

Ye Feng

LOW CARBON LIFE

Thesis

**CENTRAL OSTROBOTHNIA UNIVERSITY OF APPLIED
SCIENCES**

Degree Programme in Chemistry and Technology

May 2012

Abstract

Department Technology and Business, Kokkola	Date 21 May 2012	Author Ye Feng
Degree programme Chemistry and Technology		
Name of thesis: Low Carbon Life		
Instructor Kaj Jansson	Pages 39	
Supervisors Kaj Jansson		
<p>This research was motivated by the current issues that have to be solved because of environmental contamination. Nowadays the climate has been changed due to the existing problems of energy and pollution in human society development. The object of the thesis was to explain what “low- carbon is” and recommend to use it in general environment. This work was based on information from Copenhagen Climate Council on December 2009 and the new achievable technology during the daily life by renewable energy.</p>		
Key words Kyoto Protocol, Copenhagen Climate Council, low carbon, renewable energy		

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Objectives of study	3
1.2	Low - Carbon, greenhouse gases and carbon emissions	3
1.3	Progression of Low-Carbon	6
1.3.1	Kyoto Protocol	6
1.3.2	Copenhagen Climate Council	8
2	The reasons for choosing Low – Carbon	10
3	Carbon footprint	11
4	Low - Carbon design in Finland	13
4.1	Energy in Finland	14
4.2	Low-carbon building of Finland	16
4.3	Three examples for reducing the carbon in daily life	21
5	The status of global Low – Carbon economy	26
5.1	Energy supply in the Low-carbon economic chain	27
5.1.1	Three important new resources	27
5.1.2	Thermal power reduction emission	28
5.2	Energy storage and transport in Low-carbon economic chain	29
5.2.1	New energy battery	29

5.2.2 Energy storage power station	30
5.2.3 Smart grid	30
5.3 Energy consumption in the Low-carbon economic chain	32
5.3.1 Industrial energy saving	32
5.3.2 Transportation energy saving	32
6 Conclusion	34
REFERENCES	36

1 INTRODUCTION

Human live on the earth who depend on a variety of factors, such as climate, water, air, food and many other elements as well known. Especially the climate is important and directly affects to the daily life of human. Climate relates to a series data of meteorological measurements in a certain arena over long term. To assesses of climate which depends on the statistics of temperature, rainfall, wind, purity and humidity of the air, and atmospheric pressure. (Energy, the Environment and Climate change Hodgson & Peter E 2010, 7)

Because of the development of global industrial economy, sharply increasing population, and the raising of human desire which make the loss of resources irreversibly, those also lead to a serious problem of global climate, the discharge amount of CO₂ going up. Earth's ozone layer was destroyed cause of global warming, disastrous weather appear often in the whole world. It is already threaten to the health and safe living of mankind. For example: cataract, skin cancer, and infectious diseases. Furthermore, it also damage to the plant and marine organism. (Energy, the Environment and Climate change Hodgson & Peter E 2010, 7)

According to the forecast from Global Energy Association: during 2007 to 2030, the global primary energy demand will increase by the rate of 1.5% per year from 12

billion tons of oil increased to 16.8 billion tons of oil, the overall increase by 40%. Correspondingly, the global primary energy will face to exhausted for the time being. By the statistics of BP World Energy Statistics 2006, the data shows that there has only more than 40 years period of the available discovered reserves of oil for the whole world production waste, and natural gas and coal can be supplied by 65 years and 155 years, respectively. (Global energy consumption situation and development trend)

This research is discussing about the emissions of greenhouse gas, particularly on carbon dioxide, and also give an explanation about how to use the new energy and technology for application with a new living manner to instead of the waste or contaminative living style. It provides the actual and superior blue print for the future with minimal power and new energy cost, and it helps the environment get less and less pollution day by day.

1.1 Objective s of study

Nowadays people overuse the non-renewable energy to establish their kingdoms; obviously the great quantity of pollutant gas has been damaged global environment and human health. Besides, we all know it is too late to consider about change the living style when all the fossil fuel has been used.

Hence, human need find the new way to ensure sustainable development plan: decreasing the pollution and using renewable or green energy sources.

The research is focus on how to solve the global climate problems that are caused by using energy which looking for a new way to save the fossils energy and also control the air pollution.

1.2 Low - Carbon, greenhouse gases and carbon emissions

Low-Carbon means the lower emission of waste gas which includes most carbon dioxide (CO₂) from green house. Due to the development of global industrial economy and population increasing, the number of CO₂ emission is raised by the endless of human demands and immoderation of manufacture with using fuels, and it caused the climate has been disastrous changed for many times. The survival environment and healthy safety of mankind were threatened in the whole world.

Even human was proud of their growth rapidly or expansion of the GDP number that reduced greatly, due to environmental pollution and climate changes. Therefore, countries have been calling the "Green GDP" model of development and statistical methods. (Energy, the Environment and Climate change, Hodgson & Peter E 2010, 7)

