Human dimensions
Methods for examining the effect of structural factors on the energy consumption of Finnish households up to the year 2015

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1. SYNOPSIS

The paper discusses the significance of structural factors in estimating the future energy consumption of Finnish households. It presents a forecasting model and examples of calculating the energy consumption caused by transportation and the household electricity demand.

2. ABSTRACT

The paper aims to examine the effect of changes in the population and consumer behaviour on households' direct and indirect energy consumption in the next 20 years. It presents an approach and example calculations. Energy consumption is regarded as an indirect consequence of the way households function and the implementation of their goals. The theoretical premise is life cycle analogy.

The future is approached via foreseeable changes in the population, from which the number and structure of households are derived. The paper calculates the direct and indirect energy consumption of individual sectors (housing, transportation, foodstuffs and other consumption). The futurological aspect is exploited in examining both the population trend and the average data for alternative trends in energy consumption. These are parts of an analytic model used to estimate various alternatives and their impact on households' energy consumption.

The total Finnish population will display only imperceptible changes up to the year 2015. The number of dwelling-units proved to be serviceable in analysing the effect of economic factors on the formation of and changes in the size structure of households. Judging from calculations, the change in the size and age structure of Finnish households appears to have a major impact on the energy consumption caused by transportation, whereas the household electricity demand seems to be strongly dependent on the increase in household appliances.

3. INTRODUCTION

This paper seeks *to determine the effect of changes in the population and consumer behaviour on the direct and indirect energy consumption* of Finnish households in the years to come. The basic premise is sociological and the aim is to describe the approach and present some example calculations. The future energy consumption of Finnish households will be addressed mainly via factors connected with households, since households constitute the basic functional and decision-making unit in Finnish society. The goals which people seek to achieve and the way they go about it, are in turn strongly community-oriented. The primary theoretical premise is the life cycle analogy (Nurmela 1989, Carlson et al. 1982).

The future is approached via the foreseeable changes in the population, from which the number and structure of households in the years to come are derived. Households' direct and indirect energy consumption has previously been calculated in 1981 and 1990, with reference to the average consumption in individual sectors (housing, transportation, foodstuffs and other consumption). The futurological perspective is exploited in examining the demographic trend and the alternative trends in energy consumption. These are parts of an analytic model used to estimate various alternatives and their impact on the total energy consumption of Finnish households (see Figure 1). This paper presents the methodological premises of a lager research project based on this model.
The paper begins by outlining the frame of reference (4), followed by an examination of how the future of households' energy consumption may be approached and the methodological innovations in this approach (5). Chapter (6.1) deals with the changes in the Finnish population and in the number and structure of Finnish households up to the year 2015. Chapter (6.2) which describes some examples, first discusses the effect of households' stage of life on the future transportation-related energy consumption and then presents calculations of the future trend in Finnish households' electricity consumption. The paper ends with a brief conclusion chapter (7).

4. GENERAL BACKGROUND

Statistics and investigations use many types of classifications in examining energy consumption. Energy consumption is often divided into that consumed by industry, transportation, and heating. These may be further subdivided, into branch of industry, passenger and goods traffic. The principle in these examinations is that the energy consumption is the final direct consumption in each sector - heat, light or power. (Energy Statistics 1993, Shipper et al. 1994)

Another method is to further subdivide the indirect energy consumption. Within one country, the items for examination are then private and public consumption, exports and investments (Nurmela 1989). The energy required in the manufacture and distribution of products and services used by the end user is then defined as his indirect energy consumption. In this context households' direct energy consumption then covers: (1) the energy required to heat dwellings and water, all fuels and household electricity included, (2) the fuels purchased for personal or hired means of transport. All other energy consumption is indirect, including the energy required to produce and distribute products and services. Data on this consumption can be obtained using coefficients to convert the sums spent on various commodities into energy. (Nurmela 1994)

This indirect energy consumption or accrued energy indicates that even in a country such as Finland, with an extremely energy-intensive export industry, the total indirect and direct energy consumption of the population is greater than that of the export industry. In 1990 indirect consumption accounted for 58% of the total energy consumption of the average Finnish household. (Nurmela 1994)

An approach such as this, assigning indirect energy consumption to the end user in addition to direct, is still rather rare. Similar calculations have, however, been made in the Netherlands (Vringer et al 1993, Perrels 1992). There the average total energy consumption by households (240 GJ/household) is almost on a par with that in Finland (223 GJ/household). In the Netherlands the average household's indirect energy consumption was 54%.

