



SATAKUNTA UNIVERSITY OF APPLIED SCIENCES

Jyrki Holttinen

BACHELOR THESIS

CLIMATE STRATEGY STUDY FOR PORI REGION

Climate strategy for Pori region (ILPOS)

Author: Jyrki Holttinen
Satakunta University of Applied Sciences
Unit of Technology in Pori
Degree programme of Environmental Engineering
February 2007
Prizztech Oy
Instructors: Esa Merivalli DI, Marjo Kekki ins (AMK)
Pages: 71+17
Supervisor: Lecturer Jyri Maunuksela
Keywords: greenhouse gases, energy, Kyoto protocol
UDC: 504.06, 504.3, 504.38

ABSTRACT

Increasing greenhouse effect and climate change are nowadays world's biggest environmental risks. Atmosphere includes greenhouse gases which absorb effectively grounds long wavelength thermal radiation but they cannot stop the solar radiation which is coming to the Earth's surface. Part of the solar radiation is absorbed to the Earth's surface for warming it up and the part of radiation is reflected back to the space. The greenhouse effect arises when the radiation is absorbed to the atmosphere so that it starts to warm up the Earth. Radiation which is coming to Earth's surface is mainly visible light. It is expected that greenhouse effect rises the average temperature of the world with 1-3,5 centigrade's for the year 2100. Greenhouse gases which warm up the Earth are: carbon dioxide, methane, steam, nitrous oxide, hydrocarbons, and carbon monoxide and nitrogen oxides and Finland is committed to follow international climate agreements like Kyoto protocol to reduce emissions of greenhouse gases. The cabinet of Finland has made a report which says that Finland must concentrate on minimization of the greenhouse gas emissions and to start to use renewable energy sources instead of non-renewable energy sources. They also say that Finland must take care of energy savings so that it is possible to slow down climate change effect. The city of Pori has made a voluntary agreement with Ministry of Trade and Industry about concerning the savings of the energy.

This thesis is done for Energy and Environment Unit of Prizztech Ltd. Purpose of the project is to make a climate strategy for Pori region. My part of the project which is also subject of my bachelor thesis is to make an interview which deals with climate change issues. Interview is made with help of computer program called Zef Solutions. Interview is published in internet so that people can answer to it. Answers of the interview are analyzed in my bachelor thesis and possible improvement suggestions are given.

Topics of the interview were: background information, traffic and moving, purchasing of devices, waste management, and use of energy and general issues concerning climate change. Background information shows that men were more active than women. Age distribution question shows that the most active age group was 46 to 60 years old people. Second question group deals with traffic and moving issues. It was noticeable to see that people think quite much things like price of fuel and etc. when they are going to buy a new car. It was big surprise that people doesn't like to use common lift and bus when they are travelling to work. Third question group asks questions which must be considered when purchasing a device. This question group shows that people think lots of energy issues for example like consumption when they are going to buy a new device. Fourth question group deals with waste management issues. It was remarkable to notice how well people recycle and sort out their wastes. Fifth question group asks questions which deals with use of energy. It includes topics like warming, lighting and consumption. It shows that electricity is most often used energy source when warming up house but also wood and district heating are used. Also use of energy saving devices is nowadays increasing significantly. Last question group deals with general issues concerning climate change. It was significant to notice that people know what greenhouse effect is. Also people know well main greenhouse gases.

Porin seutukunnan ilmasto-ohjelma (ILPOS)

Työn tekijä: Jyrki Holttinen
Satakunnan ammattikorkeakoulu
Tekniikan Porin yksikkö
Degree programme of Environmental Engineering
Helmikuu 2007
Prizztech Oy
Työn ohjaajat: Esa Merivalli, DI, Marjo Kekki ins (AMK)
Sivuja: 71+17
Työn valvoja: Lehtori Jyri Maunuksela
Asiasanat: kasvihuonekaasut, energia, Kioton pöytäkirja
UDK-luokka: 504.06, 504.3, 504.38

TIIVISTELMÄ

Kasvihuoneilmiö ja ilmastonmuutos ovat nykyään luonnon suurimpia ympäristöuhkia. Kasvihuoneilmiön aiheuttavat ilmakehän sisältämät ns. kasvihuonekaasut, jotka tehokkaasti absorboivat maanpinnan lähettämää pitkäaaltoista lämpösäteilyä, mutta eivät estä auringonsäteilyn kulkua maan pinnalle. Osa auringonsäteilystä imeytyy maan pinnalle lämmittäen maan pintaa ja osaa heijastuu takaisin avaruuteen. Maan pinnalle tuleva säteily on pääasiassa näkyvää valoa. On oletettu, että kasvihuoneilmiö nostaa maapallon keskilämpötilaa 1-3,5 astetta vuoteen 2100 mennessä.

Kasvihuonekaasuiksi luokitellaan: hiilidioksidi, metaani, vesihöyry, di-typpioksidi, hiilivedyt, hiilimonoksidi ja typen oksidit. Suomi on sitoutunut kansainvälisten sopimusten kuten esimerkiksi Kioton pöytäkirjan avulla vähentämään kasvihuonekaasupäästöjä. Valtioneuvoston selonteon mukaan Suomi tulee panostamaan kasvihuonekaasupäästöjen vähentämiseen, uusiutuvien energialähteiden käyttöönottoon ja energiansäästöön. Porin alueella on tehty erityyppisiä toimenpiteitä. Porin kaupunki on tehnyt kauppa- ja teollisuusministeriön kanssa vapaaehtoisen energiansäästösopimuksen.

Tämä insinööri työ tehtiin Prizztech Oy:n Energia- ja Ympäristö toimialalle. Projektin tarkoituksena on tehdä Porin seutukunnalle ilmasto-ohjelma. Yhtenä projektin osana, joka on myös insinööri työ aihe, on tehdä kysely ilmastonmuutokseen liittyvistä asioista. Kyselyn tekemisen apuna on käytetty tietokoneohjelmaa, jonka nimi on Zef Solutions. Kysely on julkaistu internetissä, mikä mahdollistaa sen että ihmiset pystyvät ottamaan siihen osaa. Kyselyn vastaukset analysoidaan lopputyössäni. Vastausten perusteella on myös tarkoitus antaa parannus ehdotuksia, jotta ilmastonmuutosta pystyttäisiin hidastamaan.

Kyselyn aihealueet olivat: taustatiedot, liikkuminen, laitteiden hankinta, jätehuolto, energian käyttö ja ilmastonmuutokseen liittyvät kysymykset.

Taustatietojen perusteella kyselyyn otti osaa enemmän miehiä kuin naisia. Suurin kyselyyn osaa ottanut ikäryhmä oli 46–60 vuotta täyttäneet henkilöt. Liikkumiseen liittyvissä asioissa kyseltiin, että mitkä tekijät vaikuttavat auton hankintaan. Huomattavaa oli, että ihmiset mieltivät tarkasti auton hankintaa tehdessään esimerkiksi polttoaineen hintaa ja kulutusta ja muita seikkoja, jotka liittyvät auton hankintaan. Kyselystä ilmeni myös, että ihmiset käyttävät harvoin kimpakyytiä ja bussia työmatkoihin. Laitteiden hankintaa koskevissa kysymyksissä oli merkittävää havaita, että ihmiset paneutuvat laite hankintaa tehdessään laitteen laatuun ja energiankulutukseen. Jätehuoltoon liittyvissä asioissa ilmeni hyvin, että ihmiset ovat sisäistäneet kierrättämisen ja lajittelun tärkeyden. Energian käyttöön liittyvissä asioissa tiedusteltiin esimerkiksi lämmitykseen, valaistukseen ja kulutukseen liittyviä asioita. Osiossa ilmeni, että yleisin lämmitystapa on sähkölämmitys, mutta myös puun ja kaukolämmön osuus oli merkittävä. Myös energiaa säästävien laitteiden käyttö oli runsasta. Ilmastonmuutokseen liittyvissä kysymyksissä kyseltiin yleisellä tasolla ilmastonmuutokseen liittyviä asioita. Merkittävää oli havaita, että suurin osa kyselyyn vastanneista henkilöistä tiesi, että mikä on kasvihuoneilmiö ja mitkä ovat yleisimmät kasvihuonekaasut.

CONTENTS

LITERATURE STUDY

1. INTRODUCTION	1
2. GENERAL INFORMATION OF PRIZZTECH OY.....	2
3. WHAT IS THE CLIMATE CHANGE.....	2-3
3.1 The greenhouse effect	4
3.2 The greenhouse effect in Finland.....	4-5
4. GREENHOUSE GASES	5
4.1 Steam.....	6
4.2 Carbon dioxide CO ₂	6-7
4.2.1 The concept of the carbon sinks.....	7
4.2.2. How Kyoto protocol has defined the carbon sink?.....	7-8
4.3 Methane CH ₃	8-10
4.4 Nitrous oxide N ₂ O.....	10-11
4.5 Indirect greenhouse gases	12
4.5.1 Nitrogen oxides (NO _x).....	13
4.5.2 Carbon monoxide.....	13
5. CLIMATE AGREEMENTS AND EMISSION TRADING IN FINLAND	
5.1 The Kyoto protocol, ECCP, IPCC	14-15
5.2 Finland's national energy and climate agreement.....	15
5.3 Communal climate strategy.....	16
5.4 Voluntary energy agreement for industry	16
5.5 Emission trading.....	16-17
6. ENERGY SOURCES AND PRODUCTION	17
6.1 Coal	18-19
6.2 Oil.....	19
6.3 Natural gas	20-21

6.4 Peat	21
6.5 Uranium	22
6.6 Fusion energy	22-23
6.7 Renewable energy	23
6.7.1 Water	23-24
6.7.2 Solar power	24-25
6.7.3 Wind power	25-26
6.7.4 Biomass	26-27
6.7.5 Geothermal and ground heat	27-28
7. POSSIBILITIES TO DEVELOP THE ENERGY PRODUCTION	28
7.1 Improvements of the efficiency	28
7.2 Combined heat and electricity production	29
7.3 Separate energy production	29-30
8. HOW TRAFFIC, AGRICULTURE, FOREST, WASTE MANAGEMENT, HOUSEHOLDS AND INDUSTRIAL PROCESSES EFFECTS FOR THE CLIMATE CHANGE	30
8.1 Traffic	31-32
8.2 Agriculture	32-34
8.3 Forest	34
8.4 Waste management	35
8.5 Households	35-36
8.6 Industrial processes	36-37
9. ECONOMICAL EFFECTS OF THE CLIMATE CHANGE	37-38
10. HOW COMMUNITIES CAN REDUCE THEIR GREENHOUSE GAS EMISSIONS?	38-39
RESEARCH STUDY	
11. MATERIALS AND METHODS	40-41

12. RESULTS	41
12.1 Background information	41-42
12.2 Traffic and moving issues	42-44
12.3 Purchasing of device	44-46
12.4 Waste management	46-48
12.5 Use of energy	49-51
12.6 General issues concerning climate change.....	51-52
13. FURTHER RESEARCHES	53
13.1 Traffic and moving.....	53
13.2 Purchasing of device	54
13.3 Waste management	54-55
13.4 Use of energy	55
13.5 General issues concerning climate change.....	56
14. CONCLUSION	56-58
15. REFERENCES.....	59-62

APPENDIXES

ABBREVIATIONS

CO ₂	Carbon dioxide
CO	Carbon monoxide
CH ₄	Methane
ECCP	European climate change strategy
HC	Hydrocarbons
IR	Infrared radiation
IPCC	Intergovernmental panel on climate change
kg	Kilogram
MW	Megawatts
MJ	Mega joule
mm	millimetre
Mtoe	Million ton of oil equivalent
NO _x	Nitrogen oxides
N ₂ O	Nitrous oxide
UNEP	United Nations environment programme
UV	Ultra violet light
VOC	Volatile organic compound
WMO	World meteorological organisation

LITERATURE STUDY

1 INTRODUCTION

Finland have had from the year 2001 national climate strategy whose purpose is to carry out the targets concerning about the minimization of the greenhouse gas emissions which limits have been announced in the Kyoto protocol and in EU agreements. The Cabinet of Finland has made a report which says that Finland must concentrate on minimization of the greenhouse gas emissions and to start to use renewable energy sources instead of non-renewable energy sources. They also say that Finland must take care of energy savings /34/.

In Pori area there have been made several of actions. The city of Pori has made a voluntary agreement with Ministry of Trade and Industry about concerning the savings of the energy. Some companies in Pori area for example Porin Linjat Oy is involved in the traffic environmental program. With this climate program of Pori area has a purpose to create a common climate strategy for the region of Pori which extends to year 2020 which all of the participants have agreed on /34/.

Purpose of this work is to recognize and describe the potential actions which must be made for the minimization of the greenhouse gas emissions. We must also produce a plan concerning about the program how we are going to do it and how we are going to put it in action /34/.

My part of the project is to make an interview for the participants of the project and analyzing the results of the interview. The questions what I make concerns about the climate change in Finland especially in Pori area and how people in the Pori region are going to take care of the climate change issues. I also present the basic principles what the climate change is.

2 GENERAL INFORMATION OF PRIZZTECH OY

Prizztech Oy is a development organization in Satakunta district, whose targets are in developing the competitiveness of the Satakunta district and economic life. Prizztech Oy accomplishes assignments by the means of development programs and projects /31/.

Prizztech Oy carries out assignments by the means of systematic working way i.e. project working. The projects are temporary, limited and systematically lead wholeness /31/.

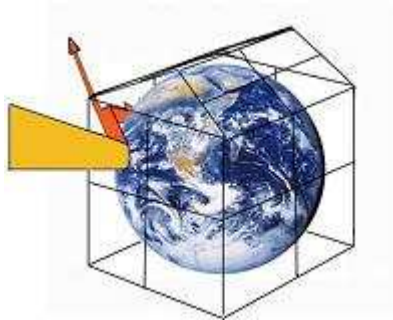
Prizztech Oy is a member of the Finnish Science Park Association. The Finnish Science Park Association is a nation-wide cooperation network which includes 23 technology centers in the university cities /31/.

The operation of the Prizztech Oy is divided into five branches. The branches are welfare and technology, innovation and business, energy and environment, The Satakunta Centre of Expertise and The Service Centre of Pori University Consortium /31/.

3 WHAT IS THE CLIMATE CHANGE?

Increasing greenhouse effect and climate change are nowadays the world's biggest environmental risks. When the Earth is warming up it radiates IR-radiation. The causes of greenhouse effect can be seen in atmosphere. Atmosphere includes so called greenhouse gases which absorb effectively

grounds long wavelength thermal radiation but they cannot stop the solar radiation which is coming to the Earth's surface. Part of the solar radiation is absorbed to the Earth's surface for warming it up and part of the radiation is reflected back to the space. The Earth surface reflects heat as IR-radiation. Part of it is absorbed to atmosphere and the other part can get through the atmosphere to the space. The amount of the radiation which is coming and leaving from the Earth stays in balance because of water and greenhouse gases of the Earth. The greenhouse effect arises when the radiation is absorbed to the atmosphere so that it starts to warm the Earth. Radiation which is coming to Earth's surface is mainly visible light. So it can be said that the atmosphere which includes greenhouse gases and water creates a phenomena which is like a same than in a little greenhouse. Visible light is getting through the walls of the greenhouse (atmosphere). It warms up the plants of the greenhouse and the ground (The Earth). When it is warming up, the plants and the Earth radiate much more IR-radiation than normally. The wall of the greenhouse and the roof is reflecting effectively the radiation of the plants and the ground back which warms up the greenhouse. So the greenhouse is coming warmer than the outside air (space) (Picture1) /1, 2/.



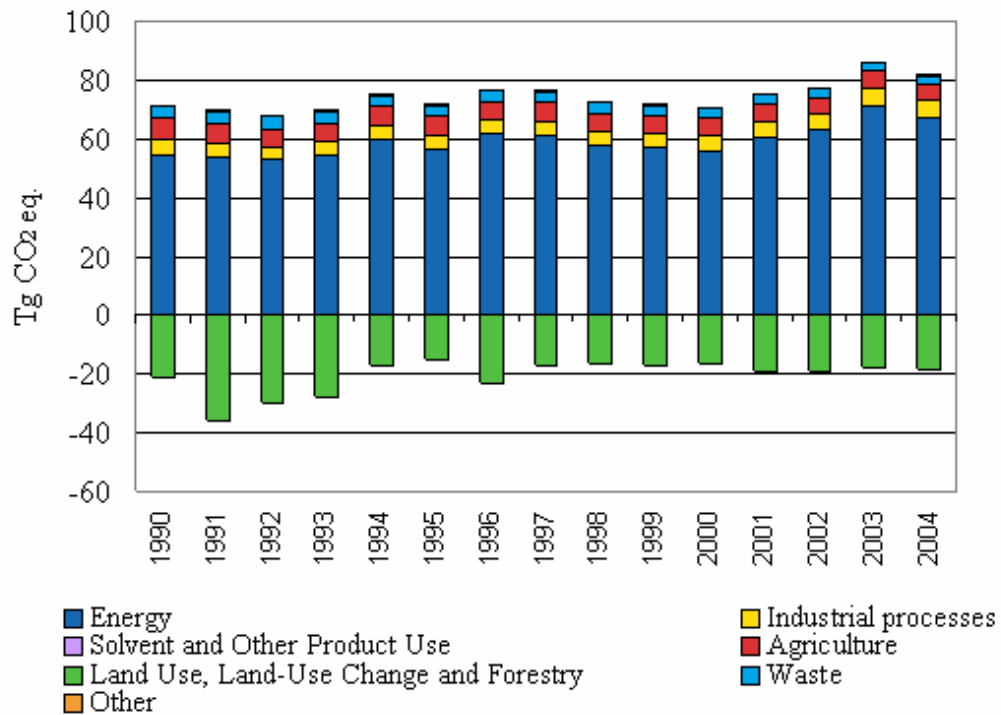
PICTURE 1 the greenhouse gases let the light gone through but prevent the heat going out like a glass in greenhouse /32/.

3.1 The greenhouse effect

The greenhouse effect is raising significantly the average temperature of the world from -18°C to $+15^{\circ}\text{C}$. There has been some suggestions that the average temperature of the world is raising about 1-3,5 centigrade's for the year 2100 and also surface of the oceans is raising about 15-95 cm if there is no significant limitations in controlling of greenhouse gas emissions. So if the Earth doesn't have any kind of atmosphere the average temperature of the ground would be about 30 centigrade lower than nowadays approximately -15°C . The changes in temperature, rain and the humidity of the ground causes global problems like for example to natural ecosystems, water resources, food production and human health /1, 2, 32/.

3.2 The greenhouse effect in Finland

It is expected that the greenhouse effect effects also to Finland. The temperature rise in Finland compared to the average temperature of the world is much faster than anywhere else. The climate of Finland has warmed by approximately 0.7 degrees centigrade during the 1900s. There have been made new scenarios to indicate an average annual warming of between 2.4°C and 7.4°C in combination with increased annual precipitation of 6% to 37% with the next 80 years. Picture 2 shows Finland's greenhouse gas emissions in 1990-2004, million tonnes of CO_2 eqv. (Picture2) /3/.



PICTURE 2 Finland's greenhouse gas emissions in 1990-2004, million tonnes of CO₂ eqv /30/

4 GREENHOUSE GASES

The action of the humans causes to atmosphere so called greenhouse gases which change the atmospheres radiation balance and they also warm up the atmosphere. The substances which cause the greenhouse effect can be called greenhouse gases. The most important greenhouse gas in the world is steam (H₂O). The main greenhouse gases are steam (H₂O), carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). There is also so called indirect greenhouse gases which in atmosphere forms actual greenhouse gases. Those so called indirect greenhouse gases include hydrocarbons (HC), nitrogen oxides (NO_x) and carbon monoxide (CO) /1, 2, 4/.