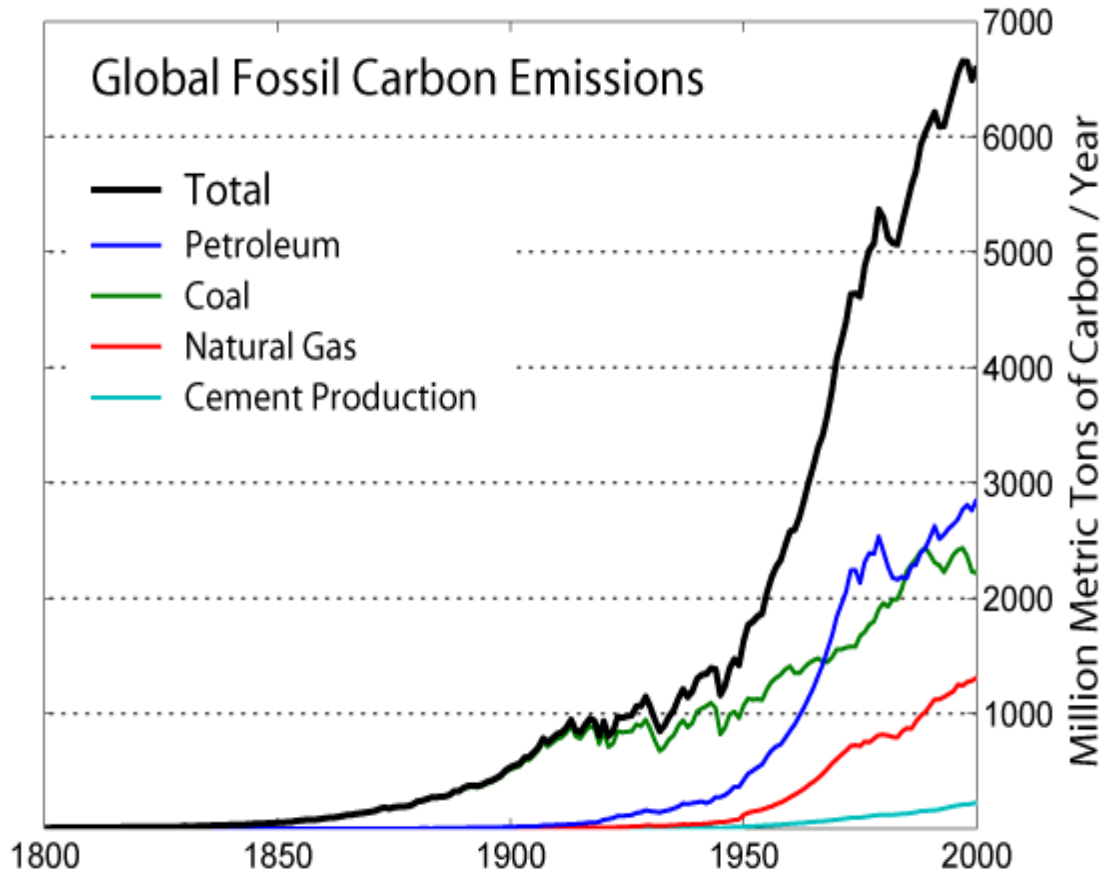
Greenhouse gases can absorb long-wave infrared radiation in the atmosphere from the Earth's surface and it has insulation effect to the Earth. The main greenhouse gas in Earth's atmosphere including the water vapor (H_2O), ozone (O_3), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydro-chloro-fluoro-carbons (CFCs, HFCs, HCFCs), perfluoro-carbons (PFCs) and sulfur hexafluoride (SF_6). (Greenhouse gasses)

Water vapor includes in greenhouse gas. In the atmosphere, its quantity is not affected directly by human activities. But the main greenhouse gases are CO_2 , CH_4 , N_2O , chlorofluorocarbons (CFCs) and ozone (O_3) that impacted by human activities. (Greenhouse gasses)

Carbon emission is a general calling of the greenhouse gas emissions. The main gas is carbon dioxide in greenhouse gases, so carbon as a representative. Most scientists and governments recognized that greenhouse gas has been and will be continued to damage the planet and hurt humanity, so the carbon emission

controlling has become the first essential task.

From the below graph Global Fossil Carbon Emissions, we can see clearly that 1850 is a turning point. Before 1850, there is nothing from fossil energy for consumption. But during a century time, people started their industry revolution; it means that human had been aware of the useful of fossil energy. From 1950 to 2000, the total number of using fossil energy has sharply increased to almost 7000 million metric tons of carbon per year from only about 1200 million metric tons of carbon per year in 1950. Just in five decades, the consumption number has increased above 6 times. In a nutshell, there was a huge using number of carbon emissions produced during a short period in the whole world, besides, the air environment was destroyed seriously suddenly.



GRAPH1. Global Fossil Carbon Emissions from 1880 to 2000

(Source: http://en.wikipedia.org/wiki/File:Global_Carbon_Emission_by_Type.png)

1.3 Progression of Low-Carbon

1.3.1 Kyoto Protocol

Facing to global climate change problem, human need reduce or control the emission quantity of CO₂ urgently. In December of 1997, the third Conference of the Parties of «United Nations Framework Convention on Climate» was held in Kyoto, Japan. The representatives of 149 countries and regions agreed with the

《Kyoto Protocol》 which designed to limit greenhouse gas emissions between developed countries to restrain global warming. The 《Kyoto Protocol》 provides that, in 2010, the emission quantity of carbon dioxide and other six kinds of greenhouse gases declined by 5.2% compared with in 1990 by all developed countries. In 2001, U.S. President George W. Bush, announced U.S. would quit from 《Kyoto Protocol》, the reason is that Protocol brings great heavy burden to American economic development. In March 2007, the leaders of EU member states agreed and unilateral commitment to that at least reduce 20% of greenhouse gas emissions until to 2020 than the emissions number in 1990. (United Nations framework convention on climate change)

February 16, 2005, the 《Kyoto Protocol》 comes into force. This is the first time when according to the form of regulations to limit greenhouse gas emissions in human history. For achieving a greenhouse gas reduction targets to encouraging countries, Protocol allows to take the following four abatement methods: (United Nations framework convention on climate change)

a) Emissions trading: the emissions credits could buy and sell between two developed countries. It means that to helps the country who had difficulty complete the reducing carbon task. Moreover, it can afford to buy the excess amount from the country who over to reach the aim.

b) Net emissions relates to calculate net amount of greenhouse gas emissions

from own actual emissions, except the amount of CO₂ absorbed by forests.