At the moment market thinking is used in Europe (and presumably elsewhere) as a model for interpreting phenomena and as a principle guiding the public sector. Viewed from this perspective, even the indirect energy consumption of the actions and purchases of individual consumers becomes a crucial factor. Under the prevailing market orientation, the end user must be clearly aware of the consequences of his actions (Nurmela & Virtanen 1994).

5. MODELLING ENERGY USE AND CONSUMPTION

The approach based on the Laspeyrer index used by Lee Schipper in examining change in energy consumption is probably among the ones most commonly used, if strictly economic models are excluded. Schipper divides the factors affecting change into three main categories: a) activity or the operational sector, b) structural change, and c) change in the use or consumption intensity of energy. "According to this formulation, changes in the level of the energy use in a given sector may be attributed to three factors: growth in aggregate activity; structural change (changes in the ratio of specific activities to aggregate activity); and changes in the energy intensities." (Schipper et al.1994) By examining these factors separately it is possible to estimate the independent effect of a change within any one of them on the overall change.

In their examination of Sweden's energy consumption Schipper et al. classify consumption under six main activities: housing, primary industry, other industry, services, passenger traffic and goods traffic. Households are directly affected by housing and passenger traffic. In the case of housing, the activity is the population. The intensity elements are the heating energy consumption per floor area, the energy consumption per domestic appliance, the cooking and hot water consumption per person corrected for the time spent at home, and the energy consumed on lighting per floor area. The structure comprises the floor area per person, the number of persons in the household and the number of appliances owned by each person. The activity in the case of passenger traffic consists of the number of kilometres annually travelled, the structure the number of kilometres travelled by various means of transport, and the intensity the energy efficiency of the different means of transport per passenger kilometre.

The indicators and classifiers used by Schipper et al. are undoubtedly unavoidable in examining historical change in order to permit long time series. The human or active component remains fairly distant and indirect. Yet in order to exert an influence or to bring about change, for example, it is probably useful to have at least some connection with the actor. In the present paper energy consumption is therefore approached via households' life cycle and the direct and indirect energy consumed in their various functions. It is then possible to use a frame of reference emphasising households' activity, decision-making and life cycle, viewing energy consumption as the outcome of other decisions. The stage of life cycle of a household, i.e. its size, the ages of its members, and earlier stages dictate energy consumption to a considerable degree. In Finland the differences between the mean values for life stage groups are marked.

Figure (1) presents a model for the future household energy consumption in which households are classified according to stage of life cycle and it is assumed that the energy consumption may be determined by different factors in different sectors. Applied to Schipper's model, the structure of households constitutes a structural component that is constantly changing due to demographic and other factors. Each household type thus has its own average consumption (i.e. intensity) for housing, transportation, foods and other consumption that may change as the factors determining the average consumption change.

Figure 1: *A model for forecasting households' energy consumption*

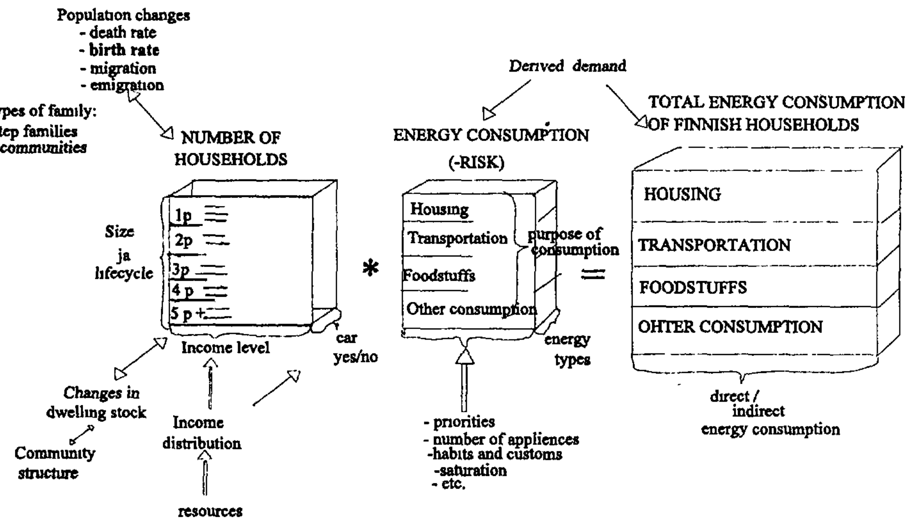


Figure (1) shows the basic model by which the present article examines future scenarios for households' energy consumption. In order to estimate the total consumption of Finnish households, it is necessary to investigate problems of two types. The first of these is how the total number and structure of households will change during the period for examination, 1995-2020, and the second is how the tendency towards energy consumption of the different sectors will change in each type of household.

