Environment and Ageing

Final Report

October 2008

COWI

COWI

COWI A/S

Parallelvej 2
DK-2800 Kongens Lyngby
Denmark

Tel +45 45 97 22 11
Fax +45 45 97 22 12
www.cowi.com

European Commission Directorate-General Environment

Environment and Ageing

Final Report

October 2008

Report no.	1
Version no.	2
Date of issue	20 October 2008
Approved	HDU
Prepared	VIHU, CVBR
Checked	MMS

Table of Contents

1 Conclusions and summary

EU is facing a steady ageing of the population, and in 2050 30% of the population is expected to be above 65 years old. This study aims to provide indications as to whether this ageing of the population is likely to have an impact on the environment. This is a complex issue involving differences in consumption patterns for both private and public provided goods and services. It is also related to the development of the total population size. The scope of the study is limited to some of the more significant elements and, hence, the study does not provide a comprehensive analysis. The study is based on existing research and statistical data.

The overall conclusion of this study is that the ageing of the population is not likely in itself to lead to significant environmental changes or pressures. The elderly generations are generally less mobile, take up new consumption patterns at a slower speed and consume on average the same or less resources than other groups in society.

An important exception is the consumption of heat, gas and other fuels, where consumption per person is higher for the elderly than for the rest of the population. This is because elderly have smaller households (often one or two persons) with larger living space in m^2 per inhabitant than younger groups leading to larger energy consumption.

Over time the elderly gradually take up the same habits as the younger generations. As the younger, used to high mobility and travelling to other countries, gets older, and as the wealth and health conditions of the elderly population improves, the high mobility habit stays. Consequently an increasing daily mobility and frequent travelling activity can be seen for the wealthier and healthier segments of the elderly. This development is visible in the northern and western European countries, but not particularly visible in the south and eastern European countries with less tradition for travelling. Travel agencies in the Nordic countries now have experienced that people above 60 becomes an increasingly important customer group, reflecting that these people brings along their travelling habits when they retire.

A limited, but increasing, number of elderly acquire second homes and/or migrates to other countries, often southern member states with attractive climate and nature. Most spend autumn, winter and spring in the south and the summer

in their native country[1]. This pattern is likely to reduce energy consumption due to less need for heat, even taking a couple of annual flights into account. However, new settlements in dry and hot areas may put additional pressure on scarce water and nature resources.

On this basis the environmental impacts of the ageing population seems to give little cause for EU to develop policy intervention directed specifically towards the environmental impacts of the growing elderly population. At a more general level, and with relevance also to the elderly population, selected intervention could however help to reduce those potential problems identified, particularly:

- Housing policy: Policy interventions could help the elderly to establish a better match between their household size and the size of their residence. If transaction costs are low and assistance is provided this could help some elderly to acquire/move to smaller dwellings which suit their needs better - this would help to reduce their housing and energy costs.

- Spatial planning: New settlements for elderly migrants often are located in tourist areas and add to the pressure on local scarce water resources and nature. This calls for better spatial planning and stricter planning and environmental requirements enforced in these areas.

The key findings of the study are presented in more details below.

Mobility:

Motorized transport, both the daily trips and the occasional tourist travels, gives rise to environmental pressure in terms of energy consumption, emission of CO_2 and air pollutants, noise, congestion and other externalities. Elderly peoples transport habits resembles the populations in general, but there are some important differences:

- The average daily transport declines after the age of 60, and particularly after 75.

- As for the rest of the population the average daily distance travelled by elderly is increasing over time (cohort effect).

- A growing share of the elderly holds drivers license and have access to cars, reflecting that habits acquired as young is - partly - sustained in higher ages and leads to gradually increasing daily transport.

- The same pattern is reflected on tourist travels. At EU level people above 65 make less tourist trips than those younger, and Norwegian data suggest that the number of trips abroad particularly declines for people aged 75+.

- Recent data from Denmark, however, suggests that with increasing wealth and better health the elderly cohorts can be expected to travel more in the

[1] By native country is understood the country of origin.

future. If such habits spread from north-western European member states to the rest of the EU member states this may entail increased travel activities among European senior citizens.

- Currently there is a significant difference in travelling habits across Europe, with high travel frequency in north-western Europe and low frequency in east and southern Europe. Increasing wealth may change this over time, and also in the long term affect the travel habits of the elderly.

In summary the motorized mobility of the elderly is lower than for the rest of the adult population, both with regards to daily transport and to tourist travels. As for the rest of the population the transport consumption of the elderly tends to increase - but at a lower level than the younger generations. An ageing of the population therefore must be expected to lead to lower transport consumption - and thus less pressure on the environment - but this effect may to some extent be weakened by the apparent increase in travelling by the wealthy and healthy segments of the elderly population in north-western Europe.

Household pattern:

The energy consumption in households is an important cause to resource consumption and emission of Greenhouse Gasses (GHGs), pollutants and wastes. The natural development of the family and its size when the adults gets older may in itself lead to increasing energy consumption and related emissions. More specifically:

- The living area per person is on average larger for elderly people than for younger as household are smaller but with larger space per person.

- Housing related costs accounts for a larger share of expenditure compared to other groups.

- In EU member states the consumption of electricity, gas and other fuels per person is higher in households with the reference person above 60 than in all other families.

- The ageing of the population and the gradual weakening of the health may over time cause to some elderly to be increasingly dependent on heating, and combined with the gradual increase in temperature due to climate change, also on cooling.

- US data also indicate a high energy intensive consumption per person in families above 65 years, but at the same time that these families are more willing to substitute their consumption than other groups if energy prices increase.

- The expected future price development on energy is not likely to change the elderly cohorts' ability to purchase energy in the future.

These findings lead to the general conclusion that elderly people have a larger consumption of energy goods such as electricity, heat and gas per person than other groups. This is mainly because when people get older their household gets smaller (as their children moves away, their partner pass away or other social events that may happen). As the household gets smaller the living area per person in the household typically increases, often even if the elderly moves to a smaller residence, and this leads to higher electricity, heat and gas consumption per person. An ageing society therefore tends to face an increasing environmental stress per capita due to increasing consumption of energy products such as electricity, heat and gas.

Migration and housing:

With increasing wealth there is a tendency that more elderly people acquire a second home and utilise it part of the year or even migrates permanently to other countries, both within and outside EU. This may lead to different effects in environmental terms:

- Annually approximately 20-25,000 elderly citizens above 60 from north-western European countries migrate to south European member states and a similar number of elderly European migrates to countries outside EU, particularly America and Asia. UK data indicates that the number of elderly migrants has been rapidly increasing since the turn of the century. There is also a significant migration of elderly from south European countries to particularly UK and Germany.

- Constructing and utilizing second homes will entail environmental impacts during the construction phase. The net effect however depends on the specific conditions and on the alternative activities that the owner would have undertaken, particularly if the alternative was longer tourist flights.

In the northern European countries:

- If elderly people utilize their second homes more intensively after retirement this can add to the pressure on the local environmental infrastructure (water supply, waste water treatment, waste collection) and electricity supply network as this infrastructure normally are dimensioned for a relatively limited utilization and only during the summer period.

- Owners of second homes tend to select their second home because of, and to give priority to, local environmental qualities and nature areas. Therefore they often tend to promote local nature conservation and oppose larger developments projects that threaten local nature and environment.

In the southern European countries:

- Elderly immigrants from north-western Europe normally only stay in their south European houses during all or part of the autumn, winter and spring and spend the summer in their native country. This reduces their energy consumption for heating and cooling compared to those staying all year in

their native country. This energy saving will most likely exceed the energy consumption needed for flights to and from the residence country of their second home.

- Rapid and poorly planned development of tourist areas and residential areas for new residents has caused and is causing negative environmental impacts and impacts in terms of loss of nature areas. The main cause to this is a lack of enforced spatial planning requirements in these areas.

- When more elderly people migrate to the south this adds to present pressures on particularly water resources, but also on other municipal services. The fact that elderly residents often leave for the hot and dry summer, which is the peak tourist season, may help to limit this negative impact.

The main conclusion is that increasing ownership of second homes and increasing migration amongst elderly people do not lead to increased environmental pressures. However, depending on the specific local conditions new elderly residents may add to local environmental challenges, e.g. in terms of additional water consumption in very dry areas, and in terms of unplanned development of new resorts for tourism and new residents. These types of difficulties mainly call for local planning and regulation.

Health impacts caused by global warming

The most important likely effect of global warming on an ageing population's health condition will be more frequent summer heat waves in Europe. The European 2003 heat wave showed how severe such heat waves can strike. The consequences of the 2003 heat wave were especially brutal in France, where - during the heat wave crisis - the excess mortality rates for elderly increased dramatically.

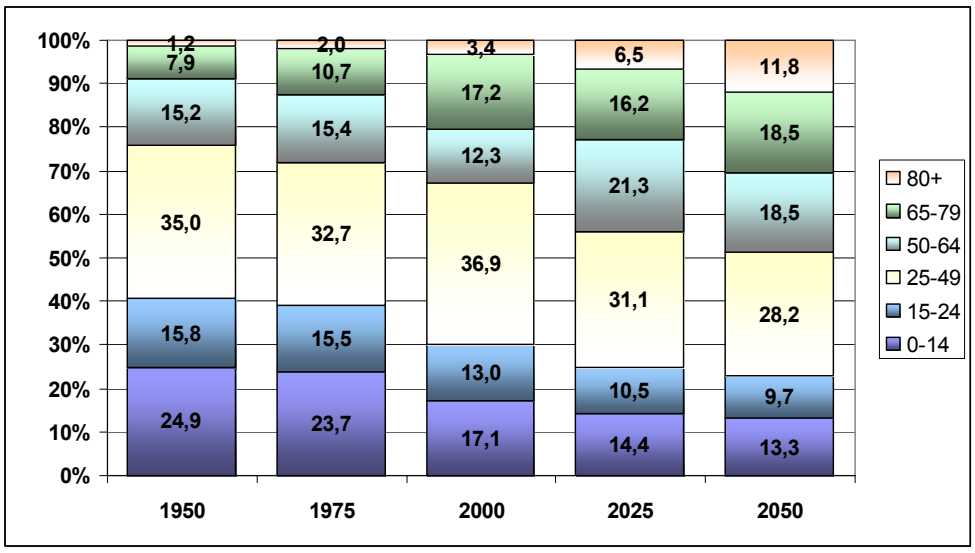
Precautionary measures are needed to mitigate similar excess death rates experienced during the summer 2003 heath wave. Such precautionary measures include architectural renovations and the installation of air-conditioning.

2 Introduction

The objective of this study is to provide an overview of how ageing of the European population may impact the environment. The study is prepared as a response to a study request from the European Commission, Directorate-General Environment.

The EU populations are changing its composition leading to increasing average age of the populations:

Figure 2-1 . Rising share of elderly population in EU-251950-2050. Numbers for 2025 and 2050 are estimated



Source: Zaidi (2008: 3)

The demographic composition of the populations is likely to continue to change towards higher median age. The ageing of populations takes place due to three factors:

- Ageing of the so called baby-boom generation (1945-65)
- Significantly lower fertility.
- Rising life expectancy at older ages (Zaidi, 2008). The increased life expectancy is related to people being fitter and improved treatment of ill people or a combination of both (Grimley Evans, 2000).

The consumption pattern of the population is dependent on a range of factors. People consume in order to cover personal needs. These needs change over time and the needs of elderly people differ in some regards significantly from younger cohorts. Elderly people buy to a certain degree different consumer goods than younger people and they have e.g. different needs for personal mobility. Some basic needs stay on the other hand the same throughout the life, e.g. the need for heating and cooling of houses.

Age and cohort effects

Fundamentally it is possible to distinguish between two kinds of drivers of needs: *age effects* and *cohort effects*.

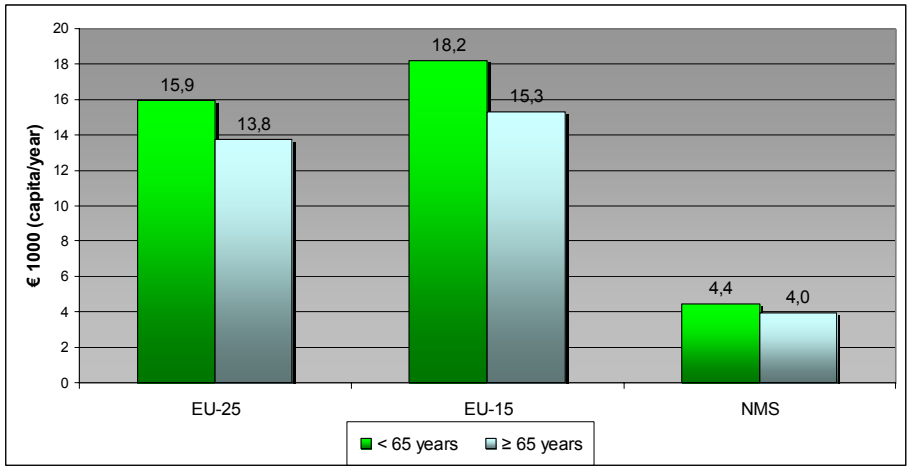
- Age effects are directly associated with ageing. An example of age effect is the declining driving skills as people's vision and physical functionality decline. An increased need for medical treatment and hospitalization are other examples of age effects.
- Cohort effects reflect different consumption behaviour between generations. The inclination to obtain drivers licence differ for instance between generations, where elderly today more frequently are holders of a drivers licence than elderly used to 15 years ago (see section 3.3). Another example of cohort effects is differences between generations in the needs and opportunities for retirement migration and going on tourist trips abroad.

This study describes these two effects based on available data.

Prosperity

One crucial factor that is influencing the framework for elderly peoples' consumption patterns is *prosperity*. Retired people have a lower income than those that are in the workforce. Figure 2-2 reflects the average disposal income for the European populations. It is evident that the new member states (NMS) have a significantly lower average income than the old EU-15 member states. Similarly, the figure shows that the older people (65+ years) have a lower income than the other part of the populations.

Figure 2-2 Average disposal income for the inhabitants in the EU-15 and the NMS in euro



Source: Eurostat.

Differences in income do, however, not exhaustively account for the opportunities for consumption, for instance may elderly use savings to increase their purchasing power. A study based on the Eurostat-Household Budget Survey for EU-15 showed that consumer expenditure of the households is age-depend. According to the study the consumer expenditure for households with one person aged 65+ was 10,500 PPS (Purchasing Power Standards), whereas the average consumer expenditure for a household with one adult aged 18-64 was 13,200 PPS. The consumer expenditure of the household with reference persons aged 65+ was therefore significantly lower than the average population (Bierings, 2000; Table 2).

According to the same study the largest expenditure for households with a reference person aged 65+was for housing, water, electricity and gas. This expenditure constituted above 30 % of the total household expenditures. The similar expenditure for households with reference person aged between 18 and 64 were below 25 % of the total consumer expenditures. The costs for housing thereby constituted a particular large share of the total household expenditures for household with elderly reference persons. The study also shows that transport constitutes a significant share the households' expenditures (Bierings, 2000; Figure 4). This indicates that elderly people are poorer than the part of the population that is part of the labour force. Moreover, housing related expenditures constitute a significant share of older people's overall consumer expenditures.

This study focuses on some of the more significant impacts that a demographic change of the European populations may entail. These environmental impacts are associated with the possible environmental impacts connected with energy consumption and consumption of scares water resources associated with second housing. This means that the study does not look into general changes in consumption patterns.

To examine this three more specific hypotheses are tested with respect to the consequences of changes in an ageing population's behaviour:

Hypothesis 1: Changes in travel and mobility pattern lead to increased energy use for transportation.

Hypothesis 2: Changes in household pattern leads to changes in energy use for heating and cooling of houses.

Hypothesis 3: Changes in housing and household location lead to increased energy consumption and exploitation of scarce water resources.

Moreover, the likely impacts that global warming may have on an ageing population are briefly discussed.

These hypotheses are investigated with respect to identification of the importance of *age* and *cohort effects*. The study is based on existing research, primarily research articles and statistical data. There are significant variations in the

comprehensiveness of the available data. Some of the conclusions of this study are therefore based on more solid evidence than other parts.

The study is not analysing the total environmental impact of the changing age composition of the EU population (i.e. that there are more elderly and less younger inhabitants) - rather whether the behaviour of the elderly population segment has larger environmental impacts than caused by the behaviour of the younger segments of society.

3 Mobility

Personal mobility has significant impact on the environment through emission from fuel consumption. Emissions from vehicle have a negative impact on the local environment by emission of e.g. NO_x and solid particles and on the global climate through emissions of GHG.