- c) To encourage reducing greenhouse gas emissions by using the green development mechanism between developed and developing countries.
- d) Group approach: it can be used in many countries together in the EU. It balances the emissions from overall, if they decline the gas emissions in some countries and increasing emissions in other countries.

1.3.2 Copenhagen Climate Council

During December 7th to 18th of 2009, in Denmark, Copenhagen held United Nations Climate Summit. More than 85 national leaders or governments' officials and the environment ministers of 192 countries attended the meeting. The aims of council are that to discuss a follow-up program after the expiration of Kyoto Protocol, and to sign a new agreement for dealing with the climate change problem in future. There is no doubt that this conference has a decisive impact on the climate change of Earth's future. (Copenhagen Climate Council)

Climate change is the global challenges affecting all countries, therefore, to reach a new global agreement on climate change that is confirm the common interests of all countries. Moreover, climate change is a global task, involving everyone. Hence, it is necessary that the participation of industrialized countries, emerging economies and developing countries. However, the fundamental principle of the Copenhagen

climate conference is “common but differentiated responsibilities”. (Copenhagen Climate Council)

A new climate agreement needs to solve four issues: (Copenhagen Climate Council)

- a) Establishing mid-term targets to reduce greenhouse gas emissions;
- b) Helping the poorest countries adapt to the negative impacts of climate change;
- c) Technology development and transfer;
- d) Financial support

2 The reasons for choosing Low – Carbon

Low-carbon is focus on the societal future, and that represents a conception of sustainable development, so we need hold this low-carbon idea to reach a sustainable improvement society. (Low-carbon life)

“Low-carbon” is a new word, but it reflects an old trouble. It reflects that the trepidation of people to the future by the climate changes, the increasingly trend of global consensus for low-carbon issue day by day. The keynote of low-carbon is that to restrict certain consumed and producing activities, because the excessive carbon emissions can lead to climate changes during human production and consumption.

With using the biomass, wind power, solar energy, hydropower, fossil energy and nuclear power, human are gradually developing from the original civilization to the agricultural civilization and industrial civilization. Due to this, the revolution between energy and economy even values has generated, that will start a new way to ecology civilization. It means that they abandon the traditional growth model in the 21th century, directly apply innovative technology and innovative mechanisms to achieve the sustainable social development through low-carbon economic model and low-carbon lifestyle. (Low-carbon life)

3 Carbon footprint

Carbon footprint marked the carbon consumption of a person or a group. "Carbon" is the general term of the natural resource of carbon element which consists by petroleum, coal, wood and etc. There is more carbon consumption, CO₂ was manufactured much more, and also "carbon footprint" was increased, vice versa. (The nature conservancy)

According to the statistics from the experts, saving each 1 degree (kWh) of electricity, correspondingly to saving of 0.4 kg of standard coal, while reducing the pollution emissions of 0.272kg of carbon dust, 0.997kg of carbon dioxide, 0.03 kg of sulfur dioxide and 0.015 kg of nitrogen oxides.(Time for change, global warming)

This could be to calculate the following formula: (Time for change, global warming)

Saving 1 degree of electricity=reducing 0.997 kg of CO₂ emissions;

Saving 1 kg of standard coal=reducing 2.493 kg of CO₂ emissions.

(Note: the coefficient of 1 kWh=0.4 kg of standard coal, while 1 kg of raw coal=0.7143 kg of standard coal.)

The following is the basic formula of the "carbon footprint": (Time for change, global warming)

Household electricity consumption of CO₂ emissions (Kg)=consumption of electricity degrees*0.785;

Fuel consumption of car CO₂ emissions (Kg) =the consumption liters of petroleum*0.785;

To calculate the CO₂ emissions of taking the aircraft: (Time for change, global warming)

Excursions: less than 200 km = kilometers x0.275;

200-1000 km travel = 55+ 0.105 × (kilometers-200);

Long-distance travel: over 1000 km =kilometers x 0.139.

We can calculate that to compensate by plant the trees if the fir trees of 30 years could absorb 111Kg of carbon dioxide.

For example: if you traveling 2000 km by the airplane, then you emit 278 kg of carbon dioxide, for which you need to plant three trees to counterpoise.

4 Low - Carbon design in Finland

Since 2008, the International Association of Industrial Design will select one city to be the World Design Capital which based on the designing application for each city during every two years. Helsinki was chosen as the 2012 World Design Capital. In 2012, Helsinki will offer five thematic activities which are urban reform, design reflection, exhibition, activities and communication. One of designing project is about low-carbon design by the Finnish Innovation Fund Stira. Marco Steinberg, the director of strategic design of Stira, who said “we only have old cities, our problem is very different, how you take existing cities, and slowly transform all to the low-carbon, because I cannot tear down the Helsinki and re-establish a new city. To achieve “low to no”, you have first to understand what low-carbon city was looks like; and then you have to understand how you take the existing cities and transform them to the low-carbon. That is all we are doing.” (Helsinki design lab)

