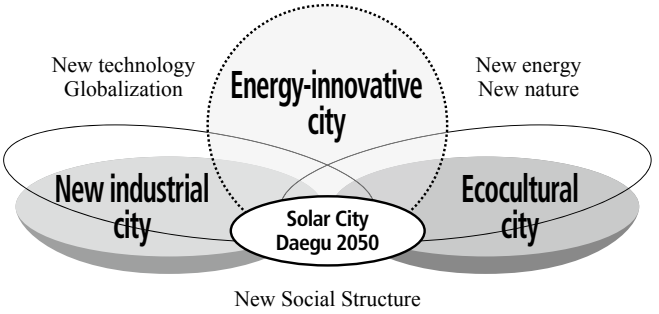

Figure 2. Multidimensional urban planning for Solar City Daegu.

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