Life Cycle Assessment for Display Products

**Background**

Samsung has recently performed the life cycle assessment (LCA) of its 55-inch UHD display and 24-inch monitor product to better understand potential environmental impacts may caused from the product through its whole life cycle including; pre-manufacturing; product manufacturing; distribution; product use; and disposal phase. The assessment has been completed according to international standard ISO 14040 series. Samsung has used Simapro7 software and a dedicated LCA S/W database to measure environmental impacts using a wide range of data categories including; Product bill of material (BOM), parts and components logistics, energy consumption in product use and end-of-life scenario data in order to attain the highest level of accuracy. The outcome of the LCA confirmed and quantified 12 potential environment impact categories including; global warming; abiotic depletion; eutrophication; ozone layer depletion and water consumption; where each impact category has been assessed for each life cycle stage. Critical review of this study result was done by an expert from Underwriters Laboratory(UL).

**Calculation basis**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>Ecoinvent 2.2</td>
</tr>
<tr>
<td>Method for impact assessment</td>
<td>Life cycle impact assessment classification and characterization factors according to CML 2001 as provided in the SimaPro 7.1.5 LCA tool</td>
</tr>
<tr>
<td>LCA software</td>
<td>SimaPro 7.1.5</td>
</tr>
</tbody>
</table>

**System boundary of LCA**

<table>
<thead>
<tr>
<th>Pre-manufacturing</th>
<th>Parts and materials constituting the products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>Product assembly by Samsung Electronics</td>
</tr>
<tr>
<td></td>
<td>(Data collection from 3 Plants)</td>
</tr>
<tr>
<td>Distribution</td>
<td>From Mexico/Vietnam/Slovakia/China to America, Europe and Asia countries</td>
</tr>
<tr>
<td>Usage</td>
<td>7 years use</td>
</tr>
<tr>
<td>Disposal</td>
<td>Waste treatment of parts and material</td>
</tr>
</tbody>
</table>
## Product Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>S24E650PL</td>
</tr>
<tr>
<td>Screen Size</td>
<td>24 inch</td>
</tr>
<tr>
<td>Resolution</td>
<td>1920x1080</td>
</tr>
<tr>
<td>Brightness</td>
<td>250cd/m²</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td>178°/178°</td>
</tr>
<tr>
<td>Power Supply</td>
<td>AC 100–240V, 50/60Hz</td>
</tr>
<tr>
<td>Wt.(kg)</td>
<td>12.4 lb. (Product Weight with stand)</td>
</tr>
</tbody>
</table>

## Material Use

- Glass: 16.0%
- Metal: 38.7%
- Other: 12.1%
- PCB: 30.6%
- Plastic: 0.1%
- Paper: 2.4%

## Characterized Environment Impact

- Abiotic depletion
- Acidification
- Eutrophication
- Global warming (GWP100)
- Ozone layer depletion (ODP)
- Human toxicity
- Fresh water aquatic ecotoxicity
- Marine aquatic ecotoxicity
- Terrestrial ecotoxicity
- Photochemical oxidation
- Primary energy demand
- Water consumption

- Raw material(Product)
- Raw material(1st packaging)
- Raw material(2nd packaging)
- Manufacturing
- Distribution
- Use
- Disposal
### Product Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>QM55N</td>
</tr>
<tr>
<td>Screen Size</td>
<td>55 inch</td>
</tr>
<tr>
<td>Resolution</td>
<td>4k UHD (3840*2160)</td>
</tr>
<tr>
<td>Brightness</td>
<td>500 nit (H/V)</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td>178°/178°</td>
</tr>
<tr>
<td>Power Supply</td>
<td>AC 100 - 240 V, 50/60 Hz</td>
</tr>
<tr>
<td>Wt.(kg)</td>
<td>17.4 (Package 23)</td>
</tr>
</tbody>
</table>