The first of these problems must inevitably be approached from a demographic point of view. Various demographic forecasts must be used to estimate the effect of the trends in fertility, mortality and (e)migration on changes in the population and its age structure. Values for the change in the number and structure of households can then be derived.

The second the factors that may influence these trends must then be estimated for the intensities or average consumptions, such as people's expectations of standard of housing and domestic appliances, changes in leisure pursuits, the commodities which households will purchase and the way these are manufactured, etc. The list is in principle endless. The following chapters examine these problems from a methodological point of view, the calculations for Finland serving more as method examples than as exhaustive forecasts of households' consumption in the various sectors or as estimates of alternatives. The writer believes that the method may be of greater interest to a broader audience than special features of Finland as such.

6. LOOKING TOWARDS THE FUTURE

This chapter begins by outlining how the population forecast can be made to yield forecasts for households. The chapter (6.2) gives two examples of the effect of structural factors on households' future energy consumption.

6.1. Basic premises: the population, household-dwelling units and households

This section describes the intermediary links by which demographic changes affect energy consumption. There is unlikely to be any opposite effect in a society such as Finland's. The process begins with the population and variations in the population change factors. These are used to derive functional units within which all consumption - energy consumption included - takes place. Such units are *households*, i.e. persons sharing the same monetary and consumption economy. The persons belonging to the same household have a joint monetary economy, and functions other than those to do with housing are subject to joint decisions and actions. It is thus natural to examine the direct and indirect energy consequences of action by the Finnish population primarily via the quantitative, structural and functional changes in households.

The analysis is based on the population forecasts for Finland (Statistics Finland 1995,preliminary version) , from which a link with changes in households is then sought using data on changes in and forecasts for household-dwelling units. Seen historically, the difference between household-dwelling units and households has become steadily smaller with the increase in housing space, the rise in incomes and standard of living. The persons living in the same dwelling, the members of the household-dwelling unit, do not necessarily have anything in common apart from the dwelling, which in the energy consumption sense means the heating, the hot water and possibly the household electricity.

Household-dwelling units serve as a suitable link in the sense that *their formation is influenced in many ways by the economic situation*, on the one hand through the number of dwellings built and on the other hand through the economic prerequisites for grown-up children to move away from home. These same factors may be of significance to the forming and splitting up of married and unmarried couples. By studying the changes in the number of household-dwelling units it is thus possible to estimate the influence of economic conditions on changes in the number and structure of households.

6.1.1. The trend in the Finnish population up to the year 2020

This section briefly examines the trend in the size and structure of the Finnish population up to the year 2020. The size of the population in a given area will, of course, be influenced by the birth rate, mortality and migration. Population forecasts are based on previous changes in the structural demographic factors, and they may include alternatives on, for example, the number of migrants. Alternative assumptions are often also made for the fertility and mortality rates, while still adhering to the trends deduced from the past.

The main findings of the recent forecasts issued in 1994 and 1995 are that there will be little change in the total Finnish population up to the year 2020. It may well be argued that the total Finnish population is not likely to change so much by the year 2015 as to have any significant impact on the energy consumption of the household sector.

There will, by contrast, be some notable changes in the age structure between 1990 and 2020. For example, the number of children aged 5-9 will fall 15%, the number of persons aged 20-24 close to 20%. The middle age group (aged 40-44) will display a steep drop of nearly 30%, but the number of persons of retirement age will show a marked increase. For example, the number of persons aged 70-74 will almost double. Aging of the population may well be assumed to have an effect on energy consumption. In this respect *the influence of cohorts will be among the items for consumer-specific examinations*, in other words, how households reaching retirement age retain the consumer habits learnt during their working years.

