

Commercial heating, cooling and hot water supply

Figure 1 Commercial heating, cooling and hot water is heavily dependent on kerosene



Source: IGES stock image.

The Low Carbon Navigator considers eight technologies for heating and six technologies for cooling in the commercial sector. In 2005, more than 80% of commercial heating was supplied from kerosene boilers, followed by gas boilers (15%) and packaged air conditioners (3.7%). Predominant appliances for cooling were gas-based absorption refrigerators (54%) and packaged air conditioners (30%). For water boilers, the predominant appliances were conventional kerosene (53%) and gas boilers (42%) (NIES, 2014).

Factors that are taken into consideration in the Japan 2050 Low Carbon Navigator as affecting commercial energy use for heating, cooling and hot water supply are energy service demand, building insulation, and choice of appliances.

Floor space for commercial activities

Commercial energy use is directly related to the amount of floor space in use for commercial activities. This is affected by Japan's economic activities. The social scenarios (R&D, MIJ, SB, RI, and Share Society), which are reflected in the top lever of the Low Carbon Navigator, allows for selection from among various levels of economic growth and industrial activities. In the R&D scenario, commercial floor space requirement shows a very

slow decreasing trend, going down from 1834 million m² in 2010 to 1789 million m² in 2050. In MIJ scenario, it increases to 1980 million m² in 2050. In SB scenario, the requirement increases to 1901 million m², whereas in RI scenario, it decreases to 1646 million m². Finally, in the Share scenario, it is assumed that there will be a sharp decline to 1386 million m² in commercial floor space.

Energy service demand per floor space

Level 1 assumes that in 2050, energy service demand per floor space for heating, cooling and hot water generation increases by 20% compared to 2010 level. This increased rate is relatively small for **Level 2**, i.e. only 10% compared to 2010 level. Under the assumptions in **Level 3**, energy service demand per floor space remains the same in 2050 as 2010 levels. Finally, **Level 4** assumes that energy service demand per floor decreases by 20% compared to 2010 levels.

Building insulation

Heating and cooling energy demand is affected by the quality of insulation of the facility concerned. **Level 1** assumes that there are negligible reductions in commercial heating and cooling through insulation. **Level 2** assumes a 20% reduction in heating and cooling demand through insulation in 2050. A higher reduction rate is assumed under **Levels 3** (42%) and **Level 4** (44%).

Choice of appliances

Choice of appliances is assumed to vary significantly across the levels, with low to high degree of shifts from carbon-intensive to low-carbon technologies.

Level 1: The share of electric heating air conditioners (central and packaged) will increase from 3.7% in 2005 to 12% in 2050. For cooling, heat pumps will account for 18% of total appliances, up from 3% in 2005. Additionally, the use of energy efficient boilers for hot water will also increase, which will hold 20% share in 2050 compared to zero in 2005.

Level 2: At this level, the share of air conditioners for heating will rise even more, reaching 16% in 2050. Similar trend will be seen for heat pumps for cooling and energy efficient boilers for hot water, with their shares reaching 22% and 30% respectively in 2050.

Level 3: The increasing trend of air conditioners for heating, heat pumps for cooling, and energy efficient boilers for hot water continue in level 3. Their shares reach 20%, 26% and 40% respectively in 2050.

Level 4: At this level, the share of air conditioners for heating reaches 24%, while heat pumps for cooling holds 30% share. In case of hot water supply, energy efficient boilers become predominant, holding 50% of the total share.

Table 1 Choice of appliances in 2050

Choice of appliances in 2050						
Space heating appliances						
Code	Mode	2005	1	2	3	4
ELECTRICITY	Central Electric air conditioner	0.0%	6.0%	8.0%	10.0%	12.0%
ELECTRICITY	Package Air Conditioner	3.7%	6.0%	8.0%	10.0%	12.0%
KEROSENE	Absorption Refrigerator	0.0%	7.0%	8.0%	9.0%	10.0%
GAS	Absorption Refrigerator	0.0%	7.0%	8.0%	9.0%	10.0%
KEROSENE	Heat pump	0.9%	6.0%	7.0%	8.0%	9.0%
GAS	Heat pump	0.0%	6.0%	7.0%	8.0%	9.0%
KEROSENE	Kerosene boiler	80.3%	25.0%	22.0%	20.0%	15.0%
GAS	Gas boiler	15.1%	37.0%	32.0%	26.0%	23.0%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
Cooling Appliances						
Code	Mode	2005	1	2	3	4
ELECTRICITY	Central Electric Air Conditioner	0.0%	30.0%	28.0%	26.0%	24.0%
ELECTRICITY	Package Air Conditioner	29.5%	30.0%	28.0%	26.0%	24.0%
KEROSENE	Absorption Refrigerator	13.3%	11.0%	11.0%	11.0%	11.0%
GAS	Absorption Refrigerator	54.3%	11.0%	11.0%	11.0%	11.0%
KEROSENE	Heat pump	2.0%	9.0%	11.0%	13.0%	15.0%
GAS	Heat pump	1.0%	9.0%	11.0%	13.0%	15.0%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%
	Subtotal (excl. Elect)	71.0%	40.0%	44.0%	48.0%	52.0%
Hot Water Supply						
Code	Mode	2005	1	2	3	4
ELECTRICITY	Heat Pump	0.0%	0.0%	5.0%	10.0%	20.0%
KEROSENE	Energy efficient Kerosene boiler	0.0%	10.0%	15.0%	20.0%	25.0%
GAS	Energy Efficient Gas Boiler	0.0%	10.0%	15.0%	20.0%	25.0%
ELECTRICITY	Electric Boiler	5.0%	5.0%	5.0%	5.0%	5.0%
KEROSENE	Conventional Kerosene Boiler	53.0%	30.0%	20.0%	15.0%	10.0%
GAS	Conventional Gas Boiler	42.0%	45.0%	40.0%	30.0%	15.0%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Authors.