ELECTRICITY INFRASTRUCTURE INVESTMENT NEEDS TO SUPPORT THE ENERGY TRANSITION

Workshop Challenges on Energy Transition in Indonesia

Jakarta | 27 September 2022
NET ZERO EMISSION (NZE) SCENARIO ENERGY SECTOR

Consolidated Energy Sector CO2 emissions 129 million tonnes by 2060, 0 for power generation*

Greenhouse gas emission levels to reach NZE by 2060 or sooner

<table>
<thead>
<tr>
<th>Emission per Sector (million ton CO2e) – LCCP **)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Energy</td>
</tr>
<tr>
<td>Agriculture</td>
</tr>
<tr>
<td>FOLU</td>
</tr>
<tr>
<td>IPPU</td>
</tr>
<tr>
<td>Waste</td>
</tr>
<tr>
<td>Net emiss.</td>
</tr>
</tbody>
</table>

Notes:
*) In the process of preparing and coordinating between ministries, international organizations, and bilateral countries
**) Source: LTS-LCCR Ministry of Environment and Forestry

Achieving lower total emissions in the consolidated scenario will need to be supported by international support (financing, studies, etc.)

**Energy Subsector**

<table>
<thead>
<tr>
<th>Energy Subsector</th>
<th>KLHK</th>
<th>NZE</th>
<th>Consolidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powerplants</td>
<td>-66</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Industry</td>
<td>51</td>
<td>231</td>
<td>60 (dengan CCS)</td>
</tr>
<tr>
<td>Transportation</td>
<td>62</td>
<td>149</td>
<td>52</td>
</tr>
<tr>
<td>Households and other building</td>
<td>41</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>87</td>
<td>401</td>
<td>129</td>
</tr>
</tbody>
</table>

Disclaimer: For Discussion Only
Long-term electricity demand is influenced by CO2 emission reduction targets

1. Without the emission reduction scenario in the energy sector (BaU), the electricity demand will be around 1,359 TWh (4.101 kWh/capita) in 2060;
2. With the emission reduction scenario, the electricity demand will be higher. The reduction in emissions in the energy sector from 401 million tons to 129 million tons in 2060 has an impact on the increase in electricity demand from 1,885 TWh (5,308 kWh/capita) to 1,942 TWh (5,862 kWh/capita) in 2060;
3. The demand for electricity in scenario 129 is higher because:
   - Electrification of industrial demand and acceleration of EV penetration;
   - Additional demand for green hydrogen production.
SCENAROS FOR ELECTRICITY SUPPLY

Challenge towards NZE 2060: LCOE tend to higher

Note: Demand 1.942 TWh

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Optimize the utilization of renewable energy development in power generation

**2060:**
- NRE Mix 100% with total capacity 708 GW:
  - Solar 421 GW, Wind 94 GW, Hydro 72 GW, Bioenergy 60 GW,
  - Nuclear 31 GW, Geothermal 22 GW, Tidal/Ocean 8 GW.
- Pumped Storage 4.2 GW, BESS 56 GW.

**Capacity:** Giga Watt

**Scenario:** To achieve NZE in the energy sector where emissions for the generating sector must be 0 by 2060, the scenario chosen is the Zero Emission (ZE) scenario.

**Coal/Gas:** Additional Coal PP is only for projects that are already under contract and construction. IPP’s Coal PP retired after the PPA ended. Combined Cycle PP retired after the age of 30 (remaining < 1 GW, PLTU: 2057, PLTGU: 2056).

**RE:** Additional generation after 2030 only from NRE. Starting in 2030 the development of Variable Renewable Energy (VRE) in the form of PLTS is increasingly massive, followed by PLTB both on shore and off shore starting in 2037.

**Geothermal:** The development is gradually maximized to 22 GW, through the development of the Advance Geothermal System and the development of other unconventional geothermal systems.

**Hydro:** will be optimized and transferred to the load centers in other islands. The other utilization is to create system balance in the increasing share of VRE.

**Nuclear:** will be commercial in 2039 to increase power system reliability. The capacity will be increased up to 31 GW in 2060.

**STORAGE:** Pump storage starting in 2025, Battery Energy Storage System (BESS) will start to be massively developed in 2034. While Hydrogen produced from RE (Green Hydrogen) based electricity starting in 2031 where its use is intended for the non-generating sector.

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1. Total Emission from power generation sector in 2022 around 243 Million ton CO$_2$.

2. Towards 2040, there will be power plant emission peak for 401 million ton CO$_2$-e.

3. Emission will sharply decrease by 2046 in line with the retirement of Coal PP and Combined Cycle PP.

4. Emission will significantly falling down after 2056, following the completion of fossil plant contract.

5. Emission on power plant will be zero before 2060.

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Super grid is a key factor to achieve Zero Emission in the power generation sector.

**A. Listed in RUPTL:**
1. 150 kV Interconnection Sumatera-Bangka (2022);
2. 500 kV Interconnection Sumatera-Malaysia (2030), Supporting ASEAN Power Grid;
3. 150 kV Interconnection Kalimantan (2023);
4. 150 kV Interconnection Sulbagut-Sulbagsel (Tambu-Bangkir COD 2024).

**B. Masih dalam narasi RUPTL dan perlu kajian lebih lanjut:**
5. Interconnection Sumatera-Singapore (including Interconnection Sumatera-Bintan), supporting ASEAN Power Grid;
6. 500 kV Interconnection Sumatera-Jawa;
7. 150 kV Interconnection Bali-Lombok (require further study for Interconnection Jawa-Nusa Tenggara);
8. 150 kV Interconnection Bangka-Belitung (require further study for the Interconnection of Sumatera-Kalimantan);
9. Interconnection Belitung-Kalimantan (require further study for the Supergrid Nusantara program);
10. 150 kV Interconnection Baubau-Sulbagsel (require further study for the Bau-Bau Sulbasel Interconnection System Reliability).

The invested interconnection will be decreased if REBID is implemented.

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INVESTMENT REQUIREMENT TOWARD NZE 2060

The average annual investment is about 28 billion USD.

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The average annual investment is about 28 billion USD.

Investment Needs:
- Powerplant: USD 995 Billion
- Transmission: USD 113 Billion
- Total: 1.108 Billion USD or 28 Billion USD/year

*Fossil investment is only for on-going projects

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HISTORICAL ELECTRICITY INVESTMENT

Target (Miliar USD)  
Realisasi (Miliar USD)

<table>
<thead>
<tr>
<th>Year</th>
<th>Target</th>
<th>Realisasi</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>11.22</td>
<td>8.06</td>
</tr>
<tr>
<td>2016</td>
<td>16.3</td>
<td>8.1</td>
</tr>
<tr>
<td>2017</td>
<td>19.4</td>
<td>9.06</td>
</tr>
<tr>
<td>2018</td>
<td>24.88</td>
<td>11.29</td>
</tr>
<tr>
<td>2019</td>
<td>12.04</td>
<td>12.07</td>
</tr>
<tr>
<td>2020</td>
<td>11.95</td>
<td>7.61</td>
</tr>
<tr>
<td>2021</td>
<td>9.91</td>
<td>6.71</td>
</tr>
<tr>
<td>Agust 2022</td>
<td>7.55</td>
<td>2.98</td>
</tr>
</tbody>
</table>
Thank you

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