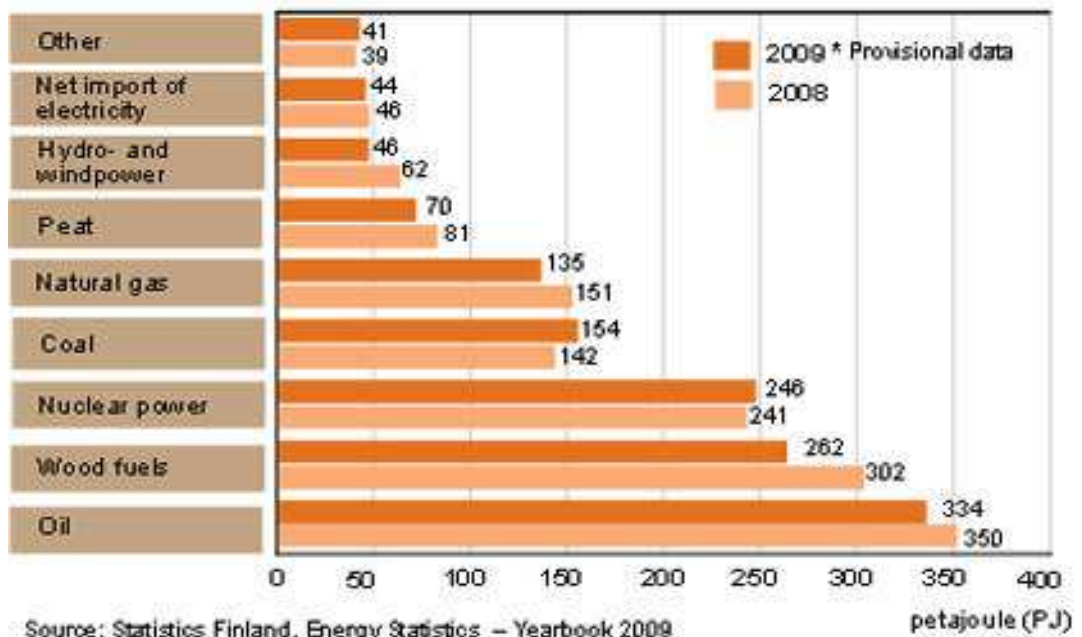
As early as 2007, the Finnish authorities had promised that in 2020 Finland will achieve the carbon emission reduction policy which decreased by 20 % compared with in benchmark year 1990. Moreover, in 2011, the Office of the prime Minister of Finland announced the carbon emission reduction statements, they planned in 2050 will decrease by 80% carbon emissions compared with in 1990. (Statistics Finland, energy consumption)

4.1 Energy in Finland

According to the Finnish Statistics, 1,086 petajoule (PJ) of energy was used in 2009. It already reduced by 1.5% of the total energy consumption in 2008 which was 1,103 petajoule (PJ). (Statistics Finland Yearbook 2009)

From 2008 to 2009, the energy using number has decreased in almost each kind of sections during only one year, except in coal and nuclear power parts.

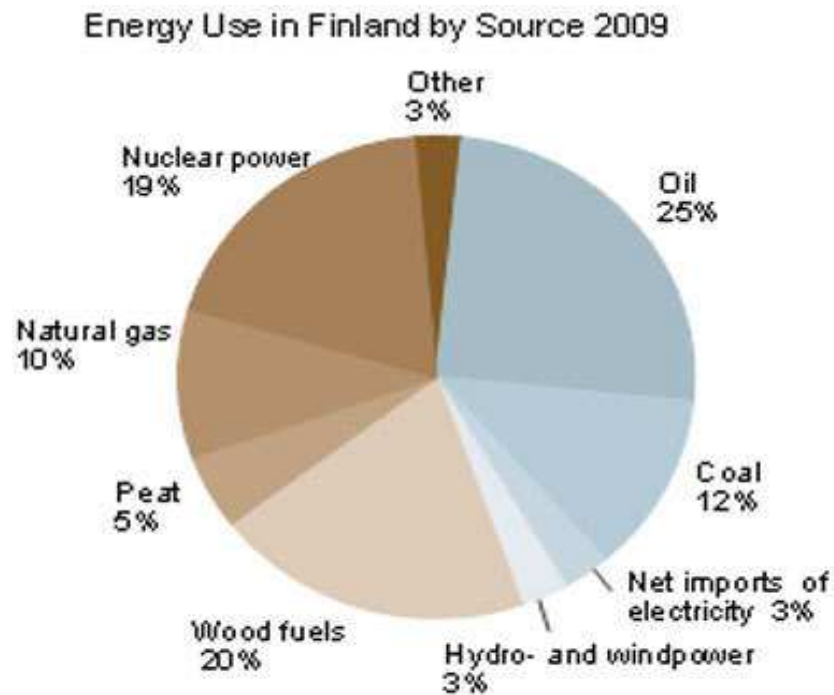
Energy Use in Finland by Source 2008 and 2009



GRAPH2. Energy Use in Finland by Source 2008 and 2009 (adapted from Statistics Finland, Energy Statistics- Yearbook 2009)

In Finland, more energy consumption was produced by the three big sections. They were oil (25%), wood fuels (20%) and nuclear power (19%), respectively. Coal and

natural gases also occupied about 10 per cent in 2009. However, the percentage of renewable power using only is 3% as the same quantity as the net imports of electricity. (Statistics Finland Yearbook 2009)