4.1 Steam

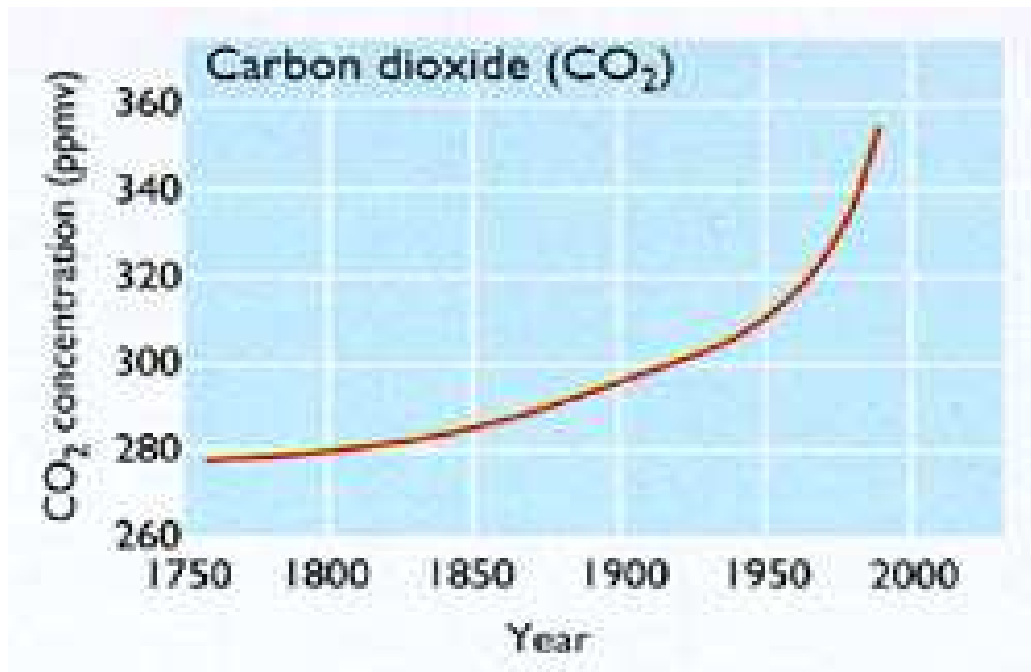
The most important factor which causes the natural greenhouse effect is steam. Steam is the basic element of the greenhouse effect. It comes from the evaporation of the water from ground, water systems and vegetation. When the atmosphere is warming up it increases the content of the steam. Because steam is very effective greenhouse gas it increases in atmosphere the temperature of the ground. On the other hand, when the steam is condensate to clouds it reflects the radiation of the sun back to the space and partly cancels the before mentioned effect. The direct effect of the humans for the cycle of water in atmosphere is unimportant. So the steam is increasing the effect of the other greenhouse gases /1, 4/.

4.2 Carbon dioxide, CO₂

The most important human produced greenhouse gas is carbon dioxide. The content of human produced carbon dioxide, which is warming the atmosphere, is about 60 %. Globally speaking, human produced carbon dioxide emissions are 25-30 billion tons per year. Human produced carbon dioxide emissions are nowadays, if we change it to carbon content, 7 or 8 billion tons per year. From that amount, 6 billion tons is coming from the burning of the fossil fuels such as carbon, oil, natural gas and peat. Also forests and plants produces carbon dioxide to the Earth almost 3,5-9 billion tons per year. So carbon dioxide is produced and coming from such activities as industry, traffic, warming of the houses and the destroying of the forests /5, 6/.

The amount of carbon dioxide which is released annually to atmosphere is 7 billion tons and only 3,5 billion tons of carbon dioxide from the annual amount is staying in the atmosphere. So scientists have long believed that the majority of the “lost” carbon dioxide disappears to oceans. But the newest evaluations have

shown that it is only 1,2 billion tons of carbon dioxide which can be removed annually from the oceans (Picture3) /5, 6/.



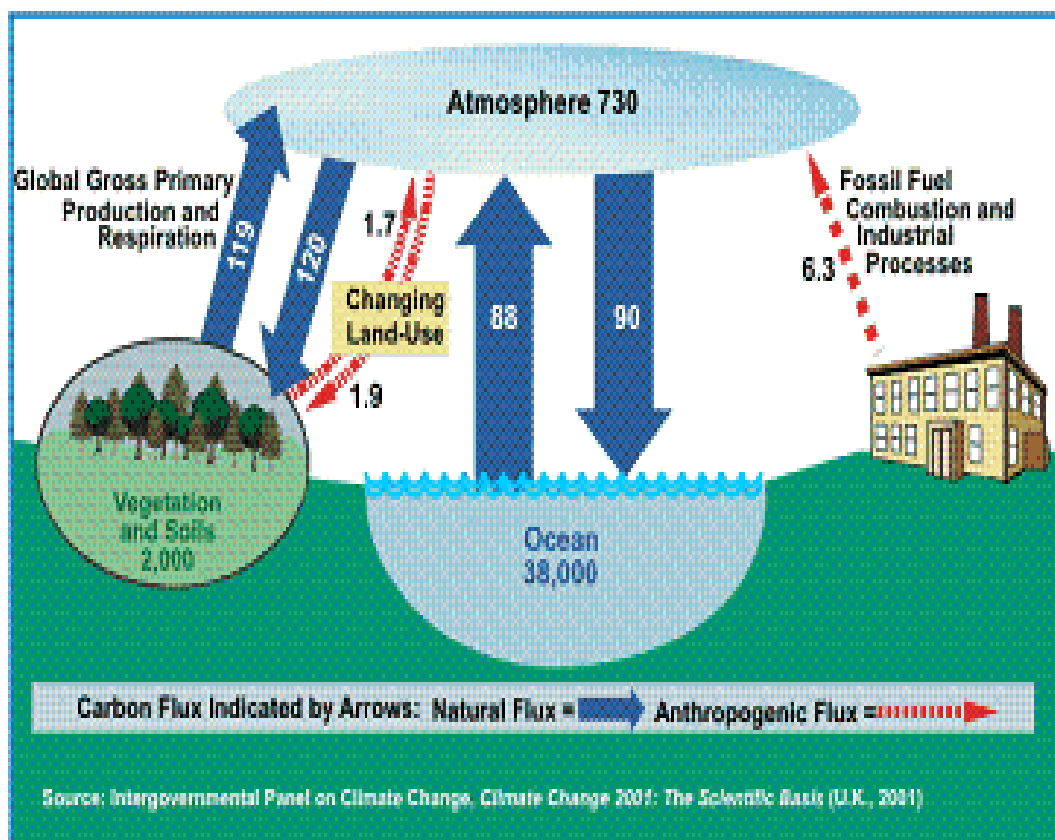
PICTURE 3 Carbon dioxide concentration in atmosphere /33/

4.2.1 The concept of the carbon sink

Forests, soils, oceans and atmosphere can store carbon dioxide. It is also possible that forest can act as a source or a sink at different times. The difference between these two occasions is that the source can release more carbon than they absorb and the sink can soak up more carbon dioxide than they can emit. So the concept of the carbon sink can be described as trees, other plants and the soil to soak up carbon dioxide and temporarily store the carbon in wood, roots, leaves and the soil /7/.

4.2.2 How Kyoto protocol has defined the carbon sink?

The Kyoto protocol has defined the carbon sink so that the atmospheres carbon dioxide is gathered to grounds, forests and oceans. When the content of the carbon dioxide in the atmosphere is reduced the climate change is getting slower and the Kyoto protocol is trying to effect especially for the carbon sinks which are located in the ground. The Kyoto protocol also determines the restrictions of carbon sinks so that the actual key point stays in emissions at that place where the emissions have been arisen. So the ocean sinks are not dealt in climate agreements. However, the carbon sinks have had contested position in climate science and in politics, because there exists uncertainties and possibilities to avoid reduction of the emissions for example in energy production (Picture4) /8/.



PICTURE 4 The natural cycle of the carbon /8/

4.3 Methane, CH₄

Methane is the second important greenhouse gas whose content in the global warming is probably about 15 %. Methane's lifetime is much shorter than the lifetime of the carbon dioxide but its short time effects are manifolds compared to carbon dioxide. So methane is very powerful but short time greenhouse gas /9/.

The content of the methane in the atmosphere has raised 145 % because of the human actions. Globally speaking, the annual methane released in the world is nowadays 500 million tons per year. From that amount 170 million tons has been estimated to come from different natural resources and 370 million tons are coming from the emissions which are caused by human actions (Table1) /9, 10/.

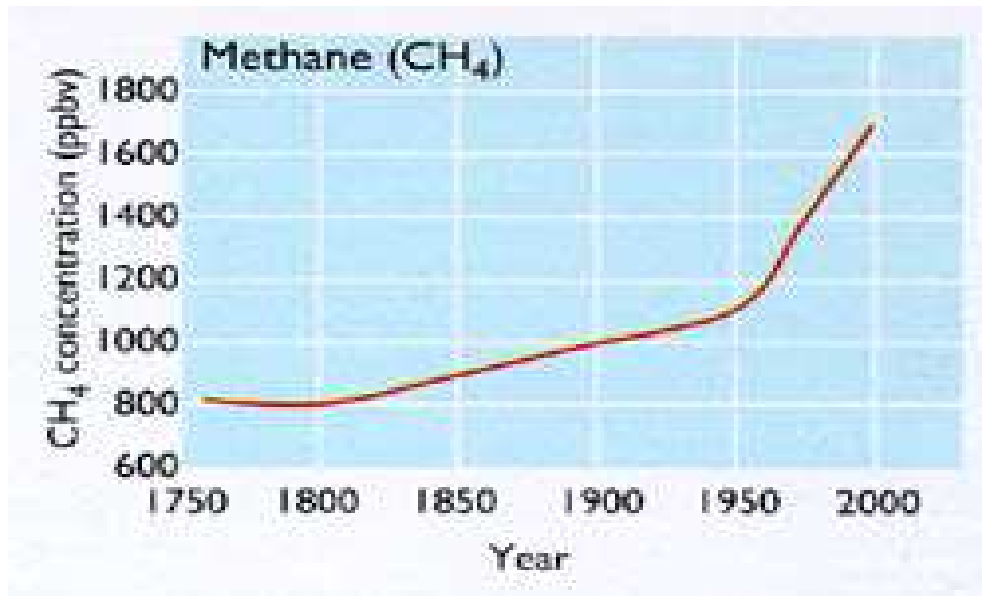
TABLE 1 Human caused methane emissions /10/

Source	Interest	Amount
Fossile fuel mining, transport and use	27 %	100 Mt
Ruminating of cattle	23 %	85 Mt
Growing of rice	16 %	60 Mt
Incomplete treatment of biomass	11 %	40 Mt
Dumping place	11 %	40 Mt
Animal manure	7 %	25 Mt
Wastewater treatment	7 %	25 Mt

Methane can be formed everywhere where exists bacteria which can break the organic material in anaerobic conditions. The most important methane resources are swamps and other wetlands, termite stacks, lakes and continent bases. Human

caused methane emissions are from artificial watered rice fields, fossil fuel production and use and from wastelands etc. /6/.

Methane has also a role in ozone depletion. Methane, what is in the atmosphere, is lost by breaking it down to a carbon dioxide and water. In the upper part of the atmosphere the breakdown of the methane creates steam which can form clouds when it is freezing, which speeds up the reactions which destroy the ozone layer (Picture5) /6/.



PICTURE 5 Methane concentrations in atmosphere /10/

4.4 Nitrous oxide, N₂O

The content of the N₂O in the atmosphere is nowadays approximately 13% higher than in pre-industrial time. Its relative amount from the greenhouse effect is calculated in different researches to be at least 4-8 %. Its life time in the atmosphere is about 120 years /11, 12/.

In the nature N_2O is produced by anaerobic bacteria. The most important human produced N_2O sources are the changes in the use of the ground, nitrogen fertilizers, manufacture of nitric acid and burning processes. Generally speaking, the N_2O is coming from the nitrogen fertilizers and from energy production /1, 11, 12/.

Human produced N_2O emissions in the world are 6 million tons per year. One molecule of N_2O warm up the climate as much as 290 carbon dioxide molecules. So probably about 4/5 of human caused N_2O emissions are from nitrogen fertilizers. Also biomass and burning of the fossil fuels, especially forest fires, create little amounts of N_2O . N_2O emissions are also increasing because of the use of the catalytic converted cars but the catalytic converters can still lower the indirect greenhouse gas emissions /6, 11/.

In Finland N_2O emissions corresponds to altogether 6.1 million tons of carbon dioxide. The dividing of the emissions can be seen from the table 2. The amounts are changed to carbon dioxide because of the calculator purposes (Table2) /12/.

TABLE 2. Finlands N_2O emissions /12/

Source	Interest	Amount
Nitrogen fertilization	47 %	2,8 MtCO ₂
Energy production	37 %	23, MtCO ₂
Manufacturing of nitric acid	16 %	1,0 MtCO ₂

4.5 Indirect greenhouse gases

The greenhouse gases promote climate change directly so that they hold part of the warm of the sun in the atmosphere. The climate change is influenced also with group of gases which affections are indirect. How these gases are behaving in the atmosphere is not yet known./13/.

The affection of the indirect greenhouse gases can be seen in different ways. The action of the indirect greenhouse gases is based on 5 processes. At first nitrogen oxides, volatile organic compounds (VOC) and carbon monoxide are reacting in the atmosphere to form ozone in the lower part of the atmosphere. Then carbon monoxide is reacting in the atmosphere forming carbon dioxide. After that, volatile organic compounds form methane and steam. Then sulphur dioxide reacts in the atmosphere forming cooling sulphur aerosols. Finally nitrogen oxides and sulphur dioxide forms aerosols, which increases the formation of the clouds and this probably cools more than heats up the atmosphere /12/.

Indirect greenhouse gases which can heat up the atmosphere can be classified to carbon monoxide, nitrogen oxides and volatile organic compounds. Sulphur dioxide however cools down the climate. In addition to before mentioned indirect greenhouse gases also from direct greenhouse gases, especially methane and halogenated hydrocarbons, affects indirectly to climate change. Table 3 shows the warming potentials of the most important indirect greenhouse gases compared to carbon dioxide /13/.

TABLE 3 the warming potentials of the indirect greenhouses gases /13/

Gas	Life-time (a)	GWP 100 y
Carbon monoxide (CO)	0,08-0,25	1-3
Nitrogen oxides (NOx)	0,01-0,03	40
NMVOG	?	11
Sulphur dioxide	?	-

4.5.1 Nitrogen oxides (NO_x)

Nitrogen oxides (nitrogen monoxides and nitrogen dioxides) arise mainly from the nitrogen of the air which is coming from the power plants and traffic burning processes. The development of burning processes and the use of the catalysator in the cars are significantly decreased the emissions. Other way speaking, catalysators increase the emissions of the N₂O. Finland's annual nitrogen oxide emissions are approximately 10 millions tons per year /14/.

Nitrogen oxides react with hydroxyl radicals or with UV-radiation forming ozone in the lower part of the atmosphere which is poison and greenhouse gas. They also form aerosols which increase the formation of the clouds. Probably the overall effect of the formation of the clouds is cooling. Nitrogen oxides can also react in the atmosphere to form nitric acid which can cause acidification in the lakes and in the forests /14/.

4.5.2 Carbon monoxide (CO)

Carbon monoxide is a poison which is formed in the incomplete burning processes of the cars and power plants. It has no direct effect for the greenhouse effect. Instead of it, it affects indirectly reacting with atmospheres oxygen to form carbon dioxide and also ozone is formed in the photochemical reactions of the atmosphere. In Finland the affections of the carbon monoxide to greenhouse effect corresponds about million ton of carbon dioxide emissions /15/.

5 CLIMATE AGREEMENTS AND EMISSION TRADING IN FINLAND

Finland is committed to follow international climate agreements. Finland is agreed to follow for example these different agreements: the Kyoto protocol, EPCC, IPCC, national climate program, communal climate strategy and voluntary energy agreement for industry /16, 26, 35/.

5.1 The Kyoto protocol, ECCP, IPCC

The Kyoto protocol was the first legally valid international emission agreement which sets binding targets from the year 2008 to the year 2012. The agreement is based on the meeting in Rio de Janeiro 1992. The agreement which was made in Rio de Janeiro says that the emissions of the greenhouse gases should be decreased to level of 1990. In the year 1997 was held a meeting in Japan, Kyoto which sets goals to industrial countries. The goal was to decrease the greenhouse gas (carbon dioxide, methane, N₂O, VOC) emissions with 5, 2% compared to the level of the 1990. It completes the United Nations climate agreement. So its purpose is to decrease greenhouse gas emissions. The agreement was accepted in the year 1997. Finland ratifies the Kyoto protocol among other European countries in the year 2002 /2, 16, 17, 18, 26/.

The commission of the European Union starts at the year 2000 a climate program which is called European Climate Change Program (ECCP). Another part of that program was launched in October 2005. ECCP prepares in the EU level the political actions which concerns the targets of the Kyoto Protocol. Preparations are made in co-operation with different departments of the commission, member countries and with interest groups. The key elements of the EPCC are to make a

follow-up mechanism for the greenhouse gas emissions, to make decisions concerning the emission trading and to bind the Kyoto protocol for the EPCC /19, 26/.

World Meteorological Organisation, WMO and UN Environment Programme, UNEP established for the support of the climate decision making Intergovernmental Panel on Climate Change, IPCC on the year 1988. IPCC is open for every member of the WMO and UNEP. IPCC prepares climate change reports in scientists groups which collect and estimate published scientifically produced information about the climate change and the affections of the climate change. IPCC is not searching itself the information but it estimates and binds together the information which is available. The government takes part in the preparation of the reports especially in the planning stage, when the targets are set and in the end of the report, when the IPCC accepts the reports. The purpose of the IPCC reports is to produce meaningful information for the decision-making but it cannot suggest specific political alternatives. In addition to climate change programs, IPCC also makes calculation programs for the emission calculations /20, 26/.

5.2 Finland's national energy and climate program

State council gives to Parliament a commentary explanation of climate program concerning obligations of the Kyoto protocol. Government promises to push forward things which concerns use of the renewable energy, saving of the energy and reduction of the greenhouse gas emissions. Furthermore, the state is going to buy more premises of emissions with the help of Kyoto mechanisms /21/.

5.3 Communal climate strategy

The purpose of the communal climate strategy is to reduce greenhouse gas emissions with the help of sustainable development principle. At first community inspects their greenhouse gas emissions, which arise from for example in use of the energy and in energy production and makes development predictions and sets own targets for the emission reduction. The strategy is then accepted by town council who puts it in action and follow up the compliance of observance of the strategy /35/.

5.4 Voluntary energy agreement for industry

The agreements between Ministry of Trade and Industry and separate organisations are frame agreements from the actual energy agreement. The target of energy agreement is to minimize the specific energy consumption and to take in action models which support energy efficiency. Energy saving agreement is part of the energy strategy whose purpose is to stop the growth of energy consumption during next 10 to 15 years. Agreements further on help to achieve the targets of the international climate agreements. Committing to a long-range and systematic improvement of energy efficiency, it is also possible to affect to environmental emissions /36/.

5.5 Emission trading

Meaning of emission trading is that a plant which has smaller emissions than allowed can sell the extra amount for the other companies. A company which has higher emissions amounts can buy allowances to satisfy the emission amounts. The decrease of the emissions is done in the plants where it is most

economic. Different factories and countries get certain amounts of emission allowances. Emission trading is applied for the factories whose capacity is over 20 MW. Factories of this area need certain permits which guarantee the rights to let carbon dioxide to the atmosphere. In Finland the allowances are given to about 550 plants which includes plants like paper mills, district heating etc. The allowances are now given for year 2005-2007. The overall amount of allowed CO₂ releases which can be released during the years 2005-2007 is 136 million tons of CO₂ /18, 22/.

6 ENERGY SOURCES AND PRODUCTION

The energy production in Finland is divided in to two categories: non-renewable energy and renewable energy. The non-renewable energy sources are: fossil fuels such as coal, oil and gas, peat, uranium and fusion energy. The renewable energy sources are: water, sun, wind, tidal, wave, biomass, geothermal and ground heat /23/.

Historically speaking, the energy was produced first mostly by burning of the wood but also fossil fuels have been used thousands of years. The use of the fossil fuels increases rapidly in the beginning of the 1800 because of industrial revolution. First oil sources have been found about hundred years ago and after the findings the consumption of the oil has increased rapidly /23/.

In Finland the consumption of the electricity in the year 2002 was about 84 TWh and the total energy consumption in Finland was at 2000 about 35 Mtoe (million ton of oil equivalent). The use of the energy is divided so that the industry is using 50% of the total energy, warming 20% and traffic 14% /23/.

6.1 Coal

Coal has been formed in coal areas 300 million years ago from the waste of plants. The content of the coal depends on its age. The older the coal is, the higher is its coal content. The coal content of the brown coal is 70%. The carbon content of the coal is 85%. When the carbon content is increased, the heat content of the coal gets better. The heat content of the coal is about 24MJ/kg [1].

