

3rd GENERATION ECOCITY

Finnish High Tech EcoCity for Tianjin China

In a conference held in 17.-19.4. in Tianjin China the VTT Technical Research Centre of Finland presented the plans to construct a high tech ecocity for 20.000 inhabitants in the Tianjin area. The project is based on the thinking of Professor Eero Paloheimo, a hard line environmentalist and aiming to a completely new urban model of a third generation city with zero environmental compromises.

Professor Eero Paloheimo is a reknown Finnish environmental thinker and strategist who's book *The Way Towards a New Europe* (Finland 1996, China 2005) has gained wide audience in Europe and China and resulted to common plan to design and construct a futuristic high tech ecocity in the industrial area of Tianjin.

Finland is regarded as the world's leading country in the environmental comparison by the World Economic Forum and at the same time as one of the most competitive countries in the world. China already harbors some of the world's most polluted areas and it's industrial development has not reached even close to it's peak yet. The coal dependent steel production in China increased by 18.5% between 2005 and 2006 when China accounted already 34% of the total global steel production. (source: World Coal Institute) The Chinese have turned to Finland to partly prevent the disastrous environmental development. The EcoCity Tianjin is one of the Finnish government's FECC (Finnish Environmental Cluster for China) projects in China.

What differs the Finnish ecocity from many other ecological urban schemes is the ecological radicality of its nature. "There will be no combustion engine cars in the EcoCity." Professor Paloheimo preached in his opening speech and continued that the city must be more or less 100% sustainable what comes to its own food, material and energy production as well as waste treatment. Professor Paloheimo's speech was followed by presentations of an army of elite Finnish researchers from the governmental Technical Research Centre, Helsinki University of Technology and Helsinki University with wide range of topics ranging from *CyberCab Future Passanger Traffic* to *Buildings Sink or Source of Energy* and all the way to *Possibilities of Environmental Art in Ecocity*.

Eco City What and Why

Professor Eero Paloheimo has written eight books about environmental issues and prospects of future. In his book *The Way Towards a New Europe* he offers a theoretical analysis and detailed solutions for tackling the problems of Europe on the basis of a broad change of ideological direction.

The idea originated in the author's concern for the future of mankind, coupled with his knowledge that the technology required to solve most of the problems either exists or is know. All that is required is the political will to take the momentous decision. The book calls for immediate action to save the environment. The book is not a technoutopia or work of science fiction, but a plan for the sustainable future that is both necessary and reasonable.

The first part of the book discusses the ideological and technological principles involved and the second part consists of a model plan to ensure the survival of our world. Although the author

limits his analysis to the highly integrated Europe of tomorrow, his basic argument is global: an immediate and radical transformation of the system of production in the industrialized countries is both necessary and inevitable. The basis of this is international agreement and cooperation of which the the proposed project of the Tianjin EcoCity is a clear example.

EcoCity Tianjin is a model community of Prof. Paloheimo's thinking backed up by existing technological solutions coordinated by the VTT Technical Research Center of Finland including solutions for self-sufficiency in food, the diversification of forests, alternative sources of energy, an economy based on recycling, new ecological agriculture, sustainable architecture and urban infrastructure, information technology, cybecabs and local traffic and the automatised and electronic distribution of goods.

Tianjin EcoCity is a model of a so-called 3rd generation city trying to answer to the problematics of the industrial city and industrialization. Paloheimo argues that the return to preindustrial times is impossible. This would mean a significant reduction in population, production and consumption. Though technically feasible, it is psychologically and politically impossible. The second alternative would be the road of minor change which, though realistic and politically acceptable, is too slow – it would not prevent the environmental disaster. Prof. Paloheimo's EcoCity offers a new industrial revolution, the 3rd generation high tech but ecological city.

Sun, Wind and Bio-energy

The energy production of the EcoCity is based on locally produced renewable energy methods. The possibilities introduced in Tianjin included more conventional wind, sun and bio-energy as well as fuel cells generating electricity by a chemical reaction.

Most of the electricity for the EcoCity can be based on wind. Two 3 MW wind turbines, one for housing electricity and one for electricity needed for heat pumps are sufficient to provide all the energy needed by 1000 single houses. However, due to natural variation in wind energy generation, additional means of electricity production are required. The combination of the various energy sources are controlled through a "smart grid" energy transportation infrastructure reading and balancing the consumer and production conditions.

