ABSTRACT

The project HEAT.AT investigates the impact of climate change on heating and cooling energy demand in Austria by a bottom-up approach. An economic valuation of the effects is carried out based on detailed building simulations and a regionalized climate scenario. In a first step of the project, ten specific buildings which are representative of the current buildings stock (different size, construction period, energy standard and building utilization) are selected. Reference buildings' energy use and its sensitivity to changes in temperature and solar radiation are calculated according to the Austrian implementation of the European Building Directive (EPBD). Baseline calculations are done for the climate normal period 1971-2000 and consider differences in regional climate conditions due to different altitudes (100m to ~1500m) and climate regimes (atlantic-maritime vs. mediterranean vs. continental influence). Then, a climate change signal is incorporated using the delta method to avoid the inclusion of systematic errors in the climate model. Temperature and global radiation changes in the period 1981/90 to 2041/50 are taken from reclip:more (Loibl et al., 2007), a regional climate scenario for the Alpine region with a maximum resolution of 10x10 km. Economic analyses of the resulting changes in heating and cooling costs (current price levels and technologies) are based on the direct cost method and are carried out both for individual buildings and on the aggregate level. Aggregation is done using detailed information on the spatial distribution of the Austrian building stock.

Results indicate for all building types a substantial shift from heating to cooling energy demand However, the extent of the effect heavily depends on building type, climate regime and altitude. A 1.6 to 2.9 °C warming (dependent on month and region), as indicated by the regional climate scenario, leads to 20 to 35 percent decrease in heating energy demand. A stronger absolute decline is shown for buildings with low thermal insulation. While for the majority of buildings types and regions the decline in heating energy demand is several times higher than the increase in cooling energy demand, the opposite might be true for low energy buildings in the warmer parts of the country (predominantly in the north-east and south-east), and in particular for non-residential building use. As cooling costs per kWh are approximately 1.5 times higher than heating costs, analyses change respectively compared to simple comparisons of final energy demand. For average Austrian climate conditions the ratio between decreased heating costs and increased cooling costs ranges from 15:1 for single family dwellings with low thermal insulation to 1:1.3 for office buildings with high thermal insulation. Altogether, calculations show that for the current building stock the warming under the scenario (~2.2°C) would result in a decrease in heating costs by approximately 500 million €/a and an increase in cooling costs by approximately 80 million €/a.