Deep decarbonization of Indonesia’s energy system: A pathway to zero emissions by 2050

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Current Indonesia’s Nationally Determined Contribution (NDC) is not aligned with the Paris Agreement, a more ambitious target is required.
A pathway to zero emissions by 2050
Bending the curve: this decade will determine the outcome of the 2050 emission target.
Bending the curve: a call for coal moratorium to peak carbon emissions by 2025
Power sector: The first sector to be carbon free by 2045 through the combination of 100% renewable energy and battery storage
Transport and industry sectors: Synthetic fuels, hydrogen, and electric heating will play a greater role in decarbonization efforts by 2045.
By 2050, all decarbonization efforts made in the previous stages will lead to a zero-emission energy system.
Four pillars of a zero-emission energy system
Pillar 1: Renewable energy
Solar energy is the backbone of the energy system
Grid integration is key in a 100% renewable energy system

Future grid planning needs to consider grid expansion and inter-island connection that will enable demand and supply balancing across the archipelago.
Pillar 2: Electrification
Direct electrification is carried out whenever possible
Pillar 3: Fossil fuel decline
Any coal plants built after 2025 would not be utilized for more than 15-20 years
Pillar 4: Clean fuels
Hydrogen, synthetic fuels, and biofuels play important roles in transport and industry
Investment needs and benefits
To achieve zero emissions by 2050, Indonesia needs a large amount of investment that is spread across a variety of technologies.

<table>
<thead>
<tr>
<th>Capex in 10-year intervals [b$]</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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<tbody>
<tr>
<td>PV utility-scale</td>
<td>35.7</td>
<td>183.2</td>
<td>89.8</td>
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<td>PV prosumers</td>
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<td>47.4</td>
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<tr>
<td>Battery</td>
<td>4.8</td>
<td>146.3</td>
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<td>Geothermal</td>
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<td>46.8</td>
<td>38.2</td>
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<tr>
<td>Hydro</td>
<td>36.2</td>
<td>22.2</td>
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<tr>
<td>Biomass/Waste</td>
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<td>0.9</td>
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<tr>
<td>Water electrolysis</td>
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<td>Synfuels</td>
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<td>17.8</td>
<td>11.1</td>
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<td>Heat electric</td>
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<tr>
<td>Storage heat</td>
<td>3.4</td>
<td>6.5</td>
<td>2</td>
</tr>
<tr>
<td>Storage electricity other</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grids HV</td>
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<td>34.8</td>
<td>53.9</td>
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<td>Fossil coal</td>
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<tr>
<td>Natural gas</td>
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<tr>
<td>Fossil oil</td>
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<td>0</td>
<td>0.4</td>
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<td><strong>Total</strong></td>
<td><strong>235</strong></td>
<td><strong>608.3</strong></td>
<td><strong>438</strong></td>
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</table>
Achieving zero emissions by 2050 is not only technically feasible but also economically attainable.
Deep decarbonization could bring massive economic opportunities to Indonesia.

**100% RENEWABLE ENERGY IN INDONESIA**

- Transition to 100% renewable energy for all sectors (electricity, transportation, and heating)

- **Utility-scale solar PV** 73.5%
- **Rooftop solar PV** 14.9%
- **Hydropower** 5.9%
- **Geothermal** 5.4%
- **Bioenergy** 0.3%

Using 100% renewable electricity for all sectors, instead of burning fossil fuels, will improve energy efficiency means you need much less energy.

- **3859 TWh** 2050 energy demand with business as usual
- **2976 TWh** 2050 energy demand with 100% renewable energy (23% lower)

**JOBS CREATED 3.2 MILLION**

**JOBS LOST 1.3 MILLION**
Key takeaways
1. Deep decarbonization through the use of 100% renewable energy is possible, but it will require transformative changes in the energy sector.

2. Solar PV will become the backbone of the energy system. Battery storage, electrification, and clean fuels will play a major role in decarbonization efforts.

3. Investment needs are huge, multi-stakeholder participation should be encouraged.

4. Deep decarbonization is essential to not only avoid climate risks but also ensure Indonesia’s economic competitiveness.

5. Strong political leadership to make deep decarbonization a national priority is needed now.
According to IEA WEO 2020, solar PV will provide the cheapest cost of electricity across all regions. An energy system with a high share of solar PV will be the most competitive one.
Thank You

Accelerating Low Carbon Energy Transition

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