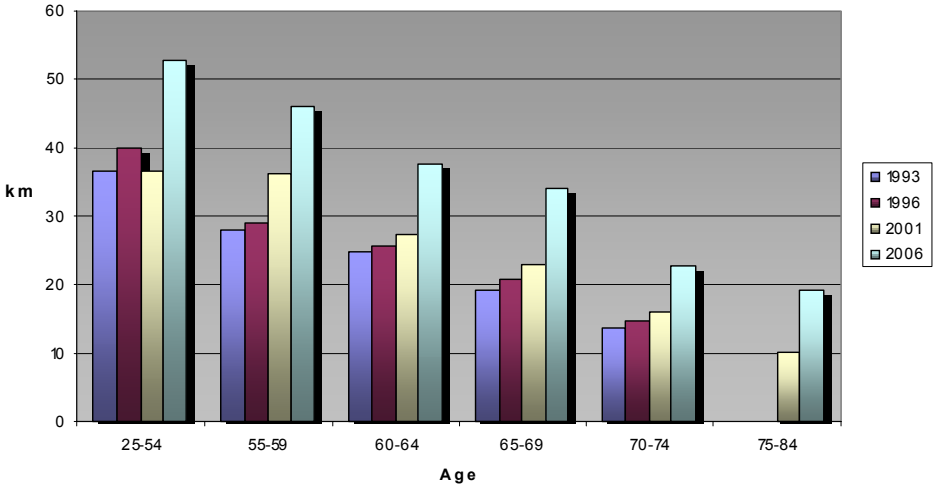
The development of the European populations' mobility patterns is investigated through statistical data. Such data has been conducted by a range of European countries, e.g. Sweden, Norway, Denmark, Finland, UK, Germany, Holland and France. The availability of data from the southern European countries is scarcer. France has gathered statistical information but no new data is available since the end 1990s. Data from smaller studies are available from Italy from the 1990s.

The data on daily travel behaviour is primarily based on data from Denmark, England and Holland.

3.1 Age effects

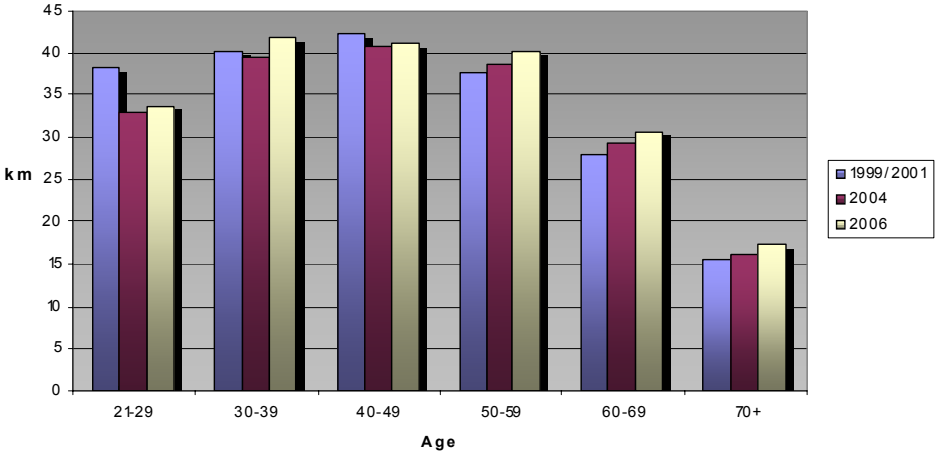
Figure 3-1, Figure 3-2 and Figure 3-3 show statistical data on the daily distance travelled in Denmark, Holland and the UK. The Danish data includes data from 1993 to 2006, the Dutch from 1985 to 2005 and British from 1999 to 2006.

Figure 3-1 Total distance travelled per person per day in Denmark1993-2006



Source: Transportvaneundersøgelsen (www.dtu.dk)[2].

Figure 3-2 Total distance travelled by person per day in the UK 1999-2006

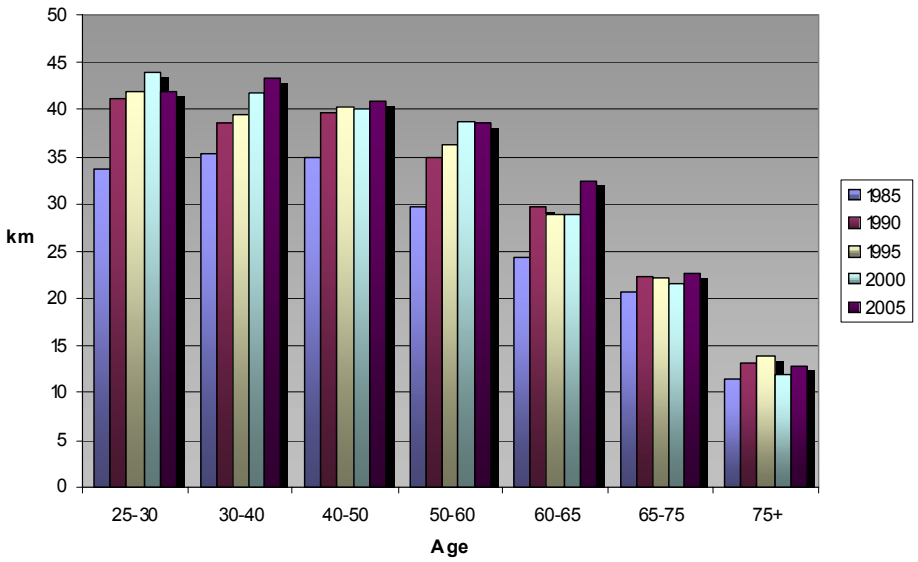


Source: TSB (2001; 2005; 2006).

In all three countries there is a clear connection between increasing age past 60 years and declining personal mobility. In all three countries there has been a development towards higher mobility for all age segments in the investigated periods. In Denmark the growth in average distance of transportation has especially been significant between 2001 and 2006 and is properly correlated to the latest years' economic growth in Denmark.

[2] The Danish data from 1993 and 1996 does not include data for people over 74 years and the data from 2003 and 2006 only includes data for the population up to 84 years of age.

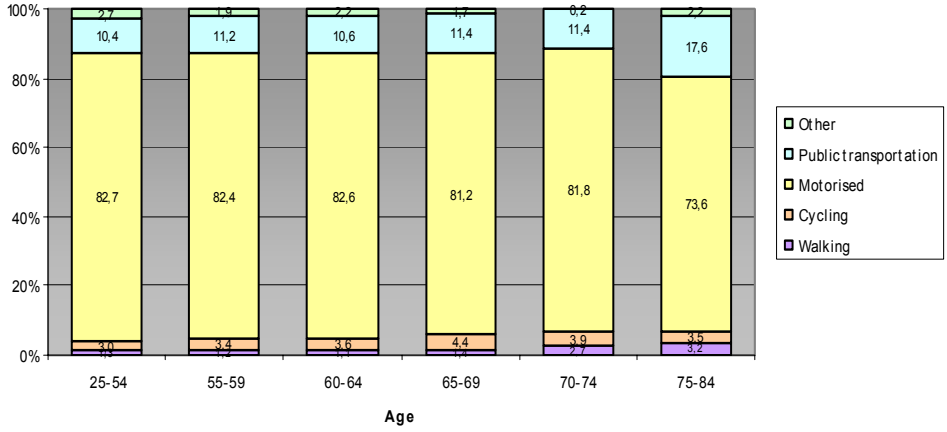
Figure 3-3 Total distance travelled by person per day in Holland 1985-2005



Source: Statistics Netherlands.

Figure 3-4, Figure 3-5 and Figure 3-6 show the percentage of mobility by different mode of transportation in Denmark 2006, Holland 2005 and the UK 2006 for the different cohorts. The mobility data from Denmark and Holland is calculated in percentage of daily distance covered and the data from the UK as percentage of trips per mode of transportation. The data from Denmark and Holland is therefore not directly comparable with the data from the UK.

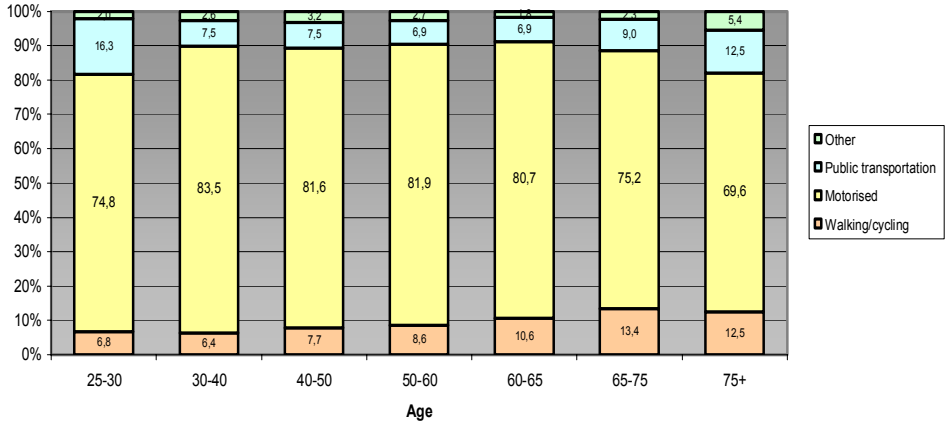
Figure 3-4 Percentage of daily distance covered by mode of transportation in Denmark 2006



Source: Transportvaneundersøgelsen (www.dtu.dk).

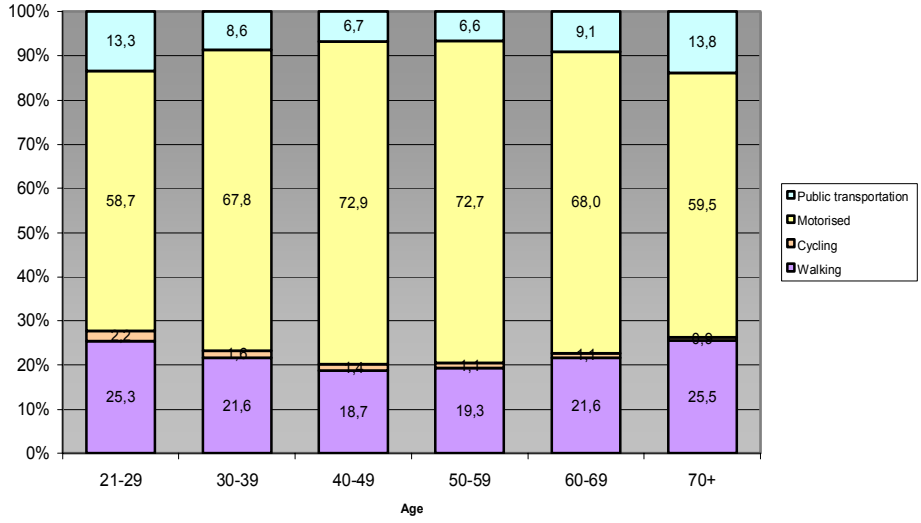
The bulk of daily distance travelled in Denmark and Holland for all age categories is done by motorised vehicles.

Figure 3-5 Percentage of daily distance covered by mode of transportation in Holland 2005



Source: Statistics Netherlands.

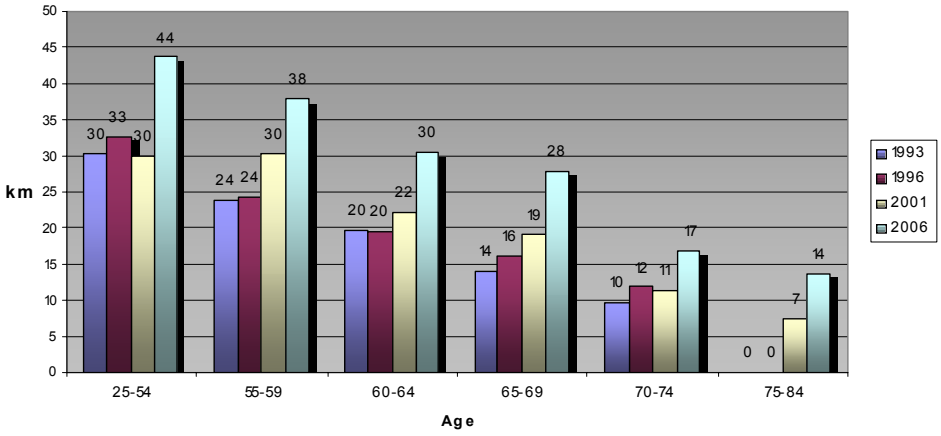
Figure 3-6 Percentage of trips by mode of transportation in the UK 2006



Source: TSB (2001; 2005; 2006)

In Denmark the percentage of distance travelled by motorised vehicles decreases after the age of 75 years, whereas the percentage of mileage covered by public transportation here increases. The picture is similar for Holland, the relative percentage of distance covered by motorised vehicles here decreases after the age of 65, whereas walking/cycling and public transportation for the population above 65 makes up a higher share of the daily mobility. The data from the UK shows similarly that the percentage of daily trips made by motorised vehicles decreases from the age of 60, whereas the share of trips made by walking and public transportation increases.

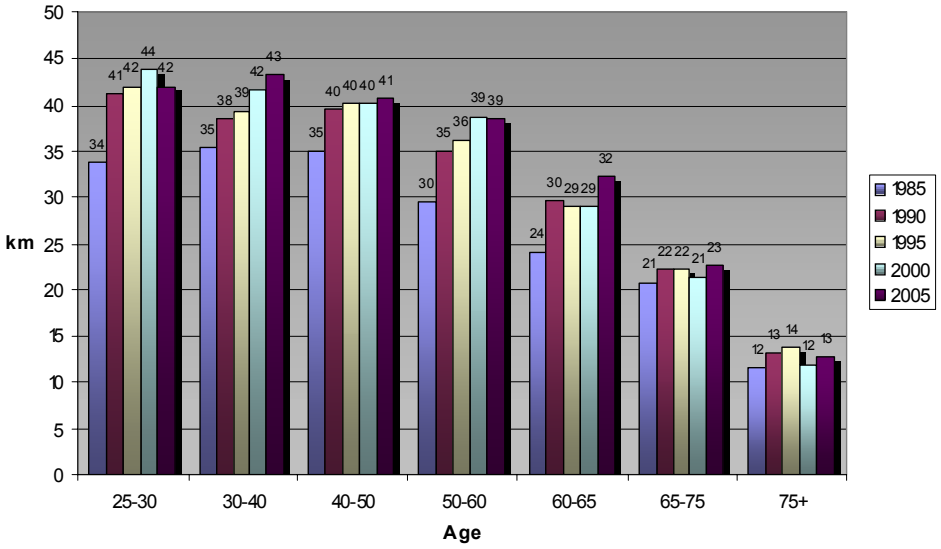
Figure 3-7 Distance travelled by person by motorised vehicles in Denmark 1993-2006



Source: Transportvaneundersøgelsen (www.dtu.dk).

Figure 3-7 and Figure 3-8 reflect the average distance daily distance travelled by motorised vehicles in Denmark 1993-2006 and Holland 1985-2005. Figure 3-9 shows the percentage of trips made by motorised vehicles in the UK 1999-2006. There is a clear correlation with increasing age and decreasing average distance travelled by motorised vehicles in Denmark and Holland. In both Denmark and Holland there has been a significant growth in the personal transportation by motorised vehicles both for the working population and for the elderly cohorts. The data from the UK similarly shows that there is a decreasing tendency to use motorised vehicles to cover personal transportation with age.

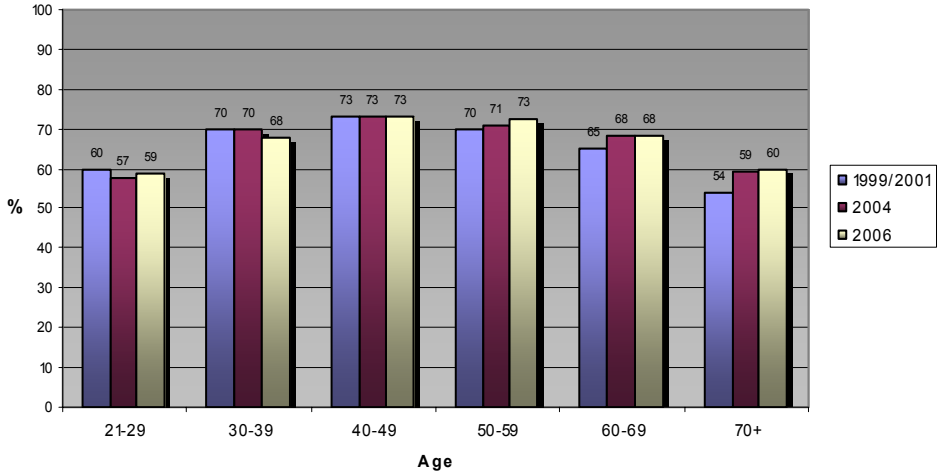
Figure 3-8 Distance travelled by person by motorised vehicles in Holland 1985-2005



Source: Statistics Netherlands.