6.1.2. Forecasting the number of household-dwelling units and households

Senior Researcher Markku Lankinen of Helsinki town has devised a programme for forecasting the number of household-dwelling units permitting closer examination of the effects of changes in the total population on future age and household-dwelling unit structures (Lankinen 1992). This programme is founded on the population forecast of Statistics Finland, data on changes in the family structure, and the trend in the number and structure of household-dwelling units. It thus adopts a bystander perspective similar to population forecasts in general, but it has, built into it, potential variations concerning either change in the total population or the annual net immigration in the forecasting period.

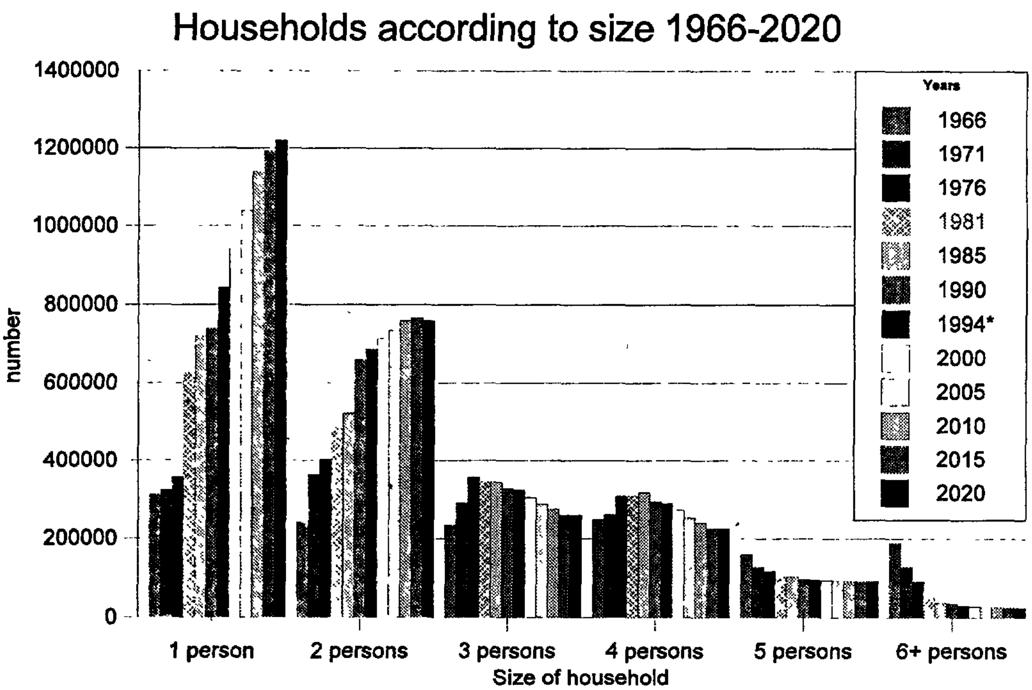
Lankinen's model can be used to examine the effects of the economic trend on the number and structure of households. There are a number of indicators based on the process by which household-dwelling units are formed. This process is influenced by, for example, a) the number of children under the age of 18 living at home, b) the number of persons living in an institution or hostel and sub-tenants who would potentially like a home of their own. The economic status of private households primarily, through e.g. their employment situation, affects the chances these groups have of moving into a home of their own, either alone or with someone else. More generally, the economic situation affects the building, sale, renting, etc. of dwellings. In the model it is possible to set a target level for the proportion of the said groups that will over a given period move into their own homes.

Lankinen's model for forecasting the need for dwellings yields a relatively good means of combining the trends in economic change with changes in household-dwelling units and the number of dwellings. It thus serves as a good link between the population and households in numerous different situations.

Using Lankinen's model it is easy to calculate various alternatives. By way of experiment, the total population and the number of household-dwelling units were calculated for the year 2020 using this model, and assuming marked immigration and emigration. The net change in the Finnish population (about 5 miljon) could be either +380,000 (+8%) or -220,000(- 4%) compared with the basic alternative by the target year 2015. At the level of households level this means about 100, 000 (5%) households more or less than in the base model were estimated.

There will in any case be far more household-dwelling units consisting of only one or two persons than there are at present. The number of singles may even double. This, of course, means that the advantages of a large household in energy and other consumption will decrease in proportion to the increase in small households. (See Nurmela 1993b). The number and structure of the consumer units are of crucial importance in estimating the Finns' future energy consumption.