Heating and cooling the houses of the EcoCity is based on heat pumps, district cooling and combined heat and electricity production (CHP) in power plants. The houses will have building integrated solar panels.

Waste is regarded as a resource of energy. The sustainable energy production will utilize biogas technology in which the anaerobic bacteria will ferment the organic waste and thus create methane biogas which can be used in small scale microturbines for localized energy production.

The ecocity will also have large biomass plantation areas for forestry and for fast growing vegetation as a renewable energy source. Converting effectively biomass into energy includes a variety of well tested technologies from gasification to fluidised bed combustion.

In conclusion the EcoCity produces its own heat, cooling and electricity. The production is sustainable and locally distributed. The means include wind, biomass, ground heat, district cooling, solar energy, fuel cells and biogas.

Buildings Sink or Source of Energy

Although the Tianjin conference was not presenting any detailed architectural design concepts for the EcoCity buildings some basic principles of architectural choices were discussed. The overlaying philosophy was to minimize the building's energy consumption and change the buildings into a source of energy. All the needed energy will be produced by renewable methods.

"The new energy strategy for buildings is based on visibility of consumption and choices." Said Dr Miimu Airaksinen. "The citizens must be able to individually choose the energy source and get used to the use of the control strategies. This will lead to the reduce of consumption and to energy conservation." Like everything, also the energy controlling in the high tech EcoCity was based on telecommunications and information technology.

Urban structure affects greatly on total energy demand. Therefore an efficient integration of urban planning, master planning and building design must be taken into consideration from the very first beginning. For example compact urban structure reduces network losses. Building orientation effects to reduced heating demand or may lead to increased cooling demand. Planning for active solar systems must be considered in the master planning as well as the decision on building standard: Passive Houses.

Good master planning is estimated to reduction of heating and cooling energy demand 10 – 30% . The cost of design is low, but the biggest decision to save energy are made in the early design phase.

In the Finland developed energy efficient buildings the heating energy consumption is 50 – 80% lower compared with the modern Chinese standards. The buildings are integrated with photovoltaics and have self cleaning windows with TiO₂ facades. With efficient building automation an additional 10 – 15% saving of the energy consumption can be achieved. Shading provides 50% savings in cooling and the heating is based on solar assisted ground heat pumps networks.

Primarily the buildings will use passive cooling: solar shading, window properties and orientation, night ventilation, attic ventilation and roof insulation . In case the active cooling is needed it is based on ground cooling and decentralized cooling networks.

"Dispite all the high technology, mother nature is clever." Dr Airaksinen concluded. Correct positioning of the buildings and understanding the local natural conditions is the biggest key to the saving of the buildings energy consumption.

No Taxidrivrs

Combustion engine vehicles are forbidden in the EcoCity. The city will set up a factory for CyberCabs which will move powered by electrical batteries and have no drivers. The eco citizens can order these CyberCabs with mobile phones "point to point and just on time" –bases. No parking problems and individuals do not have need to have their own vehicles.

CyberCabs are rubber wheeled, electric vehicles and having lightweight and environmentally friendly structures. The traffic is based on normal road infrastructure. Cabs are fully automatic (no taxidrivrs) and easy to operate. Satellite positioning enables JOT (Just On Time) human

transportation and radar sensors outside the car will provide extra safety to the passengers. CyberCab will also have airbags outside the vehicle. Roads and light traffic are separated with green fence. The CyberCabs will have a relatively low speed.

Most of the transportation in the EcoCity is by foot or bicycles. Taipei was also a strong bicycle and bicycle-rikshaw city until 1966 when the rikshaws were banned because the city government wanted Taipei to be modern.

EcoCity Tianjin may sound futuristic or a science fiction day dream. Maybe it is a laboratory testing solutions for the existing industrial cities to take the needed steps towards the 3rd generation urban future. The Finns are serious with their mission and China for sure has a need for an EcoCity, but this is not the core of the environmental problem. The core is here. It is the existing cities that together with the industry produce the majority of our global environmental problems. It is the existing cities that concentrate the combustion engine vehicles and it is the modern cities that are sucking endlessly growing amounts of energy. It is the industrial city that has alienated the urban man from the nature.

How about EcoCity Taipei ... the 3rd Generation Taipei? All the technology exists, Professor Paloheimo says, only the political will is required. Only that and then we have...lets see...

