IRENA
International Renewable Energy Agency

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Note of the Director-General

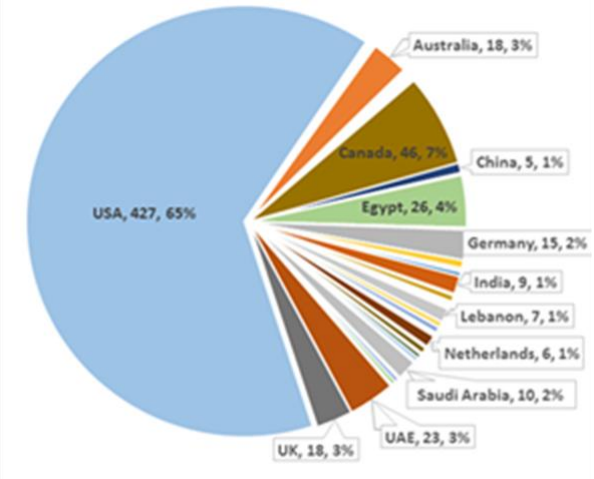
Perspectives for the energy transition: Investment needs for a low-carbon energy system

1. Among the most transformative events of the current decade has been the dramatic and sustained improvement in the cost-competitiveness of renewable electricity generation technologies. A virtuous cycle of decreasing costs, rising investments and technology innovation has resulted in an unprecedented growth in renewable energy deployment over the past decade. Today, renewable energy is a viable and cost-effective option in many markets. Renewable energy deployment is growing at an unprecedented pace, particularly in the power sector. Only in 2016, over 160 GW of new renewable generation was added, bringing the global total capacity to over 2,000 GW.

2. Growing maturity of renewable energy markets, coupled with technology advancements and policy refinement, offer an opportunity to develop an energy system that underpins sustainable development and climate objectives. Understanding the energy investment landscape and how it should evolve to meet multiple economic, environmental and social goals are central element of the transition.

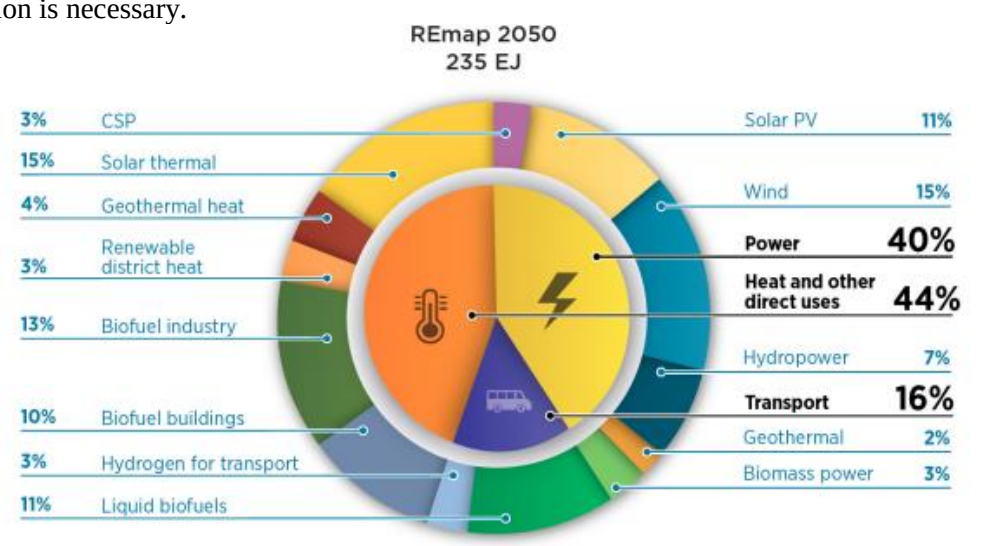
3. Against this backdrop, the German government in its capacity as G20 Presidency requested IRENA and the IEA to examine the essential elements of an energy sector transition that would be consistent with limiting the rise in global temperature to well below 2°C, as set out in the Paris Agreement. The overarching objective of the study, *Perspectives for the Energy Transition: Investment needs for a low-carbon energy system*, was to analyse the scale and scope of investments in low-carbon technologies in power generation, transport, buildings and industry needed to facilitate such a transition in a cost-effective manner. IRENA also explores the additional benefits that an energy system with a large share of renewables would bring.

4. Building on previous IRENA work in the context of *REmap 2030* and *Renewable Energy Benefits*, this study explores the renewables-based pathway to 2050. IRENA's findings show that renewable energy, coupled with energy efficiency, can provide 90% of the energy CO2 emissions reductions needed by 2050, with each being roughly of equal weight. This would also mean that renewables would assume a dominant role in primary energy supply, accounting for two-thirds in 2050. This study has been prominently featured in the media, with close to 600 articles published in 47 countries.