The picture these data show is that the personal mobility declines with increasing age, and the percentage of mileage covered by motorised vehicles decreases with age whereas the share of personal mobility covered by public transportation and walking/biking increases. In the time periods investigated, there has, however, been a significant change towards increasing mobility for all age groups including the elderly. However, there is not strong evidence that there is a significant growth for the segment of the population that is above 75 years.

Figure 3-9 Percentage of trips per person by motorised vehicles in UK 1999-2006



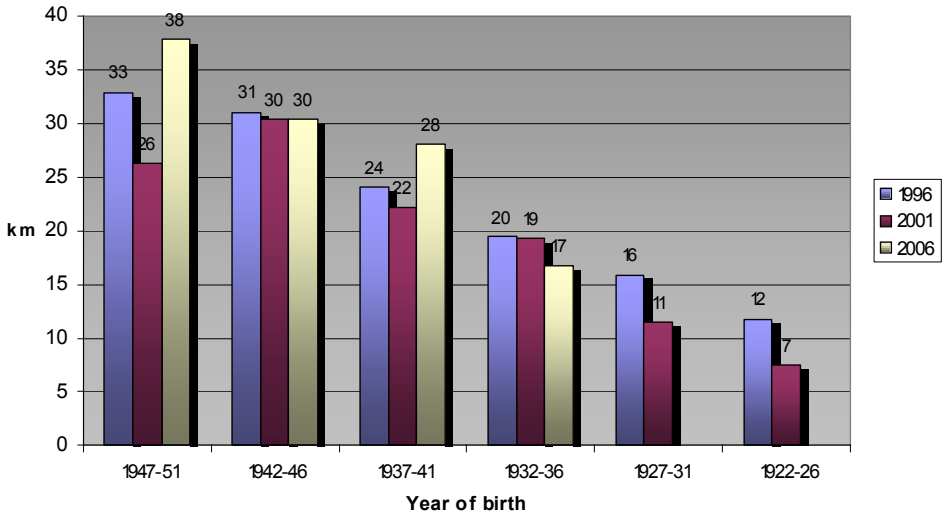
Source: TSB (2001; 2005; 2006)

These findings are in accordance with studies previously made on the correlation between age and mobility. The private car driving among elderly people declines with increasing age, and as the elderly people prefer to make their trips out of rush hour, the environmental impact in relation with local air pollution is reduced (Brög *et al*, 1998; Hjorthol, 1998).

3.2 Cohort analysis of transport pattern

Based on the Danish data for the population's mobility a cohort analysis is made. Intra-cohort comparison is made by following the same cohort over time. The period of time investigated is 1996-2006. The data is not differentiated for the part of the population that is between 75 and 84 years. Because of this no data has been available in 2006 for those cohorts between 75 to 79 and 80 to 85, i.e. those born from 1922-1931.

Figure 3-10 Cohort analysis of motorised vehicle users in Denmark 1996-2006



Source: Transportvaneundersøgelsen (www.dtu.dk).

Figure 3-10 shows a cohort analysis of usages of motorised vehicles as mode of transportation. There are 5 years between the surveys which matches the interval between the age groups. The birth years of the cohort groups are 1922-26, 1927-31, 1932-36, 1937-41, 1942-46 and 1947-51, which corresponds to the age groups 45-49 years, 50-54 years, 55-59 years, 60-64 years, 65-69 years and 70-74 years in 1996.

For the cohort groups born before 1936, there has been a decline in average distance covered by motorised vehicles with age. For the generations born after 1936, the average distance covered by motorised vehicles have improved or stayed the same with increasing age. This shows that the cohorts of people younger than 60 years in 1996 have had a steady or an increasing mobility with increasing age. This indicates that the personal mobility with motorised vehicles differs significantly between different cohorts.

3.3 Elderly people and car driving

With regard to personal mobility, elderly people are a heterogeneous group. Some elderly have the time and desire for a high personal mobility, whereas other elderly are physically handicapped and do therefore not have the same opportunity for mobility. To maintain personal mobility is important in order to stay independent, and independency is an important part of personal dignity and well being (Hjorthol, 1998; Brög *et al*, 1998).

Perquisite to drive cars is to have a drivers licence and access to a car. A study made in Finland, Germany and Italian on outdoor mobility of an aging population showed that 62 % of the Finnish and German and 44 % of the Italian respondents stated that they were driving less than they were doing in the previous years. As reasons for driving less was the ability to reach everything without a car, health impairments and having difficulties in finding parking space (Raitanen *et al*., 2003).

Table 3-1 Factors affecting the transportation patterns and needs of the elderly

Age effects	Cohort effects	Period effects[3]
Declining driving skills	Increased licensing	Increased income and standard of living
Greater susceptibility to injury	Increased car ownership	changes in societal maintenance programmes
Greater ambulatory problems	Increased labour force experience by women	Educational/training opportunities, cost and prices
Greater potential for dementia	Decreasing labour force experience by men	Healthcare availability and education
Increased fear for personal safety	Changes in household size and structure	Labour force policies
Accelerating rates of decline after 80-85	Changes in material patterns	Economic development objectives and strategies
Declining physical and mental skills	Increasing longevity	Petrol and parking prices
Unwillingness/inability to face new or different situations	Changes in role expectations	Cost and availability of private cars
Slower processing times/need for greater repetition of information	More female-headed older households	Availability, cost and price of public transportation
Greater occurrence of specific illnesses or conditions		Roadway costs, assess and availability

Source: Rosenblooms *et al*. (1998).

Table 3-1 shows an overview of the factors that impact on the mobility of elderly people. The aging effects are eventually setting up limits for the personal mobility. The cohort and period effects are on the other hand variables. In the UK the development in driver licence holders has for instance develop from 57 % of the age group between 60 and 69 years in 1992/94 to 76 % in 2006. For the age group above 70 years the share of car drivers holders has increased form 33 % in 1992/94 to 50% in 2006 (TSB, 2006: 12, Table 2.3). Similar trends have been seen in Norway (Hjorthol, 1998). A higher income, better health and increased licensing are among other factors that may have an impact on the future mobility pattern of elderly people.

The mobility pattern differs significantly between cohort groups. Mollenkopf *et al.* (2002: 101) concludes based on large study of elderly people's mobility patterns that the present generation's mobility behaviour should not be used to prediction for the future, as people behave according to previous practise.

[3] Rosenbloom *et al.* (1998) distinguish between *cohort* and *period effects*. This study does not distinguish between cohort and period effects.

3.3.1 The impact of changes in mobility pattern on the environment

There is an overall tendency to higher mobility for all adults over 25 years. This implies increased fuel consumption for transportation in the future.

Age is a very important factor with respect to the European population's mobility. The share of the population that is between 25 and 59 has a higher personal mobility than the people that are 60+. There is, however, a clear tendency towards elderly people up to 75 years becoming more mobile. Motorised transportation constitutes the largest share in terms of mileage covered for all age groups. The effect of an aging population can be expected to result in a lower over-all need for mobility as an increasing share of the population will be above 60 years. As less fuel is being consumed the impact on the environment can be expected to get lower. Cohort effects can, however, entail that the elderly people in the future will drive more than the elderly people do to today. This will to some extent even out the environmental advantage.

3.4 Travel

The environmental impact of travel is dependent on the number of trips, modes of transportation and the distance of travels. Generally, there is a tendency towards the European populations travelling more frequently and longer distances which leads to an increased pressure on the environment.

Longer trips and holidays can be divided into domestic destinations and international destinations. The number of trips made is closely correlated to the wealth. As the personal incomes raise so does the number of holiday trips made.

3.4.1 Travel patterns of retired people in Europe

Travels may roughly speaking be undertaken for private reasons (visiting friends and relatives, tourism) or related to work. Since the elderly people mostly are retired, focus here is on private travels, here after called trips.

Table 3-2 presents the annual number of international tourist travels[4] made by Europeans aged 65 years and older and split on member states for the period 1996 to 2007. Though data are not complete a general trend can be identified. A more intensive travel pattern for the elderly is seen in the north and western European member states as compared to the southern and eastern member states.

[4] *Outbound trips* are defined as travels to other countries as opposed to domestic trips.

Table 3-2 Number of outbound trips (more than 4 days) by people older than 65 years (number in 1000)

in 1000	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Belgium	639	-	-	-	-	-	-	-	475	595	622	839
Czech Republic	-	-	-	-	-	-	-	237	219	136	171	-
Denmark	300	275	262	241	249	252	276	306	257	-	-	-
Germany	-	-	-	-	-	-	6.733	7.263	7.983	7.809	6.385	-
Ireland	-	-	127	-	-	262	346	351	443	521	654	-
Greece	-	69	21	48	68	80	41	58	67	108	177	-
Spain	-	197	239	184	307	284	298	253	261	421	317	-
France	-	3.381	3.377	3.172	3.356	3.041	3.114	3.167	3.464	3.664	3.644	-
Italy	-	687	746	755	848	816	732	702	605	1.226	956	-
Cyprus	-	-	-	-	-	-	21	24	25	32	31	-
Latvia	-	-	-	-	-	-	-	20	17	18	44	-
Lithuania	-	-	-	-	-	-	-	-	25	16	14	-
Luxembourg	-	50	63	57	75	72	88	81	89	104	94	100
Hungary	-	-	-	-	-	-	-	-	154	73	113	-
Netherlands	-	-	1.248	1.134	1.051	1.079	1.896	1.673	1.886	1.936	1.852	1.715
Poland	-	-	-	-	-	-	-	310	222	350	259	-
Portugal	-	118	65	89	141	135	155	97	140	155	132	-
Romania	-	-	-	-	-	-	-	-	-	-	26	-
Slovenia	-	-	-	-	-	-	-	53	52	62	90	69
Slovakia	-	-	-	-	-	-	-	116	79	184	150	162
Finland	89	81	124	105	120	189	193	155	200	226	224	-
Sweden	-	470	-	-	-	-	123	100	172	159	788	-
United Kingdom	2.000	2.400	3.000	3.600	6.400	6.100	5.700	5.700	5.200	4.571	4.216	-
Croatia	-	-	-	-	-	-	-	-	69	-	-	135
Iceland	8	-	-	-	-	-	-	-	-	-	-	-
Norway	-	-	-	277	212	210	195	224	326	219	-	-

Source: Eurostat.

The age affects the tourist travel behaviour of residents in EU. A Eurostat analysis of age and tourism concludes that[5]:

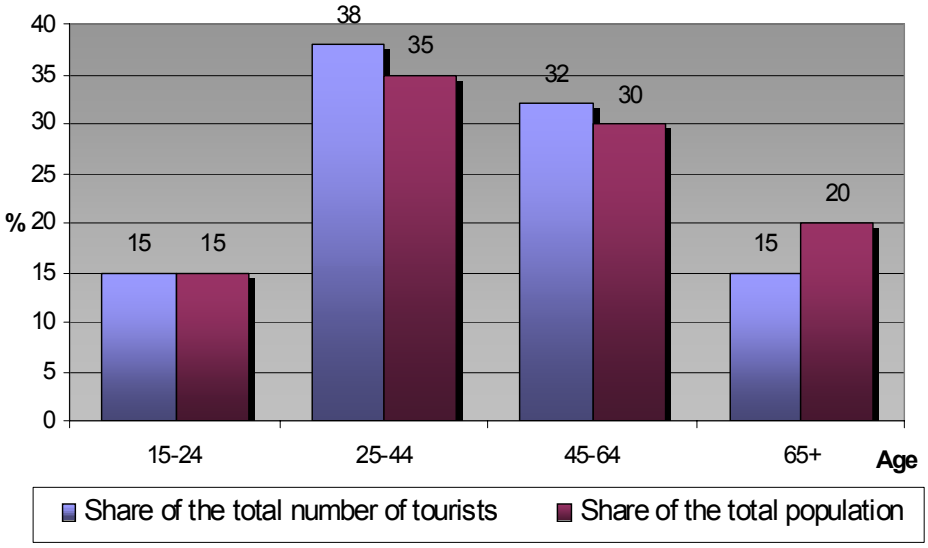
- People aged between 25 to 44 years make up the largest share of the total number of tourists.
- While on average 55 % of the population makes at least one annual holiday trip of a duration of four nights or more, this is only the case for 41% of the population aged 65 years and older.
- More than 6 out of 10 holiday trips are spent within the country of residence, for the older cohorts more than 7 out of 10 trips are domestic trips.
- Of the tourists, those aged 65 and older on average make the most and the longest trips (in terms of days).

This indicates that a large share of the elderly do not at all make tourist trips while on the other hand there is a group of active elderly who makes relatively frequent - and in terms of days long - tourist trips.

Figure 3-11 shows that the elderly population accounts for 20 % of the population but only 15 % of the tourists, whereas the share of tourists from other age segments roughly speaking matches their share of the population.

[5] Urhausen (2008: 1).

Figure 3-11 Share of tourists by age in %, 2006[6]



Source: Urhausen (2008).

3.4.2 Non-domestic tourism

There are large age dependent differences on the frequency of non-domestic tourist travels within the EU populations. Table 3-3 shows the number of outbound tourist travels per person per year in EU for different age groups.

Table 3-3 Outbound tourist trips, 2006

Age	Number of travels per person per year
15-24	0,43
25-64	0,50
65+	0,25

Source: Own calculations based on Eurostat, Tourism statistics and population statistics.

Table 3-3 indicates the EU citizens above 65 travels abroad for tourism half as frequent as the younger population. This probably reflects that this group includes both healthy and active elderly and older and less mobile cohorts.

This is supported by data from Norwegian National Travel Survey, presented in

Table 3-4.

[6] Only the part of the population aged 15+ is included in the data.

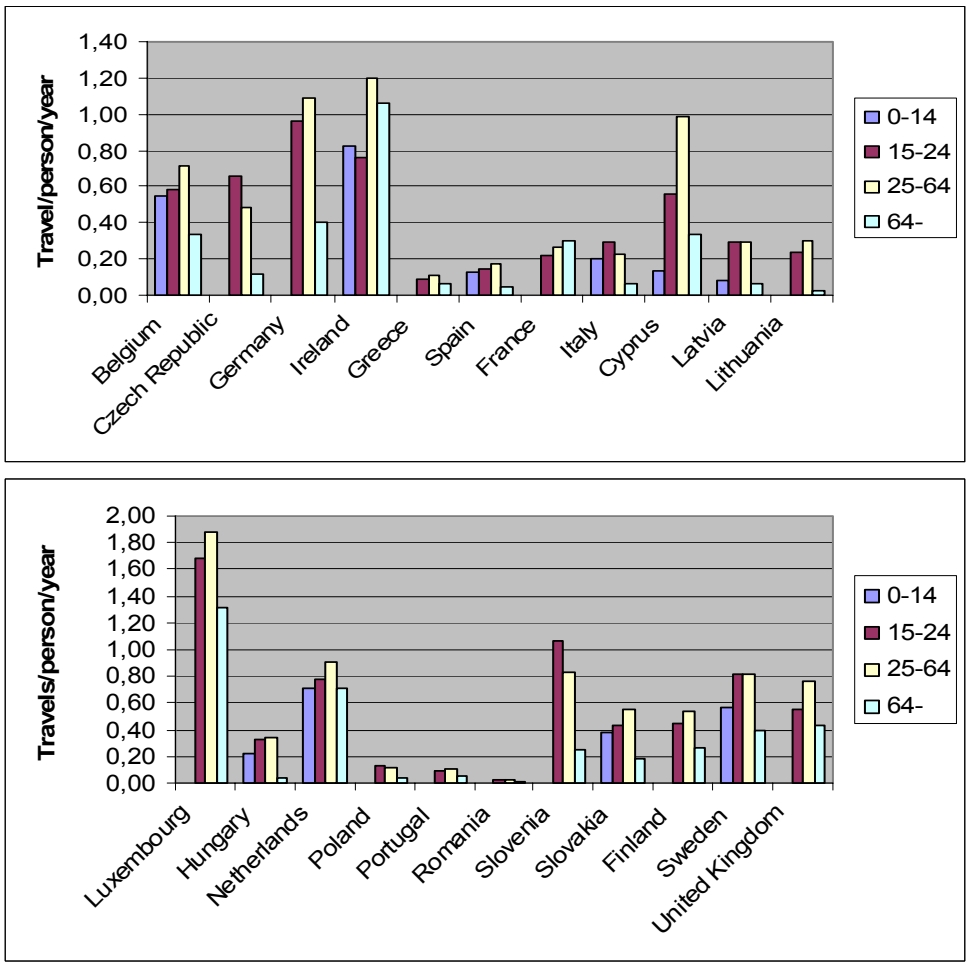
Table 3-4 Question: Have you made any trip aboard this year (2005)?

Age	Yes	No
55-66	24	76
67-74	20	80
74+	11	89

Source: Statistics Norway and Den Nasjonale Reisevaneundersøkelsen 2005 - nøkkelrapport

The EU average stated above covers large variation between EU member states. The figures below show the distribution of outbound tourist travels on age groups and EU member states.