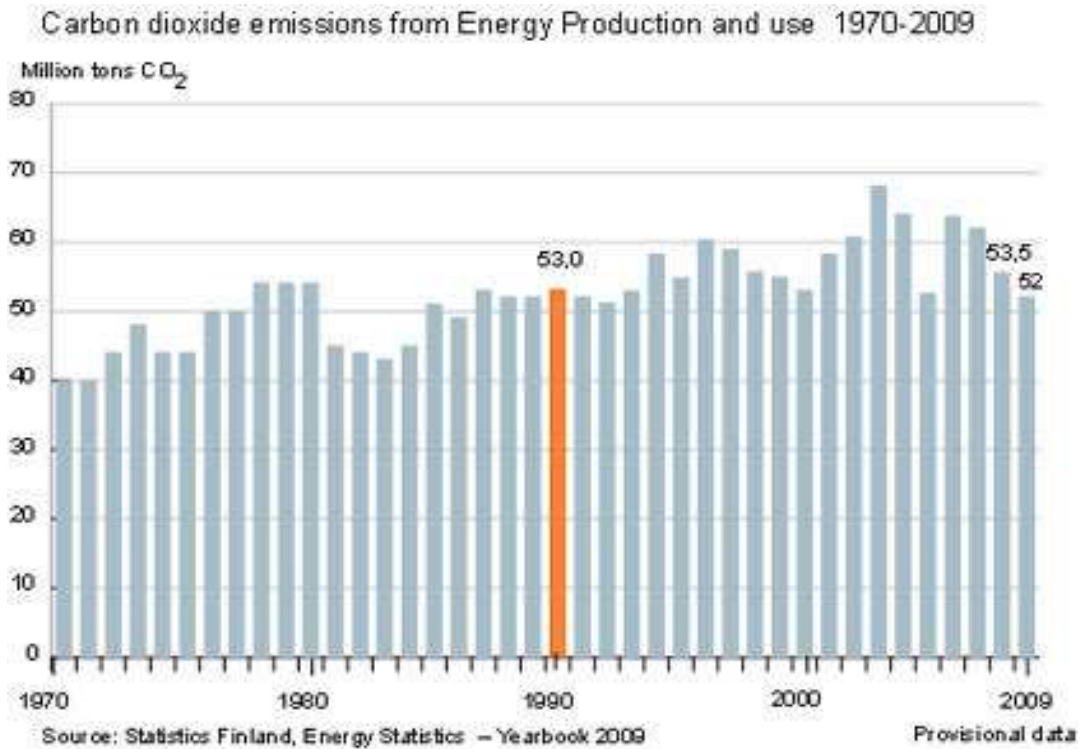


Source : Statistics Finland, Energy Statistics – Yearbook 2009

GRAPH 3. Energy Use in Finland in 2009 (adapted from Statistics Finland, Energy Statistics – Yearbook 2009)

As the below column chart shows that carbon dioxide emissions in Finland during 1970 to 2009. In 1970 and 1971, the CO₂ emission amount is the same as the lowest number in this research as 40million tons. Since 21 century, there are five years produced over 60 million tons CO₂ emissions in each year, especially in 2003, it has almost about 70 million tons to be the greatest amount from 1970. In previous

several years, it became a slightly decreased emission trend from 64 million tons in 2006 to 52 million tons in 2009. (Statistics Finland Yearbook 2009)



GRAPH4. Carbon Dioxide emissions from energy production and use in 1970-2009
(adapted from Statistics Finland, Energy Statistics – Yearbook 2009)

4.2 Low-carbon building of Finland

In the spring of 2010, the Finnish pavilion “giant’s kettle” called Kirnu in Finnish which stood at the world EXPO in Shanghai, China. The design reflects the many new environmentally concepts.



GRAPH5.Finland Kirnu Pavilion at Shanghai EXPO 2010

(Source: <http://www.resonatorhelsinki.com/>)

This pavilion is a sustainable building laboratory. It shows the solution of urban architecture for the future in Finland. By the environmental factor, Finnish pavilion was designed into a variety of renewable parts.

For the roof, the solar panels on the roof for supplying of cooling equipment in the summer and also offer the electricity directly for the pavilion building network or store the electricity in batteries. Furthermore, growing plants on the roof also balance the heat load. (Finland data EXPO 2010)



GRAPH6. Finland Kirnu Pavilion at Shanghai EXPO 2010 (Adapted from Finland data EXPO 2010)

For the fresh air ventilation, new material walls and special window structure both reduce the heat intensity by sunshine. To uses more of natural ventilation to deceases the demand of mechanical ventilation. Collection of air which is from the following horizontal acquisition of the building can supply the fresh air. The thick walls of the atrium to form a natural channel, the internal spiral ramp is from the entrance. The opening of walls and the ceiling promotes the natural ventilation, the reasonable position of the facilities, the using of new material surface and the structures of windows are reduced heat intensity due to sunshine. (Finland data EXPO 2010)



GRAPH 7. Finland Kirnu Pavilion at Shanghai EXPO 2010 (Adapted from Finland data EXPO 2010)

The materials of building are carefully selected to ensure that produce less greenhouse gases emissions. The load of material, re-use and regeneration were analyzed according to the entire life cycle of the pavilion. (Finland data EXPO 2010)

In Finland, the growth rate of trees is faster than to cut down them, and the woods are the best way to absorb carbon, so Finnish consider using wood to build in the city instead of concrete buildings. (Sitra, the future)

This is the first time for using wood and plastic composite material to be the external decoration of the wall. The external walls consist by thousands “ice cubes” which made by 25,000 pieces of deck. This decorative material uses innovative UPM ProFi wood plastic composite (WPC) material. Its main raw material is waste paper and plastic. (UPM ProFi. UPM ProFi Deck Environment)



GRAPH 8. Wood plastic composite

(Source: http://en.wikipedia.org/wiki/Wood-plastic_composite)

UPM ProFi material has the advantages from wood fibers and plastics. The good processing performance, waterproof, anti-corrosion, and long service life make UPM ProFi especially suitable for outdoor applications. The important advantage is changing waste into treasure and the materials can be 100% recycled back into the reproduction processes. The raw plastic material of WPC materials is high density

