

Electricity Saving Potential of LED Lighting

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LED (light emitting diode) light consumes one-eighth of the electricity consumed by incandescent light for creating the same brightness and has attracted attention as one of the future means of energy conservation. Lighting accounts for 16% of Japan's total electricity consumption, indicating that LED lighting's electricity saving potential is great. If all lighting in Japan is switched to LED lights, electricity savings are estimated to total 92.2 terawatt hours, amounting to 9% of Japan's total electricity consumption. The switch is expected to cost a total of about 16 trillion yen. But a switch from incandescent lamps to LED lamps can recover initial investment costs in one or two years. The introduction of LED lighting, including a switch from incandescent lamps to LED lamps, can be implemented immediately and greatly benefit the national economy. The expansion and enhancement of central and local government measures for supporting the introduction of LED lamps are important for their further diffusion. Since ordinary households are sensitive to initial costs, for example, eco-point and other discounting measures would be effective for the LED lamp diffusion. As for businesses, energy conservation tax incentives and subsidies to alleviate investment burdens may be effective for the LED diffusion.

1. Electricity saving potential

Annual electricity consumption for lighting in Japan totals 150.6 TWh, accounting for 16% of total electricity consumption, including 38.2 TWh for the residential sector (13% of residential consumption), 89.1 TWh for the commercial sector (33% of commercial consumption), and 23.3 TWh for the industrial sector (6% of industrial consumption).

The replacement of all incandescent, fluorescent and high-intensity discharge lamps with LED lamps¹ is estimated to cut electricity consumption by 92.2 TWh, amounting to 61% of annual electricity consumption for lighting. The amount is equivalent to about 9% of Japan's total electricity consumption. A potential electricity consumption cut comes to 24.1 TWh for the residential sector (8% of residential electricity consumption), 54.5 TWh for the commercial sector (20% of commercial consumption), and 13.6 TWh for the industrial sector (3% of industrial consumption).

LED lighting's electricity saving potential at 92.2 TWh amounts to electricity generation by 13 nuclear reactors (13 GW) or by 88 GW of photovoltaic plants with lower capacity utilization rates.

¹ No component or labor is required for switching from incandescent lamps to LED ones. But some labor and tools could be required for switching from fluorescent lamps to LED ones.

Chart 1 Number of bulbs/lamps in use at present (estimates)

	Residential sector	Commercial sector	Industrial sector	Total
Fluorescent lamps	460 million	420 million	150 million	1,030 million
Compact fluorescent lamps	150 million	60 million	-	210 million
Incandescent lamps	250 million	80 million	-	340 million
HID lamps (e.g., mercury lamps)	-	10 million	10 million	20 million
Total	870 million	580 million	160 million	1,600 million
Electricity consumption	38.2 TWh	89.1 TWh	23.3 TWh	150.6 TWh

Note: LED lighting has just begun to diffuse. Present LED lamps consume little electricity and are excluded from the above estimates.

Chart 2 Lighting electricity consumption savings by sector

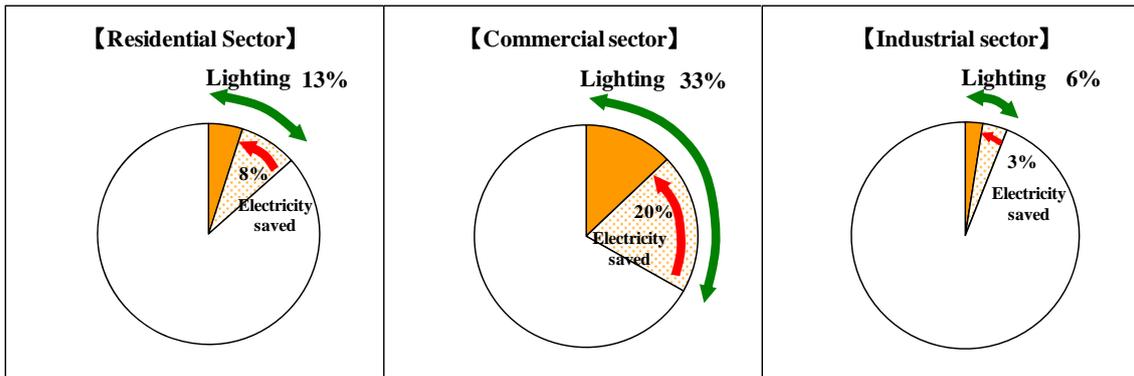
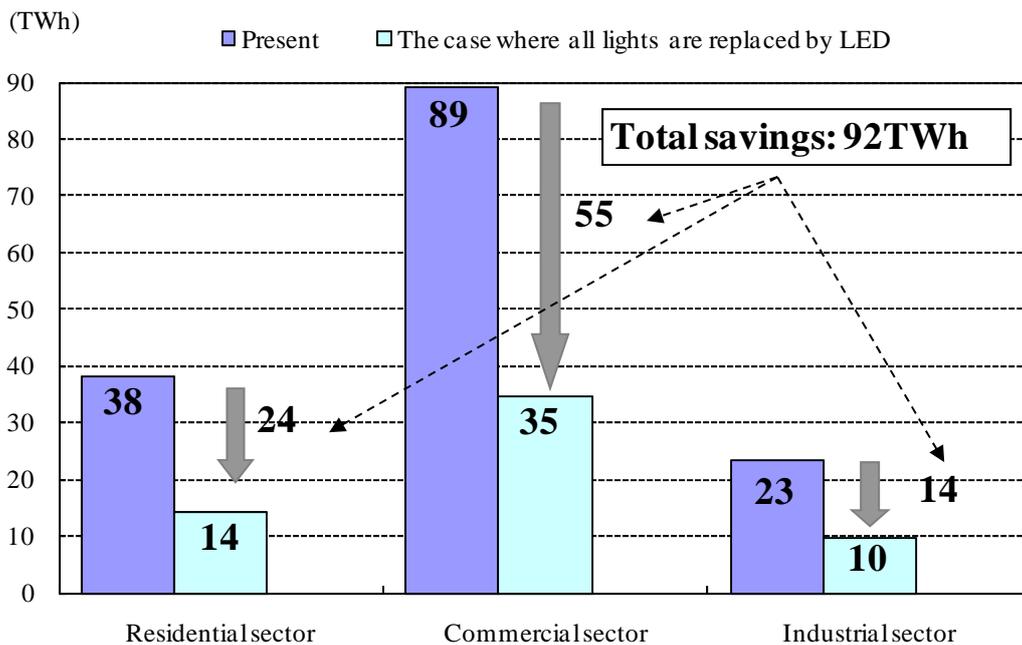