No more cars, no more scooters. The MRT is the backbone of the transportation. Like Danshui river was before. Smaller streams of collective transportation are linked to the MRT –river. These may be the light rail or tramways with free transportation from MRT onwards. The MRT stations will be the hot spots loading the batteries of your electrical scooters and cybercabs. Also the parking of your office house is a loading station since the office building is an electricity source itself: solar panels, small bio micro turbines, even windmills on the facade or on the roofs...unless the roof is not cultivated for biomass production.

Yes: biomass, more biomass. Where to grow? The flood reserves along the rivers are perfect! Full of biomass. Some sort of weed or what ever fast growing vegetation for the localized bioenergy plants. Subtropical climate is perfect for this and the vegetation will clean the river too. People can play basketball in the old parking houses, rivers are for biomass. Danshui river, Keelung river, Xindian river, Jingmei river and Dahan river will become vivid wild green corridors cutting through the urbanized Taipei Basin to the mountains. Wild animals will come back to the city and more clean fish in the rivers. Series of tall windmills will raise along the river corridors competing with the renewable energy production with the localized solar and bio energy plants.

Then when the people are accustomed enough for the 3rd generation city the old irrigation channels, creeks and streams are opened from below the urban layers of asphalt and concrete to provide natural air conditioning for the whole city center with running cool water. The communities will take care of their own waste and have community farms led by grandmothers. All the waste is recycled, turned to energy or to top soil. The communities are competing in the self sufficiency of localized energy production. The skyscrapers are turned into building reactors taking care of the waste of the surrounding city and providing them energy. It will be a blessing to live in the shadow of the skyscraper, the ecological needle of urban acupuncture.

But no taxidrivers. This can not be. Maybe the bicycle-rikshaws should come back. The post industrial Taipei taxidrivers will be the fittest people on Earth.

Data boxes:

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Prof. Eero Paloheimo

- Prof. Paloheimo is a designer, politician and university professor. He has written eight books and many articles about the prospects of future and environmental issues.
- Paloheimo has been a member of the Finnish Parliament (representing the Green Party) 1987 – 1995 and Chairman of the Committee of Long-Term Future Options in the Parliament 1994 – 1995. Professor in the Helsinki University of Technology (wood-construction) 1995 – 2000.
- Presently busy with developing a new traffic system and future development of Africa.
- Two doctorates: Dr (eng.), Munich Germany and Ph.D., Helsinki Finland
- www.eeropaloheimo.fi

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Finnish High Tech EcoCity Tianjin Conference Presentation topics:

- Whose EcoCity how to embed ecological innovations in peoples everyday life – Researcher Sirkku Wallin, Centre of Urban and Regional Studies, Helsinki University of Technology
- Waste is a resource in EcoCity – Ulla-Maija Mroueh, Customer Manager, VTT Technical Research Centre of Finland
- Urban solar energy schemes as sustainable energy – Prof. Peter Lund, Helsinki University of Technology
- Urban green spaces in the ecocity – Dr Susanna Lehvavirta and Prof. Dean Jari Niemela, Helsinki University
- Telecommunication as its best – Prof. Jussi Paakkari, VTT Technical Research Centre of Finland
- Sustainable transport – Prof. Risto Kuivanen, VTT Technical Research Centre of Finland
- Re use of materials – Kari Heiskanen and Harri Lehto, Helsinki University of Technology
- Possibilities of environmental art in ecocity – Prof. Markku Hakuri, Helsinki University of Art and Design
- Indirect reuse of used water or wastewater instead – Prof. Heikki Kiuru, Helsinki University of Technology
- How to optimise energy consumption in our neighbourhood – Jyri Nieminen, Customer Manager, VTT Technical Research Centre of Finland
- Energy from Waste – Dr Anni-Mari Lehtomäki, Jyväskylä Innovation Ltd.
- Electricity from our village - Dr Pasi Makkonen, VTT Technical Research Centre of Finland
- CyberCab Future passenger traffic for the demands of ecology and comfort – Dr Sami Ylonen, Helsinki University of Technology
- Buildings sink or source of energy – Dr Miimu Airaksinen, VTT Technical Research Centre of Finland
- How to create the best possible environment - Prof. Kari Larjava, VTT Technical Research Centre of Finland
- Eco City what and why – Prof. Eero Paloheimo