Global Renewables Outlook

Dolf Gielen
Director, Innovation and Technology
2nd RD20 technical session on renewable energy, 29 September 2020
Profile

Dolf Gielen
Director, Innovation and Technology
International Renewable Energy Agency (IRENA)

As director of the IRENA Innovation and Technology Centre in Bonn since 2011, Dolf Gielen oversees the agency's work on advising member countries on energy scenarios and planning, power sector transformation, cost and markets, technology status and innovation outlooks.
Falling costs make renewables a cost-effective investment

Renewable energy costs declined rapidly over the last 10 years (2010-2019)

- Solar Photovoltaics (PV): 82%
- Concentrating Solar Power (CSP): 47%
- Onshore Wind: 39%
- Offshore Wind: 29%

56% of capacity additions for utility-scale renewable power in 2019 achieved lower electricity costs than cheapest new coal plant
Levelised cost of electricity
Onshore wind, solar PV

Global weighted avg (2010-2019):
• Total installed cost reduced by 18% from USD 2,745/kW to USD 2,263/kW
• Total installed costs over 50% higher in Japan

Total installed costs weighted avg (2010-2019):
• Total installed cost reduced by 62% from USD 5,431/kW to USD 2,070/kW
• Japan PV costs more than double global costs

Source: IRENA Renewable Cost Database
Exploring pathways to zero emissions

Energy-related CO₂ annual emissions trajectories from 2010 till 2050 and IRENA’s scenarios – From IRENA’s Global Renewables Outlook, April 2020
Renewable power generation technologies are setting records for new capacity

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Historical progress 2015-2018/2019</th>
<th>Where we are heading (PES/2030 and 2050)</th>
<th>Where we need to be (TES/2030 and 2050)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable share in electricity generation (%)</td>
<td>23% → 26%</td>
<td>38% 55%</td>
<td>57% 86%</td>
</tr>
</tbody>
</table>

- Worldwide in 2018, 26% of power generation came from renewables
- By 2050 renewables would generate 86% of electricity
Solar PV capacities would need to be significantly scaled-up in coming decades

<table>
<thead>
<tr>
<th>TOTAL INSTALLED CAPACITY</th>
<th>2010</th>
<th>2018</th>
<th>2030</th>
<th>2050</th>
<th>Tracking progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV (GW)</td>
<td>39</td>
<td>480</td>
<td>2480</td>
<td>8519</td>
<td>Off track</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANNUAL DEPLOYMENT</th>
<th>2010</th>
<th>2018</th>
<th>2030</th>
<th>2050</th>
<th>Tracking progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV (GW/yr)</td>
<td>17</td>
<td>94</td>
<td>270</td>
<td>372</td>
<td>Progress</td>
</tr>
</tbody>
</table>

Solar accounts for a fifth of the emission reduction effort between now and 2050

N.B. Capacity includes utility and distributed
Typical concerns often heard

“the lights will go out if we deploy more renewables”

“we need baseload”

“we need batteries to stabilise the grid”

“we need natural gas to stabilise the grid”

“renewables are too expensive”
### COVID-19 crisis: A testbed showing how far we can go with VRE integration today

Europe - an innovation front runner in VRE integration

<table>
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<tr>
<td>Total generation (TWh)</td>
<td>1,810.27</td>
<td>- 5.8%</td>
</tr>
<tr>
<td>Average share of RE generation</td>
<td>42%</td>
<td>+ 6.2%</td>
</tr>
<tr>
<td>RE generation (TWh)</td>
<td>740.68</td>
<td>+ 10.1</td>
</tr>
<tr>
<td>Other sources generation (TWh)</td>
<td>1,069.59</td>
<td>- 26% Coal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 13% Nuclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 9.7% Gas</td>
</tr>
<tr>
<td>Top 3 days with highest share of RE generation</td>
<td></td>
<td>5 Jul: 55%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Jun: 53%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 May: 52%</td>
</tr>
</tbody>
</table>

Source: [https://www.wartsila.com/energy/transition-lab](https://www.wartsila.com/energy/transition-lab)
An increasing role for electricity as the energy carrier of choice in buildings, industry and transport

- Green hydrogen and PTX for:
  - Ammonia production
  - Iron making
  - Methanol production
  - Synthesis of hydrocarbons

![Graph showing electricity in total final energy consumption (EJ/yr)]

- 2016: 19% electricity (total)
- 2050: 42% electricity (total)

TES 2 degrees scenario
Renewable electricity
The world’s main energy carrier by 2050

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<tbody>
<tr>
<td>Electrification share of final energy (%)</td>
<td>![Image] 19% → 20%</td>
<td>![Image] 24% → 30%</td>
<td>![Image] 29% → 49%</td>
</tr>
</tbody>
</table>

- The share of electricity in final energy consumption would increase from just 20% today to almost 50% by 2050.
- The share of electricity consumed in industry and buildings would double. In transport, it would increase from just 1% today to over 40% by 2050.
- The electrification of end uses will drive increased power demand to be met with renewables.

