Decarbonisation of Energy and Industry: Towards Economic Transformation

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Renewables, efficiency and electrification dominate energy transition

- Renewables: 25%
- Energy efficiency: 25%
- Electrification: 20%
- Hydrogen: 10%
- Fossil-based CO₂ removals: 6%
- Biomass-based CO₂ removals: 14%

36.9 Gt CO₂
New investment priorities: renewables, efficiency and electrification

Where current plans will take us (PES):

- Energy efficiency: 33%
- Renewables (power and direct use): 10%
- Electrification of heat and transport and infrastructure: 13%
- Innovation: 44%

Total additional investments needed (1.5-S):

- Energy efficiency: 34%
- Renewables (power and direct use): 26%
- Electrification of heat and transport and infrastructure: 22%
- Innovation: 12%
- Others (carbon removals and circular economy): 2.5%
- Fossil fuel and nuclear: 3.5%

Total additional investments: 33 trillion USD

Annual additional investments:

- Energy efficiency: 0.5 trillion USD per year
- Renewables (power and direct use): 1.1 trillion USD per year
- Electrification of heat and transport and infrastructure: 35.1 trillion USD per year
- Innovation: 26 trillion USD per year
- Others (carbon removals and circular economy): 22 trillion USD per year
- Fossil fuel and nuclear: 14 trillion USD per year

Total annual additional investments: 131 trillion USD per year
Every USD 1 spent on the energy transition yields between USD 2 and USD 5.5
The 1.5°C Pathway provides a boost in global GDP

GDP difference between the 1.5°C Scenario and PES, with GDP drivers
Shifts in the value of trade in energy commodities, 2020 to 2050

2020
USD 1.5 trillion

2050
USD 1.6 trillion

- Oil
- Coal
- Gas
- Electricity
- Ammonia
- Methanol
- Hydrogen
- Bioenergy
IRENA’s Work on the Socio-economics of Renewables
Jobs in Renewable Energy – by Year and Selected Countries

<table>
<thead>
<tr>
<th>Year</th>
<th>Million jobs</th>
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<tbody>
<tr>
<td>2012</td>
<td>7.3</td>
</tr>
<tr>
<td>2013</td>
<td>8.5</td>
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<tr>
<td>2014</td>
<td>9.5</td>
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<tr>
<td>2015</td>
<td>10.0</td>
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<tr>
<td>2016</td>
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<td>2017</td>
<td>10.5</td>
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<td>2018</td>
<td>11.1</td>
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<td>2019</td>
<td>11.5</td>
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<tr>
<td>2020</td>
<td>12.0</td>
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</tbody>
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**Total**: 12 million jobs in 2020

- Solar photovoltaics
- Hydro power
- Solar heating/cooling
- Wind energy
- Others

- Includes liquid biofuels, solid biomass and biogas.
- Direct jobs only.
- “Others” includes geothermal energy, concentrated solar power, heat pumps (ground based), municipal and industrial waste, and ocean energy.
Jobs in Renewable Energy - by Technology and Women’s Share

- Solar photovoltaic: 3,975 jobs, 21% women’s share
- Liquid biofuels: 2,411 jobs, 32% women’s share
- Hydropower: 2,182 jobs, 21% women’s share
- Wind energy: 1,254 jobs, 21% women’s share
- Solar heating/cooling: 819 jobs, 21% women’s share
- Solid biomass: 765 jobs, 21% women’s share
- Biogas: 339 jobs, 21% women’s share
- Geothermal energy: 96 jobs, 35% women’s share
- Municipal and industrial waste: 39 jobs, 28% women’s share
- CSP: 32 jobs, 28% women’s share
- Others: 105 jobs, 22% women’s share

Average share in renewable energy:
- Administrative professionals: 45% (35% women’s share)
- Non-STEM professionals: 35% (32% women’s share)
- STEM professionals: 28% (21% women’s share)

Average share in oil and gas: 22% women’s share
Just Transition - A Comprehensive Policy Framework
Current status and trends in the energy sector in Japan

Total final energy consumption

Renewables in electricity

Key policy and target: Japan’s green growth strategy through achieving carbon neutrality in 2050

(Reference) Proposed process of transition to carbon neutrality
The values are CO₂ emissions from energy production

2018
1.06 BT

2030 mix
0.93 BT (-25%)

2050
Practically 0 BT by emissions + absorption (~100%)

(Reference value for deepening future discussions. Analysis will be conducted using multiple scenarios, not limiting to the below.)

Power
Decarbonisation

Non-power

Electrification

Hydrogen, methanation, synthetic fuel, biomass

Fossil fuel

Decarbonised power sources
Renewable energy (50-60%)
Nuclear power
Thermal + CCUS/carbon recycling (30-40%)
Hydrogen, ammonia (10%)

Tree planting, DACCS, etc...

Tertiary industry and household
Primary and secondary industries
Transportation

Maximum utilisation of CO₂ recovery and recycling

Power demand increases by 30-50%
IRENA’s energy transition roadmap: Japan

Note: PES = Planned Energy Scenario; TES = Transforming Energy Scenario.
Source: IRENA analysis.
Socioeconomic footprint of the energy transition: GDP and welfare in Japan

Source: IRENA analysis
Energy sector jobs in Japan

Note: PES = Planned Energy Scenario; TES= Transforming Energy Scenario
Source: IRENA analysis

- Power grid and energy flexibility
- Fossil Fuels
- Energy Efficiency
- Nuclear
- Renewables

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Source: IRENA analysis
THANK YOU!

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