Chart 3 LED Lighting's maximum electricity saving potential



2. Introduction cost

The biggest problem with LED lighting is cost. Even LED bulbs with falling prices still cost 2,000 to 3,000 yen each, against some 100 yen for an incandescent bulb and 1,000 to 1,500 yen for a compact fluorescent lamp. Fluorescent-type LED (straight tube) lamps and LED lighting tools cost more.

Cost for switching to LED lighting may be reduced in the future. Based on the present costs, a total switch to LED lighting is estimated to initially cost 15.7 trillion yen. The costs include 9.6 trillion yen for replacing straight-tube fluorescent lamps with LED lamps, 3.5 trillion yen for replacing circular fluorescent lamps, 1.8 trillion yen for replacing HID lamps and 850 billion yen for replacing incandescent lamps.

But a switch to LED lighting can lower electricity charges. An LED lamp's service life is as long as 40,000 hours (11 years if it is used for 10 hours daily), against 1,000 hours for an incandescent lamp and 10,000 hours for a fluorescent lamp, bringing about future replacement cost savings. Therefore, one may be able to recover the cost for a switch from a straight-tube fluorescent lamp to an LED lamp in some 10 years and that for a switch from an incandescent lamp in some 17 months.

The electricity saving cost, which is estimated by dividing the initial cost by the total electricity savings for 40,000-hour use, stands at 1.3 yen per kilowatt hour for a switch from incandescent lamps and 14 to 17 yen/KWh for a switch from others. On average, the electricity saving cost is 9.2 yen/KWh. It is far lower than the 40-50 yen/KWh in photovoltaic power generation cost.

Chart 4 Initial costs for LED introduction and number of years for recovery of costs

	Japan's total number of lamps for replacement	Price per lamp	Total initial costs (yen)	Number of years for recovery of initial costs	Electricity savings (TWh/year)	Electricity saving cost ^{*2} (Yen/KWh)
Incandescent bulbs ⇒LED bulbs	340 million	2,000-3,000 yen	0.8 trillion	1 year and 5 months	27.3	1.3
Fluorescent lamps (straight tube) ⇒LED lamps (straight tube)	690 million	10,000-25,000 yen ^{*1}	9.6 trillion	9 years and 11 months	49.7	14.0
Fluorescent lamps (circular) ⇒LED lamps	350 million	7,000-15,000 yen	3.5 trillion	18 years and 6 months	6.8	14.7
HID lamps ⇒LED megalights	20 million	100,000 yen ^{*1}	1.8 trillion	10 years and 11 months	8.4	16.7
Total	1,600 million	—	15.7 trillion	—	92.2	9.2

*1 Including instrument exchange and other labor costs for installation

*2 For 40,000-hour use

The electricity saving potential of LED lighting is very great. If the supply side were to provide the volume of electricity corresponding to the savings, there would be power generation cost, safety and other problems. The introduction of LED lighting, particularly a switch from incandescent lamps to LED lamps, can be implemented immediately and benefit the national economy greatly. Some Western countries have launched programs to provide compact fluorescent lamps and other energy-saving lamps free of charge. In Japan, the government asked lamp makers in 2008 to terminate incandescent bulb production by 2012. In response, major lamp makers have already ended production of some incandescent bulbs in a voluntary manner.

While a switch from incandescent lamps to LED lamps is expected to accelerate, central and local governments have implemented various measures to support the introduction of LED lamps as highly efficient instruments in consideration of the high introduction cost. These measures may have to be expanded and enhanced to further promote the diffusion of LED lighting. Since ordinary households are sensitive to initial costs, for example, eco-point and other discounting measures would be effective for the LED lamp diffusion. As for businesses, energy conservation tax incentives and subsidies to alleviate investment burdens may be effective for the LED diffusion.

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