Technologies

- **Electric cars** (mln units)
  - 2015: 1.2mln
  - 2019: 7.9mln
  - 2030: 269mln
  - 2050: 627mln

- **Heat pumps** (mln units)
  - 2017: 20mln
  - 2019: 38mln
  - 2030: 63mln
  - 2050: 119mln

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Source of hydrogen – today and 2050

A shift to clean hydrogen with a key role for green hydrogen

**Today:**
Produced mainly from fossil source - **green and blue hydrogen production is each about 1% of total**

**2050:**
Two-thirds of hydrogen produced could come from green hydrogen
Hydrogen demand may double or even quadruple in case of deep decarbonisation

Green Ammonia poses an early opportunity (recent project announcements)
The four dimensions of power systems flexibility
Need for a systemic approach

Source: IRENA (2019), Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables
A toolbox for countries
30 Innovation Briefs for power system flexibility

Solar PV technology development trends

Innovation areas

- Materials and module manufacturing
- Applications: beyond fields and rooftops
- Operation and maintenance
- End of life management of solar PV
- Batteries for systems integration

Notes: CIGS = copper-indium-gallium-diselenide; CdTe = cadmium telluride. PERC = passivated emitter and rear cell/contact

LEVEL OF MATURITY AND PROSPECTS

<table>
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<tr>
<th>Technology</th>
<th>Description</th>
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<tr>
<td>Half-cut</td>
<td>According to the ITRPV, a significant uptick is foreseen in the near future – from less than 3% market share in 2017 to 5% in 2018 and 10% by 2020.</td>
</tr>
<tr>
<td>Shingles</td>
<td>Although several companies are displaying prototype shingle modules, the Fraunhofer ISE believes that the technology is not yet mature enough, especially due to the fact the manufacturing machinery is not completely optimised.</td>
</tr>
<tr>
<td>Bifacial</td>
<td>From almost negligible presence in 2017, the ITRPV anticipates the bifacial concept to gain close to 10% market share in 2018, 15% in 2020 and 40% within the next 10 years.</td>
</tr>
<tr>
<td>Glass-glass modules</td>
<td>Despite the small growth foreseen in the short term, the ITRPV expects the technology to pick-up within the next 10 years and reach a 40% share.</td>
</tr>
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<td>Multi-busbars</td>
<td>The ITRPV expects the three-busbar layout to be phased out progressively and be replaced by layouts with 4, 5, 6 and more busbars (Shravan, K., Chunduri, K., 2019).</td>
</tr>
</tbody>
</table>
Key recommendations

- Focus on power systems flexibility and systemic innovation
- Continue to enhance the module performance, reduce cost and develop new applications (floating PV, BIPV, road integrated PV etc.)
- Focus on cost reductions for the BoP
- Develop new storage solutions e.g. green hydrogen
Thank You!

Global Renewables Outlook
April 2020

Reaching Zero
September 2020
(forthcoming)

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Backup
Wind power would be a major electricity generation source, supplying more than one-third of total electricity demand. Solar PV power would follow, supplying 25% of total electricity demand. Power system capacity would need to grow to 20 000 GW by 2050, with over 70% of it coming from solar PV and wind.
Renewable energy technologies bring new patterns of socio-economic development

GDP growth

Job creation

Source: IRENA analysis
Scaling up renewables investments is critical
Solar PV is one of the key technologies contributing to emissions reduction needs

Accelerated deployment of solar PV generation when coupled with deep electrification would contribute to **21% of the total emissions reductions needed** (nearly 4.9 gigatonnes of CO₂) in 2050.
Offshore wind
Asia to take the lead in the coming decade

- Offshore wind capacity in Asia would need to grow from 5 GW by 2018, to more than 600 GW by 2050.
- **Floating offshore is potentially a game-changing technology** that multiplies the global offshore wind potential, covering 5-15% of global offshore capacities by 2050.
- Japan would increase offshore wind installed capacity to around 45 GW by 2050.