Figure 2: *Households according to size 1966 - 2020*



The trend bas been obvious. The number of households is growing all the time, while the average size is rapidly decreasing. There are undoubtedly many factors accounting for this, among the most important probably being the rise in the standard of living and the lower number of children in families. Judging from the forecasts for the trend in family types, the number of families with children can be expected to decrease steadily at least until the year 2020, even allowing for single-provider families.

Finland, like many other countries in Europe, witnessed the emergence of big age groups with the baby boom following the Second World War. Their life cycle has, as is widely known, brought about some far-reaching changes in society, such as an increase in places in education, mass migration into the towns and, in Finland, also mass emigration to Sweden in the late 1960s and early 1970s. Right now the big age groups represent "a pensions bomb" that will "explode" in the years 2010-2020.

As regards energy consumption, the main stages affecting households are, firstly, the setting up of a home, the birth of a child or children, the children's leaving home, and retirement. There is clear proof from earlier studies that these stages in life cycle also affect the consumption of energy. The total energy consumption of, for example, a Helsinki old-age pensioner with no car is only about 45% of that of the average Finnish household. On the other hand, the Helsinki family of 3-4 members with a car and children over the age of 13 consumes 70% more energy than the average household. The gap between both example households and the average household grew between 1981 and 1990. (Nurmela 1993b) Allowance must, therefore, be made in the energy consumption forecasts for such household life cycle factors, even though the differences can be expected to level off, since the incomes of persons retiring are rising all the time and the age-specific differences in consumption habits would also appear to be growing smaller. The traditional concepts of what grandfather or grandmother can or may do have for the most part vanished.

6.2. Example calculations of households' future energy consumption

Here now are two example calculations on the future transportation-related energy consumption and the household electricity demand.

6.2.1. The effect of the age structure on the accrued transport-related energy consumption of households

This section examines how the energy consumed by households' use of a private car (a apart of the direct energy consumption) and public transport and through holidays abroad (parts of the indirect energy consumption) will change up to the year 2020. The analysis is based on the household size-structure forecast made above adjusted in the case of one- and two-person households by the age-structure distribution (see Table (1)). We can thus effectively demonstrate the significance of the life cycle of the big age groups on the demand for energy, because they will be reaching retirement age during the period under examination. Transportation serves as a good example because research has shown that the use of a private car is strongly age- and family stage-specific. Young one- or two-person households use their cars about three times as much in a year as pensioner households (Nurmela 1990).

The tendency of different types of household to use energy for transportation is based on the figures calculated for 1990. The aim is to determine first how households' accrued energy consumption would change, if it was affected only by the structural changes in households, but the average consumption did not change. Finally we shall take a look at the changing group-specific consumption tendencies.

Table (1) summarises the results of the calculations. The first column shows the types of household used in the calculations. The next two columns state the numbers of such households in 1990 and 2020. The forth column gives the accrued transportation-related energy consumption for each type of household in 1990, estimated from a study made in 1990. The next two columns give the total transportation-related accrued energy consumption for different types of household in different years, and the final column compares the overall change in the accrued energy consumption of households of different sizes between 1990 and the year 2020.

***Table 1:** Estimates for households' accrued transportation-related energy consumption in the years 1990 and 2020 according to size of household, calculated according to the average energy consumption in 1990*

Household type	Number of		Average energy	Energy consumption,		Difference 1990 -
	1990	2020		1990	2020	
1 person age -35	153.6	140	47.2	7249	6608	
1 person age 35-59	230.7	145	36.8	8492	5336	
1 person age 60-	355.5	935	18.6	6613	17391	
1 person total	739.8	1220		22 353	29 335	+7000
2 persons age -30*	125.7	80	91.7	11522	7336	
2 persons age 30-64	373.4	100	36.8	31218	8360	
2 persons 65-	159.7	580	333	5321	19331	
2 persons total	658.7	760		48062	35027	-13035
3 persons	327.2	260	96.4	31543	25064	-6479
4 persons	294.2	225	113.0	33246	25425	-7821
5 persons	97.3	92	144.5	14064	13294	-770
6+persons	36.3	26	144.5	5249	3757	-1492
Total	2154	2613	4200	154517	131902	-22615

** household-unit according to age of head of household*

According to the table, the total energy consumed on motoring, public transport and holidays abroad will increase only in the case of one-person households over the period under review, assuming that the average consumption tendencies remain at the level of 1990 and the number of households changes as assumed in the previous section. The significance of the change in age structure would indeed be considerable over the period under examination, because households' total energy consumption on transportation would fall 15 per cent.