Figure 3-12 Outbound trips (more than 4 days) per year by age, 2006



Source: Own calculations based on Eurostat, Tourism statistics and population statistics.

Figure 3-12 reflects large differences in travel behaviour between the member states. The figure, moreover, shows a declining preference to make outbound tourist trips with increasing age. Travel patterns seem dependent on at least two factors, namely:

- *Economics*: The wealthier member states have higher travel frequency in general - which also holds for senior citizens.
- *Geographical location*: The southern European member states, which have a very strong tourism industry, have less of its own citizens going abroad for holiday trips.

There is no data available that allows cohort analysis to assess changes in the travelling habits between generations. Though, travelling is closely correlated with income and wealth and travelling may be expected to increase as the generations that are retiring in the coming years are expected to get richer than present generations.

As the share of the European populations made up by elderly (aged 65+) in the future is expected to increase (from approximately 20.6 % in 2000 to 30 % by 2060 (Zaidi, 2008: 3; Urhausen, 2008)) the share of elderly tourists is expected to grow. Due to various influencing factors, e.g. improving health conditions, older cohorts' share of the population will most probably increase even faster than expected on the basis of the demographic trend. In contrast to the older cohorts younger age groups have been going on tourist trips from their childhood. Thus, they will most likely keep on travelling when they get older which will also increase the share of older people in the number of tourists (Urhausen, 2008).

Danish data indicate a strong appetite amongst elderly people (60-70 years) to travel.

Table 3-5 Number of tourist travels per person per year. Survey in Denmark, 2006

Age	Number of tourist trips[1] per year
60-70	2.2
50-59	2.1
40-49	1.5
30-39	1.5
18-29	1.3
All	1.7

1: Travels including one or more nights abroad
Source: Ugebrevet A4 (2006): Internet survey with 2,611 respondents.

This indicates that amongst the wealthy and healthy group of elderly people in Europe there is a large potential for increased travelling if similar travel habits spreads to east and southern European countries.

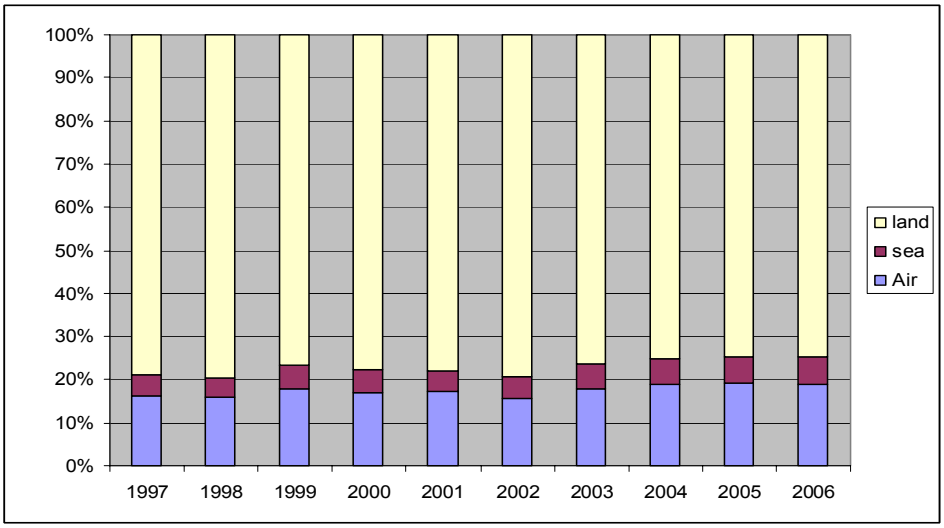
3.4.3 Mode of transportation

Private cars and aviation are the main modes of transportation for holiday trips, both coursing serious environmental impacts.

There are no data available for the retired population on the mode of transportation for tourist travels. Therefore it is assumed that they have more or less the same pattern as the population in average. At some stage, however, elderly people will become incapable of driving car - due to reduced vision and mobility impairment - and will need to travel by other modes, e.g. plane or bus.

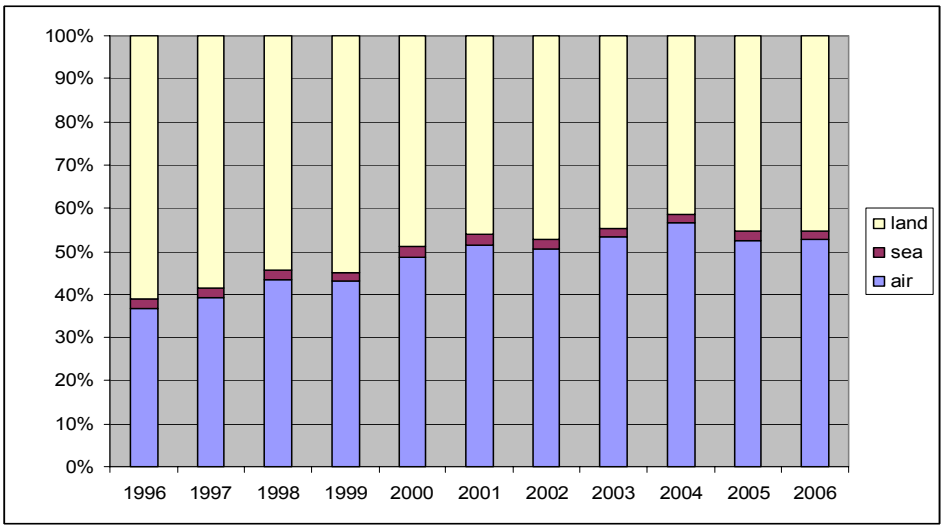
To assess the distribution of transport modes two cases have been chosen, namely Italy and United Kingdom. As shown in the figures below there is in Italy only little variation in the distribution on modes of transport from 1997 to 2006, whereas UK has witnessed a growth in the share of aviation.

Figure 3-13 Italy: Holidays domestic and outbound



Source: Eurostat.

Figure 3-14 United Kingdom: Holidays inbound and outbound

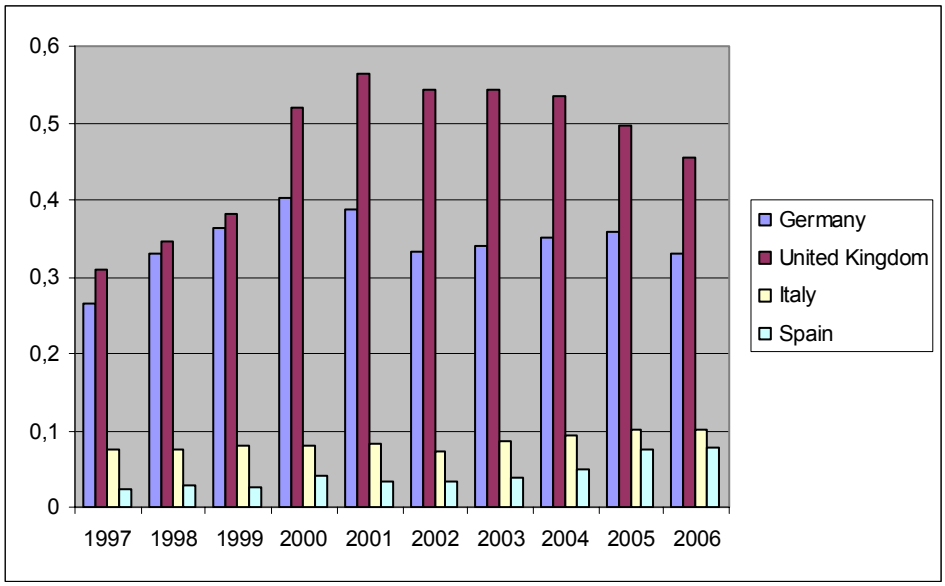


Source: Eurostat.

The choice of mode of transportation reflects the infrastructure within the country, the link to the neighbour countries, the distance to holiday destinations and traditions. Germans make many international travels by car compared to citizens of Spain, Italy and UK, but including domestic tourist trips the total number of trips is around the same for Italy and UK.

Figure 3-15 presents number of trips per person, indicating that the citizens of UK and Germany make significantly more tourist trips by plane than people from Italy and Spain. The tendency towards tourist trips by plane seems to have peaked in UK and Germany, whereas there seems to be a steady growth for Italy and particularly Spain.

Figure 3-15 Number of trips by plane per person per year in Germany, United Kingdom, Italy and Spain



Source: Eurostat.

3.4.4 Destination

The choice of destination is very import to the environmental impacts, particularly the energy consumption and related GHG emission, but also to the intensity of the environmental pressure that tourism results in. Destinations with large scale tourism may be more vulnerable to additional tourism, e.g. in terms of new buildings or additional use of water in certain time periods of the year. No systematic data is available on the distribution of tourism on age and destination.

Generally, southern European countries attract large number of non-resident tourists, whereas other member states accommodate larger shares of resident tourists. In 2005 the total number of holiday trips In EU amounted to almost

900 million. The three main destinations of outbound tourism where Spain, Italy and France[7] (Spörel, 2007).

No EU data on the preferred tourist destinations of the elderly is available, but qualitative information suggests that in the northern member states retired people are becoming an increasingly important market for charter tour organizers. A major Danish and Scandinavian travel agency and organizing charter tours to southern European and Asian destinations has stated that people above 50 years account for more than 50 % of all customers and that the share of customers above 60 is increasing (Ugebrevet A4, 2006). Data for Norway provide supports this development of increasing travelling by retired people (see Box 3-1)

Box 3-1 Growing international tourism in Norway

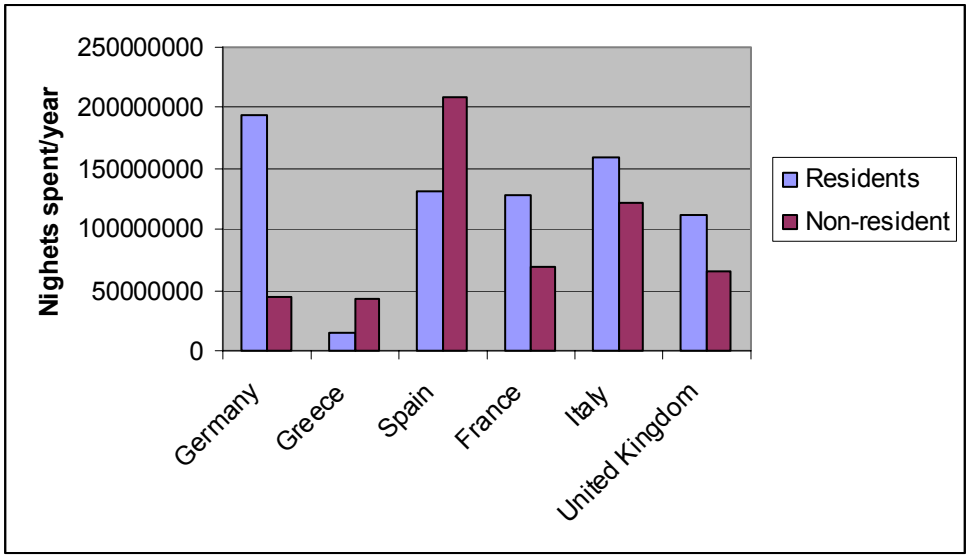
"The number of trips done by the age group 65-79 in the period from 2001 to 2007 has been stable with regards to number of trip have been made to other Nordic countries, doubled to other EU countries and tripled to destinations outside Europe."

Source: Statistics Norway; Denstadli *et al*. (2006)

Statistics of the hotel industry in general terms support that international tourism is very large in southern European countries compared to the north-western European countries.

[7] The share of trips measured by the number of trips of 4 or more nights. Spain constituted a share of 16.7 % of all holiday trips in Europe, whereas Italy and France made up respectively 9.8 and 8.3 %.

Figure 3-16 Indication of tourism industry: Number of resident and non-resident nights spent in hotels, apartments and other holiday accommodation.



Source: Eurostat: Tourism statistics

3.5 Environmental impacts

On the basis of the available data, it can be concluded that retired people - as well as the whole population - travels more frequently. In the future this trend is expected increase further as the *baby-boom* generations retire. This generation are characterized by being wealthy and having a high preference for travelling. Furthermore, it can be concluded that there is a trend towards younger cohorts travelling longer distances.

Some of the key environmental impacts from travelling arise from fuel consumption and the associated emissions of GHG. Per kilometre of passenger transport the fuel consumption and associated emissions differ not necessarily significantly between road transport and aviation. The main difference is that air travels often are much longer distances than trips by car. At the same time the high speed of air travels is a precondition for going on long trips - by other modes of transportation such trips would have been too time consuming.

In the Box 3-2 some examples of the CO_2 emissions from different trips are presented. It is very clear that the key factor determining CO_2 emissions is the total distance rather than the mode of transport (car versus airplane). With more people travelling by the same car the efficiency of car trips is increased. Other modes of transport, particularly rail and bus, may offer significant less emission. For comparison it should be mentioned that the average annual CO_2 emission per capital in Europe of 11 tons CO_2-eqv.

Box 3-2 CO_2 emissions from plane and car travelling

Examples of plane trips:

London-Malaga round trip	372 kg CO_2/person	3500 km
London-Singapore round trip	2396 kg CO_2/person	21787 km
London-San Francisco round trip	1940 kg CO_2/person	17632 km

CO_2 emissions from car trips are in average 160g CO_2/km (with a range from 100g CO_2/km to 500g CO_2/km. depending on distance of the trip).

When people are going on holiday trips by car they hardly never go alone, so it is assumed that two persons travel in the car, a driver and one passenger.

Examples of car trips:

1000 km trip gives an emission of 80 kg CO_2

3500 km trip gives an emission of 280 kg CO_2

Source: cheap-parking; DEFRA; carpages.

3.6 Conclusions

Motorized transport, both the daily trips and the occasional tourist travels, gives rise to environmental pressure in terms of energy consumption, emission of CO_2 and other air pollutants, noise, congestion and other externalities. Elderly peoples transport habits resembles the populations in general, but there are some important differences:

- The average daily transport declines after the age of 60, and particularly after 75.
- As for the rest of the population the average daily distance travelled by elderly is increasing over time (cohort effect).
- A growing share of the elderly holds drivers license and have access to cars, reflecting that habits acquired as young is - partly - sustained in higher ages and leads to gradually increasing daily transport.
- The same pattern is reflected on tourist travels. At EU level people above 65 make less tourist trips than those younger, and Norwegian data suggest that the number of trips abroad particularly declines for people aged 75+.
- Recent data from Denmark, however, suggests that especially with increasing wealth and better health the elderly cohorts can be expected to travel more in the future. If such habits spread from north-western European member states to the rest of the EU member states this may entail increased travel activities among European senior citizens.
- Currently there is a significant difference in travel habits across Europe, with high travel frequency in north-western Europe and low frequency in east and southern Europe. Increasing wealth may change this over time, and also in the long term affect the travel habits of the elderly.

In summary the motorized mobility of the elderly is lower than for the rest of the adult population, both with regards to daily transport and to tourist travels. As for the rest of the population the transport consumption of the elderly tends to increase - but at a lower level than the younger generations. An ageing of the population therefore must be expected to lead to lower transport consumption - and thus less pressure on the environment - but this effect may to some extent be weakened by the apparent increase in travelling by the wealthy and healthy segments of the elderly population in north-western Europe.

4 Changes in household pattern

4.1 Household size and consumption

This section focuses on age dependent changes in household patterns which may have environmental impacts. Of particular importance are changes in energy use for heating and cooling.

The environmental impacts of household consumption have recently been studied (AEA Energy & Environment, 2008). The analysis showed that high income households have a greater impact on the environment than low income households, and that single adult households without children have the relative lowest environmental impact per household, but a high impact per capita, closely correlated with disposable income per capita.

The environmental impact factors are taken from a recent study on the Environmental Impacts of Products (EIPRO) undertaken by the European Science and Technology Observatory (ESTO 2005)12, which estimated normalized environmental impact scores per unit expenditure for detailed consumption categories for eight different environmental domains[8].

The analysis of the relative emissions of major air pollutants attributable to households with different socio-economic characteristics reached similar conclusions, i.e. that relative emissions are primarily driven by household size, and therefore physical consumption. For this analysis, however, it was not possible to further decompose the data into average disposable income per capita and thus, it was not possible to assess the extent to which the differences in emissions were driven by differences in income levels[9].

