

**INTERNATIONAL RENEWABLE ENERGY AGENCY**

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**Note of the Director-General  
Renewable Technology Outlook:  
Innovation driving the decarbonisation of the energy sector**

1. The global energy transition must be accelerated in the coming decades in order to decarbonise the energy sector by the middle of this century in order to meet the climate objectives of the Paris Agreement. To make the transition a reality, the deployment of mature renewable energy technologies, such as solar photovoltaics and onshore wind, will have to be scaled up, and the rollout of emerging technology solutions accelerated.

2. Yet important innovation challenges remain. IRENA's REmap, Roadmap to Double the Global share of Renewable Energy by 2030, shows that economically viable renewable energy supply alternatives for approximately one-third of energy-related CO<sub>2</sub> emissions are not yet fully available. For example, renewables only account for 3% of the energy demand of the transport sector. While passenger road transport has started to observe promising developments in electric vehicles, other transportation modes, like aviation, heavy trucks and shipping, require advanced liquid biofuels to become competitive against fossil fuels. Commercially viable renewable energy options for high-temperature heat generation, which typically accounts for a large share of the energy demand in heavy industries, have not yet emerged.

3. Given the significant expansion of renewables in the power sector, an alternative option is to couple the power and the end-use sectors. The coupling between power and road transport is underway, and this approach can be replicated in other economic sectors. For example, while power to heat is widely recognised as a valid approach, its implementation has so far been limited to a few demonstration projects. Solutions for district heating systems using renewables power have been put in place in the district heating network of Aarhus, Denmark. Electric boilers have been deployed in Lemgo, Germany, and Hohhot, China, which use for example excess power sold by wind turbine operators. Power to gas is another option. In this scenario, abandoned oil and gas platforms in the North Sea can be refurbished into units that convert electricity from offshore wind farms into hydrogen and synthetic gas. Nevertheless, the nexus between the power and other sectors still requires additional analysis.

4. The magnitude of these challenges calls for a collaborative global programme from R&D up to commercialisation, as well as partnerships between public and private sectors, to develop new technology solutions where innovative approaches need to be shared, applied and widely replicated by a network of partners. A transformation of the energy sector calls for active cooperation amongst all actors involved, including utilities, regulators, consumers, the ICT sector, industry and entrepreneurs. To increase the effectiveness of international collaboration initiatives focused on fostering innovation, it is important to identify key technology needs and trends. This can be facilitated by creating a common understanding of what could be achieved and where to focus international efforts in order to deliver the technology required.

5. Forward-looking technology studies are a cornerstone of IRENA's work. The *Renewable Energy Innovation Outlook* series analyses developments that are making renewable energy technologies increasingly competitive in global energy markets and help integrate them into dynamic energy systems. The analysis also includes the policy implications of the emergence of such technologies for the decarbonisation of the energy sector. During the second half of 2016, IRENA issued three such studies, focusing on advanced biofuels, mini-grids and offshore wind. These studies complement previous work of the Agency on marine technologies, battery storage and other enabling end-use technologies.

6. Policy makers need information regarding the status and development potential of such emerging technologies, their economics and fields of application to allow them to make informed decisions on their national energy policies and to better coordinate their international cooperation efforts.

### **Guiding questions**

- What are the renewables RD&D priority needs to decarbonise the energy sector by 2050?
- What are the key aspects that facilitate a win-win type cooperation for renewable technology RD&D between public and private sector?
- How can the IRENA technology outlooks better support policy developments to accelerate energy sector transformation?
- How can IRENA help to close the gaps in meeting the climate policy objective through the provision of policy-relevant information concerning innovative renewable solutions to decarbonise the energy sector?