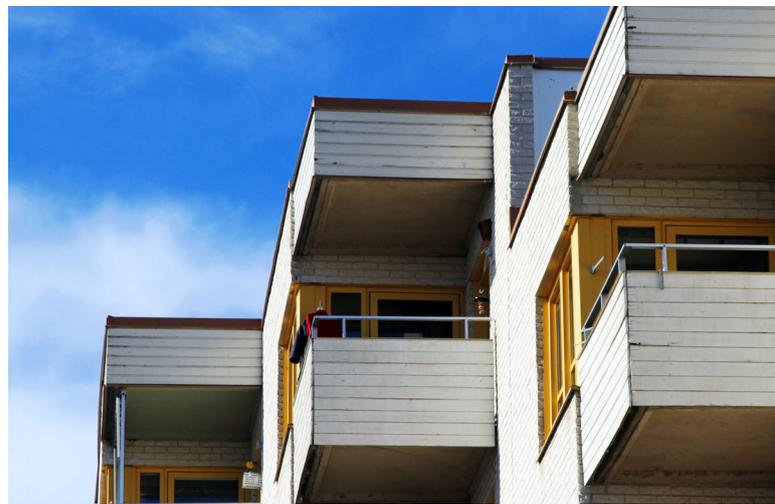


Mistra Urban Futures Brief
2013:1

Low-carbon Gothenburg

Technological potentials and lifestyle changes



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This is an English summary of the following report written in Swedish: **Mistra Urban Futures Reports 2013:5 "Klimatomställning Göteborg. Tekniska möjligheter och livsstilsförändringar"**

Together with the rest of the world, we in the Gothenburg Region are facing one of the greatest challenges of our time – to mitigate climate change. The EU, Sweden and Gothenburg have adopted the so called 2°C target, which says that the global average surface temperature must not increase more than 2°C above the pre-industrial level. *The purpose of this report is to increase the knowledge about possible measures for reducing emissions from Gothenburg's residents to a sustainable level.*

In the report we take a consumption perspective, meaning that the climate impact is based on the inhabitants of Gothenburg consumption patterns, regardless of where the emissions actually take place. This means that the climate impact includes the manufacturing of imported goods and all air travel abroad. This is not the case in the official climate statistics which are based solely on emissions within Sweden.

In Gothenburg, as in the rest of the Western world, greenhouse gas emissions need to be reduced to the equivalent of less than two tonnes of CO₂ per person per year in order to reach a level that is sustainable in the long run. Currently the emissions are several times greater. In order to achieve substantial reductions in emissions the national, regional and local strategies and objectives must be followed up by sufficient measures. For both organisations and individuals the journey must start with an insight into what needs to be done.

The report throws light on the following questions:

- In what ways do the climate impacts vary between different types of households in Gothenburg and the surrounding region of Västra Götaland?
- What will the climate impact look like from a consumption perspective in 2030 and 2050, based on different climate policy approaches?
- How might the various changes needed to mitigate greenhouse gas emissions affect the quality of life?
- What changes in political focus are needed to enable us to live well in a low-carbon Gothenburg?

METHODOLOGY

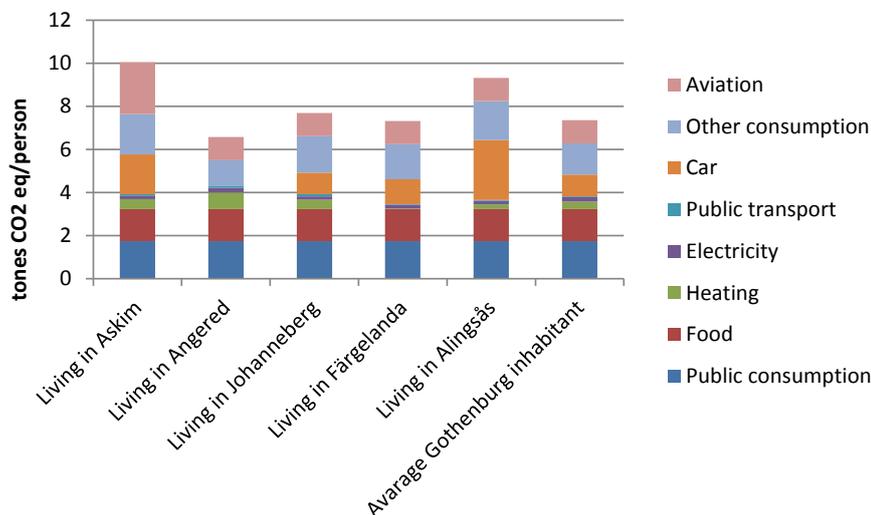
Based on investigations and research, we describe how the transition to a low-carbon Gothenburg might actually occur for six types of households in Gothenburg and in Region Västra Götaland. With the help of statistical information about the residents, the following types of households have been created:

