

**INTERNATIONAL RENEWABLE ENERGY AGENCY**

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**Note of the Director-General**  
**Renewable power generation costs****I. Introduction**

1. IRENA is continuously updating its data and analysis of the costs and performance of renewable power generation technologies. IRENA's database of over 9,000 utility scale projects and 750,000 small-scale solar PV projects allows IRENA to be the authoritative voice on renewable power generation costs and conduct relevant analysis. The report *Renewable Power Generation Costs* will provide the energy and climate community with the most up-to-date, transparent analysis of the costs and competitiveness of renewable power generation technologies available in 2015, to aid domestic policy-makers, provide powerful messages about the enhanced business case for renewables and inform the international discussions leading up to COP 21 in Paris 2015. The report provides a comprehensive assessment of the recent cost reductions for solar and wind, as well as lays out the continued competitiveness of biomass for power generation, geothermal and hydropower.

**II. IRENA's Analysis of Renewable Power Generation Costs**

2. The economics of renewable power generation are at the heart of the debate about the role renewables can play in a country's energy mix, how fast a transition to a sustainable energy system can be achieved and what levels of support for renewables should be set. Accurate, up-to-date, timely data and analysis of recent renewable power generation cost trends and their current levels are therefore critical to efficient policy-making. IRENA has developed a database and analysis to fill the significant information gap that exists and has positioned IRENA as the source of verifiable cost data from a trusted source.

3. The decline in the costs of a range of renewable power generation technologies has continued in 2013 and 2014. The competitiveness of renewable power generation technologies has reached historic levels as onshore wind power, solar photovoltaic (PV) and concentrated solar power (CSP) installed costs continue to fall at the same time as performance has improved; significantly lowering the cost of electricity from these sources.

4. Solar PV module prices in 2014 were 75% below their level at the beginning of 2009, while the total installed costs of utility-scale PV have fallen by between 41% and 65% between 2011 and 2014. The levelised cost of electricity (LCOE) of these projects can be as low as USD 0.08/kWh. Where good resources exist and low-cost financing is available, utility-scale PV projects are now being built that provide electricity at a lower cost than fossil fuels (e.g. in the United Arab Emirates, Chile and parts of

the United States), even if indigenous fossil fuels are abundant. A similar story is unfolding in the residential solar PV sector, as the LCOE of solar PV has fallen by between 44% and 66% from 2009 to 2014. The danger to utilities is that solar PV is now increasingly cost competitive compared to residential electricity rates and with battery costs falling, the economic level of self-consumption is only set to grow.

5. Onshore wind is now one of the most competitive sources of electricity available where good resources exist, as continued technology improvements have increased capacity factors at the same time as installed costs have been declining. As a result, the LCOE of wind is now extremely competitive and has fallen by 37% outside of China between 2010 and 2014. As an example, the best wind projects in the United States are delivering electricity for USD 0.04/kWh without financial support. This is cheaper than using gas, despite the low-cost of natural gas in the United States.

6. