Renewable Energy: Jobs along the supply chain

Presenter: Michael Renner

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IRENA
Evolution of global renewable energy jobs, 2012-2021

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar photovoltaics</th>
<th>Bioenergy</th>
<th>Hydropower</th>
<th>Wind energy</th>
<th>Solar heating/cooling</th>
<th>Others</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>2012</td>
<td>0.22</td>
<td>0.89</td>
<td>0.75</td>
<td>1.66</td>
<td>2.40</td>
<td>1.36</td>
<td>7.3</td>
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<td>2013</td>
<td>0.23</td>
<td>0.83</td>
<td>0.50</td>
<td>2.21</td>
<td>2.50</td>
<td>2.99</td>
<td>8.5</td>
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<tr>
<td>2014</td>
<td>0.19</td>
<td>0.76</td>
<td>1.03</td>
<td>2.04</td>
<td>2.04</td>
<td>2.99</td>
<td>9.5</td>
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<tr>
<td>2015</td>
<td>0.20</td>
<td>0.94</td>
<td>1.08</td>
<td>2.16</td>
<td>2.16</td>
<td>2.88</td>
<td>10.0</td>
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<tr>
<td>2016</td>
<td>0.24</td>
<td>0.83</td>
<td>1.16</td>
<td>2.06</td>
<td>2.06</td>
<td>2.74</td>
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<tr>
<td>2017</td>
<td>0.16</td>
<td>0.81</td>
<td>1.15</td>
<td>1.99</td>
<td>1.99</td>
<td>3.05</td>
<td>10.5</td>
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<tr>
<td>2018</td>
<td>0.18</td>
<td>0.80</td>
<td>1.16</td>
<td>2.05</td>
<td>2.05</td>
<td>3.18</td>
<td>11.1</td>
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<tr>
<td>2019</td>
<td>0.18</td>
<td>0.82</td>
<td>1.17</td>
<td>1.96</td>
<td>1.96</td>
<td>3.58</td>
<td>11.5</td>
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<tr>
<td>2020</td>
<td>0.27</td>
<td>1.25</td>
<td>2.18</td>
<td>2.18</td>
<td>2.18</td>
<td>3.98</td>
<td>12.0</td>
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<tr>
<td>2021</td>
<td>0.43</td>
<td>1.37</td>
<td>2.37</td>
<td>4.29</td>
<td>4.29</td>
<td>4.44</td>
<td>12.7</td>
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Total: 7.3 + 8.5 + 9.5 + 10.0 + 10.1 + 10.5 + 11.1 + 11.5 + 12.0 + 12.7 = 12.7
Renewable energy jobs by technology, 2021

- Solar photovoltaic: 4,291 jobs
- Liquid biofuels: 2,421 jobs
- Hydropower: 2,371 jobs
- Wind energy: 1,371 jobs
- Solar heating/cooling: 769 jobs
- Solid biomass: 716 jobs
- Biogas: 307 jobs
- Geothermal energy: 196 jobs
- CSP: 79 jobs
- Municipal and industrial waste: 30 jobs
- Others: 125 jobs
Renewable energy jobs in selected countries, 2021

- **China**: 5368 thousand jobs
- **United States**: 923 thousand jobs
- **Brazil**: 1272 thousand jobs
- **European Union**: 1242 thousand jobs
- **Germany**: 352 thousand jobs
- **Rest of Africa**: 235 thousand jobs
- **South Africa**: 48 thousand jobs
- **North Africa**: 24 thousand jobs

**Total**: 12.7 million jobs in 2021
Factors influencing renewable energy job creation

- **Technology advances and falling costs / investment trends**
  - Rising competitiveness
  - Lower costs enable more deployment per dollar spent

- **Deployment: new and cumulative capacity**
  - Jobs in project development; manufacturing; sales; construction and installation
  - Jobs in operations and maintenance

- **COVID-19 responses and recovery efforts**
  - Impacts along supply chain
  - Renewables versus fossil fuel dynamics
  - Stimulus and job retention
  - Remote work arrangements

- **Policy ambition**
  - Deployment, integrating, and enabling policies
  - Industrial policies; trade policies; skill-training; labour market measures; gender policies

- **Changes in labour intensities**
  - Automation; use of drones; artificial intelligence
  - Economies of scale
  - Learning effects

- **Supply chain structures**
  - Commodity, technology and trade dependencies
  - Geographic footprints
  - Localisation efforts
Extended renewable energy supply chain

Inputs (1)
- Logging, mining, processing

Inputs (2)
- Intermediate goods

Inputs (3)
- Biofuel feedstock

Equipment manufacture/component assembly

Logistics

Project construction and installation

Grid connection as applicable

Operations and maintenance

Energy delivery as applicable

Decommission (materials handling: site restoration; Repowering)

Recycling and reuse of materials
(metals, glass, steel, rare earths, composites, etc.)

Installation of larger wind turbines

Along the supply chain:
- Support services
- Enabling functions
- Governance

- Research and development
- Education and skills training or retraining
- Policymaking (regulations and incentives; industrial, educational, labour policies)
- Financing (public and private; national and communal; bilateral and multilateral)
- Public infrastructure planning
- Project design and planning (site surveying, environmental studies, etc.)
- Legal services (contracting, permitting; land acquisition, etc.)
- Administrative functions and sales
Holistic policy framework

Labour market policies
Industrial policies for local value addition
Skills and educational policies
Policies for circular economy

Source: IRENA, 2023c.
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10 min
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