1. High income family in detached house in Gothenburg – "Askim resident"

2. Single low-income person living in a flat in Gothenburg – ”Angered resident”
3. Couple, no children, with average income in centrally located flat in Gothenburg – ”Johanneberg resident”
4. Family with average income in detached house in Färgelanda – ”Färgelanda resident”
5. Family with average income in Alingsås who commute by car – ”Alingsås resident”
6. Average resident in Gothenburg – ”Average resident in Gothenburg”

In most of our calculations of the emissions we have used a bottom-up-methodology since the report aims to demonstrate how individuals and their lifestyles affect the climate, and how different actions and behaviours can be modified in order to reduce the climate impact. With a bottom-up-methodology one estimates emissions based on the specific household data. This resembles a life cycle analysis of one year’s activity in the various types of households (estimated per individual).

The ambition is to include climate impact from all areas, and the estimates are made for the eight domains seen to the right in the diagram below. We began analysing the climate impacts in 2010 for the various types of households. The results below demonstrate that emissions per person vary from just over 6.5 to 10 tonnes of CO₂ per year. Emissions by the average resident in Gothenburg are 7.5 tonnes of CO₂ (when CO₂ is mentioned in this report it refers to CO₂-equivalents, which means that the climate effect of other gases, e.g. methane, is included).



Emissions from the various types of households in 2010 based on the different domains

The main part of the work has been to estimate the climate impact for the years 2030 and 2050. We have analysed three different scenarios. The first scenario, Business as usual, is intended to show what the situation might look like if the trends that we have observed in

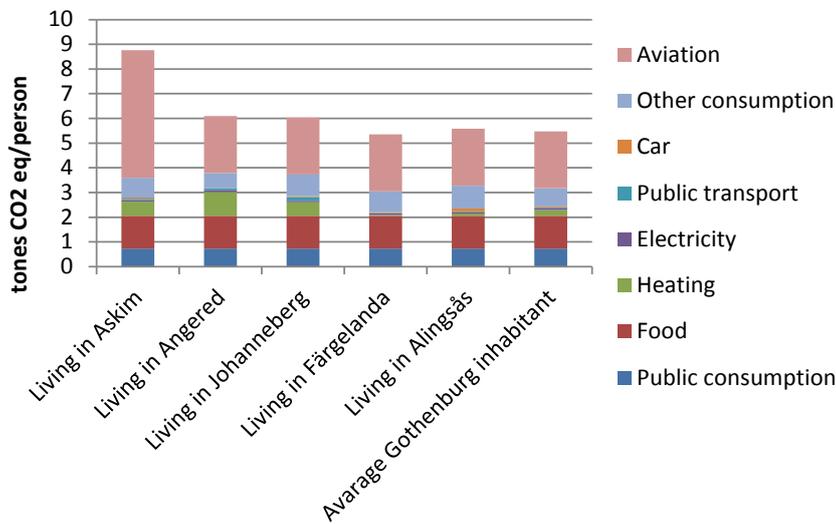
recent decades continue, such as larger homes, more car driving and increases in consumption of meat and air travel, but also improved efficiency that have to some extent helped to reduce emissions. The second scenario, Contemporary climate policy approach, shows how far we would get if the contemporary political ambitions at a national, regional and local level are achieved, with for example entirely fossil-free vehicles, expanded public transport and more renewable electricity. In the third scenario, Low-carbon transition, these changes are implemented to an even greater extent. In addition, this scenario includes a significant reduction in the consumption of meat, plus a stabilising of air travel at the 2010 level. The table below gives a detailed overview of our assumptions for the average Gothenburg resident in 2050 in the three different scenarios (in some cases different assumptions have been made for other types of households).