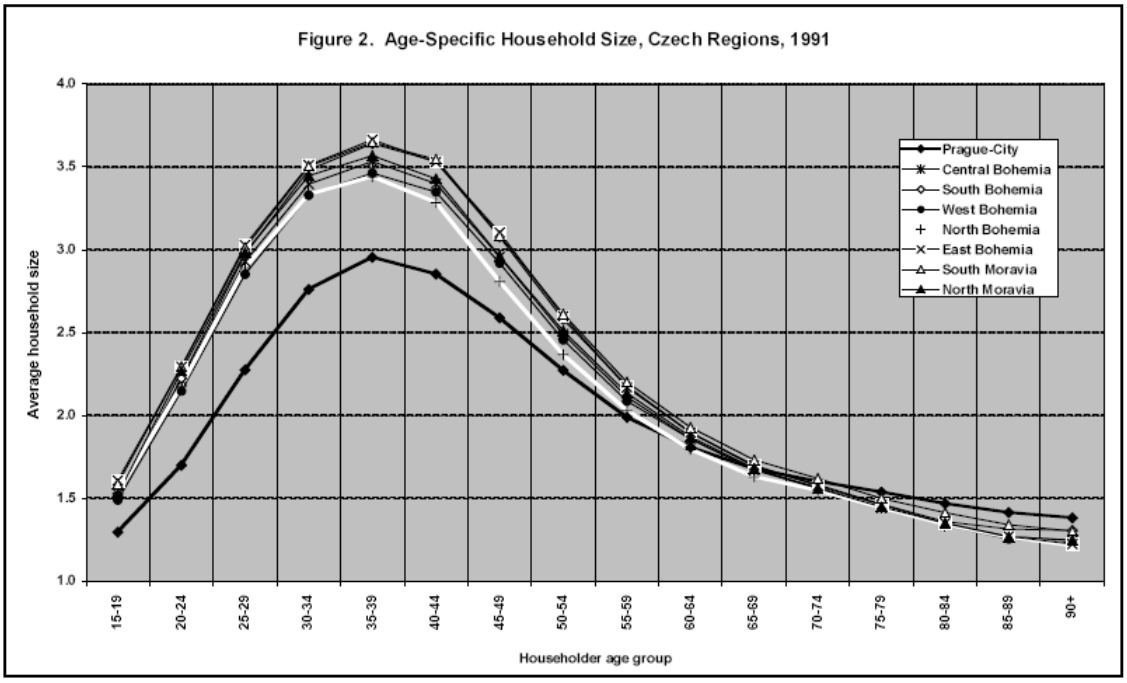
This section will - to a large extent - use information about household size, household expenditure and the living area of the residence of the elderly population to try to get indications on the environmental pressure compared to other groups of society.

[8] Abiotic depletion (AD), Global warming (GW), Ozone layer depletion (OD), Human toxicity (HT), Ecotoxicity (ET), Photochemical oxidation (PO), Acidification (AC), Eutrophication (EU).

[9] Ibid.

The figure below indicates the relationship between the age of the householder and the size of the household.

Figure 4-1 Age-Specific Household Size



Source: Akkerham (1991: 252).

The figure indicate that households size on average declines when the householders age increase and gradually falls below 1.5 when the inhabitants age pass 75 years.

Eurostat provides data on the average household consumption by the age and employment status of the reference person. These data, presented in the figures below, shows that the average household consumption expenditure declines when the reference persons age exceeds 59 years, i.e. that households with older persons have lower consumption expenditures, and also that expenditures are lower in retired households than in households with employed reference person.

The fact that households with reference persons age above 59 are of a smaller size than average will to some extent offset the lower consumption levels. No comparable data have allowed for more definitive results.

Figure 4-2 Average household consumption expenditure by age of reference person, 1999

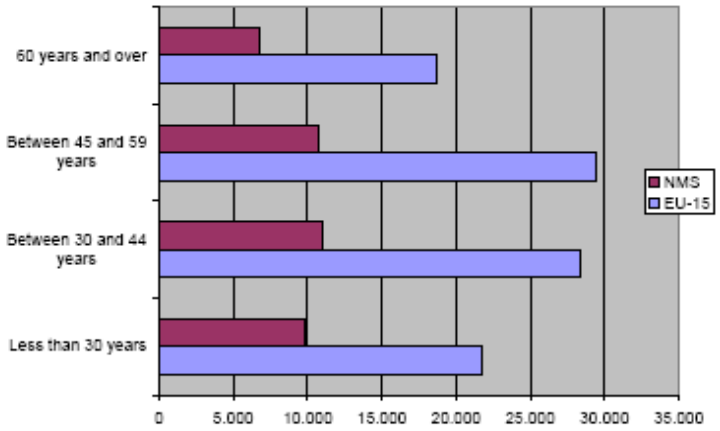
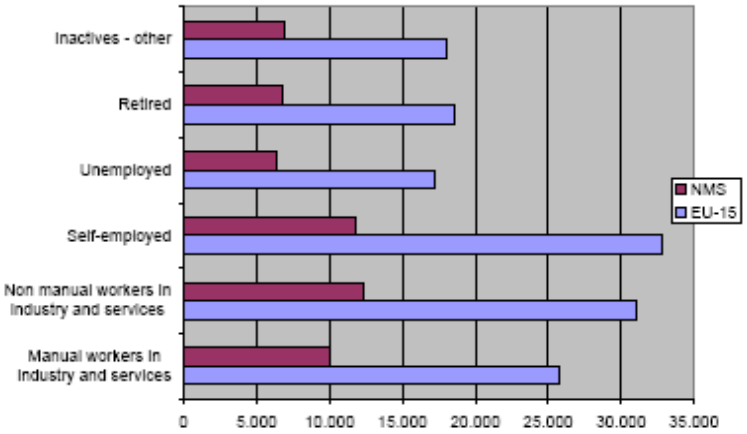


Figure 4-3 Average household consumption expenditure by employments status of reference person, 1999



Source: Eurostat.

Larger residential area per inhabitant and larger expenditures on heat, electricity and gas may lead to higher expenditure on housing related energy products. Generally, the smaller the households the larger the area for each member of the household. This is substantiated by data about size of residence and household size from Germany and Norway:

Table 4-1 Size of households and residence in Germany, 2002

	N of household (in 1.000)	Average size of residence (m^2)
1 person	12.503	67,5
2 persons	12.068	93,2
3 persons	5.036	104,8
4 persons	3.959	117,9
5+ persons	1.465	130,6
Total	35.033	90

Source: Statistisches Bundesamt (2006: 140; Table 7).

Table 4-2 Size of residence for different age and households in Norway 2007

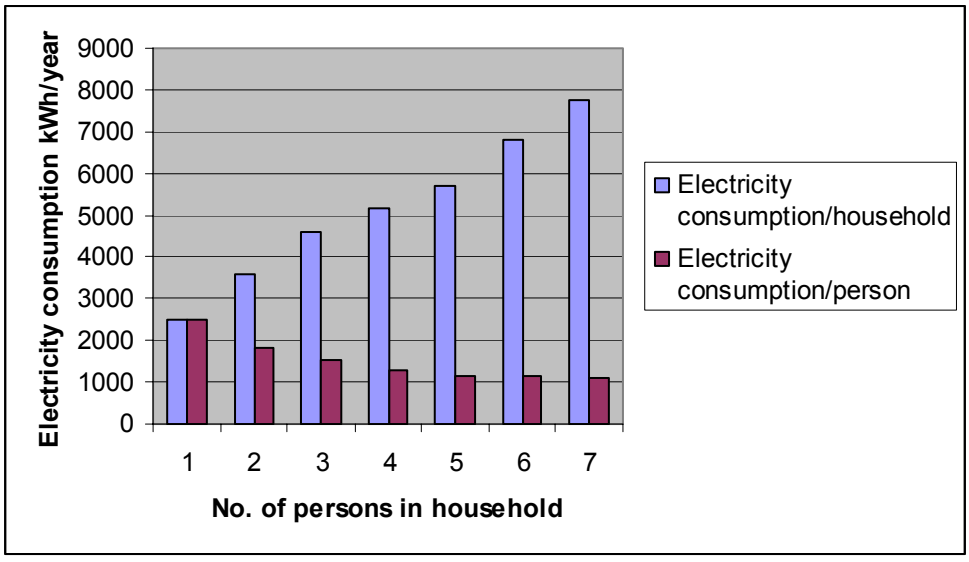
	16-44 years	45-66 years	67+ years
Area for singles (m2/person)	75,0	95,8	97,4
Area for couples (m2/person)	47,2	66,2	58,6

Source: Statistics Norway.

4.2 Energy consumption

Danish data indicate that there is a strong link between the size of household and the electricity consumption. The figure below shows that whereas the electricity consumption increase with increasing household size, the consumption per person is declining.

Figure 4-4 Electricity consumption in households, Denmark 2005

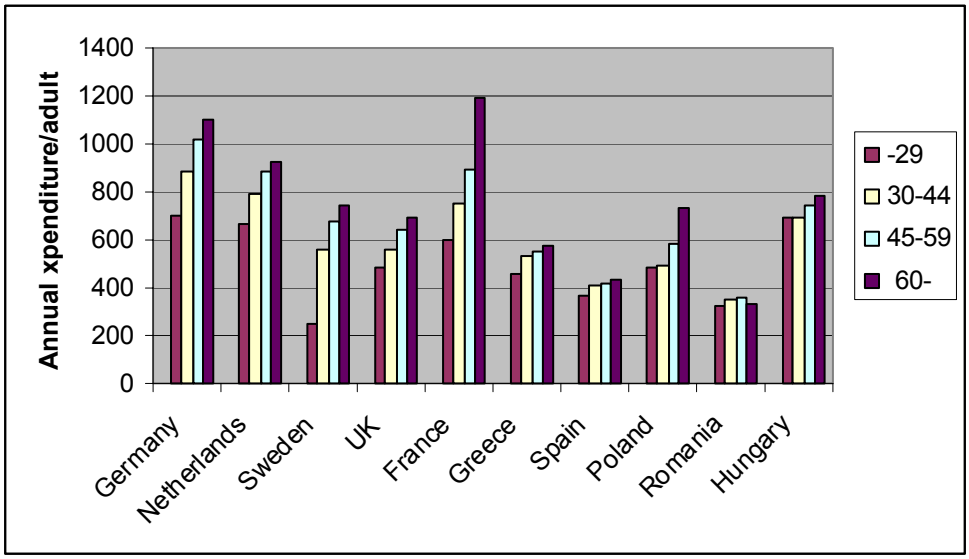


Source: SBI (2005: 15).

As elderly people on average live in smaller households and with more area/person it is likely that they consume more energy, gas and electricity per person than younger persons, living in larger households with less living area per person.

This hypothesis is supported by Eurostat household budget survey. The figure below presents the annual expenditure on electricity, gas and other fuels per adult in households with different age of the reference person. The annual expenditures to these energy products are largest for the group of households with the reference person above 60, though the level of consumption and level of difference between age groups vary across Europe.

Figure 4-5 Annual household expenditure on electricity, gas and other fuels by age of reference person in selected countries. 2005

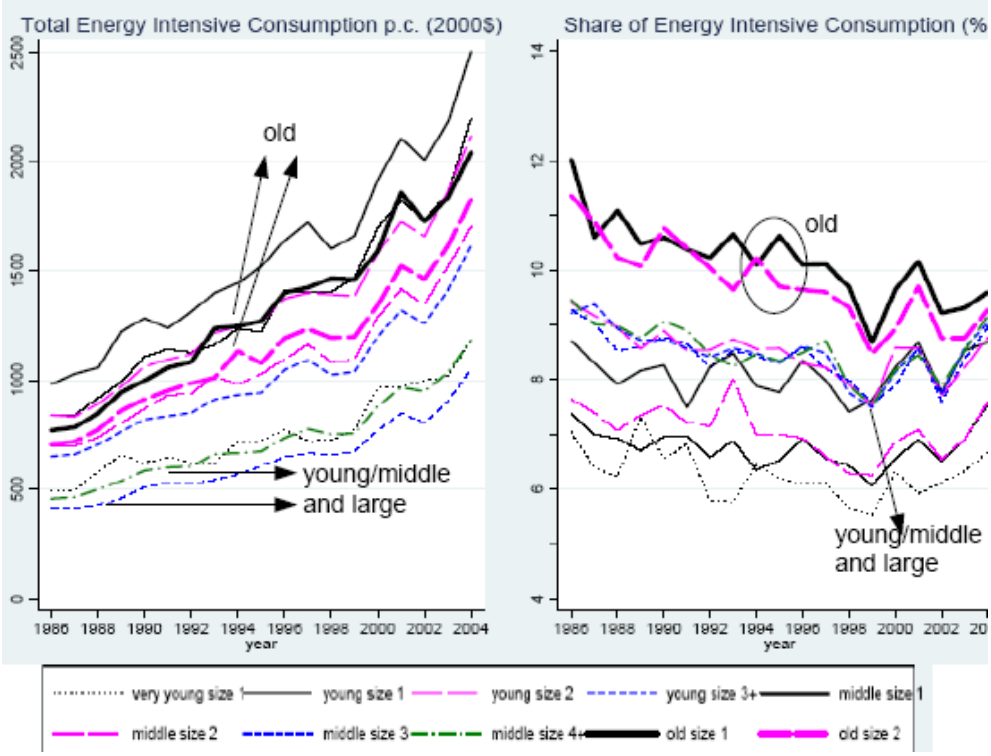


Source: Eurostat: Household budget survey.

A survey from the USA supports these findings. A study of the consumption of energy intensive goods in different types of households revealed the same pattern. Different household types were defined, namely by age and size: above 65 with 1 or 2 members (old), 35-64 (middle age) with 1, 2, 3or 4 and more members, 25-34 (young) with 1, 2 or 3 and more members, and finally below 25 (very young) with 1 member.

The figure below shows the energy intensive consumption per person and its development 1986-2004. The families above 65 years with 1 or 2 members has a high consumption in absolute terms, exceeded only by the very young households with 1 member and the middle aged with 1 and 2 members. When measured upon the share of expenditures for energy intensive consumption the families above 65 years are clearly those spending most.

Figure 4-6 Energy intensive consumption per person in different family types. USA 1986-2004



Source: Dalton *et al.* (2008).

The analysis of the US consumption pattern for different family types and ages however indicate that even though the older households are using a larger share of the expenditures on energy intensive consumption they react more to increasing prices and have the highest tendency to substitute their consumption towards other, less energy intensive, products.

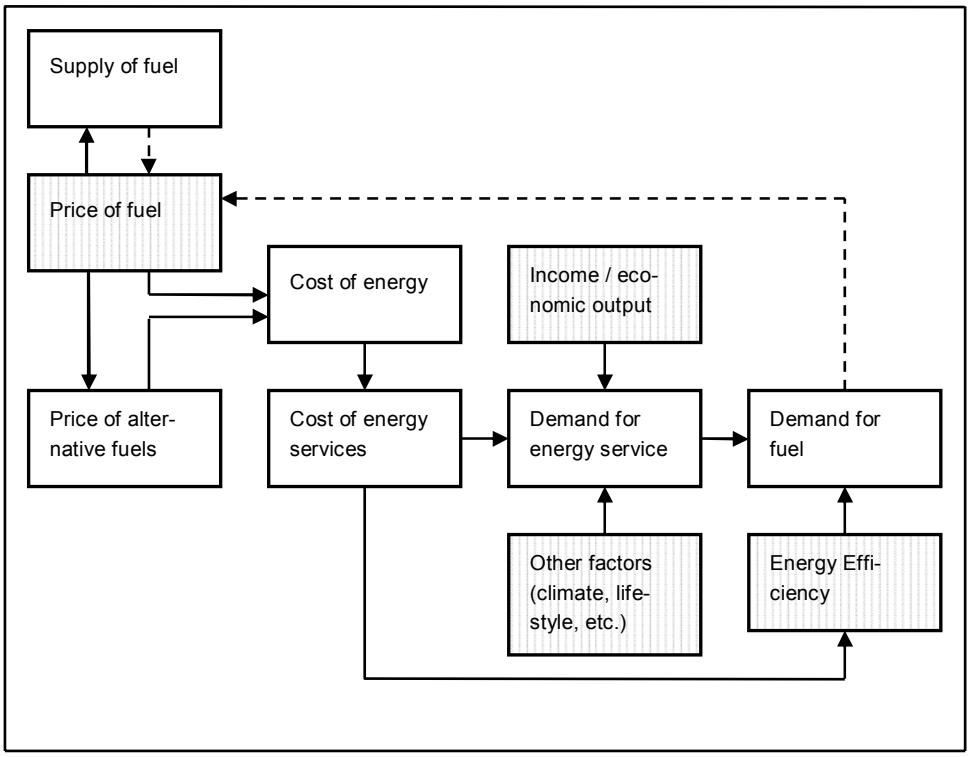
Part of the reason for the relatively large energy consumption of the elderly may also be the need or requirement for comfort, e.g. higher indoor temperature during winter time and more air-conditioning during summertime. For example are the elderly cohorts more severely affected by extreme weather phenomenon. An example is the heat wave that killed thousands of especially elderly people in France in the summer 2003 (se section 6.1.1). Generally heating and cooling equipment (often combined heating pumps and air conditioners) are being widely installed in southern European houses. This will also affect the habits of future elderly generation, and particularly in view of increasing temperatures the use of air conditioning during summer time is likely to increase rapidly.

