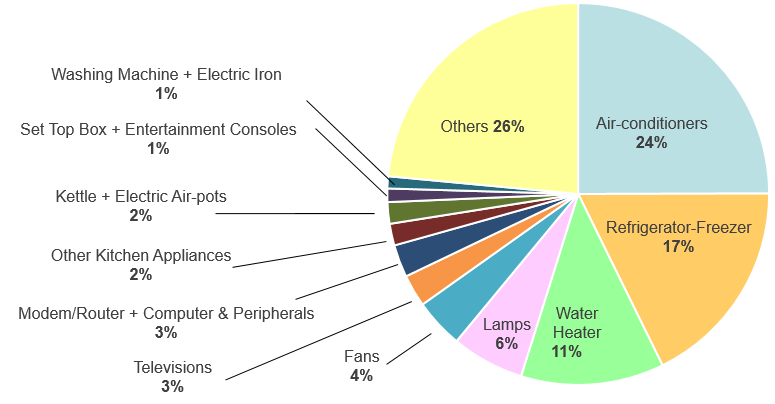
**Annex A**

**Breakdown of Household Energy Consumption**

**Across All Housing Types**



*Source: Household Energy Consumption Study 2017*

**Annex B**

**MEPS for Incandescent, CFLi & LED bulbs**

|  |  |  |
| --- | --- | --- |
| Table 1: Current MEPS for Incandescent, CFLi & LED bulbs | | |
| **Type of Lamps\*** | **Wattage (W)** | **MEPS Cut-off Levels** |
| *Incandescent* | *25 - 200* | *Pmax = 0.8 x (0.88φ + 0.049φ)* |
| Compact fluorescent lamps with integrated ballast (CFLi) | ≤ 60 | Pmax = 0.24φ + 0.0103φ |
| LED Bulbs | ≤ 60 |
| Covered CFLi | ≤ 60 | Pmax|covered CFLi = Pmax|bare CFLi /0.95 |

\**Lamps with Edison screw and bayonet lamp caps, which are designed to be connected directly to the 230V A.C. mains by means of a socket or connector*

Pmax is maximum allowable power consumption

φ is light output in lumen

|  |  |  |  |
| --- | --- | --- | --- |
| Table 2: Life Cycle Costs of Different Types of Lamps | | | |
| **Type of Lamp** | **Inefficient Lamp** | **Energy Efficient**  **Replacement Lamps** | |
| Incandescent  halogen bulb(Tungsten-halogen) | CFLCFLi | LED bulb |
| **Annual Cost [[1]](#footnote-1)** | $11.10 | $3.60 | $3.00 |

**Annex B**

|  |  |  |
| --- | --- | --- |
| Table 3: Proposed Revised MEPS Levels for Incandescent, CFLi & LED bulbs | | |
| **Type of Lamps\*** | **Wattage (W)** | **MEPS Cut-off Levels** |
| *Incandescent* | *25 - 200* | *Pmax = 0.24φ + 0.0103φ* |
| LED Bulbs | ≤ 60 |
| CFLi | ≤ 60 |
| Covered CFLi | ≤ 60 | Pmax|covered CFLi = Pmax|bare CFLi /0.95 |

\**Lamps with Edison screw and bayonet lamp caps, which are designed to be connected directly to the 230V A.C. mains by means of a socket or connector*