Our assumptions for the 2050 scenarios			
	Scenario: Business as usual	Scenario: Contemporary climate policy approach	Scenario: Low-carbon transition
Emissions from electricity (affects other consumption, electric cars, other electricity use)	Same as 2010 (based on Nordic electricity mix)	Reduction in emissions per kWh: 65%	Reduction in emissions per kWh: 97%
Air travel	Air travel kilometres: +350% Efficiency: 1.2%/year	The same as Business as usual	Air travel kilometres: same as 2010. Efficiency: 1.2%/year
Other consumption	Volume: +120% Efficiency: 0.9%/year	Same as Business as usual + about 65% lower emissions from industrial electricity use	Same as Business as usual + plus fossil-free electricity from industrial electricity use
Car	Volume: +32% Efficiency: 20%	Volume: - 20% No fossil fuels Efficiency: 50%	Same as to the left Volume: - 38%
Public transport	Volume: same as 2010 Reduction in emissions per km: 20%	Volume: doubled Reduction in emissions per km: 60%	Volume: doubled Reduction in emissions per km: 85%
Electricity consumption	Volume: +25%/person	Volume: +12%/person	Volume: -50%/person
Heating	Housing size: +58%	Housing size: +58% Efficiency: 25%	Housing size: +/- 0% Efficiency: 50%
Food consumption	Meat consumption: +50%	Meat consumption: +50% Fossil-free production	Meat consumption: - 87% Fossil-free production
Public sector consumption	Same as 2010	Reductions in proportion to the above items	Reductions in proportion to the above items

RESULTS OF THE SCENARIO ESTIMATES

The results show that in the Business as usual scenario, the greenhouse gas emissions increase by over 30% by the year 2050 compared with today. The analysis of the Contem-

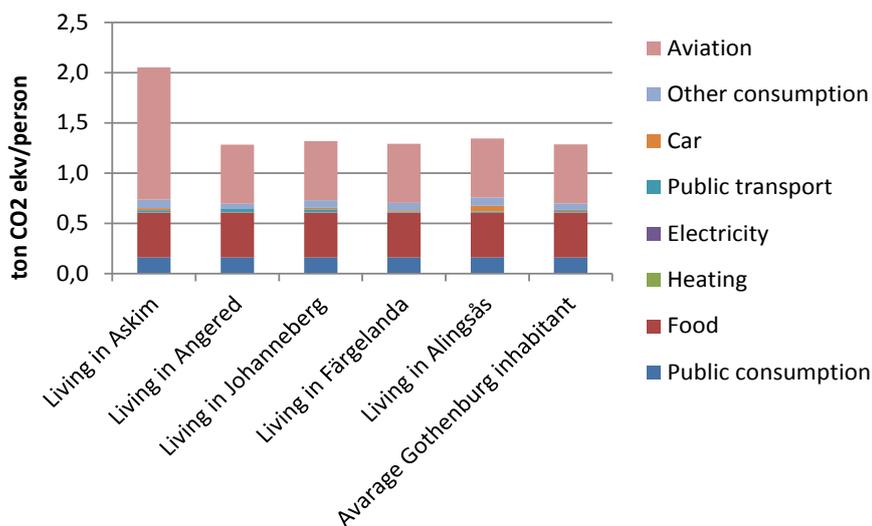
porary climate policy approach shows that it would lead to only a small reduction in total emissions (see diagram below). The substantial reductions in emissions primarily from road traffic will be offset by the increase in air travel and meat consumption.



Emissions from the various types of households in 2050 in the “Contemporary climate policy approach” scenario.

A supplementary analysis shows that shorter working hours (- 18% of working hours), roughly equivalent to a reduction to a four-day week, could reduce emissions by another 10% or so. This implies a slower increase in private consumption.

The estimates in the Low-carbon transition scenario indicate that it is possible to achieve emission levels lower than two tonnes per person by 2050. The exception is high income individuals – the “Askim residents” – who need to cut back on air travel if they are to end



Emissions from the various types of households in 2050 in the “Low-carbon transition” scenario.

The Low-carbon transition scenario assumes extensive changes in both private and public sector consumption. The scenario presupposes that the contemporary climate policy approach will, at all levels (internationally, nationally, regionally and locally) also include food and air travel, and that the objectives already set for transport and industry are in fact achieved.

Below is a list of changes that, according to our analysis, is needed in order to achieve a sustainable and fair emission level for Gothenburg. Our study has focused on Gothenburg but we believe that similar changes are needed elsewhere in order to meet climate targets.

- International level – the EU must introduce policies strong enough to:
 - bring about fossil-free electricity generation within the EU (in other words implement the measures described in the Energy Roadmap 2050, High RES scenario),
 - continue to reduce the emissions per air travel kilometre, and stop the increase in total air travel,
 - achieve substantial energy efficiency,
 - reorganise the agricultural and food sectors by, for instance, a substantial reduction in the production of beef.