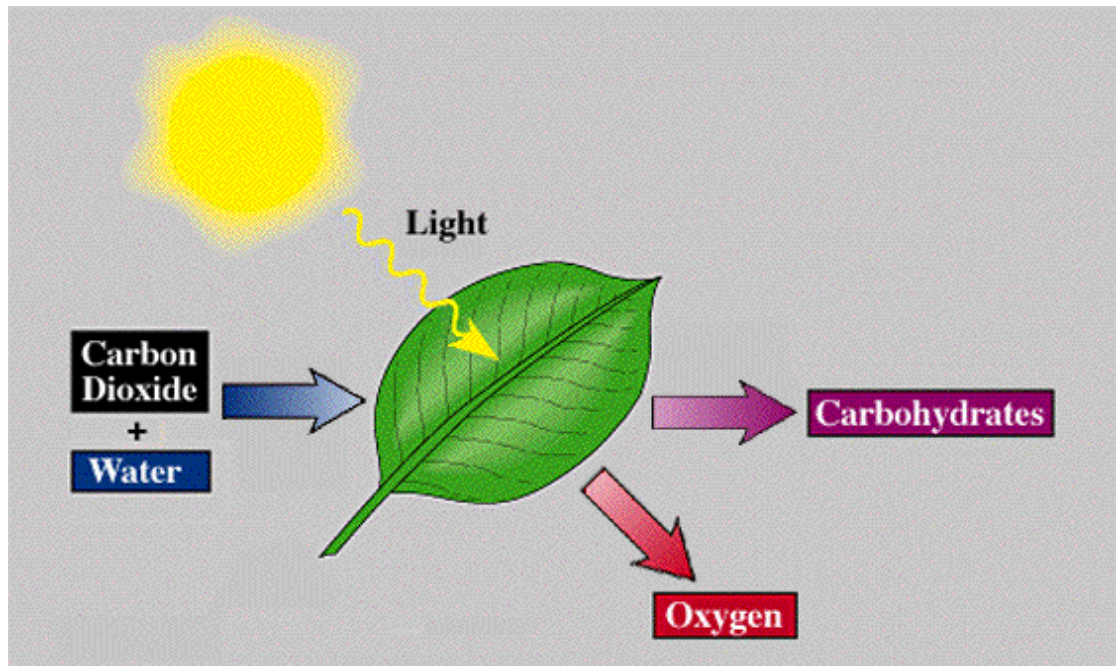
polyethylene or polypropylene; the raw wood materials can be wood flour, bran or wood fiber. (Wood-plastic composite)

UPM ProFi WPC is fully green material. It only releases approximately 1.84 kg of CO₂ if by 1 kg of label waster instead of being incinerated. 10kg of label waste occupies about 1 m² of UPM ProFi WPC Boards which would release 18.4 kg of carbon dioxide into the atmosphere. According to the calculation, the carbon footprint of producing process of UPM ProFi WPC is 0.7 kg of CO₂ from 1 kg of production if the Deck is not further recycled. Compared with the normal many concrete paving stones, they have more than half the amount than it. Hence, releasing CO₂ of UPM ProFi WPC is the minimum quantity for the lifetime.(UPMProFi. UPM ProFi Deck Environment)

4.3 Three examples for reducing the carbon in daily life

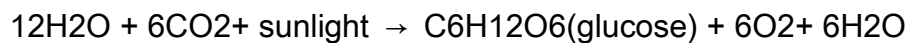
Firstly, as we all know, Finland is the one of the countries who has the highest rate of occupied forest in the world. Plants are the best way to absorb and reduce the carbon emission. Through the photosynthesis, CO₂ was absorbed by trees, oxygen was produced. Trees also can absorb 20-60 tons of all kinds of dust and reduce the noise pollution. 40 meters wide of forest could reduce 10-15 dB belt noise. Last but the least, trees secretions can kill bacteria. The research shows that there are approximately 40000 bacteria exist in the air in per cubic meter of an open space,

but only about 300- 400of it in the forest. (Photosynthesis)



GRAPH 9. An overview of photosynthesis (adapted from BioCoach Activity)

The chemical formula is following: (BioCoach Activity)



This reaction processes in chloroplast. On the right side, the oxygen comes from the water participation in the reaction. In this formula, the water both on left and right side cannot cancel out. The reason is that the water on the left side was obtained by planet absorption, and use into produce oxygen and hydrogen ions. But on the right side, in H_2O molecule the oxygen atom comes from carbon dioxide.

(BioCoach Activity)

Secondly, refuse sorting is an effective method as the same action. From the methods of global urban garbage classification, most of classification is combined with the resources and local recycled solution. Such as in Germany, they are generally divided into paper, glass, metal, plastic, etc.; in Australia, generally to divide into compostable waste, recyclable waste, and non-recyclable garbage; in Japan, are generally divided into burnable garbage, non-burnable garbage. (Refuse sorting)

Waste classification is the collection refers to the performance of waste, technical, or other available categories, its purpose is to bring the convenient for resource recovery and subsequent disposal, and improve the efficiency of utilization and disposal. The waste classification is a systematic project. Waste classification is more particular, the more recycled items would be dividing, the efficiency of classifying regeneration process would be fast, finally, less amount of garbage would landfill and saving resources. (Refuse sorting)

Separation and recycling of garbage can boost resource conservation and environmental protection for human. In general, garbage collection and regeneration divided into three basic methods from household which is following: (Refuse sorting)

- a) Directly recycling, such as glass bottles;
- b) Recycling, such as paper, plastic, metal, glass, etc.;

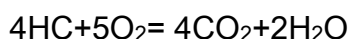
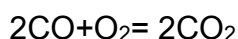
- c) Comprehensive utilization, such as the organic matter from garbage of household can be used for compost and generate electricity after treatment.

There are many different kinds of ways to reduce carbon emissions during the daily life by people. The important points are saving fuel energy and using more renewable energy to instead of waste resources.