The reserves of the coal are the largest compared to other fossil fuels. From the crust of the Earth it is estimated that the coal content is about 10000 billion tons. From that amount 10% can be used with new technology. The biggest coal reserves are located in the United States, Russia and China [1].

The meaning of carbon as an energy source is getting higher and higher. The content of carbon from the world's energy is about 30%. The use of the carbon in the world is about 3 billion tons [1].

The use of the carbon in Finland was about 13% of total energy content in a year 1995. The coal is mainly used in Finland for the purposes which include electricity, district heat production and it was also used in industrial scale as a fuel [1].

The usage of coal is best suitable for the cities which are located in the coast so that they can combine it to electricity and heat production and also use it as a source of energy for industrial purposes. The three biggest users and methods of applications of coal are: the use of condensate power, the use in community heating and electricity production and industrial production of the process steam, heat and electricity. The most purified use of the coal can be achieved in big tanks which include powerful desulphurisation devices, electrical filters and the removal of nitrogen oxides [1].

It is also possible to produce synthetically manufactured crude oil from coal. Synthetically manufactured crude oil, which is manufactured from the coal, can

replace the use of oil in traffic fuels. At this moment it is too expensive compared to traditional fuels but in future it maybe a good choice /1/.

6.2 Oil

Oil reserves of the world are not evenly distributed and the main part of the known oil reserves is located in the Middle-East. There exists also oil reserves which are not yet found. At the end of the year 1994 the known crude oil reserves were 137 billion tons. The imported crude oil amount in Finland in last few years has been at the level of 9 to 10 millions /1/.

Oil is appearing in mainland and in the coast of the mainland which ground is geologically same as mainland. It is also possible to get oil from the bottom of the seas /1/.

The advantage of oil is that it is easy to use and it is suitable for many applications in fuel business. In addition to upper once, oil has also fairly big energy content and it is easy to store /1/.

Oil is still the biggest primary energy source in Finland. The proportion of the oil has decreased significantly. The biggest users of the oil in Finland are industry, heating and traffic. The use of the oil in heating and in industrial applications is decreasing /1/.

It is commonly known fact that the oil cannot last forever. The efficient use of energy and the use of other energy sources has decreased request of the oil and this kind of development is still continuing especially in industrial countries /1/.

6.3 Natural gas

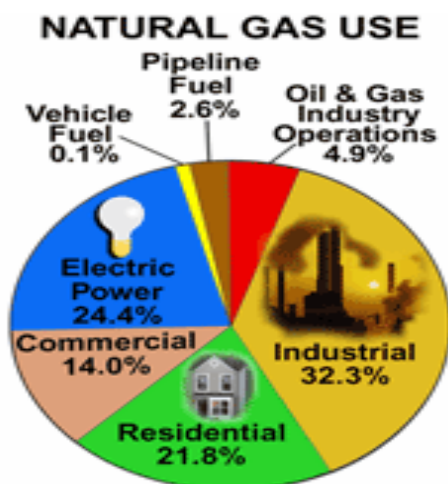
The natural gas is mostly appearing next to the oil fields when it might be mixed with crude oil. The natural gas is also appearing in separate areas. The composition of the natural gas varies where it is come from. Natural gas is a mixture of hydrocarbons and its main component is methane /1/.

Natural gas is mainly imported from the Russia. The consumption of the natural gas in Finland is 3, 3 billion cubic meters. Natural gas content of the overall consumption of the energy in Finland was about 9%. Wood industry is using about $\frac{1}{3}$ of the imported natural gas and the rest is used in electricity production, heating and in glass – and metal industry /1/.

The location of the Finland is very advantageous if thinking about the use of natural gas. The neighbouring countries Russia and Norway have big natural gas reserves. So they can sell it to Finland /1/.

Natural gas is the most pure fossil fuel, because it is pure methane and it also includes little amounts of sulphur. On the other hand the use of natural gas also creates nitrogen oxides and carbon dioxide. Carbon dioxide emissions of the natural gas are significantly lower than compared to burning of the coal. Depending about the burning technique the burning of natural gas can create fairly big amounts of nitrogen oxides /1/.

In Finland natural gas is mainly used in combined heat and electricity production and as an energy source for the industry. The use of natural gas in combined power plants is very effective because it can create from the same energy content of the fuel more electricity (Picture6) /1/.



PICTURE 6 Natural gas use /37/

6.4 Peat

The peat originates when the plants are decomposed. In nature swamps produce peat about 0.2-1 mm thick layers in the year. So peat can be considered to be a non-renewable resource /1/.

The peat is not always categorised to be a fossil fuel because of its low carbon - and heat content and high water content. But it can be compared to fossil fuels because of its formation rate is very slow. In addition to that emissions which are coming from the burning of the peat are similar to emissions of fossil fuels /1/.

Worldwide meaning of the peat is very rare. The Earth's peat reserves are located in northern part of the world. Finland has got big peat reserves. Finland has got about 10 million hectares of swamps and the number of swamps which have been reserved for the peat production is about 0.1 million hectares. The peat content of the overall energy production in the year 1995 was about 5% /1/.

Main part of the peat in Finland is used for district heating and after that comes industrial power plants. The transport of the peat is not profitable because of its energy content compared to its volume and high transportation costs /1/.

6.5 Uranium

World has got lots of uranium. The average amount of the uranium in the Earth's crust is about 4 g/t. The biggest uranium sources are located in market economy countries about 3.6 million tons /1, 23/.

There exists nowadays over 400 nuclear power plants in the world. The number of the nuclear power plants in Finland is nowadays four but the fifth nuclear power plant is now under construction. Present nuclear power plants use so-called light water reactors which can use only U-235 isotope as a fuel resource /1, 23/.

There exists hardly any kind of emissions in normal situations when we are using nuclear energy. The benefit of nuclear power compared to fossil fuels is that, nuclear power does not cause any kind of emissions or acidification which can promote the greenhouse effect. In normal conditions, the radiation from the nuclear power plants to surrounding environment is very small /1, 23/.

The problems what nuclear power plant can cause for the surrounding environment can be very serious because of the radioactive radiation. So that's why it is vital that the security system is working without any kind of problems /1/.

6.6 Fusion energy

The future energy aspect might be fusion energy. Fusion reaction is happening when two different isotopes of hydrogen (deuterium and tritium) are immersed together so that helium, one free neutron and lots of energy are born. The resources of deuterium and tritium are almost unlimited. Tritium can be manufactured from lithium. Ten grams of deuterium and 15 grams of tritium should be able to produce enough electricity to satisfy the lifetime consumption

of the citizen of industrial country. The commercial use of the fusion energy will still take some decade's /1/.

6.7 Renewable energy

The renewable energy sources are: water, sun, wind, tidal, wave, biomass, geothermal and ground heat. The most ideal energy source is renewing continuously and producing high quality, clean and economical energy. The world's energy production in future must concentrate on renewable energy sources because of the fact that the non-renewable energy sources cannot last forever /1, 23/.

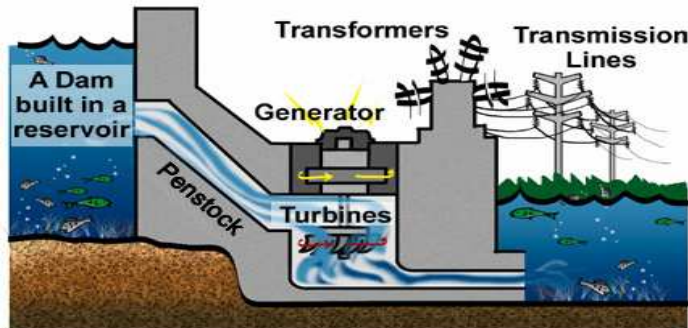
6.7.1 Water

Water power is clean and renewable energy which is based on the cycle of the water. About 10% of worlds water resources are in use. The biggest unused water resources are located in development countries /1, 23/.

The biggest producers are United States, Russia and Brazil. The production of electricity which can be getting from water power is about 2000 TWh in a year. In Finland the electricity production is about 12 TWh in a year and representing 19% amount of the whole electricity production. The amount of the water plants in Finland is about 200 and no new water plants are under construction. The use of water power in Finland is quite small because Finland's lakes and rivers are moderately shallow /1, 23/.

Water power is the main renewable energy source in Finland. Its benefits are that it is clean, domestic, renewable and easy to adjust in electricity production. Effective use of the water needs also effective adjustment of water or building of

artificial bonds. Adjustment of water or building of the artificial bonds however changes the nature and water system (Picture7) /1, 23/.



PICTURE 7 Water power plant /42/

6.7.2 Solar power

The most valuable benefits of the solar power are that it is renewable and emission free. Energy which is coming from the sun is 15000 times the use of energy in the world. The amount of the solar power what can be used with modern technique is relatively small because of the fact that about half of the radiation is reflected back to the space or is absorbed to steam and other substances /1, 23/.

Two types of collection systems are used: light/ electricity method or collection of heat. Nowadays heat and electricity which is produced from solar power is not competitive in large scale. In small scale energy production the solar can be competitive. The problems which arise when using the solar power in electricity production are the changes of the radiation which is coming from the sun. Storing of the electricity in large scale is not possible (Picture8) /1, 23/.



PICTURE 8 Solar receiver /38/

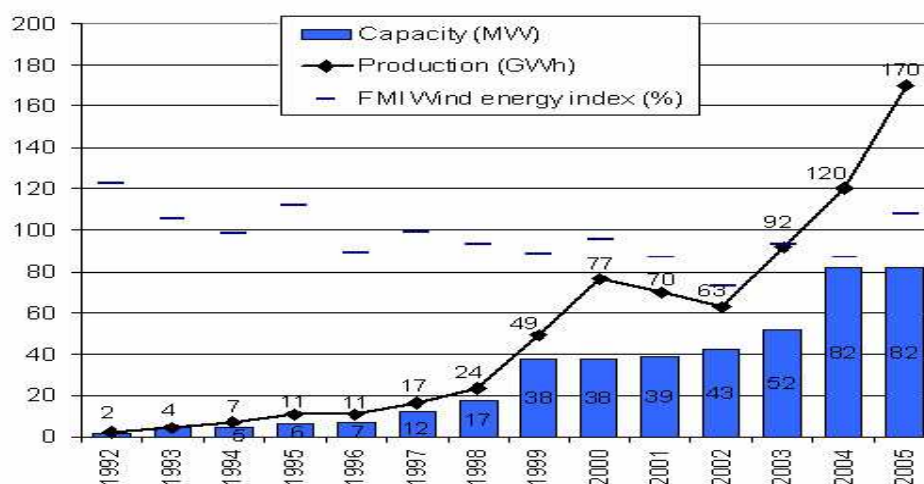
6.7.3 Wind power

Wind power is also renewable and emission free energy source. Wind power can be best used in areas where the winds are steady and rather powerful. Speed of the wind should be 5-25 m/s so that it can be effectively used with modern technique. If the wind speed is smaller than 5 m/s, wind power plants cannot produce energy. The effective use of the wind power plants is annual about 2000 h/a /1, 23/.

Wind power plants cannot be located so that they are very closely to each other, because they can steal the wind so that the other plant cannot use the wind. Wind power plants cannot be located near the residential area because of the noise problems /1, 23/.

The power of the wind power plants depends on power of the wind. If the wind speed is doubled the power of the power plant is increased to 8 times bigger than

the speed of wind. In 1995 the amount of the wind power plants was 22 and the energy production about 7200 MWh/a. Problem of the wind power is how to store the energy and also the investments costs are high (Picture9) /1, 23/.

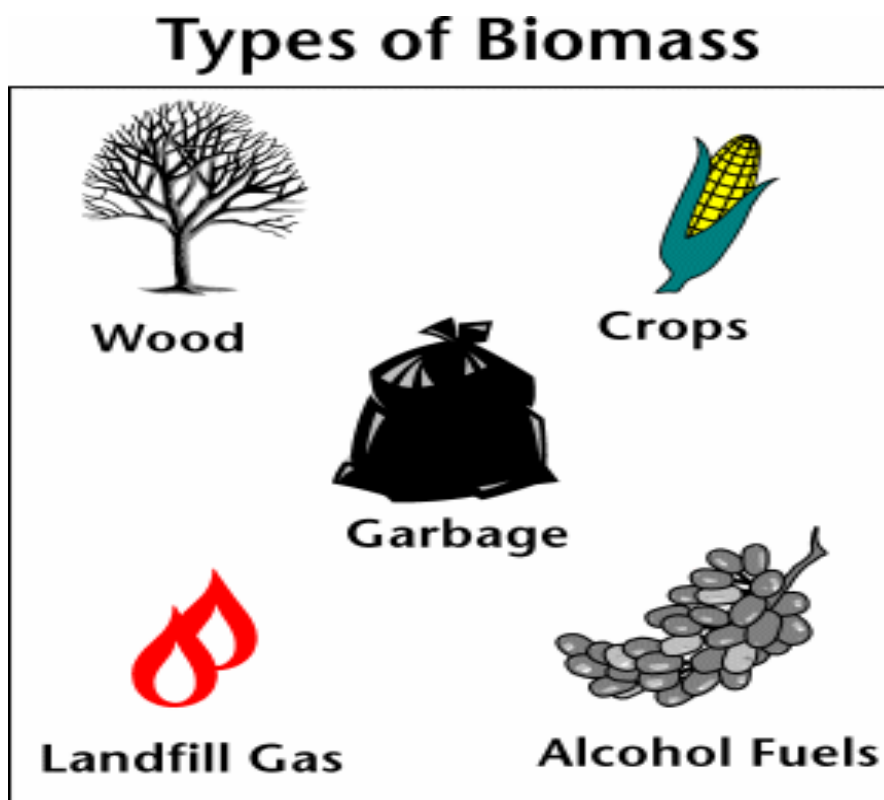


PICTURE 9 Installed wind power capacity and production in Finland /39/

6.7.4 Biomass

An organic carbon substance which includes the solar energy is called biomass. Biomass includes products like wood, sugar, starch, grass etc. The energy can be received from the biomass by burning it or used it in anaerobic conditions. The most usual way of using biomass energy is still burning. The most used biomass in Finland is wood and the waste liquors of the forest industry. The products which can be manufactured from the biomass are biogas, bio fuel, bio diesel and ethanol. UPM-Kymmene is going to build a production plant in near future so that it can utilize wooden biomass in bio diesel production. The location of the production plant is not yet known but it will be together with some paper mills maybe in Finland, United Kingdom, and France or in Germany. Bio fuels are manufactured from biomass by refining received liquefied fuels so that they can be used for example in diesel motors. Most common bio fuel is bio diesel which

is general name for vegetable oil based diesel fuels. Methane is the main biogas which is used. Biomass is best suitable for local use, for example to local district heating plants (Picture10) /1, 23, 44/.



PICTURE 10 Types of biomass /40/

6.7.5 Geothermal and ground heat

Geothermal heat is born when radioactive substances are breaking down in the Earth's crust. The breakdown of the radioactive substance brings heat, which is stored inside the Earth's crust. Geothermal heat is usually attached to either hot water or steam. The use of the geothermal energy is limited to volcanic areas. So its amount in energy production is small. The biggest geothermal heat producers in the world are Japan, Indonesia, Philippines and Taiwan. Also Iceland has used geothermal energy in energy production because of geysers. In Finland the use of

geothermal energy is not an option because of the fact that Finland is not located in volcanic area /1, 23/.

The solar radiation which coming from the sun and is stored to Earth's crust as heat can be called the ground heat. The ground heat can be used with the help of the heat pump. In Finland the use of the ground heat with the help of the heat pumps is not large scale production. It can be used to warm up small houses /1, 23/.

7 POSSIBILITIES TO DEVELOP THE ENERGY PRODUCTION

Energy production and consumption have major effects for the condition of the environment. Every consumer can affect to the environment by producing harmful emissions. By choosing the responsible supplier consumer can be sure that the company is taking care of the environmental issues and development of the energy production /24/.

7.1 Improvements of the efficiency

Traditionally used energy production methods are boiler –and burning techniques. They are highly developed. Efficiency in big boilers is nowadays over 90%. Instead the new energy production applications like pressurized fluidized bed burning and solid gasification joint with combined power plant techniques are coming to make better the efficiency of the energy production and especially the relationship of the building (power of the electricity/ power of the heat) compared

to technology which is nowadays used. Moreover concerned techniques makes possible to reduce the emissions /1/.

7.2 Combined heat and electricity production

In energy production relationship between the used fuel and profitable energy is nowadays getting better by building as much as possible combined heat and electricity production, in fact building so called district heat power plants and industrial pressure power plants. Moreover building of the district heat power plants has had positive effect for the condition of the air in cities. Nowadays majority of the industrial and communal combined electricity and heat production is produced in pressure power plants /1/.

Characteristic for the energy consumption in Finland nowadays is that consumption of the electricity is much higher than the consumption of the heat. The reasons which have caused these kinds of characters are for example automation of industry, shift from the direct use of fuels to electricity etc. Households, service companies and offices are nowadays taking in action new activities like different gadgets which can improve the efficiency of electricity production /1/.

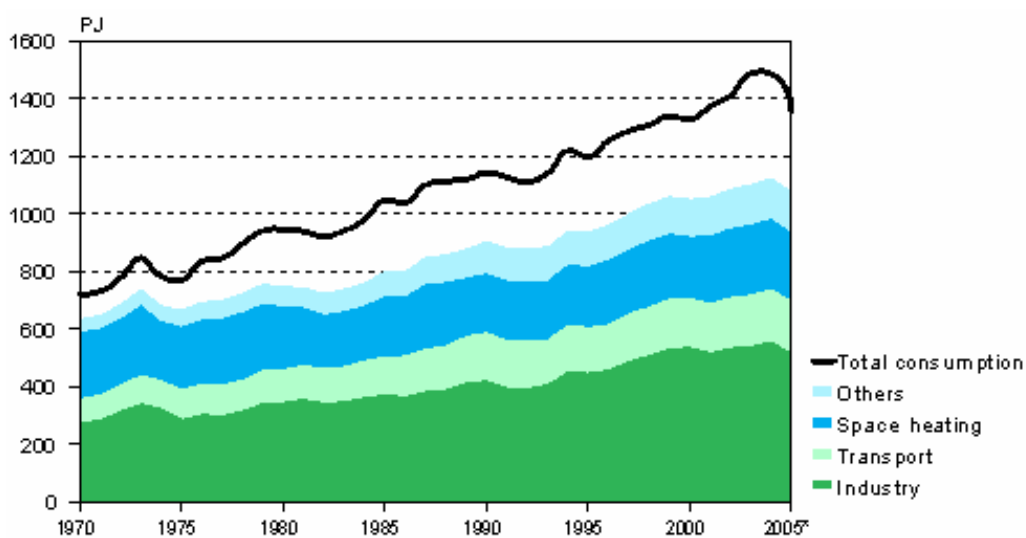
The total efficiency of the combined electricity and heat power plants is 80% and even higher. Total efficiency does not include much improvements because high total efficiency capacity. Instead the building relationship (power of the electricity/ power of the heat) brings possibilities for better efficiency /1/.

7.3 Separate energy production

Intensifying the separate energy production is possible with the economical technique especially in natural gas area. The efficiency of the combined technique is about 45 % and advanced gas turbine process (STIG) has efficiency about 40%. On the other hand the future possibilities of the pressurized burning associates still many kind of unsolved problems /1/.

8 HOW TRAFFIC, AGRICULTURE, FOREST, WASTE MANAGEMENT, HOUSEHOLDS AND INDUSTRIAL PROCESSES EFFECTS FOR THE CLIMATE CHANGE

Traffic, agriculture, forest, waste management and industry are effecting for the climate change. They pollute air and improve the greenhouse effect (Picture11).



PICTURE 11 Energy consumption progress in Finland 1970-2005 /47/

8.1 Traffic

Traffic consumes about 14% from the total energy production and the amount is increasing continuously. Private cars consume energy about 60% and the truck traffic consumes about $\frac{1}{3}$ of the energy. Also the plane traffic has increased energy consumption recently. Most of the energy what the traffic is consuming is use of different kind of fuels /1, 18/.