The consumer habits related to the age and size structure of households may have a very significant effect on the demand for energy, especially at the stage when, for example, the big age groups proceed to a new stage of life cycle. Using this basic calculation it is possible to begin debating the factors influencing the average consumption. These factors can be classified into two groups. On the one hand we must estimate how, in the case of Finland, the use of a car and travelling by aging households in particular will change as new cohorts reach retirement age. Will they retain the habits they have acquired during their working lives, or will there be any strong cultural and social norms that will alter their behaviour to resemble that of previous pensioner cohorts? The crucial factors will then include motoring and tourism, both of which are energy-intensive. One side of the coin is thus forecasting the shift in consumer tendencies as birth cohorts grow older. The other side is deciding how the car and air travel technology will change during the period under examination. For example, can the energy efficiency of cars (litres/personkm) increase so much that it will compensate for the probable growth in pensioners' use of cars so that the above assumption on the average transportation-related energy consumption remains unchanged, or could it even fall?

Further, interesting information on these matters may be obtained by seeking analogies might be comparison of households with different income levels but at the same stage of life cycle, because the pensioner cohorts of the future will probably have higher incomes than the present ones. A level of income adjustment should then be made in the forecasts for the transportation-related energy consumption tendency, followed by an assessment of the effects of a change in technology.

There is unfortunately not enough space to undertake such experiments in the present context, but the example has no doubt demonstrated that socio-demographic factors are of major significance in forecasting.

6.2.2. The future household electricity demand and change in the number of domestic appliances

This section draws on the data on household electricity consumption calculated according to size of household and domestic appliances for 1981, 1985 and 1990 and the above forecasts for the number and structure of households. The main perspective in making the example calculations is analysis of the effects of trends in domestic appliances and of the size of the household. It is assumed that the size of the household affects the use of least some of the appliances, and that the range of appliances changes at different rates in households of different sizes. (See Nurmela & Ollila 1993)

Table 2 was compiled on the assumption of how households' basic appliances will grow from 1990 to the year 2015. The number of appliances, and how many more appliances one- and two-person households will purchase, are extremely important as regards the future household electricity demand.

Table 2: *The number of households in 1990 and 2015 estimated according to the size of the household and the range of appliances (per cent)*

Size of households	Year	Range of appliances by the level of equipment* (per cent)											Households in thousands
		1	2	3	4	5	6	7	8	9	10	11	
1 person	1990	2	22	16	14	24	3	1	2	10	3	4	735.5
	2015		**5**	**10**	**10**	**15**	**20**			**0**	**30**		1193
2 persons	1990		5	8	7	36	11	1.0	1.0	15	13	3	658
	2015				**5**	**40**	**5**			**25**	**25**		765
3 persons	1990		1	3	3	29	29	1	1	13	25	3	327.5
	2015					**10**	**40**			**10**	**40**		260
4 persons	1990			1	1	17	32			7	38	3	294.5
	2015					**10**	**40**			**5**	**45**		225
5 persons	1990					17	36			4	38	0	98.1
	2015						**40**				**60**		92
6+ persons	1990					14	41			3	39	0	36.2
	2015						**30**				**70**		26

* Level of equipment.

1 = Not even a refrigerator
2 = Refrigerator, but not freezer or washer
3 = Refrigerator and freezer, but no washer
4 = Refrigerator and washer, no freezer
5 = Refrigerator, washer, freezer, no dishwasher
6 = Refrigerator, washer, freezer, dishwasher
7 = Electric sauna stove and level 3
8 = Electric sauna stove and level 4
9 = Electric sauna stove and level 5
10 = Electric sauna stove and level 6
11= unknown

As can be seen from Table 3, the average consumption of household electricity will clearly rise as the number of appliances increases, regardless of the size of the household. There will be a shift to the right of the table. One particularly Finnish feature is that many dwellings have an electric sauna stove, which raises the annual household electricity consumption by about 1000 kWh in spite of the other basic appliances are the same. A clear increase in the number of appliances is expected up to the year 2015 (Table 2). The growth estimate for appliances in one-person households is perhaps conservative.

