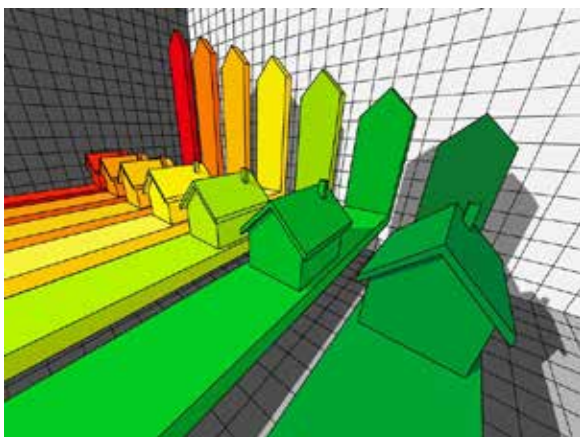


Residential heating and cooling

Figure 1 Residential space heating and cooling demand in Japan is high



Source: IGES stock image.

In 2010, residential heating and cooling energy demand was about 133 TWh/year, which is roughly a quarter of the total residential energy consumption. The Japanese climate requires that homes have both heating and cooling facilities. Consequently the ownership rate of air conditioners in households is as high as 90% (2011 estimates) (EDMC, 2013).

The Japan 2050 Low Carbon Navigator considers

several factors that critically affect household heating and cooling energy use. These levers vary significantly across the four levels. These levers and their levels settings are explained below.

Installation of Home Energy Management System (HEMS)

HEMS is a networked system that helps manage the residential power supply to reduce energy consumption (Umer et al., 2014). Currently the use of HEMS is negligible but it is expected that with proper policies, more households will be equipped with HEMS over time. HEMS also applies to residential hot water supply.

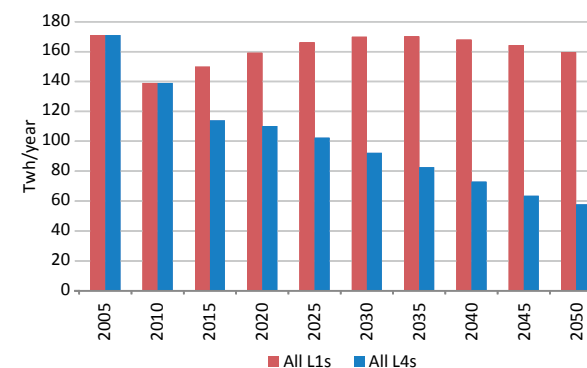
Level 1 assumes that no HEMS is installed in the households and thus no energy demand reduction takes place. **Levels 2, 3 and 4** assume domestic heating/cooling energy demand reduction at 7%, 9% and 10% rates respectively compared to **Level 1**, thanks to progressively higher rate of HEMS installation.

Home insulation

Heating and cooling energy demand is affected by the quality of insulation of the facility concerned. In 2010, about 6% of houses met the current insulation standard set in 1999. More than half of all houses only meet the pre-1980 standard, which is less than

half as energy efficient as the 1999 standard. Under **Level 1**, it is assumed that there will be negligible reduction in domestic heating and cooling through insulation. **Levels 2, 3 and 4** assume progressively increased and more efficient use of insulation, which will lead to 35%, 38% and 40% energy demand reduction respectively in 2050.

Figure 2 Residential heating and cooling energy demand



Note: Society scenario is set at R&D under both all L1s and all L4s scenarios.

Source: Authors.

Home heating/cooling electrification

Under **Level 1**, electrification rate will remain at 2005 levels all the way to 2050. For this level, 50% of heating appliances are electricity-based, and 28% are gas-based with the remaining using kerosene (22%).

For **Level 2**, the proportion of new domestic heating

systems using electricity will increase to 60% in 2050. This share will further increase to 70% and 80% under the assumptions in **Level 3** and **Level 4**.

Energy efficiency

For **Level 1**, the coefficient of performance (COP) for heating and cooling air conditioners keep the same level of 2010, and energy efficiency of gas and kerosene boilers remains the same level of 2010. Under **Levels 2, 3 and 4**, COP for heating and cooling air conditioners increases (1.66 times increase for heating air conditioners and 1.95 times increase for cooling air conditioners, compared to 2010 levels) over time up to 2050, but energy efficiency remains more or less the same for gas and kerosene boilers.