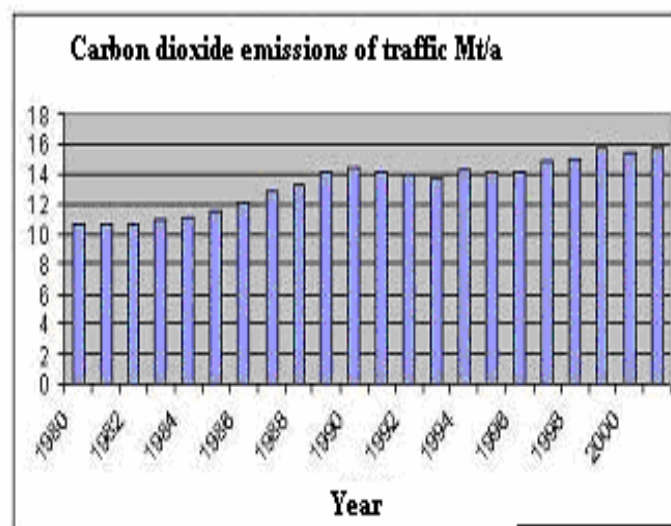
Mainly different traffic forms uses fossil fuels. Exhaust gas and its included impurities are the products which born in the burning reactions of the motors and that's why the burning process influences it /1/.

Main part of the exhaust gas emissions is in gas form, but the exhaust gases from the diesel motors includes also significant amounts of particle like substances. These are partly inorganic carbon and partly complicated organic and inorganic ringed hydrocarbon compounds. The emissions what arises in traffic are carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide, particles and carbon dioxide /1, 18/.

It is very hard and complicate to define car as source of the harmful emissions. There exist lots of factors which influences the amounts of the emissions. Most important of these factors are: the motor type and structure, used fuel, manufacturing year, driving amount and condition of the car, driving habit and speed, traffic jams and the temperature of the air /1/.

Reduction of emissions and energy consumption is important for every traffic forms. Car traffic is only traffic form in Finland which has clear emission limits. Even tough many limit values are nowadays only fractions from the past; the development of the emission agreements is not stopped. Law writers have noticed that beforehand agreed limitations have worked well. According to already made agreements limitations concerning private cars and trucks have tighten in European Union during the year 1996 /1/.

Consumption of the energy and emission disadvantages in traffic can be reduced for example by means of car –and motor technology, choice of the traffic form, right use of the vehicle, reasonable designing and maintenance of traffic routes and different kind of administrative ways. At first stage environmental disadvantages of the traffic must be reduced with limitations of emissions. This is in short sight, the fastest and most effective way to limit the exhaust gas emissions. When all possible technical applications are used for the reduction of the traffic emissions, the only possibility to reduce the emissions is to reduce traffic and also lowering of the speed limits (Picture12) /1/.



PICTURE 12 Emissions of carbon dioxide from the traffic in Finland /30/

8.2 Agriculture

Production of the agriculture is influencing primarily to balance of the carbon dioxide, methane and nitrous oxides. The changes in use of the ground, like clearance of the swamps for cultivation, and forming of the ground stimulates the

breakdown of the organic material of the ground and that way increases the flow of carbon dioxide to atmosphere /25/.

Organic agriculture soils releases nitrogen oxides when the organic material is breaking down. According to SILMU-research swamp fields releases about 15 Mg of carbon dioxide per hectare in a year. If this kind of fields are supposed to exist in Finland about 300 000 hectares, would the total amount of carbon dioxide emissions be almost 5000Gg in a year /25/.

Methane is formed in the ground as a result of the microbiological activity in anaerobic conditions. On the other hand, the microbes in the ground also oxidize methane to carbon dioxide and water. Cropping lands binds methane less than natural lands because intensive cycle of nitrogen oxide prevents oxidation of methane /25/.

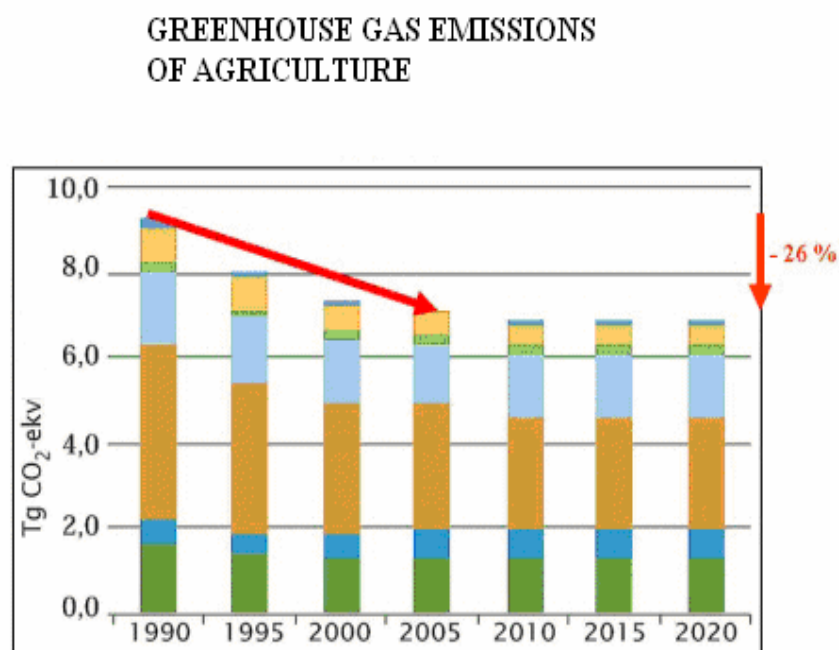
The most effective meaning of agriculture for the methane balances maybe its ability to reduce the oxidation effect of the methane. Methane emissions can be appear locally but effect of these emissions is however scarce. Effects of Finnish cropping lands for the methane balances are not estimated quantitatively excluding swamp fields, which releases methane about 0,8Gg in a year. In cattle production methane is released from the digestion of the animals and when the excrements are breaking down anaerobically /25/.

Ground is a significant nitrogen oxide source. In cropping lands fertilizers, cattle manure, sludge and biological binding of nitrogen increases loading of the nitrogen and raises the N₂O emissions. On the other hand also many other factors than loading of the nitrogen is influencing for the amounts of nitrogen in cropping lands /25/.

When climate is warming up organic material of the ground may reduce because of carbon dioxide emancipation until new balance in atmosphere is received. On the other hand radical climate change has effect on the annual cycle of carbon dioxide exchange between Earth and atmosphere. In summer time, energetic

growth binds more carbon dioxide of the air but also the breakdown of the material in autumn and spring time is more intense /25/.

In wet lands the risk of methane and nitrous oxide release is increasing. This would happen, if the rainfall is increasing and the ground stays unfrozen longer time. On the other hand nitrous oxide emissions depends on the amount of the nitrogen and if we think about the total balance this means also the use of the ground and use of the fertilizers (Picture13) /25/.



PICTURE 13 Greenhouse gas emissions from agriculture /41/

8.3 Forest

Growth of the trees binds carbon dioxide. The growth of trees is predicted to increase even 40%. The growth of birch will increase more than pine or spruce. Emissions from the forest industry remain almost as before. Annual greenhouse

gas emissions from the forest and swamps are 28 000t CO₂ equivalents. The use of the wood has however increased in 1990s, which has decreased the net growth and that way decreased the ability of growing forest to act as carbon sink, even if the total growth of the forest has been increasing /2, 25, 45/.

8.4 Waste management

Carbon dioxide, methane and nitrous oxide are forming when dealing with solid waste, sludge and waste water. The most important greenhouse gas emission is methane emissions from the dumping place /25/.

Microbes are breaking down organic waste materials to methane and carbon dioxide in anaerobic conditions of dumping places. Because waste carbon is mainly non-fossil, released carbon dioxide may assume to bind back to organic material. From this reason carbon dioxide emissions are not usually taking into count in analysis of greenhouse gases /25/.

Waste management emissions in Finland were in 1994 about 120Gg methane per year. They form about half of the all human originated methane emissions in Finland. The largest part of methane is originating from the communal waste in dumping places even though about 1/3 dumping place carbon is coming from industry /25/.

The formation process of methane in dumping place is very slow process. Every organic material in dumping place is not breaking down so dumping places can also act like a carbon sink. So there exist lots of uncertain estimations when we are concerning the greenhouse effect of the waste management system. Especially in dumping place, the changes in specific emission amounts has big influence for the stored carbon amounts in dumping place /25/.

8.5 Households

European Union has taken seriously the issue which concerns climate change. It has given strict limitations for emissions. European Union started his own campaign concerning about the climate change in 5.6.2006. Its purpose is to give advices for private citizens how they can change consumption habits and that way reduce the greenhouse gas emissions. If for example reducing the temperature inside the house with one degree, it is possible to save even 10% of warming energy. And if you shut down the electrical devices instead of putting them in standby position, you can also achieve 10 % energy savings. If every household in Europe could adjust heating and turning of electrical devices, it would decrease greenhouse gas emissions with 5 to 10 percent /27/.

Households use about 30% of energy in European Union countries. They also cause about 16% of greenhouse gas emissions in European Union. Private cars cause about half of the greenhouse gas emissions in Europe. So changing of the driving habits can decrease fuel consumption even with one third. For these emissions citizens can affect directly. There exists also so called indirect use of energy. Private Citizens affect also indirectly to other emissions which occur in society, like emissions which comes from industry. Reducing of material consumption and recycling of waste can significantly reduce greenhouse gas emissions which come from production of the material /26, 27/.

8.6 Industrial processes

Industry uses over 50% of produced energy in Finland, so it is that way a significant emission source. However, there is many direct greenhouse gas emissions from industrial processes, which forms 3 to 4 percent of our emissions. Manufacturing of nitric acid causes nitrous oxide which corresponds about one million ton of carbon dioxide per a year. Cement industry causes about 300 000

tons of carbon dioxide emissions per a year. Iron industry causes also little amounts of methane emissions /30/.

Electricity and electronic industry is a source of halogenated hydrocarbons, although the amount of these in Finland is rather small. Electronic industry produces over 90% of our SF₆ emissions. HFC-compounds are nowadays compensating the CFC-compounds /30/.

Industrial process emissions could be reduced by using the waste of blast furnace in manufacturing process of cement, developing compensate methods for the production process of nitric acid and developing compensate methods for the production process of electronic industry /30/.

9 ECONOMICAL EFFECTS OF THE CLIMATE CHANGE

The climate warming of the world more than over 2 degrees would cause billion euros economical damages and also immeasurable damages for humans and ecosystems. For example until year 2100 over 2 degrees change in temperature could cause 17 billion euros expenses which will be 6 to 8 percent of the worlds predicted gross domestic product. Estimation is very careful, because it does not contain any kind of damages which concerns nature's destruction or unexpected catastrophes /28/.

The report also shows that, expenses which come from limitation of the climate change are reasonable. Limitation of the temperature rise to 2 degrees compared to pre-industrial time would cost 2, 5 billion euros per a year and would prevent damages in lieu of 10 billion euros /28/.

Finland's economical life would benefit from the climate change, mainly because of positive view of the forest sector, if we only regard domestic effects. Agriculture would also benefit. Both estimations do not concern the effect of the plant diseases /25, 29/.

Negative influences of the climate change for Finnish economy come from through the international development. Globally speaking, economical affections are estimated to be few percents decrease in gross domestic product. So the economical globalization will transfer harmful effects of the climate change also to Finland /25, 29/.

10 HOW COMMUNITIES CAN REDUCE THEIR GREENHOUSE GAS EMISSIONS?

Reduction of the greenhouse gas emissions in communities can be accomplished in different ways: planning of meaningful community structure, saving of energy, using renewable energy sources instead of non-renewable sources, collection of dumping place gases and proper handling of the waste in dumping places and with good traffic route and machine solutions. Prevention of the climate change demands strong will and broad co-operation between different parties inside the community /43/.

Community structure can help to reduce especially emissions from traffic. The structure of the community and location of the different services can essentially effect for the amount of the traffic. New residents should be located so that they are along with light traffic routes and public routes but not too far from the

centrums. With the help of community planning it is possible to progress the use of the natural gas and district heating /43/.

Energy consumption in public places inside the community is very big. So the communities have to think how they can reduce the energy consumption of the public places for example by adjusting the air-conditioning system /43/.

Every community buys annually lots of different kinds of equipments and services. So it is good to buy things with doesn't consume lots of energy so that it is possible to reduce energy consumption and greenhouse gas emissions /43/.

Majority of the emissions in communities is produced by burning fossil fuels. So using of renewable energy sources decrease significantly the greenhouse gas emissions and also guarantees the better quality of the local air /43/.

Reduction of the waste amounts and recycling reduces greenhouse gas emissions in communities. The reduction can be carried out so that the products are manufactured from recycling materials instead of using lots of energy to produce the same material from new material sources. So the waste is primarily utilized as raw material. Utilization of the sorted waste as an energy source is acceptable when the production of specific fuel from waste stands for all quality agreements and is suitable to use as an energy source /43/.

Traffic, which also includes working machines, causes over half of the overall emissions. Concentrating into traffic planning would promote the fluency of the traffic which reduces the emissions. Development of logistics, right machine choices for different routes and the condition of the machines influences to consumption of the fuels and generation of exhaust gases and that's way reduces the climate change effect /43/.

RESEARCH STUDY

11 MATERIALS AND METHODS

Purpose of the project was to make a climate strategy for Pori region. One part of the project, which was also subject of my bachelor thesis, was to make an interview of issues which concerns climate change. The issues of the questions were: traffic, purchase of devices, waste issues, use of the energy and general issues concerning climate change. The questions of the interview were made with the help of computer program called Zef Solutions which was a very powerful tool for making interviews because it allows categorizing questions to different question groups. Questions can be asked by using multiple-choice, alternative, free feedback and segment of line system and with help of four field systems. Four field system includes system of co ordinates in x and y plane. So it makes possible to ask two things with one question. When results of the different question groups were received it was possible to analyze them separately from each other or altogether by using absolute or standard values. Absolute values means that results were analyzed by using average values of the answers. Standard values means that program process values so that average values were situated in the middle of the answer tables and the answer points were dispersed evenly to the tables. In this way it was possible to eliminate attitude distortion.

At first the interview was tested in Prizztech Oy so that it was possible to see how many was responding to it and which kind of corrections or developments must be done so that the interview can be published. The test period of the interview lasts one week and after that the results were analyzed and possible corrections or developments were going to be made. Development and correction suggestions were discussed with the Environmental office of Pori, who was a partner of the project and after discussions with them possible corrections for the interview were going to be made. When the correction part of the interview was ready, the

interview was sent to different kind of analyzing groups. The groups, which will be analyzed, were: Porin kaupungin koulutusvirasto, Porin kaupungin rakennusvalvontatoimisto, Porin kaupunkisuunnittelu, Porin kaupungin ympäristötoimisto, Satakunnan ammattikorkeakoulu tekniikan Porin yksikkö, Satakunnan ammattikorkeakoulu liiketalouden Porin yksikkö and anonymous evaluators. Anonymous evaluators mean that ordinary people can take part to the interview by answering to it via internet page of Environmental office of Pori. Answering time for the public interview is maximum 2 weeks because of the fact that analyzing of the results takes time. The answers are then analyzed and the results are published in my bachelor thesis. After the analyzing part of the results, purpose was to give development suggestions how people can reduce the influence of the climate change.

12 RESULTS

Results of the interview were analyzed in this section. Evaluation of results was done so that all evaluation groups are analyzed altogether because that way it was possible to achieve reasonable results because the number of the evaluators can vary significantly between different evaluation groups. Also the amount of the answers, which was quite big, impacts for the fact that the answer can be properly analyzed if they are, analyzed altogether. The answers of the interview are analyzed by using absolute value method. The results of the interview can be seen from appendixes.

12.1 Background information

The first question group asks background information of the respondents which included questions like: sexuality, age and has respondent got any kids. Results show that, men were more active than women. Age distribution question shows that the most active age group was 46 to 60 years old people. It was also reasonable to notice that young people age group from 18 to 30 years was quite active. It was also nice to see that old people age from 61 and higher also take part in the interview. So in that way the interview was successful because different age group takes part for the interview. The last question in this group deals with the fact that has the evaluator got any kids. Regular answer for this question was that respondents have got kids (over 70% of the respondents have got kids). So it will be interesting to see if this kind of fact has some kind of effects for how respondents have answered for the questions.

12.2 Traffic and moving issues

Second question group deals with traffic and moving issues. It included questions like: What kind of factors effects for the purchasing of the car, how the price of the fuel and performance of the car effects for the purchasing of the car, does your car have catalytic converter or not, how you travel to work, have you used so called common lift for travelling to work, is it good feature that your car includes air condition system, is it possible that you can buy bio fuel car in future, have you considered to buy a hybrid car and how public transport is working in your living area.

The first question in this question group dealt with the fact that which kind of factors effects for the purchasing of the car. The factors which can effect for the purchasing of the car were: trademark, price, use, consumption, performance and some other factor. The most effective factors were price, trademark and

consumption. These were normal factors when you are considering buying a new car.

Second question dealt with the fact: How the price of the fuel and performance of the car effects for the purchasing of the car when considering buying either gasoline or diesel car. This question was asked with the help of so called four field system. This kind of system included system of co ordinates in x and y plane. So it makes possible to ask two things with one question. The variables in this x- and y-plane were the price of the fuel and performance of the car. The question was eased by giving so called sub factors which were: importance and influence. The average answer for this question was that the price of the fuel was very important and performance of the car also influence for the purchasing of the car. So it shows that the price of the fuel was more important factor than the performance of the car.

Third question asks: Does your car have catalytic converter or not. Options in this question were: yes, no, I don't know, I don't have car. The most common answer was yes and after that comes no. So this shows that the base of the car was strongly nowadays toward cars which have catalytic converters which can reduce carbon dioxide emissions.

Fourth question in this question group dealt with the fact: How you travel to work? Options in this question were: by using own car, bus, and bicycle and walking. Normal answer for this question was by using own car. After that comes cycling and walking. It was surprise that people doesn't use bus when they travel to work. This shows the fact that people does not like to use public transport for travelling to work.

Fifth question asks: Have you used so called common lift when you are travelling to work? Choices in this question were: yes, I cannot say, no. The most common answer for this question was that people does not like to use common lift when they are travelling to work. Maybe reason for this kind of answers was that the distance between home and work was not so long that people like to use common lift as travelling habit to work.

Sixth question asks that: is it good feature that your car includes air condition system. This question was asked with the help of so called segment of line system. It was almost same kind of system than four field system but much simpler because it does not include the y-plane. The options in this question were: yes, no and I cannot say. The average answer for this question was that people consider air condition system as a good feature when thinking of the other features in car.

Seventh question deals with the fact that: is it possible that you will buy a bio fuel car in future. This question was also asked with the help of segment of line system. Options for this question were same than in sixth question. The most common answer for this question was that people might in future buy a bio fuel car. So hopefully this kind of trend continues so that the use of the bio fuels can increase in future.

Eighth question asks that have you considered to buy a hybrid car and the question was asked with the help of segment of line system. The answers for this question were almost same than in bio fuel question. So people are thinking of buying a hybrid car.

The last question in this question group was free feedback question dealing with the public transport issues. The public transport was working moderately but improvements must be also made. The biggest problems in public transport were the price of the buss ticket, the amount of buss shifts and confused time tables. Maybe these things were reasons why people are not using public transport for travelling to work.

12.3 Purchasing of device

The third question group asks questions which must be considered when purchasing a device. The questions which are included in this category were: What are the reasons which effect when you are making a purchase of the device

for example television, how consumption of energy and quality of the device influence does when you are going to buy a new device, do you check that your new device includes environmental certificate, do you notice recycling and re-use possibilities when you are going to buy a new device, do you think how long you will use different kind of devices, do you think raw material/material solutions when you are going to buy a new device.

First question in this question group deals with the fact that which reasons effects when you are making a purchase of the device for example television. Options in this question were: price, trademark, appearance and other factor. The most common answers were price and trademark. These factors are quite typical reasons when you are considering buying a new device.

Second question asks: How consumption of energy and quality of device influence when you are going to buy a new device. This question was asked with the help of four field system. The variables in x- and y-plane are quality and consumption. Sub-factors in this question were importance and influence. The average answer in this question was that consumption of energy influences when you are making a purchase of device but also importance of the quality was important factor when purchasing a new device. So quality and consumption must be taking into consideration when purchasing a new device.

Third question in this question group asks that do you check that your new device includes environmental certificate. Choices in this question were: yes, I cannot say and no. The most common answer was that people are checking that the device includes environmental certificate. So the environmental issues were taking into consideration when purchasing a new device which guarantees the fact that the device was not consuming energy so much as usual.