### Characterized Environment Impact

- **Global warming (GWP100)**
- **Abiotic depletion**
- **Acidification**
- **Eutrophication**
- **Photochemical oxidation**
- **Ozone layer depletion (ODP)**
- **Fresh water aquatic ecotoxicity**
- **Marine aquatic ecotoxicity**
- **Terrestrial ecotoxicity**
- **Human toxicity**

### Material Use

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic</td>
<td>38%</td>
</tr>
<tr>
<td>Glass</td>
<td>19%</td>
</tr>
<tr>
<td>Metal</td>
<td>31%</td>
</tr>
<tr>
<td>Paper</td>
<td>10%</td>
</tr>
<tr>
<td>PCB</td>
<td>1%</td>
</tr>
<tr>
<td>Others</td>
<td>1%</td>
</tr>
</tbody>
</table>

- Pre-manufacturing(Product)
- Pre-manufacturing(1st package)
- Pre-manufacturing(2nd package)
- Manufacturing
- Distribution
- Use
- Disposal
Life Cycle Assessment for Mobile Products

Background

Samsung has developed strong technical experience in assessing the life cycle environmental impacts of its smart phones. The most recent life cycle assessment (LCA) has been for the Samsung Galaxy S6; Note5; TAB E: J1x; On5x; Tab S2; Tab A 7.0; Note8; Galaxy Book model. The assessment considers potential environmental impacts across the whole life cycle including; pre-manufacturing; product manufacturing; distribution; product use; and disposal phase.

To ensure technical quality; the analysis methodology has been completed according to international standard ISO 14040 series. Samsung has used Simapro7 software and a dedicated LCA S/W database to measure environmental impacts using a wide range of data categories including; Product bill of material (BOM), parts and components logistics, energy consumption in product use and end-of-life scenario data in order to attain the highest level of accuracy. The outcome of the LCA confirmed and quantified 12 potential environment impact categories including; global warming; abiotic depletion; ocean acidification; eutrophication; and ozone layer depletion; where each impact category has been assessed for each life cycle stage. These LCA results will continue to be considered during product development phase as we aspire to improve the environmental specifications of our products.

Calculation basis

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>Database</td>
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<tr>
<td>LCA software</td>
<td>SimaPro 7.1.5</td>
</tr>
</tbody>
</table>

System boundary of LCA

<table>
<thead>
<tr>
<th>Pre-manufacturing</th>
<th>Parts and materials constituting the products and its transportation (from supplier to Samsung factory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>Product assembly by Samsung Electronics (Data collection period : 3 months ahead of assessment)</td>
</tr>
<tr>
<td>Distribution</td>
<td>From China or Vietnam to United States</td>
</tr>
<tr>
<td>Usage</td>
<td>2 years use</td>
</tr>
<tr>
<td>Disposal</td>
<td>Waste treatment of parts and material</td>
</tr>
</tbody>
</table>
Product Features

- **Model name**: SM-W727V (Galaxy Book)
- **Processor**: Intel, Core i5, 3.1GHz Dual-Core 64bit
- **Dimension**: 199.8 * 291.3 * 7.4(H*W*D)
- **Display**: AMOLED, OCTA, SDC, 2160 x 1440 (FHD+) 12.0", 303.7mm 16M
- **Battery**: Li-Ion 5070 mAh
- **Camera**: 13 MP / 5MP
- **Wt.(g)**: 1881.9g

Material Use

- **Polycarbonate**: 23%
- **Paper**: 22%
- **Polystyrene**: 10%
- **LCD module**: 9%
- **Polyester**: 9%
- **Magnesium**: 8%
- **Copper**: 7%
- **Epoxy**: 4%
- **Stainless steel**: 1%
- **Others**: 7%

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Characterized Environment Impact

- **Acidification**
- **Eutrophication**
- **Global warming (GWP100)**
- **Ozone layer depletion (ODP)**
- **Human toxicity**
- **Fresh water aquatic ecotox.**
- **Marine aquatic ecotoxicity**
- **Terrestrial ecotoxicity**
- **Photochemical oxidation**
- **Primary energy demand**
- **Water consumption**
- **Waste Generation**

