

Executive summary

Residential end-use electricity demand: Development over time

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In recent years, there has been a great deal of debate about end-use energy consumption in Norway. One question is to what extent Norwegian residential electricity consumption for different end uses varies over time. We deduce a model for using cross-sectional data for total annual electricity consumption for a sample of households, together with information from energy surveys, to estimate the end uses within an econometric demand model conditional on appliance ownership. By applying a consistent method to Norwegian data for 1990, 2001 and 2006 (repeated cross-sections) we compare results over time and detect possible trends.

Residential electricity consumption is very heterogeneous, and several variables are important in relation to explaining both total electricity consumption and the different end uses. These explanatory variables vary both between households and over time. Explanatory variables for electricity consumption and electricity for different end uses include electricity prices, prices of other energy goods, outdoor temperature, technology, income, policy measures, efficiency, appliance ownership and other household characteristics. In this paper, we study the importance of different explanatory variables to households' electricity consumption for different end uses over time, with particular focus on electrical appliances.

Our results show that electricity consumption for many of the estimated end uses varies somewhat from year to year. While the temperature-corrected share of *electricity* consumption for heating varies between years, we find that the temperature-corrected share of *energy* consumption used for heating Norwegian residences is quite stable for the years 1990, 2001 and 2006. One explanation of this could be the good substitution possibilities between energy types for heating in Norwegian homes. Other end uses, such as washing, drying and refrigeration, are also relatively stable. While end use for necessities, like heating and washing, is quite stable, we find that the end use including newer electronic equipment increases over time. Examples are smart phones,

smart TVs, laptops, tablets and kitchen equipment. Many of these appliances are luxury goods, and, as household income increases, such end uses increase more than necessity goods. This is confirmed by our results as the end use containing luxury goods increase more than the mean household income. Our results show no clear trend as regards the consumption of electricity and other types of energy for heating. Since 1990, the use of oil/paraffin for heating purposes are reduced, but the substitution possibilities in residential energy consumption still seem to be high (the use of wood is very common). The next few years will see a further phasing out of the use of oil in Norwegian homes (regulated by the government). Furthermore, since 2006 there has also been a huge increase in the use of air-to-air heat pumps, and they are now very common.

Current and future policy measures used to increase energy efficiency and the consumption of renewable energy form the political background to the interest in end-use consumption. A range of instruments have been used: taxes on electricity and fuel oils; government subsidies for investing in more clean-burning wood stoves, pellets stoves, heat pumps and heating control systems; and a variety of softer policy measures, such as information campaigns and energy labeling. The EU has also adopted an integrated energy and climate policy aimed at cutting greenhouse gas emissions, increasing energy efficiency and increasing the renewable share, all by 20 per cent by the year 2020. To analyze the effect of past and future policies it is important to know the amount of electricity used for different purposes and whether and why changes have taken place over time.