Fourth question deals with the fact that do you notice recycling and re-use possibilities when you are going to buy a new device. Alternatives in this question were: yes, I cannot say and no. The average answer in this question was that people are thinking of recycling and re-use issues. This was good to notice

because of the fact that the waste amounts in dumping places were increasing all the time.

Fifth question in this question group asks that do you think how long you will use different kind of devices. This question was asked by using segment of line system. Alternatives in this question were: no, I cannot say and yes. Most common answer was yes. It is good thing to notice that people were thinking how long they are going to use different kind of devices because it saves lots of valuable raw materials which must be used when manufacturing a product.

Last question in this question group was: Do you think raw material/material solutions when you are going to buy a new device. This question was also asked in same way than the previous one. The answers show that people were thinking quite much about material solutions when buying a new device. This was good thing to notice because it reduces waste amounts when the product was manufactured. .

12.4 Waste management

Fourth question group deals with waste management issues. This group was the largest question group. It included questions like: Have you received guidance/information when you are dealing with waste issues, have you voluntarily find information about waste issues, which are the reasons to start recycling, is it acceptable method to burn wastes, do you sort out your rubbish in your working place, do you sort out your waste in home, do you use collection points which are located in supermarkets, how to collect released methane emissions effectively in dumping places, do you sort out your problem waste and put them in right collection place, what do you think about waste taxes and what do you think about composting of wastes.

First question in this question group was: Have you received guidance/information when you are dealing with waste issues. Options in this

question were: yes, I cannot say and no. The most common answer was that people are well-known about waste issues. So hopefully in the future the minimization of waste amounts would occur but this kind of trend is not very easy to achieve because the consumption of products brings always waste.

Second question dealt with the facts that have you voluntarily find information about waste issues. Alternatives in this question were: yes, I cannot say and no. Most common answer was yes (more than 80% of the answers) and it was nice to see that people are voluntarily interested to find information about considering the waste issues. Hopefully the answers were honest and people are willing to take care of waste issues.

Third question was so called free feedback question which dealt with recycling issues especially which were the reasons to start recycling. The most common reason was the concern about the future. There were also answers which does not regard recycling as a method to stop the climate change. But regularly speaking the answers were toward sustainable development.

Fourth question in this question group asks: Is burning of waste a suitable method to dispose waste. This question was made with the help of four field system. The variables in this question were significance and opinion. The average opinion was that burning of waste was good and important method to dispose waste. So hopefully in future it is possible to get a waste burning factory to Pori.

Fifth question asks that do you sort out your rubbish in your working place. Choices for this question were: yes, I don't know and no. The most common answer was that people are sorting out their rubbish but it was surprise to notice that some people are not aware about sorting issues in their working place. Hopefully there exists different kind of waste bins for different kind of waste in working place because it helps waste companies to sort out wastes and handle them in right way.

Sixth question also dealt with sorting issues but now the target was focused to households. Alternatives for this question were: yes, no comments and no.

Almost 90% of the respondents says that they were taking care of sorting of waste at home. That was revealing information because of the fact that waste amounts are increased all the time and sorting out of the waste is one or perhaps the only solution to decrease the waste amounts.

Seventh question asks that do you use collection points which are located in supermarkets. 81 percent of the respondents say that they were using collection points located in supermarkets. That was also good way to sort out waste because the waste which is coming to these bins was collected by local waste management companies.

Eighth question asks opinion about the re-use of the waste. This question was asked with the help of segment of line system. Public opinion was that re-use of waste is acceptable method in waste management. So that way it was possible to reduce waste amounts.

Ninth question deals with collection of methane. The question was eased by giving information detailed information what kind of greenhouse gas methane is. It was asked with the help of four field system. The variables in the x- and y-plane are opinion and significance. Public opinion was that the methane should be collected from dumping places more effectively than nowadays. The collection efficiency can be improved by installing new collection system like for example new piping system. That way it will be possible to reduce methane emissions.

Tenth question in this question group dealt with problem waste issues. It asks: Do you sort out your problem waste and put them in right collection place. Over 90 percent of the respondents sorts out their problem waste. It was good to notice that old car batteries and stuff like that are not stored in storerooms because there exists also collection places for this kind of waste for example recycling centres.

Eleventh question was free feedback question which gives opportunity for respondent to say what him or her thinks about waste taxes. Average answer was that they are acceptable, moderate and necessary activities. But there were also

strong opinions against the waste taxes for example one response says that waste taxes are tip of foolishness because waste companies should pay money for citizens. But generally speaking, waste taxes were necessary payments because otherwise waste amounts in backyards and in forests would increase significantly.

Last question in this question group asks opinion about composting of waste. This question was asked with help of segment of line system. General opinion was that it is important to compost waste. One reason for composting of waste in big composting factories was biodegradable waste amounts because almost one third of households' waste amounts are biodegradable waste. Gardening wastes can be stored in open composts.

12.5 Use of energy

Fifth question group dealt with energy issues. It included things like warming up, lighting and stuff like that. The question, which were asked in this question group, were: How you warm up your house, do you adjust room temperature inside the house when it is necessary, are you ready to use renewable energy sources, what do you think about energy expert activity, can you adjust your office room temperature or air conditioning system, do you switch off lighting when you leave from your office room, is there some kind of instructions for switching off lights in your working place, what kind of printing mode you use when you are printing out papers in your office, do you watch your water and electricity consumption, do you use energy saving devices and do you know how standby mode effects for your electricity bill.

First question in this question group asks: How you warm up your house. Alternatives for this question are: electricity, district heating, oil, wood, ground heat pump and some other heating method. Over 35 percent of the respondents use electricity to heat up their houses which was quite predictable. After that comes wood and district heating. Noticeable was that only 16 percent of the respondents use oil when they warm up their houses. It was also good to notice

that someone heats up their house with ground heat pump which saves lots of heating expenses.

Second question dealt with temperature adjustment issues inside the house. It asks: Is it possible that you adjust room temperature inside your house? Public Opinion was that people can adjust their room temperature. That way they can save money and also slow down the climate change effect.

Third question asks opinion about renewable energy sources. Are people willing to start to use renewable energy sources? This question was asked with the help of four field system. The variables in x- and y-plane were opinion and significance. Average answer for this question was that people are willing to change towards renewable energy sources. So it was nice to notice that there was still possibility to slow down climate change effect.

Fourth question in this question group dealt with energy expert activity. This kind of activity means that there was one person in dormitory who was trained to take care of energy issues. This question was asked with the help of segment of line system. Public opinion was that it was good to have persons who were trained to take care of energy issues. So people were willing to know how they can save energy and that way money.

Fifth question asks: Can you adjust your office heating or air conditioning system? Over 50 percent of the respondents say that they cannot adjust their office room temperature. One reason for that was central heating system which warms up entire office.

Sixth question dealt with lighting issues. It asks: Do you switch off lighting when you leave from your office room? Over 60 percent of the respondents switch off lighting when they leave from office room. That way it was possible to save money and reduce carbon dioxide emissions.

Seventh question in this question group asks: Is there some kind of instructions for switching off lights in your working place? Over 64 percent of the

respondents say that there are no instructions concerning about lighting in working place. One reason was that it was hard to control.

Eighth question dealt with printing issues. It asks: What kind of printing mode you use when you are printing out papers in your office? Options for this question were: one-side black and white copy, two-side black and white copy, one-side colour copy, two-side colour copy. General answer was to take one-side black and white copy. It is not the best option but the usual one. The best option was to take two-side black and white copies because that way it was possible to save ink and printing paper.

Ninth question asks: Do you watch your water and electricity consumption? Over 80 percent of the respondents watch their water and electricity consumption. It can be easily noticed from water and electricity bill if the consumption of energy was increased rapidly. That way it was also possible to start saving operation.

Tenth question asks: Do you use energy saving devices? Public opinion was that it was worthwhile to use energy saving devices. For example if you start to use energy saving lamps it was possible to save in lightning expenses and it was also known fact that energy saving lamps last longer than normal lamps even though they were more expensive than normal lamps.

Last question in this question group asks: Do you know how standby mode effects for your electricity bill? Alternatives for this question were: yes, I don't know and no. It was important to notice how aware people were when this question was asked from them. Over 80 percent of the respondents know how standby mode effects for their electricity bill. Regular use of the standby mode for example in television increases significantly energy consumption.

12.6 General issues concerning climate change

Last question group in this interview handle general issues concerning climate change. It asks questions like: What do you think about climate change, is it possible to slow down climate change, do you know what greenhouse effect is, and do you know how greenhouse effect influences to us, what are the main greenhouse gases and would increase of nuclear power solve climate change problems.

First question in this question group asks public opinion about climate change. So people can give free feedback concerning this issue. General answer was that it was happening and it was hard to slow down. It was also important to notice how worried people were when this question was asked. There were also answers which didn't take climate change seriously.

Second question asks: Is it possible to slow down climate change? This question was asked with the help of four field system. The variables in x- and y-plane were opinion and significance. Average answer for this question was that it was very important to try to slow down climate change effect. So it was nice to notice how people were keen on climate change issues. Generally speaking, reduction of carbon dioxide emission was key element when we are trying to solve the climate change problem.

Third question deals with greenhouse effect and asks: Do you know what greenhouse effect is? Almost 98 percent of the respondents know what greenhouse effect was. So it was remarkable to notice how aware people were when dealing with greenhouse effect issues. Sceptically speaking, hopefully people were honest when they answer to this question.

Fourth question in this question group asks: Do you know how greenhouse effect influences to us? Alternatives in this question were: climate is warming up; climate is freezing, carbon dioxide emissions will increase, reduction of radiation of sun and it has no influence toward us. Correct answers were: climate is

warming up and carbon dioxide emissions will increase. Generally speaking, people were aware how greenhouse effect influences to us.

Fifth question asks: What are the main greenhouse gases? Alternatives in this question were: methane, carbonic acid, carbon dioxide, sodium hydroxide and steam. It was obvious that the right answers were: methane, carbon dioxide and steam. It was remarkable to notice that people know these things and only one people suggest that carbonic acid was a greenhouse gas.

Last question in this question group asks: Would increase of nuclear power solve climate change problems? This question was asked with help of segment of line system. Public opinion was that it could be one solution to solve climate change problem because it doesn't create any carbon dioxide emissions.

13 FURTHER RESEARCHES

Future research of the results is dealt in this section. Purpose was to give overall improvement suggestion concerning the results of the interview.

13.1 Traffic and moving

Traffic performance per capita (kilometres of vehicle/capita) and energy efficiency and specific emissions of the vehicles influence mainly for greenhouse gas emissions which were coming from traffic. Even tough energy efficiency and specific emissions of the vehicles will decrease the amount of traffic performance was predicted to increase clearly. So if people could adopt economical driving

habits instead of buying a high performance car, the greenhouse gas emissions in cities will decrease significantly. It was estimated that economical driving will decrease greenhouse gas emissions of traffic approximately 2 percent. It was also possible to decrease the amount of greenhouse gas emissions and energy consumption of traffic with proper infrastructure of cities because road traffic was in key position when we were dealing with whole traffic emissions. It was also purpose to further on emphasize importance of land use because that way it was possible to control increase of car traffic and secure the operation conditions of public transport. So fluency of the traffic can be improved with good city and traffic planning. Also using of bio fuel and hybrid cars it will be possible to decrease road traffic emissions /2/.

13.2 Purchasing of device

Quality has always been key criteria when buying devices. More and more people are coming aware how much different kind of devices consumes energy. It is good trend because that way it is possible to save energy, resources and money. Always when you are buying devices which includes environmental certificate or energy certificate, guarantees that the device is not consuming energy or other resources as much as early devices. Also thinking of re-use or recycling possibilities of devices can decrease significantly the amount of waste. So increasing of environmental awareness can significantly influence to consuming habits so that it will be possible to buy more environmental friendly devices. Also factories should think more and more material solutions when they are manufacturing devices because that way it is possible to decrease amount of waste materials. Also consumers should think same kind of issues when they are buying new devices. So buying environmental friendly devices is one solution to slow down climate change.

13.3 Waste management

Key factors which produce greenhouse gas emissions in waste management were: waste amount per capita, amount of anaerobic waste, collection of biogas, burning of waste and wastewaters per capita. General goal in waste management was to reduce the amount of waste. Key elements in reduction of waste amounts were: guidance and information. Recycling and re-use of wastes were also important factors. Collection of methane in dumping places should be arranged more effectively because methane is powerful but short-life greenhouse gas. New kinds of piping systems for collection of methane must be manufactured otherwise methane emissions from dumping places will increase significantly and it is then even harder to slow down climate change. People must also more properly sort out their waste so that it is easier to collect them. It is important to reduce bio waste amounts because they generate lots of greenhouse gas emissions. Also burning of waste reduces amounts of methane in dumping places and waste which is burned can be also used in energy production so that it replaces other fuels which are used in energy production.

13.4 Use of energy

People use energy for heating, lighting and etc. So they need energy to survive. Most respondents say that their house is warmed with electricity. Electricity should be replaced with for example district heating because that is much cheaper and environmental friendly way to warm up house and doesn't need so much energy than generation of electricity needs. Wood is also good choice to heat up house because it can bind carbon dioxide and that way reduce climate change effect. The best choice is still ground heat pump if you want to save money. Also adjusting inside temperature of house with one degree Celsius can reduce significantly carbon dioxide emissions and slow down climate change effect. Also using of renewable energy instead of non-renewable energy reduces carbon

dioxide emissions. Hopefully renewable energy sources can replace non-renewable energy sources in future. It is also good way to save energy when you start to use energy saving devices. They are more expensive than regular devices but they last longer and use less energy than regular devices. It is also important factor to notice that when you are using standby-mode it uses lots of energy and your electricity bill can rise more than 60 euros per year. So it is important to switch off different kind of devices when you are not using them. One way to follow energy consumption is to check every time when electricity and water bill comes how much you have used them. If the consumption of energy is rising rapidly you must start to think about what to do.

13.5 General issues concerning climate change

Climate change is nowadays a global problem. People must try to slow down it some way. But it is not only people how have caused it. It is also natural things which effects for climate change. The first thing which must be done is to give guidance and information for people about what climate change really is. That way it is possible to minimize it. Reduction of greenhouse effect is also very important thing when we deal with climate change issues. So reduction of carbon dioxide and other greenhouse gas emissions must occur otherwise it is not possible to slow down climate change effect. Climate change effect can be reduced so that people start to use for example renewable energy sources instead of using non-renewable energy sources. Also using of nuclear power is one option because it does not create any kind of carbon dioxide emissions but maybe it is not the best alternative. Using of bio fuel cars is also one option to reduce climate change effect in future if we figure out how traffic emissions can be reduced. Hopefully people realize that climate change is a big problem and start do something before it is too late to slow down it.

14 CONCLUSIONS

Topics of the interview were: background information, traffic and moving, purchasing of device, waste management, use of energy and general issues concerning climate change. Generally speaking, research went well and answers were good.

Results from traffic and moving section shows that price of car and fuel influences when people are going to buy a new car. Also consumption of fuel plays big role when people are going to buy a new car. But it was also important to notice that people doesn't like to use bus when they are travelling to work. Also use of common lift for travelling to work was rare. Generally speaking, people like to use own car when travelling to work. Development of public transport is one key point to reduce use of private car when people are travelling to work. One reason why people are not using so much common lift when they are travelling to work is distance between home and working place. If distance between home and working place is long then it is wise to use common lift to save money and environment. Also moving towards bio fuel cars will be one option to reduce emission from traffic.

Second question group deals with purchasing of device issues. It seems that quality and consumption are important things which must be taking into consideration when buying a new device. Also material solutions influence when making buying decisions but people must concentrate more to this issue so that the product can be manufactured as environmental friendly as possible. So people think waste and energy consumption issues when they are going to buy a new device. This kind of thinking saves energy and reduces waste amounts which is good thing to notice. People also think recycling and re-use questions which concerns devices which they are not going to use anymore. But people must concentrate to check that does new device contain environmental- or energy certificate because that way it is possible to save energy and money. Generally speaking, people have nowadays better knowledge of energy issues than in past.

So if this kind of trend continues it is possible to reduce waste amounts and save energy.

Results from waste management section shows that people take nowadays seriously care of recycling issues. It is good thing to notice because waste amounts are increasing nowadays very rapidly. It seems that sorting of waste plays nowadays big role in every day life. If these kinds of actions are made then it is possible to reduce waste amounts. Also burning of waste reduce waste amounts and hopefully in the future Pori also has got own burning facility for waste. More effective collection of methane in dumping places must be done otherwise methane emissions from dumping places will increase rapidly and then it is even harder to stop climate change.

Results from use of energy section shows that electricity is still most often used energy source when people are heating up their houses. But important thing to notice was that oil is not used anymore so much when people are warming up their houses. Results also show that people are nowadays using more wood and district heating when they are warming up houses. People are also using more energy saving devices so that way they can save money and energy. Also switching of lights and adjusting room temperature are key points when we are dealing with energy issues. People must remember to switch off lights or other devices when they are not using them anymore and that way avoid use of standby mode because standby mode increases significantly consumption of electricity and electricity bill. Use of renewable energy sources must also take into consideration because that way it is possible to reduce climate change effect. But generally speaking, it is good thing to notice that people are now taking into consideration energy and environment issues more seriously than in past few decades.

Last question group deals with general issues concerning climate change. Results show that people take seriously issues which concerns climate change and are willing to fight against it. It was also significant to notice that people knows what greenhouse effect is and what are the main greenhouse gases. Generally speaking, hopefully people have been honest when they have answered to these questions otherwise it is not possible to get truthful results.

15 REFERENCES

1. Hellgren, M., Heikkinen, L. & Suomalainen, L. 1996. Energia ja ympäristö. Helsinki: Hakapaino Oy.
2. Kuopion ilmastostrategia. 2003. Kuopio
3. Finland's environmental administration. Climate change [online]. [Referred 5.10.2006]. Available: <http://www.ymparisto.fi/default.asp?node=5311&lan=en>
4. Ilmasto.org. Kaikki ilmastonmuutoksesta. Kasvihuonekaasut [online]. [Referred 5.10.2006]. Available: <http://www.ilmasto.org/ilmastonmuutos/perusteet/kasvihuonekaasut.html> [updated 28.9.2006].
5. Isomäki, R. 1996. Luvassa lämpenevää. Ilmastonmuutos ja sen seuraukset. Helsinki: Oy Edita Ab
6. Hakahuhta, A., Isomäki R., Laine, M., Peltonen, L., Reijonen, S & Ulvila, M. 1995. Myrsky ja Mylväys!. Forssa: Forssan kirjapaino Oy.
7. The Forests and the European Union Resource Network. Carbon sink [online]. [Referred 13.10.2006]. Available: <http://www.fern.org/pages/climate/carbon.html>
8. Ilmasto.org. Kaikki ilmastonmuutoksesta. Nielut [online]. [Referred 30.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/politiikka/kioton_poytakirja/nielut.html [updated 28.9.2006].
9. Ilmastonmuutos. Metaani [online]. [Referred 03.10.2006]. Available: <http://www.ilmastonmuutos.info/fi/cfmldocs/index.cfm?ID=1097>
10. Ilmasto.org. Kaikki ilmastonmuutoksesta. Metaani [online]. [Referred 30.10.2006]. Available: <http://www.ilmasto.org/ilmastonmuutos/perusteet/kasvihuonekaasut/metaani.html> [updated 28.9.2006].
11. Ilmastonmuutos. Dityppioksidi [online]. [Referred 03.10.2006]. Available: <http://www.ilmastonmuutos.info/fi/cfmldocs/index.cfm?ID=1098>
12. Ilmasto.org. Kaikki ilmastonmuutoksesta. Dityppioksidi [online]. [Referred 12.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/perusteet/kasvihuonekaasut/muut_kaasut.html
13. Ilmasto.org. Kaikki ilmastonmuutoksesta. Epäsuorasti vaikuttavat kaasut [online]. [Referred 30.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/perusteet/epasuorasti_vaikuttavat_kaasut.html [updated 28.9.2006].
14. Ilmasto.org. Kaikki ilmastonmuutoksesta. Typen oksidit [online]. [Referred 30.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/perusteet/epasuorasti_vaikuttavat_kaasut.html [updated 28.9.2006].
15. Ilmasto.org. Kaikki ilmastonmuutoksesta. Hiilimonoksidi [online]. [Referred 30.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/perusteet/epasuorasti_vaikuttavat_kaasut.html [updated 28.9.2006].