The main driver for this is however the increasing wealth and the widespread implementation of heating and cooling equipment in houses rather than the ageing of the population - the elderly will just gradually uptake the same habits as the younger generations.

4.2.1 The link between expected future energy prices and elderly cohorts' energy demand

The elderly peoples' demand for energy is related to the energy prices. Figure 4-7 reflects this relationship between fuel price and demand. The figure reflects the link between fuel prices, cost of energy services and demand for energy services

Figure 4-7 Link between fuel prices and fuel demand



Source: After IEA (2006: 285; Figure 11.10)

The grey boxes are the conditions most relevant for the older peoples' demand for energy. The elderly people's demand for energy services depend on the cost of such energy services. Older people have a lower income than the population in general, and the poor part the elderly population can be expected to be particular sensitive towards changes in energy prices. The households' demand for energy services depends on the available economic resources, i.e. level of prosperity and income. This is reflected in the grey box 'Income/economic output'. The demand for energy services, moreover, depends on various other factors as climate, life-style, geography, etc. The demand for heating is higher in northern Europe than in the Mediterranean area, and the demand for electricity for cooling is likely to be higher in the southern European countries than in the north.

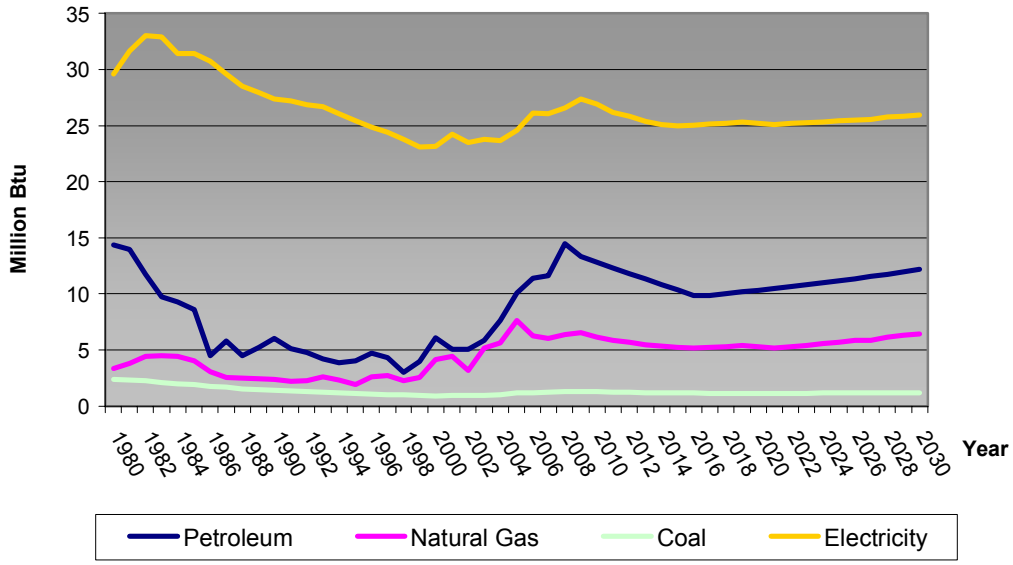
The application of measures to increase energy efficiency is an effective approach to decrease the demand for energy. The reduction of fuel consumption will go hand in hand with economic savings. Increasing energy efficiency through the 'low-hanging fruits', i.e. taking the measures that demand modest

investments, are the easiest approach to prevent an energy demand crisis among the poorest - and hence also the oldest - part of the European populations.

Costs for energy constitute a larger share of the structural consumption expenditures for low-income households compared to high-income households. Poor households face a treat for utility service cut of if the energy bills are not paid. Such market-based exclusion from energy supply is a comprehensive problem for poor families - and therefore also a threat to the poor older households (http://www.cpag.org.uk/info/Povertyarticles/Poverty120/utilities.htm#footnote%201). Increasing energy cost will enhance this problem.

The International Energy Agency (IEA) has made a forecast of energy prices from 2006-2030. It is extremely difficult to make accurate estimates of future energy prices, and such estimates should be used with precaution. Figure 4-8 shows the development of energy prices from 1980-2006 and the anticipated future development until 2030. The prices are calculated in US$ 2006 dollar.

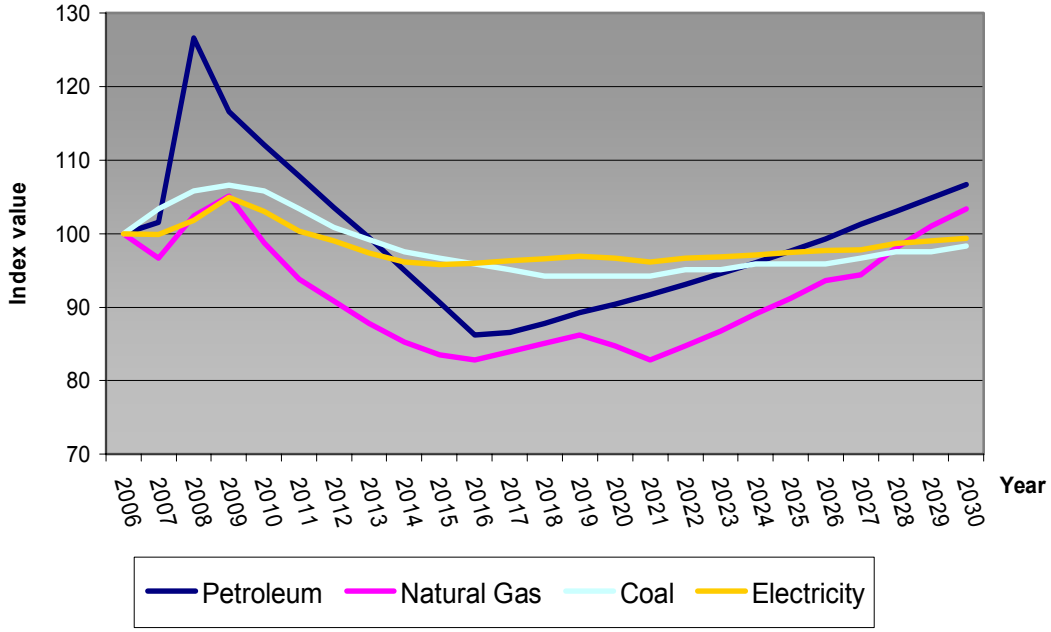
Figure 4-8 Energy prices from 1980-2030, in 2006 US$ per million Btu



Source: EIA, Annual Energy Outlook 2008.

Figure 4-9 reflects the estimated energy prices 2006-2030 as index value, where 2006 equals index value 100. After peaking in 2008-09 the fuel prices are expected to decline, and not to reach 2006 price level before 2027-30. Assuming a constant real wages among the elderly cohorts, such fluctuations of fuel prices are not likely to impact negatively on the elderly consumers' opportunities for using energy based on petroleum, natural gas, coal or electricity. Raising European summer temperatures may entail an increased future demand for cooling (se section 6.1). This will entail augmented energy costs for European households, and the oldest cohorts, may not be able pay such increasing energy related costs. This may have a negative impact on this population segment's health.

Figure 4-9 Index value of estimated energy prices 2006-2030



Source: EIA, Annual Energy Outlook 2008.

4.3 Conclusions

The energy consumption in households is an important cause to resource consumption and emission of GHGs, pollutants and wastes. The natural development of the family and its size when the adults gets older may in itself lead to increasing energy consumption and related emissions. More specifically:

- The living area per person is on average larger for elderly people than for younger as household are smaller but with larger space per person.
- Housing related costs accounts for a larger share of expenditure compared to other groups.
- In EU member states the consumption of electricity, gas and other fuels per person is higher in households with the reference person above 60 than in all other families.
- The ageing of the population and the gradual weakening of the health may over time cause some elderly to be increasingly dependent on heating, and combined with the gradual increase in temperature due to climate change, also on cooling.
- US data also indicate a high energy intensive consumption per person in families above 65 years, but at the same time that these families are more willing to substitute their consumption than other groups if energy prices increase.

- The expected future price development on energy is not likely to change the elderly cohorts' ability to purchase energy in the future.

These findings lead to the general conclusion that elderly people have a larger consumption of energy intensive goods per person than other groups. This is mainly because when people get older, their household gets smaller (as their children moves away, their partner pass away or other social events that may happen). As the household gets smaller the living area per person in the household typically increases, often even if the elderly moves to a smaller residence, and this leads to higher electricity, heat and gas consumption per person. An ageing society therefore tends to face an increasing environmental stress per capita due to increasing consumption of energy intensive products as electricity, heat and gas.

5 Changes in housing and household location

An increasing number of elderly people owns a second home. The second homes are typically purchased while the elderly where still working - with the intention of intensifying the use of the second home when retiring. The purpose of owning second homes varies depending on the geographical location; it makes a big difference whether the second house is located domestically or abroad.

Box 5-1 Reasons for owning second houses

"Significant reasons for the international use of a second home abroad include a growing, readily available income, as well as a higher level of experience in other countries gained through professional and/or tourist endeavours."

Source: Breuer (2005).

People acquiring homes or second homes abroad can be divided into three groups, those:

- acquiring homes or second homes in the north of Europe
- acquiring homes or second homes in the south of Europe
- acquiring homes or second homes outside Europe

Some of the senior citizens choose to migrate permanently, others only use their second home for shorter or longer periods. Data are available for permanent international retirement migration in Europe. Data for part-time retirement migration is on the other hand inadequate.

There are many reasons for retirement migration, e.g. better climate, lower living expenses, access to nature and recreational activities. As stated below second home owners tend to prioritize nature and care for the environment in their new surroundings.

Box 5-2 Second home owners interest in maintaining environmental quality

"Sometimes, the second home owners are against any development that would have a negative effect on the recreational recourse of the area (Jaakson, 1986). In this context, it is argued that second home owners have an interest in maintaining environmental quality at high standards and that second home owners act as preservers (Marcouiller et al., 1988). In northern Wisconsin in the United States, Green et al. (1996) reports that second home owners and permanent residents had different views upon economic development. In general, the second home owners were opposed to larger economic investments that would affect the recreational quality of the place in a negative way, whereas the permanent residents were more positive towards larger industrial developments in the area, because this would bring much needed work opportunities. Of course, the different strategies and expectations regarding the countryside can cause problems and conflicts. In general, second home owners consume the countryside as a recreational resource while the local population tries to make a living out of the area (Müller, 2002c). However, sometimes the local population is against the development of second homes for reasons of environmental and recreational quality (Nordin, 1997)."

Source: Marjavaara (2008).

5.1 Migrants

5.1.1 Permanent migrants

Table 5-1 reflects the migration pattern between EU member states for people above 60 years of age. Data are in-complete, but sufficient to substantiate that the main trend for the elderly migrants from the north-western EU member states are to the southern European member states.

Table 5-1 Number of people older than 60 migrating from one EU country to another, 2006

Country of next residence	Denmark	Germany	Spain	Netherlands	Austria	Poland	Romania	Slovenia	Finland	Sweden	total
Greece	8	2441	1	55	19	7	0	0	2	114	2647
Spain	186	2260	0	540	32	5	7	1	117	218	3366
France	98	862	367	472	30	30	31	8	11	118	2027
Italy	14	2662	65	108	47	7	18	19	11	35	2986
Cyprus	2	14	0	4	0	1	0	0	1	18	40
Malta	0	14	2	3	0	0	0	0	1	5	25
Portugal	8	900	50	137	3	1	0	0	8	15	1122
total	316	9153	485	1319	131	51	56	28	151	523	12213

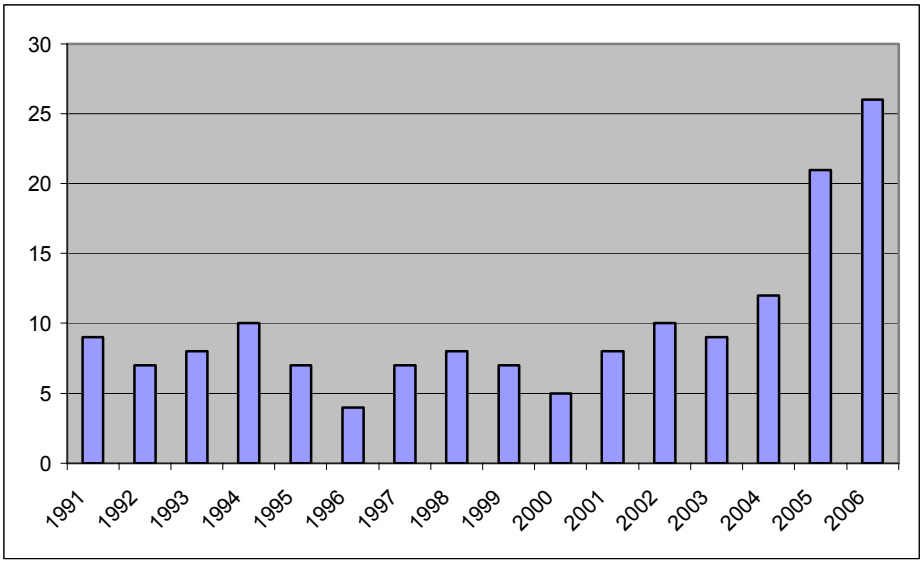
Source: Eurostat.

However, there is also a significant migration of elderly people moving from the southern member states, particularly Spain, to north-western member states, particularly UK and Germany[10].

[10] Eurostat, Immigration statistics.

The UK contributes with an important share of the European migration, but unfortunately Eurostat data are not available in the above format. UK statistics show that since 2005 more than 20,000 people above 60 years annually migrate from the UK. Parts of these elderly leave Europe, others settle in other European countries. Assuming that half of the UK migrants settle in south European member states this will lead to an approximate total of around 25.000 elderly people migrating to South European countries. This should be seen in relation to a total intra-EU migration of around 50,000[11] persons above 60 years of age.

Figure 5-1 Number of British migrants older than 60 (in 1000)



Source: UK Statistics Authority.

The UK data shows a rapid increase from 2004 in the migration of elderly citizens. This gives rise to the expectation of increasing demand for second homes abroad in the future. As the *baby-boom* generations in the coming years are retiring this trend is expected to continue.

[11] Eurostat immigrant statistics state a total of 39,000 migrants aged 60+, but data are lacking for UK, Belgium, Italy, Hungary, Ireland, Estonia, Romania, Malta and Luxemburg. Based on the available data from EU-25 countries it is estimated that 10-15,000 elderly persons are migrating from these countries.

Table 5-2 Number of EU migrants to other continents and above 60 years, 2006

	Denmark	Germany	Spain	Cyprus	Latvia	Lithuania	Netherlands	Austria	Poland	Romania	Slovenia	Finland	Sweden	Total
continent of next residence														
Africa	40	828	194	0	0	0	239	69	3	3	0	10	54	**1440**
America	136	2315	1885	22	27	60	795	271	265	371	40	38	225	**6450**
Asia	148	2463	74	9	35	27	369	444	1	39	2	28	275	**3914**
Australia	16	218	23	0	3	0	42	40	18	30	10	13	19	**432**
Total	**340**	**5824**	**2176**	**31**	**65**	**87**	**1445**	**824**	**287**	**443**	**52**	**89**	**573**	**12236**

Source: Eurostat.

Table 5-2 reflects the number of EU citizens that migrated in 2006 to other continents. Again data are not available for all countries. Based on the available data from EU-25 countries it is estimated that additional 10,000 migrants from the member states *not* included in Table 5-2 (e.g. the UK) migrates to other continents. Thus, the total annual migration of elderly people amounts to approximately 22,000.

5.1.2 Temporary migrants

The data available only deals with permanent migration. People who have second homes either in their own country or abroad are not represented. Similarly, those who move to a location within their own country are not included.

Box 5-3 Second houses used on a seasonal basis

> *"If we take a closer look, however, we see that the foreign residence is frequently only used as a second home on a seasonal basis. In this case the new mobility should be seen more as a variation on international tourism than as a permanent move."*

Source: Breuer (2005).

This provide an indication of how many people that use second homes abroad but are not registered in national statistics as migrated. Still, their housing habits cause environmental impacts, maybe even more if they have to maintain two households.

5.2 Second homes and migration

5.2.1 National second homes, regional migration

The ownership of second homes within the country of resistance is high in the Nordic countries.

Box 5-4 Second houses in Sweden

"According to Statistics Sweden (2007), 46% of the inhabitants in Sweden have access to and can utilize a second home. Further, second homes generate some 34 million overnight stays, or 23 percent of all overnight stays in Sweden (Turisdelegationen, 2004). In 2001, Sweden had around 469,900 registered second homes (Müller, 2007). Compared to the country's low population numbers, approximately 9 million in 2004 (Statistics Sweden, 2005), this means high second home density."

Source: Marjavaara (2008: 2)

Only few people stay full time in their second homes. Often the legislation is limiting the legal use of second homes to temporary use and not as permanent resistance.

