Lighting

HIGHLIGHTS

PROCESS AND TECHNOLOGY STATUS – Lighting accounts for approximately 19% of all electricity generated worldwide. Global sales of lamps are estimated at 2,913 million units in 2010 and are expected to increase up to 4,661 million units by 2020. Lighting energy consumption can be reduced by energy efficiency improvements to the lighting systems, which are made up of lamps, luminaires and ballasts (the latter for discharge lamps). Key efficiency improvements are associated with the choice of lamp. Major lamp types used in the domestic sector include the traditional (inefficient) incandescent tungsten filament lamps (general lighting service, **GLS**), halogens lamps (**HL**) and the more efficient compact fluorescents lamps (**CFL**). In 2010, GLS and halogen lamps accounted for approximately 72% of market share in the European Union and 84% in the United States (2009). Many countries (e.g. Australia, the European Union, the Republic of Korea) have regulations in force to phase out the use of GLS. In the Republic of Korea, where regulations have been in force for some years, GLS and halogen lamps account (2009) for only 24% of the total units, the rest (76%) being CFLs; in the European Union and in the United States, CFLs account for 28% and 16% of the market share, respectively. In 2007, the global sales of GLS lamps were estimated at 12.5 billion units per year, while the production of CFLs increased by 70% from 2005 to 2007, reaching the level of approximately 3.5 billion lamps in 2007. In the non-domestic sectors (commercial, street lighting), fluorescent tubes comprised approximately 76.5% of light output in 2005 with the remainder being made up of GLS, CFLs, light emitting diodes (**LEDs**) and high intensity discharge (**HID**) lamps, the latter used for street lighting.

PERFORMANCE AND COSTS – The domestic lighting market is undergoing a significant transformation driven by the phase out of GLS lamps that are being replaced by the 50% more efficient halogen lamps and by CFLs, which are up to 80% more efficient and durable. GLS lamps have a typical efficiency of 6 to14 lumens per watt (lm/W) of electrical power absorbed and about 1,000-hour lifetime. More efficient lamps for the domestic market include new infrared coated (**IRC**) halogen lamps with 10 to 30 lm/W efficiency and 2,000 to 8,000 h lifetime, CFLs (35 to 70 lm/W, 6,000 to 15,000 h), and LEDs (25 to 100 lm/W, 12,000 to 50,000 h). New products for non-domestic market include ceramic metal halides (**MH**) with 70 to 107 lm/W efficiency and 6,000 to 20,000 h lifetime, and **T5** fluorescent tubes (38 to 106 lm/W, 16,000 to 48,000 h). CFL lamps cost between €1.5 and €11.4 while halogen lamps cost between €2.0 and €8.0. In the non-domestic lighting market, T5 fluorescent tubes are the most efficient option, with good efficacy level, good colour rendering and appearance. Some HID lamps such as **MH** and high pressure sodium lamps (**HPS**) are mostly used in the commercial non-domestic sector. With efficiencies of 65-130 lm/W and 70-107 lm/W, respectively, they are the most efficient options for street lighting. MH lamps also offer high colour rendering for street lighting. The cost of HPS and MH lamps range from €8.0 to €25.0 and from €11.0 to €50 per unit, respectively.

POTENTIAL AND BARRIERS – The global demand for CFLs has risen significantly over the last decade and will continue to increase over time. In OECD countries, sales could increase from 1.35 billion units in 2010 to 1.6 billion units in 2027. Global demand for halogen lamps is also expected to rise, though at a slower rate. By 2014, LEDs, ceramic MH lamps and T5 fluorescent tubes are expected to emerge as the most efficient lamp types. They are also known as ultra-efficient lamps (UEL) because they can reach efficacies of over 100 lm/W, with good lighting quality and colour appearance (e.g. 2,500-4,000 K). Improvements to luminaire and ballast designs are also likely to occur. Major barriers to the take up of these technologies include the lack of information and customer awareness of efficiency and cost benefits, as well as a certain reluctance to change due to the higher initial (capital) cost. A certain health risk perception associated with the mercury content of CFLs should now disappear with the new CFL generations entering the market.

PROCESS AND TECHNOLOGY STATUS

Lighting accounts for approximately 19% [1] of all electricity generated worldwide. Global sales of lamps are estimated at 2,913 million units in 2010 and are expected to increase to 4,661 million units by 2020 [20]. In 2005, he global consumption for lighting was estimated at 2,650 TWh, or 134.7 petalumen-hours (Plmh) [1]. Today's lighting technologies offer significant potential for electricity savings and greenhouse gas emissions reduction compared to older technologies, which are currently being phased out in most OECD countries.

A lighting system consists of the following components:
- **Lamp,** a light bulb or tube, i.e. the source of light;
- **Luminaire,** a fitting for the lamp; and
- **Ballast,** a device that is required for discharge lamps, low-pressure sodium (LPS) and high intensity discharge (HID) lamps to control the voltage running through the lamp, enable lamp ignition and operation.

Lamp Technologies -. Most common lamp technologies are discussed below.

Incandescent tungsten filament lamps, also referred to as general lighting service (**GLS**) lamps, are the

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