16. Ilmasto.org. Kaikki ilmastonmuutoksesta. Kioton pöytäkirja [online]. [Referred 16.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/politiikka/kioton_poytakirja.html [updated 28.9.2006].
17. Euroopan unioni. Kioton pöytäkirja ilmastonmuutoksesta [online]. [Referred 05.10.2006]. Available: <http://europa.eu/scadplus/leg/fi/lvb/l28060.htm> [updated 30.1.2003].
18. European commission. Environment. The Kyoto Protocol [online]. [Referred 29.10.2006]. Available: <http://ec.europa.eu/environment/climat/kyoto.htm> [updated 20.9.2006].
19. Suomen ympäristöministeriö. Euroopan ilmastonmuutosohjelma [online]. [Referred 17.10.2006]. Available: <http://www.ymparisto.fi/default.asp?contentid=166475&lan=FI> [updated 17.1.2006].
20. Suomen ympäristöministeriö. Hallitustenvälinen ilmastonmuutospaneeli [online]. [Referred 17.10.2006]. Available: <http://www.ymparisto.fi/default.asp?contentid=205205&lan=FI> [updated 11.10.2006].
21. Suomen ympäristöministeriö. Kansallinen energia ja ilmastostrategia [online]. [Referred 14.11.2006]. Available: <http://www.ymparisto.fi/default.asp?node=568&lan=fi> [updated 27.10.2006].
22. Energiamarkkinavirasto. Päästökauppa [online]. [Referred 05.10.2006]. Available: <http://www.energiamarkkinavirasto.fi/select.asp?gid=172>
23. Virtanen, K. 2004. Energy and Environment. Pori
24. Kuntatiedon keskus. Energiatehokkaat hankinnat [online]. [Referred 20.10.2006]. Available: http://www.kunnat.net/k_perussivu.asp?path=1;29;356;1033;36689;37941
25. Kuusisto, E., Kauppi, L & Heikinheimo P. 1996. Ilmastonmuutos ja Suomi. Helsinki: Yliopistopaino Helsinki University Press
26. Turun seudun jätehuolto. Sinä vaikutat ilmastonmuutokseen [online]. [Referred 27.10.2006]. Available: <http://www.turunseudunjatehuolto.fi/ilmastonmuutos?pid=699>
27. MEP Riitta Myllerin verkkosivut. Kolumni Radio Rexissä kesäkuussa 2006 [online]. [Referred 27.10.2006]. Available: http://www.riittamyller.net/Kolumnit/0606_RadioRex.htm
28. Maan ystävät. Ilmastonmuutoksen kustannukset nousevat biljooniin ilman toimia [online]. [Referred 27.10.2006]. Available: http://fi.oneworld.net/external/?url=http%3A%2F%2Fwww.maanystavat.fi%2Ftiedotus_artikkeli.php%3Faid%3D809%26kid%3D0 [updated 13.10.2006].
29. Ilmasto.org. Talous [online]. [Referred 05.10.2006]. Available: <http://www.ilmasto.org/ilmastonmuutos/seuraukset/suomessa.html> [updated 13.1.2006].
30. Ilmasto.org. Teollisuuden prosessit [online]. [Referred 27.10.2006]. Available: http://www.ilmasto.org/ilmastonmuutos/torjuminen/paastojen_vahentaminen_suomessa.htm [updated 28.9.2006].

31. Prizztech Oy. Maakunnallinen kehittäjä [online]. [Referred 27.10.2006]. Available: <http://www.prizztech.fi/sivu.asp?taso=1&id=1>
32. Ilmasto.org. Kasvihuoneilmiö [online]. [Referred 27.10.2006]. Available: <http://www.ilmasto.org/ilmastonmuutos/perusteet.html> [updated 28.9.2006].
33. Ilmasto.org. Hiilidioksidi [online]. [Referred 30.10.2006]. Available: <http://www.ilmasto.org/ilmastonmuutos/perusteet/kasvihuonekaasut/hiilidioksidi.html> [updated 28.9.2006].
34. ILPOS. 2006. Porin seudun ilmasto-ohjelma. Projekti suunnitelma. Pori
35. Kuntatiedon keskus. Kuntien ilmastonsuojelukampanja [online]. [Referred 08.11.2006]. Available: http://www.kunnat.net/k_peruslistasivu.asp?path=1;29;356;1033;36689;36692
36. Ympäristötietopankki. Vapaaehtoinen energian säästösopimus [online]. [Referred 07.11.2006]. Available: http://www05.turku.fi/ytiotopankki/energia_saastosopimus.html
37. Energy Information Administration. Natural gas use [online]. [Referred 31.10.2006]. Available: <http://www.eia.doe.gov/kids/energyfacts/sources/non-renewable/images/Ngasuse1.gif>
38. Ympäristöenergia. Aurinkokeräin TX 2006 [online]. [Referred 05.12.2006]. Available: http://www.y-energia.com/aurinkolampo/aurinkokerain/Kerain_Tx-2006/vaajakoski.jpg
39. VTT. Installed wind power capacity and production in Finland [online]. [Referred 31.10.2006]. Available: http://www.vtt.fi/kuvat/cluster7_energia/capacity.jpg
40. Energy Information Administration [online]. [Referred 30.10.2006]. Available: <http://www.eia.doe.gov/kids/energyfacts/sources/renewable/images/BIOMASSTYPES1.gif>
41. MTK. Maatalouden kasvihuonekaasupäästöt [online]. [Referred 30.10.2006]. Available: <http://www.mtk.fi/maatalous/ymparisto/ilmastonmuutos/paastot/fiFI/paastotetu/files/11368440750011649/defaultFS/kasvihuonepaastot.gif>
42. Florida power and light. Water power [online]. [Referred 30.10.2006]. Available: <http://www.fplforkids.com/graphics/lhw2.jpg>
43. Kuntatiedon keskus. Miten kunta voi vähentää kasvihuonepäästöjään? [online]. [Referred 30.10.2006]. Available: http://www.kunnat.net/k_perussivu.asp?path=1;29;356;1033;36689;37941 [published 31.03.2006].
44. FINBIO. Bioenergia Suomessa. Biopolttonesteet [online]. [Referred 28.11.2006]. Available: <http://www.finbioenergy.fi/default.asp?init=true&InitID=456;0>
45. Metsä vastaa. Muutoksia Suomen metsissä [online]. [Referred 30.11.2006]. Available: <http://www.metsavastaa.net/index.cfm?docID=8209> [updated 30.11.2004].
46. Statistics Finland. Greenhouse gases in Finland [online]. [Referred 12.1.2007]. Available: http://www.stat.fi/tk/yr/khkaasut_etusivu_en.html [updated 28.9.2006].

47. Statistics Finland. Total Energy Consumption and Final Energy Consumption by Sector 1970-2005 [online]. [Referred 12.1.2007]. Available: http://www.stat.fi/til/ekul/2005/ekul_2005_2006-03-16_kat_001_en_001.gif [updated 23.3.2006].

Ilmastonmuutokseen vaikuttavat tekijät

Perustiedot

Raportti on absoluuttinen.

Arvioijaryhmät

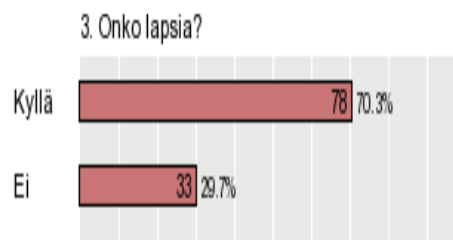
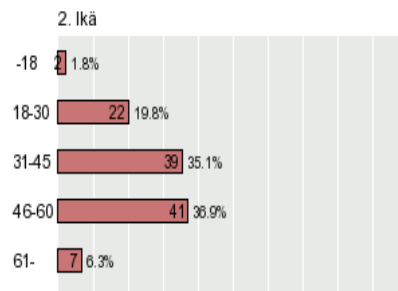
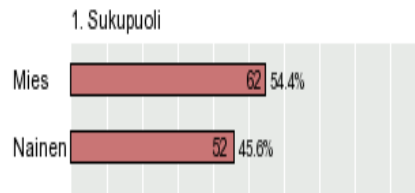
Nimi	Määrä	Vastaamassa (%)	Lopettanut (%)
KOVI	33	11 (33.3)	8 (24.2)
LIPO	55	6 (10.9)	5 (9.1)
TEKPO	95	12 (12.6)	10 (10.5)
TPK	26	7 (26.9)	6 (23.1)
Ympäristötoimisto	8	2 (25.0)	2 (25.0)
[AUTO] Anonymous Evaluators	126	77 (61.1)	71 (56.3)
Yhteensä	343	115 (33.5)	102 (29.7)

Kysymysryhmät

APPENDIX2

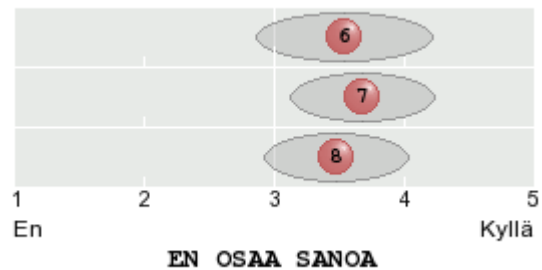
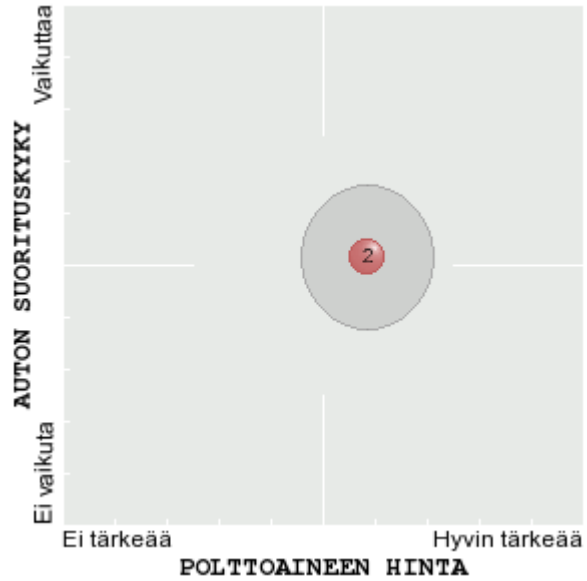
Taustatiedot

1. Sukupuoli (114)
2. Ikä (111)
3. Onko lapsia? (111)

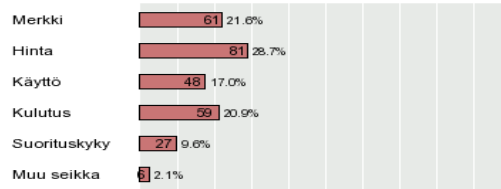


Liikkuminen

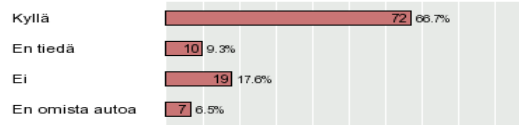
1. Mitkä tekijät vaikuttavat auton hankintaan? (282)
2. Miten polttoaineen hinta ja auton suorituskyky vaikuttavat auton hankintaan? (109)
3. Onko autossasi katalysaattori? (108)
4. Miten kuljet työmatkasi? (143)
5. Oletko käyttänyt kimppekyytiä työmatkoihin? (107)
6. Pidätkö tärkeänä ominaisuutena, että autossasi on ilmastointi? (107)
7. Voisitko harkita biopolttoaineella toimivan auton ostamista lähitulevaisuudessa? (107)
8. Voisitko kuvitella ostavasi hybridauton? (106)
9. Miten joukkoliikenne toimii asuinpaikkakunnallasi? (99)



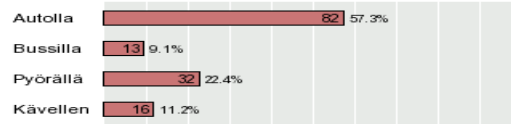
1. Mitkä tekijät vaikuttavat auton hankintaan?



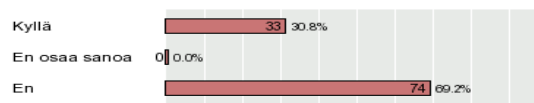
3. Onko autossasi katalysaattori?



4. Miten kuljet työmatkasi?



5. Oletko käyttänyt kimppekyytiä työmatkoihin?



Laitteiden hankinta

1. Millä perusteella teet valintasi kun olet hankkimassa uutta laitetta esimerkiksi televisiota? (200)

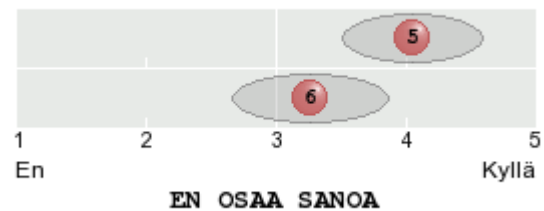
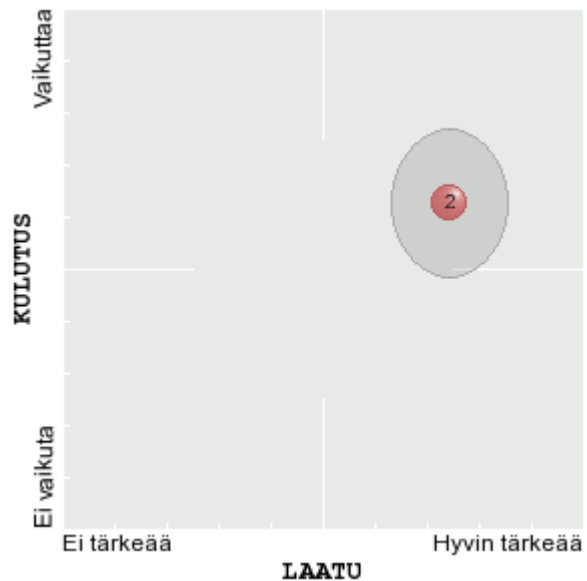
2. Miten energian kulutus ja laitteen laatu vaikuttavat uuden laitteen hankinnassa? (106)

3. Tarkastatko kun teet laitehankintaa, onko laite varustettu ympäristömerkinnällä? (104)

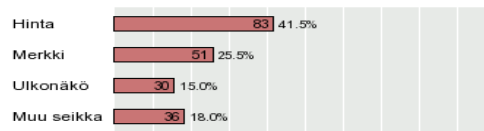
4. Huomioitko vanhan laitteesi osalta kierrätys/uusiokäyttö-mahdollisuutta kun hankit uuden laitteen tilalle? (101)

5. Mietitkö uutta laitetta hankkiessasi, kuinka kauan tulet käyttämään kyseistä laitetta? (106)

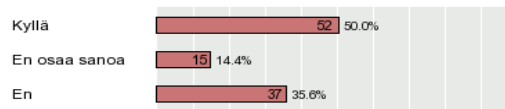
6. Mietitkö raaka-aine/materiaaliratkaisuja kun teet ostopäätöksen uuden laitteen hankkimisesta? (105)



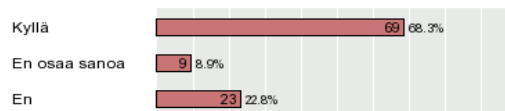
1. Millä perusteella teet valintasi kun olet hankkimassa uutta laitetta esimerkiksi televisiota?



3. Tarkastatko kun teet laitehankintaa, onko laite varustettu ympäristömerkinnällä?

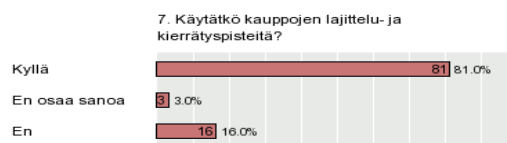
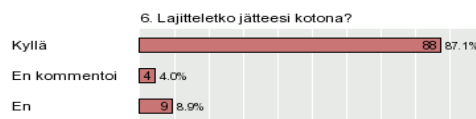
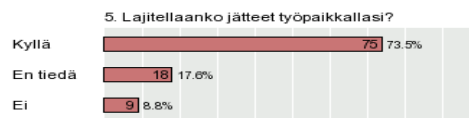
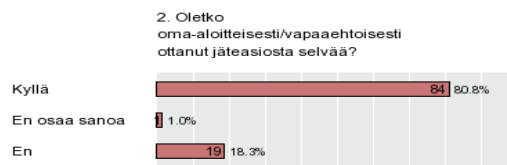
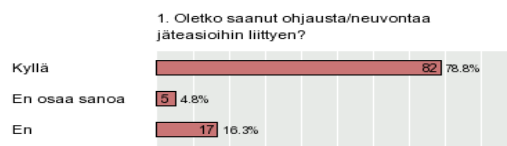
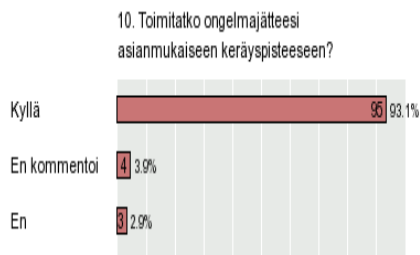
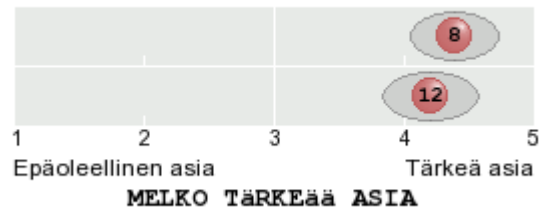
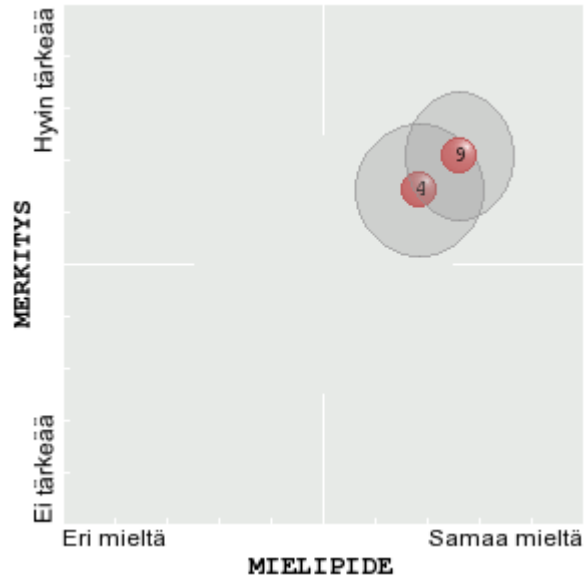


4. Huomioitko vanhan laitteesi osalta kierrätys/uusiokäyttö-mahdollisuutta kun hankit uuden laitteen tilalle?



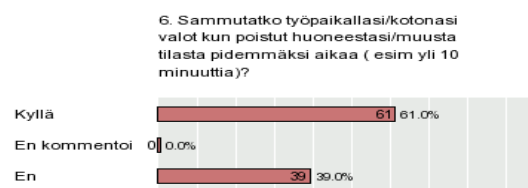
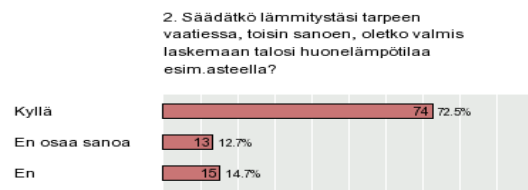
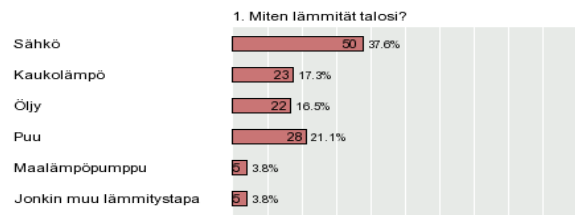
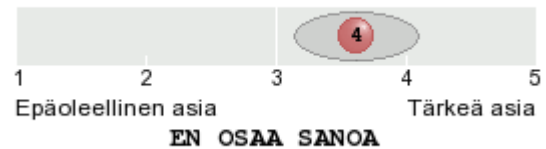
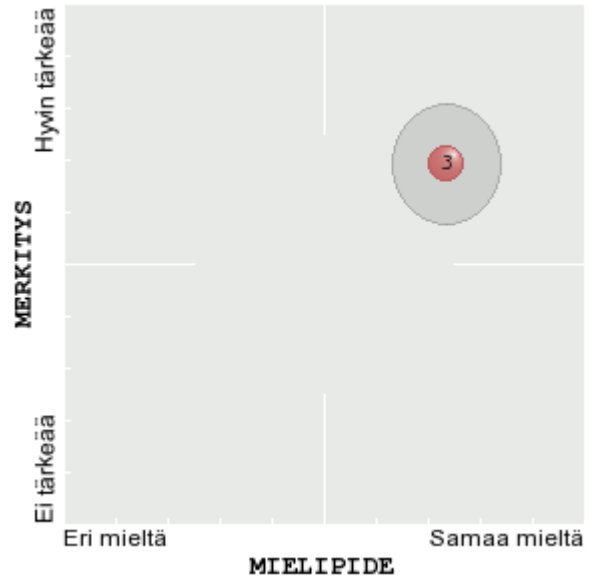
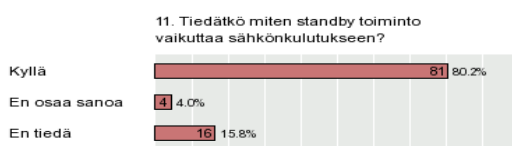
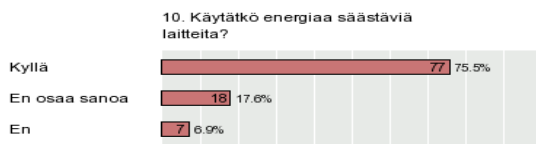
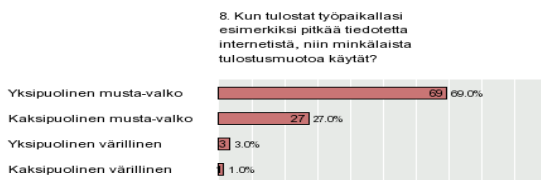
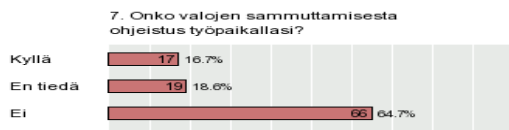
Jätehuolto