- **Pre-manufacturing**
- **Manufacturing**
- **Distribution**
- **Use**
- **Disposal**
### Product Features

- **Model name**: SM-N950U (Galaxy Note 8)
- **Processor**: Qualcomm 2.35GHz, 1.9GHz Octa-Core 64bit
- **Dimension**: 162.5 x 74.8 x 8.6 mm
- **Display**: 6.3" 2960 x 1440, 16M In-Cell Touch LCD
- **Battery**: Li-Ion 3300 mAh
- **Camera**: 12 MP / 5MP
- **Wt.(g)**: 186.34g

### Material Use

- **Paper**: 46%
- **aluminium**: 9%
- **Polycarbonate**: 7%
- **Battery**: 7%
- **LCD module**: 6%
- **Copper**: 6%
- **PET**: 5%
- **stainless steel**: 3%
- **Polyester**: 3%
- **Others**: 8%

### Characterized Environment Impact

- **Acidification**
- **Eutrophication**
- **Global warming (GWP100)**
- **Ozone layer depletion (ODP)**
- **Human toxicity**
- **Fresh water aquatic ecotoxicity**
- **Marine aquatic ecotoxicity**
- **Terrestrial ecotoxicity**
- **Photochemical oxidation**
- **Primary energy demand**
- **Water consumption**
- **Waste Generation**

- **Pre-manufacturing**: 80%
- **Manufacturing**: 10%
- **Distributed**: 2%
- **Use**: 8%
- **Disposal**: 0%
### Product Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model name</strong></td>
<td>SM-T280 (Galaxy Tab A 7.0)</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td>Quad-Core</td>
</tr>
<tr>
<td><strong>Dimension</strong></td>
<td>186.9 x 108.8 x 8.7 mm</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>1280 x 800 (WXGA) TFT</td>
</tr>
<tr>
<td><strong>Battery</strong></td>
<td>Li-Ion 4000mAh</td>
</tr>
<tr>
<td><strong>Camera</strong></td>
<td>5.0 MP / 2.0 MP</td>
</tr>
<tr>
<td><strong>Wt.(g)</strong></td>
<td>283 g</td>
</tr>
</tbody>
</table>

### Material Use

- **Plastic (PC)**: 29%
- **Paper**: 14%
- **LCD module**: 25%
- **Battery**: 3%
- **Printed Circuit Board**: 27%
- **Metal**: 1%
- **Others**: 1%

### Characterized Environment Impact

- **Acidification**
- **Eutrophication**
- **Global warming (GWP100)**
- **Ozone layer depletion (ODP)**
- **Human toxicity**
- **Fresh water ecotoxicity**
- **Marine aquatic ecotoxicity**
- **Terrestrial ecotoxicity**
- **Photochemical oxidation**
- **Primary energy demand**
- **Water consumption**
- **Waste Generation**

#### Segments
- **Pre-manufacturing**
- **Manufacturing**
- **Distribution**
- **Use**
- **Disposal**
### Product Features

- **Model name**: SM-T817V (Galaxy Tab S2)
- **Processor**: Octa-Core 1.9 GHz, 1.3 GHz
- **Dimension**: 237.3 x 169.0 x 5.6 mm
- **Display**: AMOLED 10.1"
- **Battery**: Li-Ion 5870mAh
- **Camera**: 8 MP / 2.1MP
- **Wt. (g)**: 379 g

### Characterized Environment Impact

#### Acidification

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Eutrophication

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Global warming (GWP100)

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Ozone layer depletion (ODP)

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Human toxicity

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Fresh water aquatic ecotoxicity