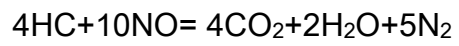
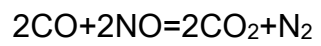
The next, we need clear the automobile exhausts. The main pollutant elements are carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x), lead (Pb), suspended solid particles, sulfur dioxide (SO₂), hydrogen sulfide (H₂S) and etc. Generally, clearing the pollutant is reduction- oxidation (redox) with catalyst. To purifying CO, NO_x and HC, the major catalysts are CuO, NiO, Cr₂O₃ and etc. The theory is that to make redox reaction between the catalyst and CO, NO_x and HC to generate harmless substances. The catalysts also called three-way catalysts.

The chemical formulas are following by: (Cleaning automobile exhaust technology)

Oxidizing reaction: (with oxidizing catalyst)



Three-way reaction: (with three-way catalyst)



5 The status of global Low – Carbon economy

Low carbon economy is to reduce greenhouse gas emissions as the goal, and build a based on the low power consumption and low pollution economic development system. It contains the low-carbon energy systems, low-carbon technologies and low-carbon industrial system. To developing low carbon economy, on the one side, it bears the environmental responsibility and achieves the requirements of the national saving energy; on the other side, it adjusts the economic structure, improves energy efficiency, and develops the new industries. (Low – Carbon economy)

Low carbon economy is trading the emission permit and carbon taxes to the high carbon economy with high emissions (coal, iron and steel, nonferrous metals, etc.), that subsidies to low or zero emission economy (clean energy), to achieve the purposes of reducing CO₂ emission and dealing with the climate problem. (Low – Carbon economy)

Low carbon economic industrial chain includes the three parts which are energy supply, energy storage and transport, and energy consumption. In the energy supply section, the main alternative energy sources are wind, solar, nuclear, hydro, biomass, in addition, the thermal power is also essential which includes the main application technologies are IGCC(Integrated Gasification Combined Cycle) and

CCS(Carbon Capture and Storage). Energy storage and transport are including the battery technology and the smart grid. Energy consumption is industrial energy saving, building energy saving, transportation energy saving and household energy saving. (Pathways to a Low-Carbon Economy, version 2 of the global greenhouse gas)

5.1 Energy supply in the Low-carbon economic chain

5.1.1 Three important new resources

Wind power, solar power, and nuclear energy are three important forms of new energy sources. They were developed in recent years, wind power and solar photovoltaic industry has made considerable progress.

Wind energy is most likely to lead in large scale application of new energy. During the 2011, the global capacity of wind power reached 41.7 GW (1 GW = 1000MW), and the capacity of wind power is 17.6 GW in China, which occupied about 42 per cent of the whole world had. China is continued to maintain the largest electricity market position of global wind power. (Low carbon marketing analyze)

The solar photovoltaic industry in recent years has more attention. For the capacity of the photovoltaic power growth over the past 30 years, it has experienced a

sharply strong growth process. During in the 1977-2007, the growth rate was 34 per cent. In 1977, the capacity of global photovoltaic power was only 500 kilowatts, however, until 2007 it growth to 3073 million watts. Solar energy is increasingly becoming one of the most important cleaning energy in the new century as the regenerated primary energy. (Low carbon marketing analyze)

Nuclear power has more and more global attention due to its stable operation, cost-efficient and its significant feature of effect of reducing carbon emission. According to the statistics of the International Energy Agency, in 2005, the world's nuclear power installed capacity of 374 million kilowatts; in 2007, the nuclear energy consumption of the world is 2.73 trillion kilowatts one hour, is about 5.61% of total global primary energy consumption.(Low carbon marketing analyze)

5.1.2 Thermal power reduction emission

Nowadays, 41% of total global CO₂ emissions are from the electricity industry with the thermal power. In the all thermal power industries of the whole world, there are 72% of the coal electricity industries. Saving energy of the thermal power is important. The main technological applications are IGCC and CCS. (Low carbon marketing analyze)

IGCC (Integrated Gasification Combined Cycle) refers to the combined whole

gasification and cycle power generation system, to manufacture the coal gasification at the beginning, burning the gas from the gasification process that in the gas turbine, and then use its waste heat gas to generate steam, and use the steam to drive a steam turbine. Pollutant emission is only 1/10 of the conventional coal-fired power plant; water consumption is half to 30 per cent of the conventional power plant. It is conducive to environmental protection. (Low carbon marketing analyze)

CCS (Carbon Capture and Storage) is technology for capturing carbon and storage. It collects carbon dioxide which produced after fossil energy combustion, avoid spreading into the atmosphere. It is more convenient to utilize CCS technology in heat power plant, because easily gather the carbon dioxide emission. Theoretically CCS can capture approximately more than 90% of carbon dioxide which produced in the heat power plant. Thus, it will achieve 20% to 28% of global carbon reduction emission target from CCS technology in 2050, the total amount of up to 10 billion tons. (Low carbon marketing analyze)

5.2 Energy storage and transport in the Low-carbon economic chain

5.2.1 New energy battery

It is the core of the new energy industry chain that is the innovation of battery

technology. Wind power, nuclear power, solar power, new energy vehicles are inseparable from the battery. The batteries are the energy storage for varieties of new energy and power grid; consequently, it is a process for changing the heart of traditional vehicles. And also, it called the fifth Industrial Revolution which using battery to replace the fuel engine. (Low carbon marketing analyze)

5.2.2 Energy storage power station

Wind power electricity and photovoltaic power are intermittent power. Energy storage power station will get uneven distribution of wind and solar power to offer the electricity to the metropolis.

