In: The 7th International Kastelli Symposium, 18.-19.2010, University of Oulu
Book of abstracts, Eds. Hannele Savela, Arja Rautio, pp. 17-19

Energy economics and wellbeing

Caló A, Chamilos I & Pongrácz E

University of Oulu, Department of Process and Environmental Engineering, and
Thule Institute, Centre of Northern Environmental Technology

Wellbeing is commonly described in terms of health, comfort, and happiness [1]. Humans spend 80-90% of their life indoors; therefore, policies regarding wellbeing and quality of life need to take into consideration the built environment. At the same time, a comfortable built environment is an energy-intensive one. According to the estimates of the World Resources Institute, commercial and residential buildings use 25% of total world energy consumption and generate 20% of CO_2 emissions [2]. There is need to find a balance between heat and visual comfort inside buildings and sustainable energy solutions to reduce environmental impacts. An energy efficient built environment will positively contribute to energy security, reduction of greenhouse gas (GHG) emissions, energy costs and global energy demand, as well as the conservation of both renewable and non-renewable energy resources. The two diploma work projects presented here aim to address some of the most crucial elements of a sustainable energy strategy in the North; defining green cities and settlements, supporting biomass- and waste-based decentralized energy solutions and assessing the potential of smart energy grids.

As a result of a rapid economic and technological growth, human settlements and, especially cities, in the industrialized world have substantially changed their face and the way they interact with their inhabitants and the natural environment. Erroneous urban and rural planning is also a sizeable contributor to environmental degradation as well as deteriorated public health. Urban planning, health, housing, energy, economic development, natural habitats, public participation and social justice all can be comprised in a single framework, that of an eco-city [3]. The concept of eco-cities is deeply rooted into bioregionalism, urban ecology and sustainable development. The vision of eco-cities is a vision of a place in harmony with nature, which creates opportunities for ecological citizenship and environmental stewardship. In this vision, the idea of efficiency and, therefore, the minimization of waste (urban, energy, time, economic, etc.) assume a critical role. A number of solutions are already in place and can be further developed, investigated and coordinated: among them waste-to-energy solutions, smart energy management systems in buildings and distributed energy production trough smart power grids.

The expression smart energy grid indicates a power grid that allows suppliers and consumers to have a two-way communication monitoring *in real-time* the grid condition (i.e. the electricity production, consumption and distribution). This kind of network allows a more dynamic control, making it possible to respond to changes in the grid conditions more efficiently. Using real-time monitoring, coupled with a *smart* control system, the envisioned smart grid system can anticipate and mitigate power peaks or power quality problems. At the same time, it allows a more prominent market position of those renewable energy resources that are characterized by a discontinuous and irregular power generation, such as wind power.

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The transition from a highly centralized energy network to a decentralized one is a transition that aims to rethink the energy industry business model: from growth through quantity to growth through quality. Such a transition implies also a more interactive and participatory role of the consumer. Owing to a real-time, two-way communication, consumers would be motivated to save energy, by reorganizing their energy usage and by selling energy back to the grid. Therefore, by enabling distributed power generation, it is possible to effectively initiate a process of *democratization* of the energy market *through participation*.

Both diploma project works will assess the potential of applying these innovative energy concepts in Northern Periphery environmental conditions. The region is characterized by harsh climate, sparse population, challenging geographical conditions and unique natural and cultural environments. In this framework, it is particularly important to understand the possibilities, the socio-economical costs and benefits that a new way of thinking the energy production and distribution can offer, evaluating the scalability and adaptability of current technologies, and contributing to a sustainable energy development strategy in these regions.

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