1. Oletko saanut ohjausta/neuvontaa jäteasioihin liittyen? (104)
2. Oletko oma-aloitteisesti/vapaaehtoisesti ottanut jäteasiosta selvää? (104)
3. Mikä saa kierrättämään? (89)
4. Onko polttokelpoisen jätteen poltto hyväksyttävä menetelmä jätehuollossa? (104)
5. Lajitellaanko jätteet työpaikallasi? (102)
6. Lajitteletko jätteesi kotona? (101)
7. Käytätkö kauppojen lajittelu- ja kierrätyspisteitä? (100)
8. Mitä mieltä olet jätteiden uusiokäytöstä? (104)
9. Tulisiko kaatopaikoilta vapautuva metaani ottaa talteen nykyistä tehokkaammin? (103)
10. Toimitatko ongelmajätteesi asianmukaiseen keräyspisteeseen? (102)
11. Mitä mieltä olet jätemaksuista? (90)
12. Mitä mieltä olet jätteiden kompostoinnista? (103)



Energian käyttö

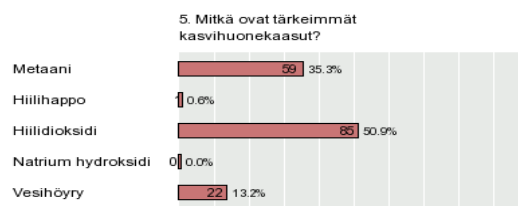
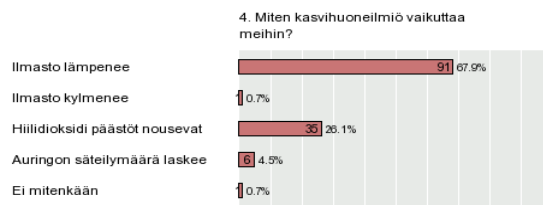
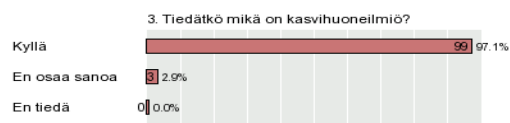
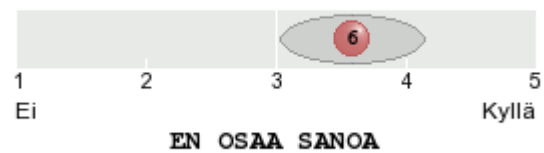
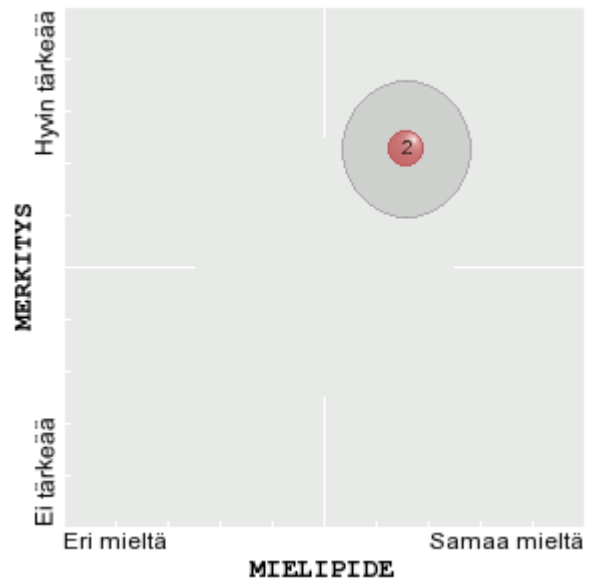
1. Miten lämmität talosi? (133)
2. Säädätkö lämmitystäsi tarpeen vaatiessa, toisin sanoen, oletko valmis laskemaan talosi huonelämpötilaa esim.asteella? (102)
3. Olisitko valmis siirtymään käyttämään uusiutuvia energianmuotoja/lähteitä? (103)
4. Mitä mieltä olet energiaekspertti toiminnasta? (103)
5. Pystytkö itse vaikuttamaan työhuoneesi lämmitykseen/ilmastointiin? (101)
6. Sammutatko työpaikallasi/kotonasi valot kun poistut huoneestasi/muusta tilasta pidemmäksi aikaa (esim yli 10 minuuttia)? (100)
7. Onko valojen sammuttamisesta ohjeistus työpaikallasi? (102)
8. Kun tulostat työpaikallasi esimerkiksi pitkää tiedotetta internetistä, niin minkälaista tulostusmuotoa käytät? (100)
9. Seuraatko esim.veden- tai sähkönkulutustasi? (102)
10. Käytätkö energiaa säästäviä laitteita? (102)
11. Tiedätkö miten standby toiminto vaikuttaa sähkönkulutukseen? (101)



APPENDIX7

Ilmastonmuutokseen liittyviä kysymyksiä

1. Mitä mieltä olet ilmastonmuutoksesta? (86)
2. Onko ilmastonmuutosta mahdollista hidastaa? (103)
3. Tiedätkö mikä on kasvihuoneilmiö? (102)
4. Miten kasvihuoneilmiö vaikuttaa meihin? (134)
5. Mitkä ovat tärkeimmät kasvihuonekaasut? (167)
6. Olisiko ydinvoiman lisääminen ratkaisu ilmastonmuutoksen kannalta? (103)



Vapaapalautteet

APPENDIX8

B. Liikkuminen

9. Miten joukkoliikenne toimii asuinpaikkakunnallasi?

- Lähin linja-autopysäkki 5 km etäisyydellä ja sieltäkin vain työmatkaliikenneyhteydet lähikaupunkiin. Työpaikalle saakka ei ole käyttökelpoisia yhteyksiä (matka 65 km). Myös muihin asiointeihin on mahdollisuus vain omalla autolla.

- Minun tarkoituksiini ja liikkumisajankohtiini verraten erittäin hyvin.

- Yleisesti ottaen keskimääräistä heikommin, siis isoista kaupungeista, mutta asuntoalueeni suunnalta hyvin.

- kohtalaisesti ja kalliisti

- En käytä, luultavasti toimii kohtalaisen hyvin

- aikas huonosti.

- kohtalaisen hyvin

- Hyvin huonosti

- Ei kovin hyvin omalla asuinalueellani.

Busseja harvakseltaan, illalla ei lainkaan, eikä sunnuntaisin.

- normaalisti

- ?

- Melko hyvin. Asuinpaikkakuntani on kyllä sen verran pieni ettei joukkoliikennettä tarvitse kaupungin sisällä paikasta toiseen liikkuesssa.

- hemmetin hyvin

- hyvin

- liian vähän vuoroja ja reittejä

- Hyvin

- huonosti

aikatauluissa ei mitään tolkkua

joskus menee, toisinaan ei

- Vuoroja vähennetty käytön vähyyden vuoksi, omalle asuinalueelleni kulkevat liian harvoin, vain kerran tunnissa.

- Ilmesesti kohtalaisesti. Käytin viimeksi kesällä kun oma auto oli rikki useamman kuukauden. En käytä autoa läheskään päivittäin, sitä ei kysytty.

- Kohtalaisesti

- Kallis. Toimii kyllä kohtalaisesti, mitä omiin kulkumahdollisuuksiin tulee.

- Joukkoliikennettä ei ole, kuin kerran päivässä kouluaikoina.

- Kohtalaisesti, vuoroja on vähän.

- Melko hyvin

- Sujuvasti ja monipuolisesti.

- Kohtalaisen hyvin aamuisin ja päiväsaikaan mutta iltaisin huonommin

- En käytä joukkoliikennettä.

- Ei tietoa eikä kiinnostusta. Bussimaksut ovat joka tapauksessa täysin älyttömät!

- Uskoisin, että kohtuu hyvin. Itselläni ei juuri ole ollut tarvetta käyttää sitä.

- Noormarkusta mahdoton kulkea töissä bussilla

- hyvin

- Melko hyvin. Joillekin "sivukylille" ei ole lainkaan vuoroja =(

- Toimii melko hyvin

- Todella huonosti. En pysty käyttämään joukkoliikennettä lainkaan, koska päivässä ajetaan yksi vuoro suuntaansa. Kunnan keskustasta varmasti paremmat yhteydet esim. Poriin.

- Ei oikein mitenkään - kallista ja aikataulut harvoja. Vähäisiä kokemuksia tosin.

- Kohtalaisesti.

- Välttävästi.

- Aikataulut ja joukkoliikenteen linjat eivät sovi minun käyttööni

- Kohtuu hyvin, mutta paikallisliikenne on liian kallista. Jos olisi halvempaa tulisi käytettyä enemmän.

- Kohtuullisesti. Asun haja-asutusalueella, mutta paikassa, jossa aamusta alkuiltaan

APPENDIX9

saakka ainakin arkisin voi käyttää bussipalveluja. Vuorotkaan eivät ole vähentyneet pahasti viime vuosina.

- Asuinpaikkakunnalla toimii, mutta oma asuinalue on uusi ja vähän joukkoliikenteen katveessa. Lasten vieminen päiväkotiin ei onnistu kuin omalla autolla.

- Olen kuullut puhetta

- huonosti

- Melko hyvin....mutta on aivan liian kallis. Kertalippu 4 e.

- Aina on parantamisen varaa. Edellyttää tosin poliittisia päätöksiä

- Asun pienessä maaseutukylässä ja joukkoliikenteen avulla ei voi käytännössä kulkea kun sitä ei ole.

- Bussit vanhoja saasteromuja, aikataulut erityisen epäselviä (Diplomi-inssinä) en osaa arvata mitä erilaiset lyhenteet XYZ vuorotunnusten perässä kulloinkin merkitsevät. -
-> satunnainen käyttö liian hankalaa ja myös KALLISTA.

- Kohtalaisen hyvin

- Joukkoliikenne toimii huonosti. Paikallisbussien liikennöinti on vähäistä, eikä siksi palvele itseäni. Työmatkat on mahdotonta kulkea bussilla tai junalla. Aikataulut laadittu koululaisille, joten lapset käyvät bussilla koulussa. Matkaa on 10km.

- -

- työmatkaani en voi suorittaa joukkoliikennettä käyttäen, muuten kotipaikkakunnallani joukkoliikenne toimii ok, mutta hinta ei ok

- Ei juuri kokemusta

- ei kokemusta koska työmatka lyhyt 2km

- Vuoroja pitäisi lisätä ja taksoja alentaa jotta käyttö lisääntyisi.

- välttävästi

- Resursseihinsa nähden tyydyttävästi.

- Median mukaan supistetaan kokoajan. Se vähän mitä käytän, olen ollut tyytyväinen.

- hinnat nousee ja vuorot vähenee

- Kohtuullisen hyvin jos työmatkat ovat kriteerinä.

- Kehnon laisesta ajatellen työpaikani sijaintia

- Kaupungin (=työpaikan) ja asuinpaikan välillä toimii hyvin.

- Mielestäni kattavasti ainakin, keskustassa ja lähiöissä.

- heikommin vuosi vuodelta

- En ole juurikaan käyttänyt joukkoliikennepalveluita. Tiedän, että muutaman sadan metrin päässä on pysäkki, josta pääsee keskustaan kohtalaisen usein.

- Erittäin huonosti

- Aika hyvin, iltaisin huonoa

- Vuorojen määrissä katsottuna keskustan tuntumassa hyvin arkisin - viikonloppuisin huonommin. Syrjemmällä huonosti ja viikonloppuisin tosi huonosti tai ei ollenkaan.

- Kotoa keskustaan hyvin.

Kotoa työpaikalle huonosti.

- Joukkoliikenne ei toimi riittävän tehokkaasti. Erityisen hankalana pidän sitä, että linja-autojen aikatauluja ei ole merkitty riittävän selvästi. Jokaisella pysäkillä pitäisi olla n. aikataulut. Nyt pitää itse osata arvioida lähtöpysäkillä ajettu aika, matka saattaa olla pitkä ja ajan arvioiminen vaikeaa.

- Ei mitenkään, pieni paikka.

- Ei onnistu ainakaan työmatkojen suhteen.

- Huonosti...

- Ei tomi

- Hyvin.

- ihan ok

- Kohtalaisen hyvin. Kertalippujen hinnat ovat mahdottoman korkeat.

- aika huonosti

- Huonosti. Liian isot autot, kaliit liput, nimenomaan vaihto ajan lyhyys. Kahden hengen on edulisempaa käyttää omaa autoa jos vaihto ehtona on auton vaihdollinen matka. (koska oman auton kiinteät kulut menevät joka tapauksessa.)

- kohtuullisen hyvin, mutta kalliisti

- En käytä, mutta olen saanut käsityksen, että

APPENDIX10

vuoroja kulkee harvakseltaan ja on kallista lystiä. Illalla ja myöhempään ei joukkoliikenne kulje.

- Suht. hyvin
 - hyvin sujuu
 - Koululaisten aikatauluihin hyvin, mutta iltaliikenne ei riittävä harrastuksiin kulkemiseen.
 - normaaliin työhön ja kouluunmeno aikana melko hyvin, mutta muuten aika harvoin on vuoroja
 - surkea
 - Kohtalaisesti.
 - En käytä.
 - välttävästi
 - Ei kovin hyvin
 - Ei siihen suuntaan, kuin työmatkaa varten tarvitsisin.
 - Vain muutama linja-autovuoro päivässä
 - Ei kovin hyvin.
 - Huonosti! Kaupungista pääsee ainoastaan yhteen suuntaan hyvin kulkemaan.
- Paljon parannettavaa kun vertaa esimerkiksi Tampereen julkista liikennettä.
- En juurikaan käytä julkisia kukuneuvoja, joten en osaa sanoa.
 - Ei kokemusta (asuminen lähellä keskustaa). Vaikuttaa kuitenkin, että joukkoliikenne on melko vähäistä verrattuna suuriin kaupunkeihin
 - Kohtalaisesti
 - kohtuullisesti
 - Toimii muuten hyvin, mutta työpaikan ja bussipysäkin väliin jää vielä matkaa noin puoli kilometriä..
 - kehnosti, pitkät vuorovälit.. työpäivä pitenee ja myöhästyy paikoista

D. Jätehuolto

3. Mikä saa kierrättämään?

- Se mikä kiertää kohtuullisen pienellä vaivalla, kierrätetään. Muusta päästään eroon muulla tavalla.
- Hyviä tuotteita ei voi viedä kaatopaikalle ja aina on olemassa henkilöitä/tilanteita, jotka tarvitsevat juuri sellaista tuotetta.

Biojäte taas tuottaa puutarhamultaa.

- Säili heittää käyttökelpoista tavaraa/materiaalia kaatopaikalle.
- ympäristön suojelu
- Onhan se järkevää toimintaa
- luonnonsuojelu
- Helpottaa, vähentää jätteiden käsittelyä kotona.
- Energian säästö
- yhteisön hyvinvointi, on myös oma etu
- pakko
- Ajatus kaatopaikoista, joille viedään aivan liikaa jätettä. Kaatopaikan tulisi olla vasta viimeinen pakollinen vaihtoehto jätteen loppusijoitukselle. On kestävän kehityksen kannalta elintärkeää säästää luontoa ja samalla tärkeitä raaka-aineita.
- napajäätiköt
- tulevaisuus
- tulevaisuus
- Ei minua saa siihen hommaan.
- luonto

raaka-aineiden rajallisuus

- Asian tärkeys, jätemäärien lisääntyminen huolestuttaa, kierrätys on erittäin tärkeää ja järkevää - nykysuurkulutuksella välttämätöntä!

- Huoli jätevuoresta. Vastuuntunto siitä että hyvä tavara pitää laittaa eteenpäin, eikä

APPENDIX11

heittää kaatopaikalle, biojätteet kompostiin, polttoaineeksi tai kierrätysraaka-aineeksi kelpaava pitää kerätä jo eettisistä syistä. Lapsille on jätettävä hyvät elämän mahdollisuudet.

- Kestävän kehityksen arvot

- Mielekkyyys.
- Mitä vähemmän turhaa jätettä sen parempi
- Jos kierrätyksestä on hyötyä luontoa-ajatellen tai rahallista hyötyä jollekin sitä kannattaa tehdä.

- Ajatus suurista kaatopaikkajätteistä.
- Ekologinen ajattelutapa.
- Ei kunnossaolevaa ja helposti kunnostettavaa kannata hylätä
- Kierrätys mahdollistaa edullisemmat hinnat, koska se pitää raaka-aineklut

alhaisina.

- Omatunto
- Luonnon säästäminen-kestävän kehityksen periaatteet
- jotta maailma ei peittyisi roskeen ja romuun
- Se on vaan opittu tapa. Jo lapsena olen saanut kipinän.. oman äidin toiminta!
- Jätevuoret kasvavat, jos ei kierrätä.
- Se, että jokin minulle turha tavara saattaa olla jollekulle toiselle käyttökelpoinen, ja tietysti myös päinvastoin. Mitä vähemmän jätettä kaatopaikalle sen parempi.

- Omakohtaiset tutustumiskäynnit kaatopaikoilla, tieto siitä että jäte makaa siellä pahimmillaan kymmeniä vuosia. Maalta tullessa on tottunut siihen, että jätettä syntyy itse asiassa tosi vähän, suuren osan voi polttaa tai laittaa kompostiin tai käyttää vielä jotenkin hyödyksi.

- Yhteiskunnan ohjeistus.
- Kestävän kehityksen edistäminen
- Koko ajan kasvavat jätevuoret kaatopaikoilla. Kierrättämällä voi auttaa edes vähän omalta osaltaan ympäristön pienempään kuormittamiseen.

- Järkevää ja siistiä. jos vanha esim. kelpaa vielä jollekin ihan ok, yleensä yritän kierrättää

- paperikeräyslaatikon käyttö ilmaista, muiden jätteiden kuljetys maksullista
- Alan ihmisenä se on vähän velvollisuuskin, mutta varmaan takaraivossa on vanhat kunnan arvot, jonka mukaan mitään turhaa ei saa heittää menemään.

- Tietoisuus asioista.
- Toimivat keräysjärjestelmät, jotka ei aiheuta lisäkustannuksia
- järki
- Lapset ja heidän tulevaisuutensa.
- Ei mikään

- Luonnonvarojen säästäminen, periaate ettei käyttökelpoista tavaraa haaskata, jäteongelmat, taloudelliset seikat eli nuukuus

- jos on helpompi kierrättää kuin hävittää
- pitemmän päälle ainoa järkevä mahdollisuus
- Raaka-aineen ja energian säästäminen ja pyrkimys ilmastomuutoksen

hidastamiseen.