No data is available on how much time owners of second homes spend in their second home.

5.2.2 Second homes owned by foreigners in the north of Europe

It is not very common for foreigners to buy second homes in the northern Europe, though significant numbers of Germans and Danishes have bought homes in Sweden.

Typically owners of houses in North European countries do not migrate to the new country but annually spent shorter or longer periods in their second house. The main reasons for not migrating is the climate but also the security of the medical care in the native country.

Box 5-5 Germans having second homes in Sweden

"Most of Germans use their Swedish homes for less then 15 weeks a year divided in 3-5 visits. Only 7% spent more then 26 weeks a year. 2/3 of the Germans owning homes in Sweden are between 40 and 60, so only few owners are more than 60 years old. Very few migrate to Sweden for living there permanently. One of them main reasons for not living there permanently at an older age is that they don't like not being covered by the German health care system."

….

"Meanwhile, many of the German second homeowners expected that they would, when retired, at least temporarily increase their visits to the second homes."

…

"They mentioned the long winters and the uncertainty regarding their ageing as reasons for staying in Germany".

Source: Müller (2002).

5.2.3 Second homes owned by foreigners in the south of Europe

Retired people migrate from the north of Europe to the south for various reasons. The main reason is the climate. Other reasons include the lifestyle and culture of the local people, the landscape and nature, being able to maintain their standard of living, getting to know the local way of living, getting to know

people with different nationalities and socializing with people of there own nationality.

A questionnaire survey shows that the British living in Tuscany, Malta, the Costa del Sol and the Algarve (Casado-Diaz et al, 2004) only visit their native country once or twice a year. As it is evident Table 5-3 there is a big spread in how much time is spend in the second home. There is a very clear tendency that older people stay in their second house during autumn, winter and spring. The preferred time of the year to return to the native country is during the summer where it is busy and warm in Costa del Sol.

Interviews show that more then 90% stay in the south in the months from November to Marts, whereas during the summer only 30% chooses to stays (Breuer, 2005: 318; Figure 2).

Table 5-3 Percentage of senior citizens using their second home on the Canary Islands

3-6 months a year (seasonal residents)	50,5%
7-9 months a year (seasonal residents)	18,9%
>9 months a year (permanent residents)	30,6%

Source: Breuer (2005: 321)

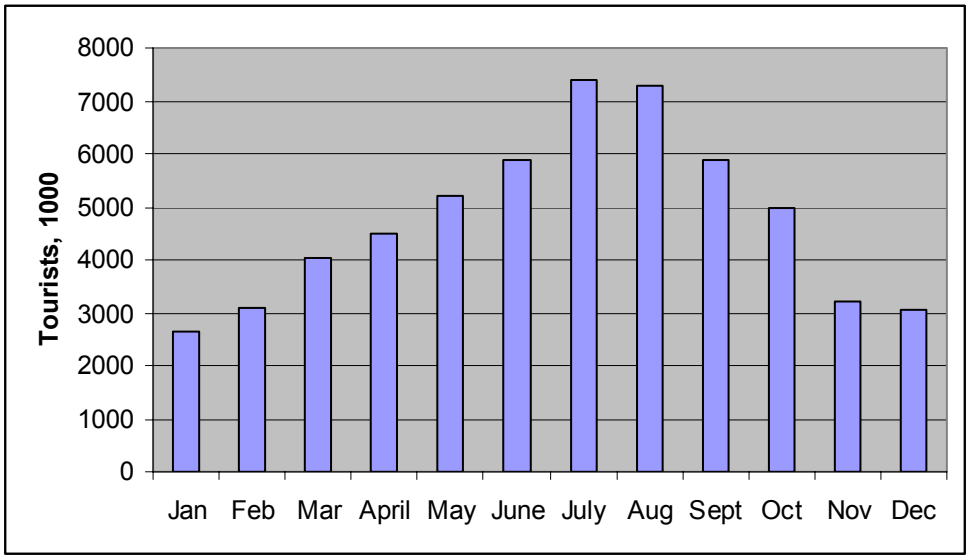
Box 5-6 Seasonal versus permanent residence

"Only 20.7 % no longer have any other residence apart from the one on the Canary Islands. In this respect the results of this case study differ fundamentally from comparable studies in the Mediterranean region, where the proportion of seasonal residents to permanent residents is almost the reverse in some target areas."

Source: Casado-Diaz *et al*. (2004)

There is a tendency for retired people to locate in many of the same areas as the tourists are visiting for holiday. But as can be seen in Figure 5-2 most tourists arrive during the summer when the bulk of the migrants return to their native country. This means that the migrants' pressure on the environment to some extent is out of phase with the pressure from the ordinary tourists. Furthermore, the number of permanent or temporary migrants is very limited compared to the number of holiday tourists.

Figure 5-2 Number of visitors in Spain each month, 2007



Source: IET (2008).

Homes outside Europe

There were approximately 20,000 Europeans migrating in 2006 to countries outside EU. Furthermore, a number of EU citizens have second homes which they use on a regular basis but which are not included in the statistics.

It is fair to assume that the environmental impacts of having a second homes or migrating to countries outside EU does not vary significantly from the migrating to or having a second home in southern Europe. The main difference is determined by the location. The further distance from the native country the larger energy consumption the travelling entails.

5.3 Environmental impacts of migration and usages of second homes

Increasing demand for second homes leads to increased pressure on the environment. The environmental impacts concern several aspects:

- The resource consumption and environmental impact of the building activities
- Effects on land use and recreational areas associated with construction of new houses
- Environmental pressures caused by energy consumption and water supply

Increased demand for houses will result in the construction of more houses unless regulated by special planning. The environmental impacts from construction of new houses include the production and transport of building material, resources used for construction of the building on the site, and the disposal of waste.

Many of the second homes are built or bought in recreational areas where nature is sensitive. This leads to a higher pressure on the environment in these attractive areas. However, the specific influence on nature and the environment differs immensely across EU member states.

5.3.1 Environmental impacts of second homes in the north of Europe

Locally, second homes may have significant adverse environmental effects in the northern member states. Many second homes are located in areas with little or no activity during the winter. Because of the climate all-year usage of these houses requires improved insulation and heating system and regular garbage collection, water supply, etc. Since cottage area services are based on seasonal occupancy, conversion to year-round housing puts tremendous pressure on the local environment and infrastructure. Too often the costs of cottage conversion including pollution control, road access, winter snow removal, water supply and garbage collection are not anticipated in cottage areal planning (Halseth, 2004: 38).

On the more general level the environmental effects of second home tourism is limited and should be seen in the context of what would have happened in the absence of this type of activity.

Box 5-7 Environmental impact of second home tourism

"The impact on the environment caused by second home tourism is a topic that has attracted more and more interest during the last decades. Of course, this development runs in parallel with the increasing demand for second homes. In some highly attractive areas the environmental impact is obvious, and the environmental impact of second home tourism is increasingly questioned (Leslie, 2007); it is known that high densities of second homes can create tremendous problems and increase the potential for environmental degradation (Halseth, 2004). In general, the increasing number of second homes causes increasing competition between locals and second home owners for shared resources such as fishing, land use and fresh water (Butler and Hall, 1998). The Swedish geographer Thorsten Hägerstrand (1954) expressed some concern regarding the increasing competition for local resources in rural Sweden, and asked how these recourses should be utilized so that no unnecessary tension is created between the rural and urban population. However, it is important to remember that the development is highly uneven, and for most locations second home tourism is not a major concern for the environment. As Ashworth (2003) argues, cases chosen for the investigation of tourism induced change are often those where change is most pronounced, which may be exceptional rather than typical.

As for any other types of tourism, second home tourism has impacts on the environment. In Sweden and elsewhere, second homes are often located near the sea, a lake, a river or in attractive mountain locations (Tombaugh, 1970; Coopock, 1977; Nordin, 1993; Jansson and Müller, 2003). Hence, water is an important attraction for second home developments. This implies high utilization of coastal locations, which can cause environmental impacts such as deteriorating water quality, erosion and decreasing public access. According to Jerling and Nordin (2007), increasing utilization of shorelines in the Stockholm archipelago causes negative effects on the local flora and has a disturbing effect on breeding sea birds. As early as the 1940s, Hedenstierna (1948) noted that second homes in the Stockholm archipelago had different localization patterns compared to traditional dwellings, which were located so that they were protected from the windy sea. The second homes were more visually present and located closer to the seashore, and hence dominated the landscape seen from the sea and contributed to a kind of visual pollution.

In recent years, the growing concern regarding global warming and climate change has generated a debate regarding tourism and to what extend it contributes to this development (cf. Gössling and Hall, 2006). This has also been recognized within the subfield of second home tourism. Leppänen (2003) concludes that in the case of Finland, second home tourism contributes to less than 1% of all local carbon dioxide emissions, and that the total environmental impact of second home tourism must be considered as moderate in terms of the scale of the phenomenon. Alternative ways of spending free time and money on long-haul vacations in distant locations probably have more negative effects on the global environment. In a recent comprehensive study of the environmental impacts of rural second home tourism by Hiltunen (2007), Leppänen's conclusion is confirmed, namely that this form of tourism has some negative impacts on the physical environment, just as any other form of consumption does. However, the impact of second home tourism is regarded as minor compared to several other popular forms of tourism, such as long haul sun, sea and sand-based tourism."

Source: Marjavaara (2008: 15)

5.3.2 Environmental impacts of second homes in the south of Europe

Energy consumption

Many of the temporarily migrated elderly from northern Europe stay in their second homes in the south of Europe during the autumn, winter and spring and spend the summer in their native country. This is a housing pattern that to a large extent utilises the most attractive parts of the climate in both their new residence country and in their native country. This will minimise the need for heating during autumn, winter and spring and limit or remove the need for cooling during the summer. This limits the energy consumption significantly and thus limits the negative environmental impacts associated with energy usage.

The distance between the new and the native country is often large and travelling cause significant energy consumption and emissions of GHGs and other pollutants. The study referred to above in 5.2.3 indicates that the elderly migrants only make relatively few annual visits to their native country. Box 5-8 provides a simple calculation of the likely relationship between the CO_2 emission caused by flight transport compared to the reduced emissions that may be obtained by reduced heat and cooling consumption. Assuming that the annual number of travels is limited to 2 and that energy consumption for heating is reduced when moving to the south the annual emissions of CO_2 of the migrant is likely to be reduced.

Box 5-8 Comparison of CO_2 emission from aviation and domestic heating

Comparison of the CO_2 emission from heating a home in the United Kingdom with the emission from travelling with a plane between two homes:

- The average CO_2 emission from heating a home with natural gas in UK: 2.16 tons CO_2/person/year
- A return flight trip from London to Malaga causes an emission of 0.372 tons CO_2/person

With two annual return flights from her second home on Malaga, a British senior citizen will cause CO_2 emissions in the range of 0.75 ton. The production of 1000 kWh in Spain entails 0.63 ton of CO_2 emissions. This implies that if a person living on Malaga - in addition to two annual return flights to the UK - yearly consumes less than 2.200 kWh, the person contribution with less CO2 emissions than a similar citizen living in the UK.

A high performance heat pump consumes when cooling approximately 0.5 kW and 0.85 kW when heating[12]. 2.200 kWh corresponds to 4.400 hours/year of cooling or ca. 12 hours/day or 2.588 hours/year of heating respectively ca. 7 hours/day.

Average temperature in Malaga in November-April is between 12-17°C, the average temperature in July-August reaches 26°C[13]. In some periods during respectively winter and summer heating/cooling may be necessary. However, the average yearly need for heating/cooling is not likely to amount to 2.200 kWh. Hence, UK citizens that have seasonal or permanent residence in Malaga are likely to have a lower annual CO_2 consuming than persons living in the UK.

Source: EDF Energy, DEFRA, National Statistics, Cheap-Parking, Environment-watch, PE International.

The houses

Compared to the number of hotels and apartments build for mass tourism, a limited number of houses in South European tourist areas are used as second home residence for migrants. However, in some cases limited requirements about spatial planning/municipal planning give rise to unregulated building activities and significant negative environmental impacts.

A classic example of a big environmental problem that is caused by extensive construction of buildings is the coast line of Costa del Sol. It should, however, be noted that by far the most buildings were built for mass tourism and not for migrants.

Box 5-9 Environmental impacts of uncontrolled development in Costa del Sol in Spain

"In the case of the Costa del Sol in Spain, environmental impacts have been very large due to uncontrolled development (Aledo & Mazon, 2004; GARCÍA, POLLARD, & RODRÍGUEZ, 2000; Mazon, 2006) and include; "landscape degradation, reduction of local biodiversity, deforestation and the increase of forest fires, the loss of vegetation, erosion and desertification, the increase of edaphic, acoustic and water pollution, both of superficial and subterranean waters and the eutrophication of the continental waters (Aledo & Mazon, 2004). The two main development issues are increase in concrete which increase urban water runoff and the sprawling low density developments (Aledo & Mazon, 2004)".

Source: Koch-Schulte (2008).

[12] A Hiyasu ASH07UI heat pump consumes 465 W cooling 70m^2 and 840 W heating 70m^2 (www.clevertec.dk).

[13] Malaga Weather Forecast.

Water and electricity supply

As suggested earlier there is a tendency for retired people to stay in there second home outside the peak tourist season in the South European member states. This means that their consumption of water and other municipal services and of electricity time-wise is outside the peak load caused by the tourist season. In that respect new elderly residents are likely to cause less additional pressure on the municipal and electricity infrastructure than additional tourism. Furthermore, elderly residents will spend more time in the cooler and more humid seasons and less in the hot and dry season when water resources are most scarce.

The wealthier immigrants, including elderly persons, are more likely to have swimming pools than the native population and this may obviously increase the pressure on the water supply.

Also construction of golf courses may cause significant pressure on water resources, the landscape and the environment by extensive use of pesticides and fertilizer. Such activities are often related to the promotion of tourism in general and not specifically to developing resort for foreign elderly residents.

Box 5-10 Pressure on local water resources from golf courses

"As one of the most rapidly expanding types of extensive land-use, golf course development has often attracted controversy when proposed as a policy to promote special-interest tourism. Malta is an extreme case in which such conflicts have arisen, being one of the world's most densely populated countries and having limited land and water resources."

Source: Markwick (2000).

5.4 Conclusions

With increasing wealth there is a tendency that more elderly people acquire second home and utilize it part of the year or even migrates permanently to other countries, both within and outside EU. This may lead to different effects in environmental terms:

- Annually approximately 20-25,000 elderly citizens above 60 from north-western European countries migrate to South European member states and a similar number of elderly European migrates to countries outside EU, particularly the Americas and Asia. UK data indicate that the number of elderly migrants has been rapidly increasing since the turn of the century. There is also a significant migration of elderly from South European countries to particularly UK and Germany.

- Constructing and utilizing second homes will cause environmental impacts during the construction phase and possibly also during utilization. The net effect however depends on the specific conditions and on the alternative activities that the owner would have undertaken, particularly if the alternative was longer tourist flights.

In the northern countries:

- If elderly people utilize their second homes more intensively after retirement this can add to the pressure on the local environmental infrastructure (water supply, wastewater treatment, waste collection) and electricity supply network as this infrastructure normally are dimensioned for a relatively limited utilization and only during the summer period.

- Owners of second homes tend to select their second home because of, and to give priority to, local environmental qualities and nature areas. Therefore they often tend to promote local nature conservation and oppose larger developments projects that threaten local nature and environment.

In the south European countries:

- Elderly immigrants from north-western Europe normally only stay in their South European houses during all or part of the autumn, winter and spring and spend the summer in their native country. This reduces their energy consumption for heating and cooling compared to those staying all year in their native country. This energy saving will most likely exceed the energy consumption needed for their flights home.

- Rapid and poorly planned development of tourist areas and residential areas for new residents has caused and is causing negative environmental impacts and impacts in terms of loss of nature areas. The main cause to this is a lack of enforced spatial planning requirements in these areas.

- When more elderly people migrate to the south this adds to present pressures on particularly water resources, but also on other municipal services. The fact that elderly residents often leave for the hot and dry summer, which is the peak tourist season, may help to limit this negative impact.

The main conclusion is that increasing ownership of second houses and increasing migration amongst elderly people does not provide a general environmental problem. However, depending on the specific local conditions new elderly residents may add to local environmental challenges, e.g. in terms of additional water consumption in very dry areas, and in terms of unplanned development of new resorts for tourism and new residents. These types of difficulties mainly call for local planning and regulation.

6 Health related impacts from global warming

In the previous chapters, the likely impacts of an ageing population on the environment have been analysed. In this chapter, the impacts on an ageing population due to changes in the environment are discussed. Focus is on effects of global warming that are likely to impact on older cohort's health conditions. Effects of global warming that will affect *all* age groups - and thus including older age groups - are not illuminated.