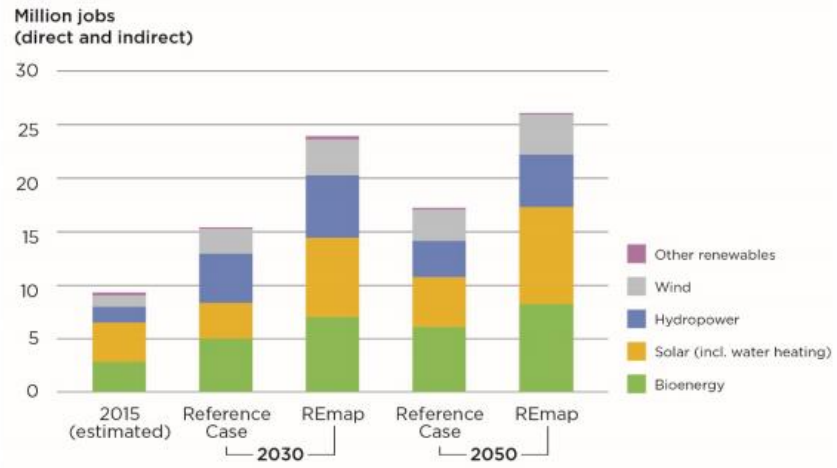
Articles related to IRENA and the study were published in 47 different countries.

5. The study shows that the power sector is currently on track to achieve the necessary share of renewables, which in turn brings greater efficiency. As the share of variable renewable power rises, grid integration, system flexibility, improved market design and sector coupling all become increasingly important. In fact, a significant electrification of the economy needs to happen: the share of electricity in final energy use needs to increase from around 20% to 30% by 2050. This will require increased share of renewables in end-use sectors, which account for 60% of potential. This in part will be achieved with a broader coupling between the power and end-use sectors, such as transport, buildings and industry. For this to occur, step-up both in terms of investment in, and scope of, innovation is necessary.



Key message • **Under REmap, final renewable energy use is four-times higher in 2050 than it is today. Power and heat consume about 40% and 44% of the total renewable energy, respectively.**

6. From a macroeconomic perspective, the renewables-based energy transition, underpinned by energy efficiency, brings a wide range of benefits. It can fuel economic growth, create new employment opportunities, and enhance human health and welfare. The analysis shows that global GDP would be boosted by around 0.8% in 2050, a cumulative gain of USD 19 trillion from 2015 to 2050. The renewable energy sector alone could support around 25 million jobs in 2050, up from 9.4 million in 2015. New job creation in renewables and energy efficiency would more than offset the job losses in the conventional energy sector. In fact, net energy sector employment would be higher by 6 million additional workers in 2050 compared to the reference case. Importantly, improvements in human welfare, including economic, social and environmental aspects, would generate benefits far beyond those captured by GDP.



Key message • **Renewable energy jobs can reach around 25 million by 2050, with solar and bioenergy being the main employers.**

7. IRENA highlighted a range of recommendations and actions that are needed to fully realise the benefits of the transition to a renewables-based energy system:

- The energy transition is affordable. It will require additional investments in energy efficiency and low-carbon technologies. Further significant cost reductions across the range of renewables and enabling technologies will be major drivers for increased investment. The cumulative additional investment would amount to USD 29 trillion over the period to 2050, representing an annual investment of 0.4% of the global GDP.
- The share of renewable energy needs to increase from around 15% of the primary energy supply in 2015 to 65% in 2050. This means an increase of around 1.2% per year, a seven-fold acceleration compared to the increase in recent years.
- Increased investment in innovation needs to start now to allow sufficient time for developing the new solutions needed for multiple sectors and processes. This innovation is needed not only in technology but also in policy, business models and market design.
- Sectoral approaches must be coupled with system-wide perspectives to address the main challenge of reducing the direct use of fossil fuels in end-use sectors. Deep emission cuts in the power sector are a key opportunity and should be implemented as a priority.

8. *Perspectives for Energy Transition: Investment needs for a low-carbon energy system* shows that we have a good understanding today of what the energy transition can look like from a technical, policy and business perspective. IRENA's findings also convey a compelling message of long-term decarbonisation of the energy system as a transformative opportunity that can bring new forms of sustainable growth and result in benefits that well exceed the costs.

9. But to unlock these opportunities and benefits – and reduce costs in the long-term - early action is necessary. Governments have a critical role in accelerating the energy transition. Enacting enabling policy frameworks that provide long-term certainty for the private sector will be key to realising the change at the necessary speed and scale.

Questions

- How significant is the decarbonisation imperative for future decisions on sustainable energy investments?
- How best can IRENA's work on policy and technology innovation and best practices be designed to support members?
- What are the key aspect of end-use sectors transformation that IRENA should prioritise in its analyses?
- Are there specific aspects of the findings that IRENA should analyse in more depth?