- Jos kierrätys jatkaa käyttöikää järkevästi, niin silloin.
- Selkeät ohjeet, toimintatavat ja vaivattomuus
- nyky-yhteiskunnan tilanne
- Se että kun kierrättää niin siitä tienaa.
- Asiaa ajattelen ammattinikin puolesta

- Tietoisuus siitä, että sillä on merkitystä ympäristöön yleisesti. Kotitalousjätteiden osalta kierrätyskynnystä madaltaa ehdottomasti se, että kotona lajiteltu jäte on helppo siirtää ulos valmiisiin jättepisteisiin joko taloyhtiön pihassa tai esim. markettien yhteydessä sijaitseviin pisteisiin.

- Se kun on paikka minne voi viedä käytettyjä ja tarpeettomia käyttöesineitä.

- Hyvän vaikkakin käytetyn tavaran heittäminen roskakoriin on hullua, koska jollekin se voisi olla käyttökelpoinen.

APPENDIX12

- Vanhat tavarat ovat toimivia. EN vain itse niitä satu tarvitsemaan. Jos taas tarvitsen jotain, niin käytetty toimivakin on hyvä ratkaisu

- Tietysti huoli raaka-aineiden loppumisesta
- Tavaroiden kohdalla se, että on täysin älytöntä heittää pois käyttökelpoista. Ja toiseksi kierrättämällä saa aikaan myös rahallista säästöä.

Raaka-aineiden (esim. lasi, paperi, metalli, muovi) kohdalla se, että pystytään vähentämään neitseellisten raaka-aineiden käyttöä.

- Se on kaikkien yhteinen asia
- Lasten vaatteet ja urheiluvälineet ovat hyvää tavaraa kierrätystä varten, koska niiden käyttöikä on monesti lyhyt. Esim. sukset ja monota tai luistimet sopivat vain yhden talven. Hyvät kierrätyskeskukset ja kirpputorit lisäävät intoa kierrätykseen.

Myös kierrätysteeman ylläpitäminen esim. yleisöosastokirjoituksissa ja lehtiartikkeleissa muistuttaa kierrätyksestä.

- Tapa.
- Pääsee vanhasta tavarasta eroon. Ajattelen, että sillä voi olla vielä jossain uusiokäyttöä.

- Jätteen määrä
- Se on ympäristöystävällistä, aina ei tarvitse ostaa uutta ja säästää rahaa
- halu vaikuttaa omalta osaltaan ympäristöasioihin
- Tulevaisuus ja raha
- Itsekäs oma etu, Turhan raakaaineiden kulutuksen vähentäminen.
- se on hauskaa
- Oma panos tuotteiden jatkaohdyntämiseen.

Ympäristönäkökulmalliset asiat. Kaatopaikkojen jätteiden kasvu. Tulevaisuus lapsilla.

- Järkiseikat.
- vastuuntunto
- Jätevuorten kuvittelu.
- hyvää käyttökelpoista tavaraa /tuotetta voi käyttää useampikin, jos kyseinen tavara vain sen kestää

käyttökelpoisen tavaran hävittäminen harmittaa aina

- Yhteisvastuu.
- Puoliso
- ei mikään
- Jätevuoret

Maapallon tulevaisuuden ajattelemisen

- Roskis täytyy muuten liian nopeasti. Lisäksi ajttelee, että jollakin saattaisi olla tuolle jotakin muuta käyttöä.
- Ajatus materiaalien ja raaka-aineiden määrän rajallisuudesta
- Luonnon kunnioittaminen,
- Kestävä kehitys ja maapallon tulevaisuus. Jokainen voi tehdä jotain yhteisen hyvän eteen.

- Ympäristön sääsätminen.
- velvollisuuden tunne ja avovaimo
- Ympäristönsuojelu
- Periaate raaka-aineiden kulutuksen vähentämiseksi. Lapsuudenkokemukset sodanjälkeisestä pula-ajasta-
- jätemäärien kerääntyminen
- Minusta on tärkeää, että kaikki mikä voidaan käyttää uudelleen, voitaisiin kerätä talteen. Myös omakotialueilla pitäisi ehdottomasti lisätä lajittelupisteitä. Sitäpaitsi kierrätys ja lajittelu on hauskaa!

- ympäristö

APPENDIX13

11. Mitä mieltä olet jätemaksuista?

- Anna keisarille, mikä keisarin on.
- Jättemaksun maksan mielelläni, jos tiedän, että siitä on vastaava hyöty. Ts. euror käytetään ympäristöhuollon hyväksi.
- Menettelee, joskin kesämökin ekomaksulle ei lähistöltä löydy vastinetta.
- ok
- Jättemaksu on typeryyden huippu. Kierrättäjälle, jätteen tuojalle, esim kaatopaikalle, pitäisi maksaa. Mitä vaarallisempi ja ongelmallisempi jäte on, sitä suurempi

korvaus pitäisi saada. Kommunismikin oli hyvä aate, mutta kaatui ihmisen raadollisuuteen. Ei näissä jäteasioissakaan pidä uskoa ihmisen epäitsekkääseen ihanteellisuuteen.

- aika korkeat
 - ok
 - ovat välttämättömiä
 - ok
 - Jättemaksut ovat välttämättömiä, ja jokaisen ihmisen tulee edes sen verran tukea jätteenhuoltoa, että maksaa jätemaksut.
 - ei niin hieno juttu, mut jonkun ne roskikset on tyhjennettävä
 - ok
 - korkeat
 - Pieni kohtuullinen maksu on aiheellinen.
 - tarpeellisia
- ohjaavaa vaikutusta pitäisi olla vieläkin enemmän maksuja kohdentamalla
- Jättemaksut aiheuttavat sen, että jätteitä kaadetaan metsiin ja sinne, minne ne eivät kuulu. Jättemaksut muutoin ovat ok, koska toiminta aiheuttaa kustannuksia. Väärinkäytön vuoksi jätemaksu olisi järkevää periä muussa muodossa.
 - Niillä pitää kannustaa kierrättämään.
 - En osaa sanoa
 - Hyvä, jos eivät nouse liian korkeiksi.
 - Tällä hetkellä ok
 - Jätevesimaksu on mielestäni kohtuuttoman suuri.
 - Kaatopaikkamaksut liian suuria.
 - Mielelläni maksan asianmukaisesta jätteiden kuljetuksesta.
 - Hyvä kunhan ei nouse kovin korkeiksi
 - Niitä kerääminen on ymmärrettävää, sillä jätehuolto on rahoitettava jollain varoilla.
 - Niillä on hyvät perusteet ja ne tulevat varmasti nousemaan.
 - Ihan ok, mutta noin satavuotiaita mummoja koskein aivan liian kallista. Yläikäraja pitäisi olla jotain 70 v
 - Niitä saisi tietyssä määrin olla.
 - Joskus oikein miettii, että voisivat ne hinnat alhaisempiakin olla, mutta jos se on tehokas keino vähentämään jätteiden määrää niin ok. Kuitenkin biojätteiden yms. hinta voisi olla paljon alhaisempi.. Tämä johtaa siihen että sekajäteeseen tungetaan kaikki mahdollinen.
 - hyväksyn
 - Tällä hetkellä jäteastian tyhjennyksestä perittävä maksu ja ekomaksu ovat liian pieniä. Jätteen tuottajalle aiheutuvien kustannusten tulisi paremmin vastata jätehuollon järjestämisestä aiheutuvia kuluja, jolloin ihmiset kiinnostuisivat enemmän lajittelusta ja kierrättämisestä.
 - Osassa tuotteita on jo ilmoitettu, että esim. ser-maksu sisältyy tuotteen hintaan. Tuotteiden valmistajien pitäisi herätä asiaan - raivostuttavaa ostaa kaupasta moneen

kertaan ja pomminkestävästi pakattuja tuotteita - ja monesti tätä pyrkii välttämäänkin. Jättemaksu siis ok, mutta ei aina yksin kuluttajan vika, että jätettä tulee.

- Pitäisi sisältyä jo nykyisiin tuotehintoihin / verotukseen.
- Jättemaksut tulisi poistaa kokonaan ja jätehuoltolain rikkomisesta tulisi olla niin kovat sanktiot, että kansalaiset pakotettaisiin jätehuoltotalkoisiin.

APPENDIX14

- Eivät ole liian suuria. Tarvittaessa voisi maksaa enemmänkin jos sillä saataisiin enemmän ympäristöä säästäviä menetelmiä.

- Hyvä, koska hyvin järjestetty, voi maksaa siitä, ettei itse tarvitse miettiä ja on vaivaton itselle

- ok

- Puollan.

- Maksan, koska asia on tärkeä. Vaadin kuitenkin vastineeksi toimivaa palvelua.

Riittävästi kierrätyspisteitä jne.

- Erittäin alhainen maksu on vielä hyväksyttävissä. Mikäli jättemaksut on korkeat tulee ongelmia ns. varjokaatopaikkoja ym.

- ainakin yksityistalouden puolella hinta/laatu jätehuollon suhteen on ok

- Kaikenlaiset maksut kannustavat kuluttajia valitsemaan halvemman ratkaisun --> luonnon kuormitus lisääntyy kun jätteet roudataan metsiin ja maanteiden taukopaikoille.

- Jättemaksut on poistettava.

- -

- Maksan mielelläni, kunhan varat kohdennetaan siihen mitä varten ne on kerätty.

- ei saisi ainakaan nostaa, korkea maksu ei motivoi keräämään jätteitä, sanoisin melkein päinvastoin - karvat nousee pystyyn ja heittää paristot tavalliseen roskikseen

- maksut pitäisi pitää alhaisina jotta ihmiset toimittaisivat jätteet oikeisiin paikkoihin, kustannukset tulisi kerätä jo tuotteita myydessä.

- välttämätön paha

- Jättemaksun periminen on perusteltua.

- Jos se takaa asiantuntevan ja tehokkaan toiminnan niin maksan kyllä.

- Tällä hetkellä vielä Ok!

- maksaa

- Ymmärrettävää.

- Käsittääkseni tarpeellinen jätehuollon toimivuuden kannalta

- Kyllä kai ne yleishyödyllisiä maksuja ovat. Mielestäni ne ovat nykyisenlaisinaan perusteltuja.

- Jättemaksu on OK jos se liittyy jätteen käsittelyyn mutta esim. jäteverot joilla vain verotetaan eikä esim vähennetä jätteiden haittavaikutuksia en pidä hyväksyttävänä.

- Maksut ovat OK, jos saa rahalleen vastinetta.

- Jotain maksu voi kyllä ottaa, mutta toisaalta maksu on jo hoidettu veroina kaupungille ja valtiolle jo laitetta hankittaessa

- Kohtuullisen maksun hyväksyn, en verotuksellista aspektia

- Ok.

- Vastaavat tarkoitusta

- En ole perillä niistä

- en tiedä.

- Aivan kohtuullisia.

- Aika edulliset toistaiseks

- Hyvä juttu, koska kuitenkin suhteellisen edullista

- pitäisi lopettaa prkl

- ok

- Kalliita

- Jakoperuste tulisi muuttaa, suuntaan ne jotka lajittelevat ja kierättävät pitäisi päästä pienemmällä maksulla. Ongelma jätteiden palautus ilman kertamaksuja hyvä asia. Tiedän takavuosilta useita tapauksia esim. jääkaapin romut jätettiin " Suulin taakse" josta freonit ajan myötä taivaan tuuliin, kerta maksun vuoksi

- tarpeetonta kiusantekoa

- Ihan hyvä, kunhan vaan rahat käytetään oikeisiin asioihin.
- Maksun pitää pysyä kohtuullisena.
- OK
- Maksuperusteiden tulisi ohjata järkevään kierrätyskäyttöön ja kattaa niiden kustannukset

APPENDIX15

- Ok.
 - ovat ihan asiallisia
 - Ok.
 - Ihan hyvä asia.
 - liian korkeat
 - Jättemaksut ovat paikallaan, kunhan samalla kehitetään kierrätysmahdollisuuksia ja annetaan ihmisille ohjausta kierrätyksestä ja jätteiden vähentämisestä.
 - OK
 - Voisivat olla nykyistä korkeampiakin. Ei merkittävä kulu vielä asumisessa.
 - Kuntien tulolähde.
 - Toisaalta hyvä tapa kerätä rahaa, ei kovin vahvaa mielipidettä asiasta.
 - OK, kunhan pysytään kohtuudessa.
 - En osaa sanoa
-
- Maksut vähentävät turhaa kulutusta
 - korkeat
 - Hmm.. Normaalit jätehuollon kuljetusmaksut ovat ihan paikallaan, mutta esim. joku hulemaksu on minusta liikaa.
 - opiskelijoille hallaa

F. Ilmastonmuutokseen liittyviä kysymyksiä

1. Mitä mieltä olet ilmastonmuutoksesta?

- On noussut maapallon olemassaoloaikana ennenkin ja korkeammalle kuin nyt näyttäisi.
- Se huolestuttaa, koska ihmisten mielipiteisiin on kovin vaikea vaikuttaa.
- Seurataan lievästi huolestuneena.
- en tiedä varmasti tapahtuuko sitä ja jos niin miksi
- Luultavasti on tosiasia ja ihmisen aikaansaannosta
- erittäin huolestuttavaa
- huolestuttaa
- tapahtumassa selvästi
- Ilmastonmuutos on nykypäiväinen asia, johon tulee suhtautua vakavasti nyt, eikä vasta silloin kun on jo myöhäistä. On typerää sulkea silmänsä sen vaikutuksilta, ja syyttää siitä johtuvien ilmiöiden johtuvan jostakin muusta.
- lunta tarttis
- pyllystä
- vaikuttaa väistämättömältä
- Paha asia.
- käynnissä , johtaa ennalta vaikeasti ennustettaviin ympäristötuhoihin
- Ihmisen toiminnan aiheuttama ilmastonmuutos huolestuttaa, toisaalta luonnon itsessään aiheuttamaan ilmastonmuutokseen ei voi vaikuttaa.
- Erittäin huolestuttava asia. Poliittista tahtoa puuttuu että tehtäisiin enemmän sen hidastamiseksi.
- En osaa sanoa
- Paha juttu.
- Pelottava asia, joka tulee vaikuttamaan viimeistään omiin lapsiini ja heidän tulevaisuuteensa.
- Ilmaston muutos näyttää vääjäämättä tulevan, toivottavasti ihmiset saavat vähennettyä saastemäärää ja saadaan hidastettua muutoksia.

- Ilmanmuutos on nyt tässä hetkessä.
- Tärkeä globaali asia.
- Ongelmaa ehkä hieman liioitellaan, mutta hiilidioksidipäästöihin tarvitsee silti kiinnittää huomiota.
- Aiheuttanee "hankaluuksia" tai ainakin tarvetta muuttaa omia tottumuksia
- Kyllä se nyt on tapahtumassa oleva ilmiö. Muutokset voivat olla yllättävänkin nopeita ja rajuja, mutta niin pitäisi olla ihmisten toimenpiteidenkin, jotta olisi edes

APPENDIX16

jonkinlainen vaikutusmahdollisuus asioiden kulkuun.

- =0(Surullista, mutta hyvin todellista.. VARSinkin kun katsoo nyt ulos ikkunasta.. Joulukuu on ja ulkona useita lämpöasteita..
- On tapahtumassa
- Ilmastonmuutos on todellinen sekä kansainvälistä että kansallista taloutta ja yhteiskuntaa yleensä koskeva ongelma.
- Nuorempana jo asiasta "paasasin", järkyttävää nähdä että kävikin näin nopeasti. Ihminen ei opi ja taas toisaalta ei käytetä tarpeeksi keinoja yhteiskunnan taholta - esim. joukkoliikenteen tehostaminen ja tiedotuksen lisääminen.
- Jotain pitäisi tehdä nyky kehityksen pysäyttämiseksi.
- Erittäin huolestuttava asia
- Siitä tuntuu olevan monenlaista, osittain ristiriitaistakin tietoa. Turhauttavaa on se että vaikka yksittäiset ihmiset kuinka koittavat taistella ilmastonmuutosta vastaan niin osa valtioista siitä viis veisaa ja päästöt ja energiankulutus on valtaisa.
- Lohduttomalta näyttää.

- Tosiasia, johon syytä varautua tehokkaammin, mitä nyt tapahtuu.
- Vääjäämätön, mutta tässä vaiheessa pitää tehdä kaikki mahdollinen, millä voidaan kuvitella olevan positiivisia vaikutuksia asiaan.
- Paska juttu
- Tapahtuu.
- Ilmastonmuutos ei ole menossa tällähetkellä.
- Uskon ilmastonmuutoksen olevan käynnissä. Sen pysäyttäminen on mahdotonta, vaikka päästöt saataisiinkin kuriin. Vaikutukset ovat arvoitus, koska erilaisten seikkojen yhteisvaikutuksia on vaikea ennustaa.
- pelottavaa...
- alentaa lämmityskustannuksiani
- perussyitä ei ole selvitetty, mutta epäilemättä ilmasto on lämpiämässä
- Se on todistettu tosiasia.
- Todellinen ja vakavasti otettava.
- Huolestuttavaa, mitä viimeaikoina on ilmentynyt. Luonnon katastrofeina ja lämpötilan noususta jne
- vakava asia
- Ei tiedä onko muuttunut. Ihminen on tialstoinut vasta vajaa 2000 vuotta 5 000 000 000 vuodesta. Ei perspektiivi riitä.
- Kovin hidasta ajatellen ihmisikää. Asiaan on silti syytä kiinnittää tarvittavaa huomiota.
- Olen kyllä seurannut julkista keskustelua.
- Asia, josta kaikkien pitäisi olla huolestuneita.
- muuttuu
- Olen huolissani, koska muutos tuntuu kiihtyvän.
- Ilmasto lämpenee se on selvä juttu.

Motoristina otan vastaan pidemmät ajokaudet, mutta muun maapallon elämän kannalta tilanne on todella huolestuttava.

- Ihminen on aiheuttanut omilla toimillaan valtavat ongelmat, eikä niitä pystytä korjaamaan.
- Kyllä tuntuu siltä, että muutosta lämpimämpään on tapahtunut
 - Ei hyvä. Pelottava.

- Tutkijana en pysty sanomaan kummat ovat oikeassa, geologit vai ilmastotieteilijät. Tutkimukset ovat ristiriitaisia.
- Tiedän ilmastonmuutoksesta vähän, oikeastaan ainoastaan sen, että se on vakava uhka maailmalle.
- Etenee pikkuhiljaa. Raskas teollisuus suurin syy.
- Suuret valtiot pitäisi saada mukaan ja sitoutumaan päätöksiin.
- Alkaa näkyä pikku hiljaa
- Vakavasti otettava asia. Kaikkien pitäisi ottaa huomioon.

PPENDIX17

- Ei hyvä.
- huono homma
- pelottava asia lähitulevaisuudessa
- Hälyttävää. Eteläamerikan sademetsien hakaaminen mm suomen Bioenergiaksi, kuljetuksineen ja Liki alkuperäisväestön kansanmurhineen. Ulkomaalaisen Biopoltoaineen käyttö Viher-piipertäjien älyttömin vaade.
- Jotain todellista pitäisi tehdä.
- ainahan se on muuttunut
- Selvä merkki vallitsevasta ympäristön tilasta.
- Kaikki ei todellakaan ole kohdallaan.
- Vakavasti otettava asia
- huolestuttavin nykyajan ilmiö
- Huolestuttavaa.
- kyllä siihen ihmisen käyttäytymisellä on jonkin asteinen merkitys, mutta uskon myös luonnolliseen ilmastonmuutokseen
- Huono asia niin ekologisesti kuin ekonomisestikin.
- Aiheuttaa kysymyksiä.

- Pelottava asia.
- Olen huolestunut
- Tutkittava asia.
- Tulee muuttamaan maailmaa radikaalisti lähivuosisikymmenien aikana. Viime aikoina yleinen suhtautuminen onneksi muuttunut eli ei enää pelkää eipäsuupas-kiistelyä.
- Vaikuttaa ihmisen jokapäiväiseen elämään.
- Uhkaava asia maailmanlaajuisesti ja paikallisesti. Valitettavasti kokonaan ei enää pystytä vähentämään sen vaikutuksia.
- Paha juttu, jos ennusteet pitävät paikkansa
- Todellinen uhka
- Uskon, että ilmastonmuutos on mahdollinen ja sitä pitäisi torjua kaikin mahdollisin keinoin
- Siihen ei voi vaikuttaa, mutta pitää varautua.
- Voimistuu kokoajan.vaikeaa pysäyttää.