- National level – Sweden needs to introduce policies strong enough to:
 - achieve the objective of a vehicle fleet not dependent on fossil fuel by 2030,
 - reduce the transport sector’s emissions to near zero by 2050,
 - stop the increase in air travel. For example by extending the CO2 tax or by introducing equivalent control measures that reduce emissions (if international policies are introduced to a sufficient extent national policies are not needed),
 - achieve a transition to a primarily vegetarian diet,
 - consider to allocate increases in productivity to shorter working hours instead of private consumption.

- Regional level – the Västra Götaland Region needs to:
 - expand public transport with a transition to fossil-free fuels,
 - initiate, drive and finance regional projects for a low-carbon transition, with the objective of achieving a fossil-free Västra Götaland Region by 2030,
 - coordinate agreements between interested organizations in Västra Götaland for minimising food waste, encouraging climate-smart technical solutions, etc.,

- use the Västra Götaland Region's own supply requirements in order to promote sustainable consumption by placing demands on procurements, the re-use of furniture through better planning etc.
- Local level – the City of Gothenburg needs to:
 - stop using fossil fuel for district heating,
 - continue to invest in renewable energy generation,
 - increase the energy efficiency of residential housing so that the energy use per square metre is reduced by half by 2050 (25% by 2030),
 - change the transport system by:
 - doubling the use of public transport by 2030,
 - reducing the emissions from public transport by 85%,
 - reducing car traffic by 40%,
 - densification of urban areas and consistently placing new housing in vicinity of good public transport,
 - improving the facilities for cycling and walking,
 - encouraging greater use of car pools,
 - serve food with less meat and dairy products and more vegetables in the public sector,
 - consider to shorten the employees' working hours or alternatively raise taxes and increase the service-based part of the city's activities,
 - campaign very actively to influence residents to adopt new consumption patterns in respect of air travel and meat.

The City of Gothenburg has a right of disposition over crucial parts of the transition like providing sustainable solutions, but is at the same time dependent on that other parties choose to implement changes in line with the municipality's climate target.

THE IMPLICATIONS FOR QUALITY OF LIFE FROM A LOW-CARBON TRANSITION

The report also includes a chapter on the connections between the climate issue and quality of life. To start with, it is vital to point out that it is crucial for future generations' quality of life that the climate objectives are fulfilled. It is also important to remember that the climate issue is global and that current political strategies can lead to fateful consequences for people in different parts of the world. Here the focus is on the consequences new technology and changes in lifestyle may have on the quality of life of today's generation. The research carried out in connection with the work on this report indicates that after a low-carbon transition overall quality of life would be about the same as today. Fears that such a transition would mean reverting to a standard of living and quality of life that prevailed long ago appears to be entirely unwarranted. But even if people's overall well-being hardly would be affected by a low-carbon transition, particular measures may of course be experienced

as both positive and negative. For example, improved public transport and more cycling may be seen as positive. On the other hand, changes in what we eat can be seen as negative, even if these also provide health benefits in the long term.

As for the idea of freezing air travel at present levels, there is a risk that this would result in missing out on a possible increase in the quality of life. Even if this can be partially avoided, for example by better train connections, there may be a potential “price” to pay in order to achieve the climate objectives. However, this applies primarily to people who use air travel frequently. In general, people with great purchasing power impose a greater burden on the climate than people with less money to spend. This is obvious at a global level, but it is also true in a Swedish perspective. Greater changes are needed for high income individuals in order to reach sustainable emission levels.

THE WAY FORWARD

A transition to a low-carbon economy involves extensive changes to our society and our lifestyles. Individuals, companies, official bodies and politicians at local, regional, national and international levels need to contribute in various ways in order to establish sustainable innovations in everything from our daily travels, our diets and our holidays. In particular, it is about politicians having the courage to introduce, and for voters to accept, sufficiently firm control measures to put these innovations into effect.

The idea is that the results of this report should form the basis for a more knowledge-based discussion about how we find a way forward. Individuals and organisations naturally have opinions about the measures to limit emissions chosen in this report. By making available the spreadsheet on which this report is based we want to facilitate the analyses of other measures. In this way, we provide critics of this report with the possibilities to be constructive and come up with alternative measures for achieving sufficient reductions in emissions. At www.bit.ly/Klimatomstallning you will find not just the spreadsheet file but also a forum for discussion.



Mistra Urban Futures is a unique international center for promoting sustainable urban futures, with its headquarters in Gothenburg, Sweden. We believe that the coproduction of knowledge is a winning concept for achieving sustainable urban futures and creating FAIR, GREEN, and DENSE cities. It is funded by the Mistra Foundation for Strategic Development, the Swedish International Development Agency (SIDA), and seven consortium members.

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