Power: investment need to 2050

**Investment needs**

**2050 targets**
Increase annual electricity production 4x to 90-130,000 TWh.

**Investment needs**
- **Zero-carbon generation**: increase installed wind capacity from 850 GW to 13,000-15,000 GW and solar capacity from 970 GW to ~30,000 GW by 2050.
- **Transmission and distribution network**: investments to expand and upgrade network needed ~5 years ahead of electricity demand.
- **Storage and flexibility**: battery storage to increase from <1 TWh today to 11 TWh by 2050; seasonal variation requires 1,000 GW of hydrogen turbine capacity and limited role for natural gas turbines with carbon capture and storage (CCS).

**Investment milestones**
$750bn today → $2 trillion by 2030

**Where?**
Investments this decade will be dominated by high-income countries and China (~$1.3bn per year). Middle and low income countries need to invest ~$700bn a year by 2030 and this requirement will increase over time.

**Gross or net?**
Estimates are presented as gross investment, though in reality this would be partially offset by declining investments in fossil fuel production and power plants. In middle- and low-income countries, the majority of investment would be required anyway to grow their electricity systems.

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**Outlook to 2030**

- Wind and solar electricity production are now cost-competitive against new and existing fossil for bulk electricity provision in countries representing 90% and 66% respectively, of global electricity generation.
- Higher fossil fuel prices have created incentives to accelerate renewables build out to create energy security and reduce future consumer costs.
- However, a temporary increase in the cost of some inputs and high interest rates have increased the nominal cost of capital – a critical determinant of the relative cost of renewable versus fossil fuel investments. This has particular implications for the significant scale up in low-carbon power required in middle and low income countries, where the cost of capital is typically higher.

**2030 target**
- 5-7x increase in annual wind and solar installations
- $2 trillion investment
- x3 scale up


1 The ETC’s investment estimates differ in approach by sector. Gross investment refers to the total investment required under a 1.5 degree net zero pathway, regardless of how much investment would have occurred anyway. Net investment is the incremental investment required compared to a BAU scenario. Note: All figures are in US dollars. Other zero carbon includes hydropower, nuclear and bioenergy.
## Power: how to mobilise finance

### Required real economy policies

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<th>Challenges</th>
<th>Real economy policies needed</th>
<th>Priority policy</th>
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| **Create a clear strategic vision** | • National power system decarbonisation strategies lacking in ambition or clarity.  
• Continued investment in new fossil fuels sends mixed signals to investors. | • National **quantitative targets** for zero-carbon electricity capacity in 2030.  
• Plans to phase out coal power generation (e.g., by 2030 and 2035) and unabated natural gas.  
• Integrated vision for power generation buildout and network design. |
| **Address the “green premium” challenge** | • Subsidies and Power Purchase Agreement (PPAs) for fossil fuels reduces relative competitiveness of renewables.  
• Uncertain pace of electrification across sectors. | • **Carbon pricing**  
• Contracts-for-difference with additional green premiums where low-carbon technologies (e.g., floating wind) are still not competitive and in certain countries.  
• Electrification incentives and subsidies (e.g., for heat pumps, electric vehicles (EVs)).  
• Remove remaining fossil fuel subsidies. |
| **Reduce downside risks** | • Uncertain and volatile future prices which increase the cost of capital.  
• Influence of cost of capital on levied costs. | • Appropriate power market design, including **long-term contracts** (e.g., 15 years) which guarantee offtake prices.  
• Annual auctions to competitively procure new renewable capacity. |
| **Remove supply bottlenecks** | • Lengthy and complicated planning and permitting processes.  
• “Not in my backyard” (NIMBY) and local opposition.  
• Insufficient / slow grid expansion due to uncertainty of demand and short-term regulatory approaches.  
• Potential supply chain bottlenecks for key materials. | • **Streamlined planning, permitting** and acquisition processes (e.g., digitalisation, “one-stop shops”).  
• Regulatory frameworks to enable anticipatory investment in power networks.  
• Sufficient investments in transmission and distribution (T&D) networks ahead of demand.  
• Clear plans for supply chain expansion and workforce.  
• Wider reforms to planning and permitting, including zoning. |

### What obstacles cannot be fully addressed by real economy policies?

| Minimal additional action required | In high-income countries and China | • With the policies described above, the vast majority of investment needed in higher income countries and China can be mobilised by the private sector. |
| Significant additional action required | In middle- and low-income countries | • Higher cost of capital is a significant barrier to investment, given the high upfront capital requirements of low-carbon power investments. |

### Additional actions required

| Financial institutions | • Development of managed phase out plans for fossil fuel assets to ensure an orderly and just transition:  
• Set out clear “red lines” defining what fossil fuel investments will not be supported.  
• Develop consensus on credible financing mechanisms for the early phase out of coal plants.  
• Develop strategies for significantly scaling up finance for low-carbon power generation. |

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See next page
Power: additional actions to mobilise finance in middle- and low-income countries

**Additional real economy policies required**

<table>
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<th>Challenges</th>
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<tr>
<td>Many countries do not yet have a fully liberalised electricity market and have less advanced system operator capabilities.</td>
<td>Massive scale up in T&amp;D investments and grid access.</td>
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<td>Off-taker risk due a lack of creditworthiness of the utilities.</td>
<td>Progressive evolution towards liberalised markets, combined with long-term contracts.</td>
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<tr>
<td>Lack of grid and network capacity.</td>
<td>While politically sensitive, reforms to improve creditworthiness of utilities (e.g., improve cost-recovery of end-user tariffs, transparency in flow of funds to electricity generators).</td>
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<tr>
<td>Lack of economic dispatch in wholesale power markets.</td>
<td>Harmonising frameworks between regions to ensure larger balancing area and power dispatch across countries and regions.</td>
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**Additional financing challenges**

High cost of capital has significant implications given the capital-intensive nature of the investments required. It reflects:

- Project-specific risks, due to weaker policy or regulatory environment for renewables in some countries.
- Sector-specific risks, including off-taker risk.
- Geography-specific risks - actual or perceived - for example, due to macroeconomic risks, the small size of some economies, underdeveloped financial systems.

Implications:

- IEA estimates that nominal financing costs are up to 7 times higher than in the US and Europe.
- At higher levels of cost of capital, financing costs account for an increasingly high share of the levelised costs of renewable energy investments compared to fossil fuel investments.
- Middle- and low-income countries do not have access to the low cost capital needed to finance a rapid scale up in clean power.

*Weighted average cost of capital (WACC), $/kWh*

**Additional actions required**

**Mobilising domestic savings and private finance**

- Improved tax collection and reduced fossil fuel subsidies to increase fiscal resources.
- Growth of local currency capital markets.

**Multilateral development banks**

- Expand financial capacity, for example, through treatment of "callable capital" in capital adequacy assessments or new capital subscriptions.
- Create the conditions for profitable investments and private finance through:
  - Policies: Help countries develop energy transition strategies and policies.
  - Pipeline: Proactively develop bankable projects.
  - Private sector: Work with the private sector to catalyse private finance, including in the form of blended finance (e.g., via guarantees).

**Financial institutions**

- Understand the scale and nature of the energy transition opportunity in different groups of lower income economies, for example, through teams on the ground in key markets.
- Actively develop project pipelines in specific areas of technology or sector focus.
- Identify where financial institutions should build relationships with multilateral development banks (MDBs) to help design and implement blended finance approaches.

Note: Middle and low income countries are not homogenous, but to different degrees, tend to face additional challenges and require additional actions.