RENKEI Summer School 2014

Project title: *Pathways towards a community inspired city: the future is now!*

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Introduction

The following work summaries our ideas for developing an energy system for a sustainable city in a near future. We decided to add the word "now" to emphasize the urgency that we, as community, need to apply sooner than ever. Many projects have used 2020 as a target year however we are getting closer to the date with a significant global change. We propose to maintain an optimistic point of view while choosing a mix of technologies and policies, which we analyzed as the ones to take into account for a carbon neutral society.

Objectives

The project investigates pathways towards the creation of a community inspired city by immediate actions. It looks at the development of a community-based energy system and sustainable solutions for the future cities.

- Design an ideal city which can be referred to while comparing ideal with reality
- Propose the energy technologies and policies needed to achieve a carbon neutral society
- Recognize the risks and limitations when going "all renewable"

Motivation

After the March-2011 earthquake and tsunami in the east coast of Japan, many lessons were learnt about how unpredictable events can impact our community. Besides, several cities have been looking forward to become low carbon. When integrating such desire with known risks and past experiences around the world, we designed our city based on such knowledge. We decided to design a future city named Fukuhampton which will have the same climate as Fukushima and Southampton, warm temperate (6). Fukuhampton is about 400km^2 with a population of 270 000 people.

Main design principles

The main design principles are built upon the ideals of public wellbeing, community engagement, behavior shift towards a one earth living and highly efficient regionally designed power generation and consumption. Some key considerations are outlined:

- Climate change resilience and weather proof design: flexible urban structure with the capacity to recover fast from extreme events, allocate sources to the most efficient use and protect the citizens.
- Self-sufficient urban communities with local power generation according to the locally available resources and economical security through wide cooperation networks.
- Compact cities with mixed use, public transport and walkability that will inspire the minimization of fuel consumption and carbon emissions.
- Modularization of key urban infrastructure to shift
- Decentralized distribution networks in combination with micro-generation technology and smart management systems to increase energy use efficiency and maximize the potential of local resources.
- Waste management towards an integrated city metabolism based on a closed system with high rates of recycling to recover materials and energy while at the same time decrease the embodied carbon.
- Biodiversity conservation.

Fig. 1 Concept design of Fukuhampton（see in appendix）

Urban planning

1)Land use:

Efficient use of land resources

- Compact building: permits more open space to be preserved, encourages buildings to expand vertically rather than horizontally.
- Preservation of land and natural resources: compact building forms, moderation in street (Neuman, 2005). Total housing area is less than 50% of the total area.
- Density lowers the per capita costs of infrastructure capital and operating costs, and reduces per capita use of all types of energy including energy for transportation and heating and cooling buildings. A minimum density of 50 dwellings per hectare is applied as a necessary baseline to support public transportation (Applegath, 2012).
- Locate stores, offices and services within walking (cycle) distance
- Create local works that will ultimately reduce people mobility and transportation energy

Transport

Convenient and interesting; Encourage walking and cycling ; Provide a variety of transportation choice ;Include bicycle lane and transit; Promotion of public transport ;Use connected network with alternative routes and bypassing of heavy traffic (Neuman, 2005)

Building

- Promoting long lasting materials and well-designed sustainable habitation

Infrastructure

For the basic infrastructure of a city, such as water treatment and waste treatment, we can try to find ways to do contribution for energy area. Such as ecological water treatment using anerobic method; and we can also use waste to produce energy. The other thing is we can use green roof or green garden to drain the rainwater and absorb the CO_2.

Energy

Fukuhampton relies on renewable energy and is carbon neutral. The system components have enough independence so that damage or failure of one component of a system is designed to have a low probability of inducing failure of other similar or related components in the system. The city has co-generated district energy plants. Each plant provides power for its surrounding area but also can be called upon to provide excess power to back up neighboring plants, should a failure occur. Each piece is independent (modular) yet also networked (redundant), thus optimizing both energy production and security. Community owned energy management system controls the local power distribution between the districts (cf Appendix).

Fukuhampton relies on solar, geothermal, biomass, wind, ocean (wave and tidal) and hydro energies. The net use of fossil fuel for electricity and heat generation is close to zero. The city produces 125% of the required energy and 25% of this is exported to the national grid.

Conclusion and recommendations

Based on current green solutions available for energy system development, we have taken a whole perspective for a city, which is to look into several sectors, such as land use, transportation, buildings and infrastructure to explore the opportunities of energy saving and production. The other highlight of our approach is based on community, which is a decentralized way to develop the whole energy system, but at the same time, we also have built EMS in the central of the city, to monitor and manage the energy supply and demand. The model has been developed for Fukuampton, but can also be referred to other similar cities development. There do exist risks in real cases, such as willingness of the people participated, high cost of technological integration and as well as natural disasters and other possible unpredictable risks.

Appendix

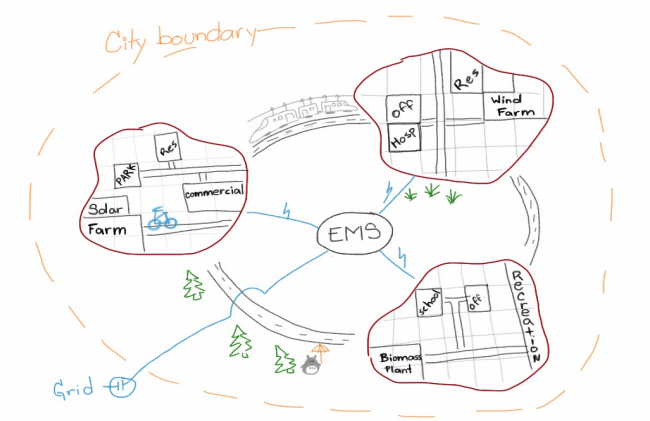

Figure 1: Concept design of Fukuhampton

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