Pmax is maximum allowable power consumption

φ is light output in lumen

**Annex C**

Diagram 1: Energy label for lamps (to be affixed or printed on each lamp packaging)



|  |  |
| --- | --- |
| Table 4: Proposed energy rating system for CFLni (G24d lamp cap) and T8 LFL of length 0.5 – 1.5m, and their LED direct replacements | |
| **Tick rating** | **Rated Lamp Efficacy, η** = **φ/P (lm/W)** |
| 3-tick | η ≥ 135 |
| 2-tick | 110 ≤ η < 135 |
| 1-tick | η < 110  where P is the **rated** lamp power   * is the **rated** luminous flux in lumen |

|  |  |  |  |
| --- | --- | --- | --- |
| **Lamp Types** | **CFLni**  [Lamp cap: G24d] | **LFL**  [Dia. 1-inch (T8 lamp)]  0.5 – 1.5m | **LED direct replacement** |
|  | image004 | LED tube |
| **Lamp survival** | 90% at 2,000h | | 95% at 1,000h (Measured)  90% at 6,000h (Declared) |
| **Lumen maintenance** | 80% at 2,000h | | 85% at 1,000h (Measured)  80% at 6,000h (Declared) |

Table 5: Lamp survival and Lumen maintenance requirements

**Annex D**

**Energy Efficiency of Fluorescent Lamp Ballasts**

|  |  |
| --- | --- |
| Table 6: Energy Efficiency Index (EEI) classification system | |
| **EEI Class** | **Description** |
| A1 | Dimmable electronic ballasts |
| A2 | Electronic ballasts with reduced losses |
| A3 | Electronic ballasts |
| B1 | Magnetic ballasts with very low losses |
| B2 | Magnetic ballasts with low losses |
| C | Magnetic ballasts with moderate losses |
| D | Magnetic ballasts with very high losses |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 7: Life Cycle Costs of Different Classes of Ballast | | | | |
| **Type of Ballast[[2]](#footnote-2)** | **Moderate Loss**  **Replacement Ballasts** | | **Low Loss**  **Replacement Ballasts** | |
| **Class B2 Magnetic** | **Class B1 Magnetic** | **Class A3 Electronic** | **Class A2 Electronic** |
| **Life Cycle Cost (LCC)[[3]](#footnote-3)** | $18 | $16 | $9.90 | $15.50 |

**Annex E**

**Fluorescent Lamp Ballasts Not Covered Under Proposed MEPS**

Fluorescent lamp ballasts that are not covered under MEPS are listed below:

1. Ballasts integrated in lamps (e.g. for HID lamp),
2. Ballasts used primarily in D.C. circuits,
3. Ballasts not used primarily for general lighting purposes (e.g. ballasts for exit signs, laboratory, ultraviolet, industrial process applications), and
4. Ballasts for luminaires that are mounted permanently in furniture which cannot be tested independently from luminaires

**Annex F**

**Examples of Acceptable / Non-Acceptable Display of Energy Efficiency Information in Publicity Materials**

|  |  |
| --- | --- |
| **🗹 Acceptable Examples** | |
| **Energy Label displayed such that tick-rating is legible** | **No. of ticks in font same size / larger than main text** |
|  |  |

**Annex F**

|  |  |
| --- | --- |
| **X Unacceptable Examples** | |
| **Energy Label with illegible / obstructed no. of ticks** | **No. of ticks in font smaller than that of other specifications** |
|  |  |

**Annex G**

**Applicable Test Standards**

Table 8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lamp Types** | **CFLni**  [Lamp cap: G24d] | **LFL**  [Dia. 1-inch (T8 lamp)]  0.5 – 1.5m | | **LED direct replacement** |
|  | image004 | | LED tube |
| **Lumen Measurement** | CIE 84 | | | CIE S 025 |
| **Other Performance standards** | IEC 60901 | | IEC 60081 | IEC 62612\* |

\*Only relevant clauses of IEC 62612 apply.

1. Upfront and energy costs are amortized to 1,000 hours, which is equivalent to around 1 year of usage, assuming 3 hours of daily usage. Energy costs are estimated based on average 2017 household electricity tariffs. [↑](#footnote-ref-1)
2. The ballasts are used with a 36W T8 tube. [↑](#footnote-ref-2)
3. Based on 10,000hr of operation which is approximately equivalent to 10 years of operation, assuming 3hr of daily usage, and 2017 average tariff including 7% GST. [↑](#footnote-ref-3)