5.2.3 Smart grid

Smart grid refers to apply variety of new technology in power generation, transmission, distribution, electricity and other sectors, to achieve the optimal allocation of electricity as well as energy saving.(International energy, international power)

In the United States on the definition of smart grid, this has 7 characteristics:
(International energy, international power)

1) Self-healing

Smart grid can find the error to responds and quickly resolve, and then reduce outage time and economic losses.

2) Interactive

In the modern power grid, the energy consumers from commercial, industrial and residential could see the electricity prices. They have the ability to choose the most appropriate power supply program and tariff.

3) Safety

When building the modern power grid, firstly should consider the security.

4) To provide power to the needs of the 21st century

The modern grid will not have the quality problem in voltage drops, voltage spikes and interruption. To adapt to data center, computer, electronic and automated production line needs.

5) Adapting to all types of power and energy storage methods

Modern grid allows connecting to every power, including the renewable energy and energy storage devices.

6) Market transactions

It supports a sustained national transaction and allows regional and local innovation.

7) Optimization of the grid assets to improve operational efficiency

Modern grid can offer more power in the built system, which only establishes few new basic facilities and cost less to operating maintenance.

5.3 Energy consumption in Low-carbon economic chain

5.3.1 Industry energy saving

Less than 20% of industrial energy consumption is in the total power consumption in United States. In Japan, the proportion is less than 30%. So the industry energy consumption is the big part in the total energy consumption. (Center for strategic and international studies, the future of low carbon growth)

5.3.2 Transportation energy saving

40% of the world's oil, 30% of China's oil was burned by car. In 2050, the all oil resources will exhaust. There are 25% of CO₂ emissions made by the motor vehicles. (Center for strategic and international studies, the future of low carbon growth)

Energy saving work is the great significant that to improve the transformation development mode and to speed up the structural adjustment of transport to achieve the scientific development of transportation. Building low carbon transport system, this is the important method for improving reducing emission and responds climate changes.

6 Conclusions

Because the excessive pollution and using fossil energy, so we should change to use and develop new technologies and energy. Roof greening, cleaning the vehicle exhaust emission, and classifying the garbage are the basic manner for protecting environment in the daily life. Low-carbon life is not just a slogan. It is an attitude toward life. To make the low-carbon concept into daily life, affecting people's lives, making it into a part of life. It has become a manifestation of a sense of the responsibility.

Even in a green building or a low-carbon city, if the residential have no sense with low-carbon, then all energy saving would become high-carbon. Therefore, for the building low or zero carbon cities, more important is the exploration of people's consumption mode. In other words, changing in human life styles and values are very important.

The carbon emissions of the buildings reached about 50% of urban carbon emission in Helsinki. Therefore, the development of green wooden building structure is most important for establishing a zero carbon city.

City, how to make life better? This issue brings the plight and pain points to modern civilization. In fact, the reality of the crisis and challenges already leaded mankind

not to indulge in that colorful buildings and economic growth, and not excited on the transformation of nature. Human being changes their ideas to the sustainable development and the future thinking.

REFERENCES

Energy, the Environment and Climate change, Hodgson & Peter E 2010, 7

Greenhouse gasses

Available: <http://baike.baidu.com/view/3185.htm>

Global energy consumption situation and development trend

Available: http://www.168qyj.com/News_View.asp?NewsID=21

United Nations framework convention on climate change

Available: http://unfccc.int/kyoto_protocol/items/2830.php

Copenhagen Climate Council

Available: <http://copenhagenclimatecouncil.com/>

Low-carbon life

Available: <http://baike.baidu.com/view/1930641.htm>

The nature conservancy

Available: <http://www.nature.org/greenliving/carboncalculator/index.htm>

Time for change, global warming

Available: <http://timeforchange.org/what-is-a-carbon-footprint-definition>

Helsinki design lab.

Available: http://www.helsinkidesignlab.org/people/Marco_Steinberg

Statistics Finland, Energy Statistics – Yearbook 2009.

Available: http://www.motiva.fi/en/energy_in_finland/energy_use_in_finland/total_energy_consumption

Statistics Finland, energy consumption

Available: http://www.stat.fi/til/ene_en.html

Finland Kirnu Pavilion at Shanghai EXPO 2010

Available:

<http://www.upmprofi.com/en/media/photo-gallery/Pages/default.aspx>

Global Fossil Carbon Emissions from 1880 to 2000

Available: <http://english.people.com.cn/90002/98666/99044/6830157.html>

Finland data EXPO 2010

Available: <http://www.finlandatexpo2010.fi/index.phtml?s=47>

Sitra, the future

Available: <http://www.sitra.fi/en/future>

Wood-plastic composite

Available: http://en.wikipedia.org/wiki/Wood-plastic_composite

UPMProFi, UPM ProFi Deck Environment

Available: http://www.upmprofi.com/SiteCollectionDocuments/Brochures_EN/UPMProFi_Deck_Environment_EN.pdf

Photosynthesis

Available: <http://baike.baidu.com/view/8885.htm>

BioCoach Activity

Available: http://www.phschool.com/science/biology_place/biocoach/photosynth/overview.html

Refuse sorting

Available: <http://baike.baidu.com/view/160814.htm>

Cleaning automobile exhaust technology

Available: <http://www.nosea.net/html/fq/20080702/291.html>

Low – Carbon economy

Available: <http://www.lowcarboneyconomy.com/LCE/AboutALowCarbonEconomy>

Pathways to a Low-Carbon Economy, the global greenhouse gas, version 2

Available: <http://www.worldwildlife.org/climate/WWFBinaryitem11334.pdf>

International energy, international power

Available: <http://power.in-en.com/html/power-1533153346366165.html>

Center for strategic and international studies, the future of low carbon growth

Available: <http://csis.org/publication/future-low-carbon-growth>