6.1 Global warming and the related health effects

Anthropogenic caused changes in atmospheric concentrations of GHG alter the balance of the climate systems and are a main driver of climate changes (IPCC, 2007: 37). From climate observation it is evident that the global air and ocean temperature is increasing, that widespread melting of snow and ice takes place and that the global average sea level is rising. Throughout the last 50 years some extreme weather events has changed in frequency and/or intensity:

- It is *very likely* that cold days, cold nights and frost less frequently occur over land areas, whereas hot days and hot nights have become more frequent
- It is *likely* that heat waves have become more frequent over land areas
- It is *likely* that more frequent and heavy precipitation has increased (or the proportion from heavy rainfall of total rainfall has increased).
- It is *likely* that since 1975 extreme high sea level more frequently occur (IPCC, 2007: 30)

For Europe various regional effects of a rising global temperature is documented with *medium confidence*:

- Excess heat-related mortality
- Changes in infections diseases vectors (in part of Europe)
- Increase in seasonal production of allergic pollen (in the Northern hemisphere high and mid altitudes) (IPCC, 2007: 33)

According to the International Panel on Climate Change it is *very likely* that heat waves and heavy precipitation will become more frequent during the 21st century (IPCC, 2007: 46). In Europe, the regional effects of climate changes is expected to increase the risks of inland flash flooding and more frequent coastal flooding and increased erosion. The consequences in Southern Europe are expected to be increased temperature, more frequent and/or more severe drought and reduced water availability. The health risks will primarily be caused by heat waves and frequency of wildfires (IPCC, 2007: 50). In summer, the number of wet days is likely to decrease over most of Europe except for northern Scandinavian and the Baltic Sea region. During the summer periods with drought are likely to increase (except for the Iberian Peninsula) and the periods with precipitation are similarly increasing during the winter (again with exception for the Iberian Peninsula) (May, 2007).

Extreme weather events such as heat waves, drought, rainfalls and flooding are likely to affect the European populations in the future due to global warming. The fragile, elderly and poor will be the most vulnerable to such extreme weather conditions. More frequent and intensive incidences of flooding and heavy precipitation constitute thereby a risk for the elderly. Through an adequate warnings system the negative consequences of flooding and heavy rainfall may be minimised. In order to mitigate the potential impact of such weather phenomena the resourceful part of the population may be expected to move from areas subject to the effect of flooding and heavy rainfall, e.g. from residences located next to the sea or rivers. Such changes in housing patterns will, however, be expected to be seen among all populations groups and is therefore not to be expected as a particular issue for old people. The effect of changes of infection diseases vectors is likely to entail particular impact on elderly as older people's immune response is relatively weak.

Heat waves constitute a particular risk to elderly. The consequences of heat waves are therefore more profoundly examined.

6.1.1 Heat waves

A result of a warming climate in almost all areas of Europe is a higher tendency towards deaths attributable to heat increase. On the other hand are deaths attributable to cold decreasing (Kovats, 2004). In post-industrial societies heat waves constitute a major mortal risk as it is the number one natural hazard (Poumadère *et al*., 2005). Based on a threshold of mean summer temperature Stott *et al.* (2004) has (with a confidence level above 90 %) estimated that anthropogenic contribution to climate change since 1851 has more than doubled the risk for heat wave incidence similar to the European 2003 heat wave.

The summer 2003 was the hottest summer in Europe since 1500 (Poumadère *et al.*, 2005). For an unusual number of consecutive days a heat wave stroke western Europe. Within the last 50 years, no developed country had experienced heat wave-related mortality crises of similar dimensions. Throughout Europe the total number of casualties amounted to astonishing 45,000-50,000. With a total number of 20,000 victims, Italy was the single country most severely hit.

The excess deaths in Italy was spread over three months, where only half of all deaths occurred in August. In contrast to France prevention campaign existed in the main Italian cities. During two weeks of August[14] in France 15,000 victims died from the heat wave. The severity of the incidence was due to a lack of immediate public health response. Because of the very unusual character of the episode the public sector's response was unprepared (Toulemon & Barbieri, 2008).

In France, the heat wave crisis was most severe in the centre and in the north of the country. The spatial spread of victims was very uneven, the most severely affected areas contributed with more than 25 % of all excess deaths, although they only constituted 10.5 % of France's total population (Toulemon & Barbieri, 2008). ⅔ of all excess deaths took place in institutions, whereof 25 % occurred in nursing homes. During the heat wave crisis, the number of deaths at home and in retirement homes doubled. ⅓ of the excess deaths occurred at home (Holstein *et al.*, 2005; Poumadère *et al*., 2005). The excess death primarily took place in urban centres, e.g. the Paris area. In Paris 92 % of the victims lived alone and 41 % resided in one-room apartments. Around 50 % of the casualties lived on the two highest floors of Parisian buildings[15]. The excess death rate in Paris was 150 % (Poumadère *et al*., 2005).

The mortality increased with more consecutive days with extreme heat (>35°C maximum temperature). For persons over 75 years the overall excess mortality amounted to 1,200 deaths during 9 consecutive days of extreme heat (Poumadére *et al*., 2005). The fragile and old people were most severely affected by the heat wave.

The death rates increased dramatically for the age group above the age of 75. Table 6-1 reflects the excess mortality rate for the oldest population groups.

Table 6-1 Excess mortality rate for the oldest population group in France August 2003, in percentage of normal mortality rates

Sex	75+ years	95+ years
Male	+51 %	+85 %
Female	+85 %	+130 %

Source: Poumadére *et al*. (2005).

The heat wave entailed a disproportional high number of deaths among older people, especially elderly women. The higher proportion of female casualties could properly be accounted for due to a higher tendency of women than men to live alone at older ages, and the high heat wave related mortality rate for people living alone. The mean age at death of the victims was 81 years (76 years for men and 85 years for women) (Toulemon & Barbieri, 2008).

[14] August 4-18 2003 (Poumadière *et al.*, 2005).

[15] During the Chicago 1995 heat wave the mortality risk for living on the top floor multiplied by a factor 4 (Poumadère *et al*., 2005).

A study investigating the harvesting effect of the 2003 French heat wave estimates the remaining life expectancy of the heat wave casualties. According to the study the heat wave victims had an average remaining life expectancy of 9.1 years (11.4 for men and 7.8 for women) (Toulemon & Barbieri, 2008).

The most significant increase in mortality was directly attributable to heat: dehydration, hyperthermia or heat stroke. Other important causes of death were due to genital-urinary and respiratory illnesses (Poumadère *et al*., 2005). The elderly people at greatest risk of death during the heat wave were those confined to bed and those having a medical diagnosis as cardiovascular or neurological disease or mental disorder. Moreover, the highest death rates were among those elderly living in buildings without insulation, those living in areas with the greatest inland heat effect, and those with a bedroom located directly under the roof. Correlation occurred between exceed mortality rates and urban living conditions, poverty, isolation and ill health. Appropriate behaviour was an important protective factor against the heat wave, most important was to dress lightly and the utilization of cooling devices. The elderly living alone were most likely not to be confined to bed and able to dress and wash them self. The elderly people with mobility impediments, on the other hand, where less susceptible to live alone (Poumadère *et al*., 2005; Vandentorren *et al*., 2006).

Architectural renovations and the installation of air-conditioning are crucial measures to prevent excess mortality during further heat waves. Moreover, Holstein *et al*. (2005) suggest the establishing of routine monitoring of all patients as a precautionary measure to avoid similar excess death rates as experienced during the summer 2003 heat wave. These measures should furthermore be applied to the general population.

The European summer 2003 heat wave catastrophe reflects the vulnerability of fragile and old people to extreme heat weather conditions. The elderly cohorts are unevenly affected by heat waves. High age, health, lack of mobility, poverty, lack of air-conditioning and housing pattern (living alone and/or living in houses with high indoor temperatures under heat waves) are the main risk factors connected with heath waves. The fit, the mobile and the rich elderly are much better prepared to withstand heat waves.

A consequence of the elderly cohorts' increased utilisation of air-conditions to protect from heat waves will be an increase in the power usages.

6.2 Conclusions

The most important likely effect of global warming on an ageing population's health condition will be more frequent summer heat waves in Europe. The European 2003 heat wave showed how severe such heat waves can strike. The consequences of the 2003 heat wave were especially brutal in France, where - during the heat wave crisis - the excess mortality rates for elderly increased dramatically.

Precautionary measures are needed to mitigate similar excess death rates experienced during the summer 2003 heath wave. Such precautionary measures include architectural renovations and the installation of air-conditioning.

7 References

AEA Energy & Environment (2008): *Environmental impacts of household consumption.* SD pillars, draft final.

Akkerman, A. (1991): "Age-Specific Household size as a Demographic Aspect of Regional Disparity: Czech Republic, 1991", in: Canadian studies in Population, 31 (2), 2004:.237-260. http://www.canpopsoc.org/journal/CSPv31n2p237.pdf, p 252

Bierings, H. (2000): "Consumption of the elderly in the EU", Eurostat, *Statstics in focus -Population and Social Conditions*, Theme 3 - 3/2000

Breuer, T. (2005): "Retirement Migration or rather Second-Home Tourism? German senior citizens on the Canary Islands", *Die Erde*, Contributions to human geography, volume 136, issue 3 pp 313-333.

Brög, W., E. Erl & B. Glorius (1998): "Germany", in: Rosenbloom. S. *et al. Transport and Ageing of the Population*, OECD, European Conference of Ministers of Transportation.

Casado-Diaz, M.A.; C. Kaiser & A.M. Warnes (2004): "Northern European retired residents in nine southern European areas: characteristics, motivations and adjustment", *Ageing & Society*, volume 24, pp 353-381

Dalton, M., O'Neill, B.C. and Zigová, K. (2008): "Effects of Household Age and Size on the Elasticity of Energy Consumption", International Institute for Applied System Analysis (IIASA), paper in connection with 31st IAEE Conference, June 2008, Istanbul, http://www.iiasa.ac.at/Research/PCC/recent-events/Zigova_IAEE08_final.pdf

Denstadli, J.M., Ø. Engebretsen, R. Hjorthol & L. Vigane (2006): "Den Nasjonale reisevaneundersøkelsen 2005 - nøkkelrapport", Transportøkonomisk Institutt, TØI-rapport 844/2006

Grimley Evans, J. (2000): "Ageing and medicine", *Journal of Internal Medicine*, 247, 159-167

IEA (2006): "World Energy Outlook 2006", International Energy Agency

Halseth, G.R. (2004): "The ”cottage” privilege: increasingly elite landscapes of second homes in Canada", in Hall, M; Müller, D (Ed) *Tourism, mobility and second homes. Between elite landscape and common ground.* Channel View Publications, Clevedon

Hjorthol, R. & F. Berg (1998): "Norway", in: Rosenbloom. S. *et al*. "Transport and Ageing of the Population", OECD, European Conference of Ministers of Transportation.

Holstein, J., Canouï-Poitrine, F., Neumann, A., Lepage, E. and Spira, A. (2005): "Were less disabled patients the most affected by 2003 heat wave in nursing homes in Paris, France?" *Journal of Public Health*, 27(4): 359-365.

IET (2008) "Frontur movimientos turísticos en fronteras", Spanish Ministry of Industry, Tourism and Commerce, Instituto de Estudios Turístico, Online version: http://www.iet.tourspain.es/informes/documentacion/frontur/NotasMensuales/2008/Coyuntura0508.pdf

IPCC (2007): "Climate Change 2007: Synthesis Report", Intergovernmental Panel on Climate Change

Koch-Schulte, J. (2008): "Planning for International Retirement Migration and Expats: a case study of Udon Thani, Thailand", A Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of Master of Arts, Winniepeg

Kovats, S. (2004): "Estimates of temperature-related mortality due to climate change in Europe", *Epidemiology*, 15: 95-96.

Marjavaara, R. (2008): "Second Home Tourism, The root to displacement in Sweden?", Academic dissertation, GERUM human geography, Umeå University

Markwick, M.C. (2000): "Golf tourism development, stakeholders, differing discourses and alternative agendas: the case of Malta", in *Tourism Management*, volume 21, issue 5, pp. 515-524

May, W. (2207): "Potential future changes in the characteristics of daily precipitation in Europe simulated by the HIRHAM regional climate model", *Climate Dynamics*, 30: 581-603

Mollenkopf, H., F. Marcellini, I. Ruoppila & M. Tacken (2002): "Ageing and Outdoor Mobility", *Assistive Technology Research Series*, IOS Press.

Müller, D.K. (2002): "German second Homeowners in Sweden: Some remarks on the tourism - migration - nexus ", in *Revue Européenne des Migrations Internationales*, 18 (1): 67-86

Poumadère, M. Mays, C., Le Mer, S. and Blong, R. (2005): "The 2003 Heat Wave in France: Dangerous Climate Change Here and Now", *Risk Analysis*, 25(6): 1483-1494

Raitanen, T., T. Törmäkangas, H. Mollenkopf & F. Marcellini (2003): "Why do older drivers reduce driving? Findings from three European Countries". *Transportation Research Part F 6: Traffic Psychology and Behaviour*, 6(2): 81-95

Rosenbloom. S. *et al*. (1998): "Transport and Ageing of the Population", OECD, European Conference of Ministers of Transportation

SBI (2005): "Husholdninger elforbrug - hvem bruger hvor meget, til hvad og hvorfor?", Danish Building Research Institute, SBI 2005:12, http://www.elforsk.dk/doks/334-026/Rapport_334_026.pdf

Spörel, U. (2007): "Inbound and outbound tourism in Europe", Eurostat, *Statistics in focus - Population and Social Conditions*, 52/2007

Statistisches Bundesamt (2006): "Datenreport 2006", *Schriftenreihe Band 544*, Statistisches Bundesamt: Germany

Stott, P.A., Stone, D.A., and Allen, M.R. (2004): "Human contribution to the European heat wave of 2003", *Nature*, 432: 610-614

Toulemon, L. and Barbieri, M. (2008): "The mortality impact of the August 2003 heat wave in France: Investigating the 'harvesting' effect and other long-term consequences", *Population Studies*, 62(1): 39-53

TSB (2001): "Transport Statistics Bulletin National Travel Survey: 1999/2001", National Statistics

TSB (2005): "Transport Statistics Bulletin National Travel Survey: 2004", National Statistics

TSB (2006): "Transport Statistics Bulletin National Travel Survey: 2006", National Statistics

Ugebrevet A4 (2006): "Gråt guld I Rejsebranchen", Interview with Managing Director Stig Elling, 28. August 2006, http://www.ugebreveta4.dk/2006/28/Baggrundoganalyse/Gratguldirejsebranchen.aspx

Urhausen, J. (2008): "Tourism in Europe: does age matter? ", Eurostat, *Statistics in focus*, 69/2008

Vandentorren, s., Bretin, P., Zeghnoun, A., Mandereau-Bruno, L., Croisier, A., Chochet, C., Ribéron, J., Siberan, I., Devlercq, B. and Ledrans, M. (2006): "August 2003 Heat Wave in France: Risk Factors for Death of Elderly People Living at Home", *European Journal of Public Health*, 16(6): 583-591

Zaidi, A. (2008): "Features and Changes of Population Ageing: The European Perspective", *Policy Brief March,* (1)

Online:

Carpages: http://www.carpages.co.uk/co2/, July 2008

CBS StatLine databank: http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=37236&D1=a&D2=0&D3=0&D4=1-7&D5=a&D6=21-24,41-42&D7=a&HDR=T&STB=G1,G2,G3,G4,G5,G6&VW=T, July 2008

Cheap-Parking: http://www.cheap-parking.net/flight-carbon-emissions.php, July 2008

Child Poverty Action Group: http://www.cpag.org.uk/info/Povertyarticles/Poverty120/utilities.htm#footnote%201

Clevertec: http://www.clevertec.dk/default.asp?Action=Details&Item=318

DEFRA: http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm, July 2008

EDF Energy: http://www.edfenergy.com/index.shtml, July 2008

EIA (Energy Information Administration): http://www.eia.doe.gov/oiaf/aeo/prices.html; Annual Energy Outlook 2008Environment-watch, http://www.environment-watch.co.uk/co2.cgi, July 2008

Eurostat: http://epp.eurostat.ec.europa.eu/

Malaga Weather Forecast: //www.malagaweatherforecast.co.uk/

National Statistics: http://www.statistics.gov.uk/default.asp

PE International: http://www.pe-international.com/danish/consulting/carbon-footprint/product-carbon-footprint/

Statistics Netherlands: CBS StatLine databank (http://statline.cbs.nl)

Statistics Norway: http://www.ssb.no/english/ July 2008 and http://www.ssb.no/bo_en/tab-2008-07-15-04-en.html

Transportvaneundersøgelsen: http://www.dtu.dk/centre/modelCenter/TU.aspx, July 2008

UK Statistics Authority: http://www.statistics.gov.uk/