***Table 3.** The average household electricity consumption (kWh) in 1990 according to the size of the household and its domestic appliances*

Size of households	Range of appliances by the level of equipment*										
	1	2	3	4	5	6	7	8	9	10	Average
1 person	.	1720	1341	2227	2631	3484	..	3942	3924	4981	2541
2 persons	..	2002	2104	3227	3586	4602	..	4343	4717	5704	4078
3 persons	..	..	2716	4319	4316	4770	..	..	5641	5887	4996
4 persons	..	..	3916	5515	4740	5434	..	..	5982	6515	5813
5 persons	..	..	..	..	5566	6762	..	..	5604	7526	6885
6+ persons	..	..	..	..	6572	7553	..	..	..	9107	8058
All	1867	1832	1669	2736	3585	5251	2693	3682	4754	6303	4245

..= too few cases
*Code of the level of equipment look Table 2 footnote

Table 4 is the result of the appliance estimates for the year 2015 given in Table 2 and the average consumptions for 1990 stated in Table 3.

***Table 4:** The estimated energy demand of Finnish households in the year 2015 according to the size of the household and the average consumption in 1990, calculated in different ways (in GWh).*

The way of calculations	Size of households						
	1 person	2 persons	3 persons	4 persons	5 persons	6+persons	Total
Change in the number of households only	3003.4	3127.8	1299.0	1307.9	633.4	206.7	9578,2
Change in the range of households' appliances too	4081.0	3398.7	1367.7	1322.7	662.5	221.7	11054,3

Lack of space prohibits a detailed presentation of all the calculations and we must confine ourselves to an evaluation of the final results. The aim is to compare the results yielded by different calculation methods for the year 2015. The differences in the household electricity demands yielded by different calculation methods stated.

Case 1. The average household consumption does not change. The consumption is the number of households in the year 2015 multiplied by the average consumption in 1990. **Result 10 974.6 GWh**

Case 2. The calculation is based on the change in the number of households of different sizes up to the year 2015 and the average consumption by each type in 1990. **Result 9 578.2 GWh**

Case 3. An estimate is made of how the change in the range of domestic appliances may affect the consumption of household electricity within the different household size groups too. **Result 11 057.0 GWh**

The consumption of household electricity in 1990 was about 8 050 GWh.

The estimated consumption varies from 9 578 to 11054 TWh, depending on how it is calculated. In other words, allowing for a decrease in household size only, the estimate for the year 2015 would be about 13% less than the estimate also allowing for a rise in the number of appliances. In this case it cannot be assumed that the age structure of one- and two-person households will cause a similar structural downward trend in consumption as in the case of transportation, because the use of household electricity is not at least as strongly age-specific as transportation. The opposite may even be assumed: that the time spent at home will increase with age, and so therefore will the use of household electricity.

The calculations in the tables thus make an approximate allowance for the effect of a growing range of basic appliances and, in the case of Finland, the role played by electric sauna stoves, but it also incorporates a strong assumption that there will not be any more appliances raising the consumption of household electricity over the next 25 years in excess of the improved energy efficiency of the existing basic appliances and/or the reduction in use tendencies. Such investigations are essential for research but cannot be undertaken in the present context.

7. DISCUSSION

The analysis of the structure of households and their stage of life has sought to demonstrate that these must be taken into consideration in order to permit a reliable forecast of households' future energy consumption. The more consumption depends on life-stage or age-specific customs and habits, the more carefully these forecasts must be made. In these cases a model founded solely on a technical perspective and examining only the number of appliances and those age structures may give erroneous assessments. Such errors can at least be reduced by the methods presented here. It would at some stage seem essential to make a closer comparison between models based on the technical perspective and those oriented towards consumer behaviour, especially from the futurological point of view. The examination of historical changes does not face the same sorts of problems as forecasts of the future, in which the conclusions drawn may lead to the execution or rejection of investments affecting energy production.

Another important observation is that allowance can, in estimating the trend in the number and structure of households, be made for not only demographic change factors but also, by using economic factors, for a forecasting model constructed on the basis of factors connected with the formation of household-dwelling units.

Whatever the case, it must always be humbly admitted in estimating future trends that the forecasts are no more than enlightened guesses at possible future developments.

8. ACKNOWLEGMENTS

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