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Marine aquatic ecotoxicity

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Terrestrial ecotoxicity

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Photochemical oxidation

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Primary energy demand

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Water consumption

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

#### Waste Generation

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

### Material Use

- Battery: 0%
- LCD module: 16%
- Metal: 1%
- Paper: 13%
- Plastic (ABS): 15%
- Plastic (PC): 11%
- Plastic (PET): 39%
- Polyester: 0%
- Printed Circuit Board: 0%
## Product Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>SM-G5510 (Galaxy On5x)</td>
</tr>
<tr>
<td>Processor</td>
<td>Quad-Core 1.4GHz</td>
</tr>
<tr>
<td>Dimension</td>
<td>142.8 x 69.5 x 8.1 mm</td>
</tr>
<tr>
<td>Display</td>
<td>LCD 5&quot;</td>
</tr>
<tr>
<td>Battery</td>
<td>Li-Ion 2600 mAh</td>
</tr>
<tr>
<td>Camera</td>
<td>12 MP / 5MP</td>
</tr>
<tr>
<td>Wt.(g)</td>
<td>149 g</td>
</tr>
</tbody>
</table>

## Material Use

- Battery: 16%
- Glass: 19%
- LCD module: 13%
- Metal: 29%
- Paper: 1%
- Plastic (PC): 14%
- Plastic (PET): 7%
- Printed Circuit Board: 1%
- Rubber: 0%

## Characterized Environment Impact

- Acidification
- Eutrophication
- Global warming (GWP100)
- Ozone layer depletion (ODP)
- Human toxicity
- Fresh water aquatic ecotox.
- Marine aquatic ecotoxicity
- Terrestrial ecotoxicity
- Photochemical oxidation
- Primary energy demand
- Water consumption
- Waste Generation

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal
### Product Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>SM-J120A (Galaxy J1x)</td>
</tr>
<tr>
<td>Processor</td>
<td>Quad-core 1.2 GHz</td>
</tr>
<tr>
<td>Dimension</td>
<td>132.6 x 69.3 x 8.9 mm</td>
</tr>
<tr>
<td>Display</td>
<td>AMOLED 4.5&quot;</td>
</tr>
<tr>
<td>Memory</td>
<td>microSD, up to 128 GB</td>
</tr>
<tr>
<td>Battery</td>
<td>Li-Ion 2050 mAh</td>
</tr>
<tr>
<td>Camera</td>
<td>5 MP</td>
</tr>
<tr>
<td>Wt (g)</td>
<td>132 g</td>
</tr>
</tbody>
</table>

### Characterized Environment Impact

![Graph showing environmental impact across different stages of the product lifecycle.](image_url)

### Material Use

- **Battery**: 36%
- **Glass**: 12%
- **LCD module**: 9%
- **Metal**: 13%
- **Paper**: 25%
- **Plastic(PC)**: 4%
- **Plastic(PET)**: 0%
- **Printed Circuit Board**: 0%
- **Rubber**: 0%

![Pie chart showing material distribution.](image_url)
### Product Features

<table>
<thead>
<tr>
<th>Model name</th>
<th>SM-T377P (Galaxy TAB E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Quad-Core 1.2GHz</td>
</tr>
<tr>
<td>Dimension</td>
<td>212.1 x 126.0 x 8.9 mm</td>
</tr>
<tr>
<td>Display</td>
<td>TFT 8.0”</td>
</tr>
<tr>
<td>Memory</td>
<td>1.5GB RAM</td>
</tr>
<tr>
<td>Battery</td>
<td>5000mAh</td>
</tr>
<tr>
<td>Camera</td>
<td>Main : 5M pixel / Front : 2M pixel</td>
</tr>
<tr>
<td>Wt.(g)</td>
<td>Product : 192g / Packaging 259g</td>
</tr>
</tbody>
</table>

### Material Use

- Battery: 27%
- Glass: 15%
- LCD module: 18%
- Paper: 25%
- Plastic(PC): 5%
- Printed Circuit Board: 7%
- Others: 3%

### Characterized Environment Impact

- Acidification
- Eutrophication
- Global warming (GWP100)
- Ozone layer depletion (ODP)
- Human toxicity
- Fresh water aquatic ecotox.
- Marine aquatic ecotoxicity
- Terrestrial ecotoxicity
- Photochemical oxidation
- Primary energy demand
- Water consumption
- Waste Generation

- Pre-manufacturing
- Manufacturing
- Distribution
- Use
- Disposal

- GWP100:
  - Pre-manufacturing: 20%
  - Manufacturing: 15%
  - Distribution: 10%
  - Use: 10%
  - Disposal: 55%
- **Model name**: SM-N920V (Galaxy Note5)
- **Processor**: Octa-Core 2.1GHz, 1.5GHz
- **Dimension**: 153.2 x 76.2 x 7.62 mm
- **Display**: Super AMOLED 5.7"
- **Memory**: 32GB, 4GB RAM
- **Battery**: 3000mAh
- **Camera**: Main : 16M pixel / Front : 5M pixel
- **Wt.(g)**: Product : 192g / Packaging 259 g

#### Characterized Environment Impact

- **Acidification**: 37%
- **Eutrophication**: 17%
- **Global warming**: 10%
- **Ozone layer depletion**: 8%
- **Human toxicity**: 6%
- **Fresh water aquatic ecotoxicity**: 5%
- **Marine aquatic ecotoxicity**: 5%
- **Terrestrial ecotoxicity**: 3%
- **Photochemical oxidation creation**: 14%
- **Primary Energy Demand**: 10%
- **Water consumption**: 5%
- **Waste Generation**: 10%

#### Material Use

- **Battery**: 37%
- **LCD module**: 17%
- **Metal**: 10%
- **Paper**: 8%
- **Plastic(PC)**: 6%
- **Plastic(PS)**: 5%
- **Printed Circit Board**: 4%
- **Others**: 3%

#### Product Features

- **Model name**: SM-N920V (Galaxy Note5)
- **Processor**: Octa-Core 2.1GHz, 1.5GHz
- **Dimension**: 153.2 x 76.2 x 7.62 mm
- **Display**: Super AMOLED 5.7"
- **Memory**: 32GB, 4GB RAM
- **Battery**: 3000mAh
- **Camera**: Main : 16M pixel / Front : 5M pixel
- **Wt.(g)**: Product : 192g / Packaging 259 g
### Product Features

<table>
<thead>
<tr>
<th>Model name</th>
<th>SM-G920V (Galaxy S6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Octa-Core 2.1GHz, 1.5GHz</td>
</tr>
<tr>
<td>Dimension</td>
<td>143.4 x 70.5 x 6.8 mm</td>
</tr>
<tr>
<td>Display</td>
<td>Super AMOLED 5.1&quot;</td>
</tr>
<tr>
<td>Memory</td>
<td>32GB</td>
</tr>
<tr>
<td>Battery</td>
<td>2550mAh</td>
</tr>
<tr>
<td>Camera</td>
<td>Main : 16M pixel / Front : 5M pixel</td>
</tr>
<tr>
<td>Wt. (g)</td>
<td>Product : 138g / Packaging 261 g</td>
</tr>
</tbody>
</table>

### Characterized Environment Impact

- Acidification
- Eutrophication
- Global Warming
- Ozone Depletion
- Human health toxicity
- Freshwater aquatic ecotoxicity
- Marine aquatic ecotoxicity
- Terrestrial ecotoxicity
- Photochemical Smog Formation
- Primary Energy Demand
- Water consumption
- Waste generation

### Material Use

- Corrugated fiber board: 32%
- Plastic(PC): 16%
- Paper: 13%
- Metal: 12%
- Battery: 10%
- LCD module: 6%
- Printed Circuit Board: 6%
- Others: 5%

**Pre-manufacturing** | **Manufacturing** | **Distribution** | **Use** | **Disposal**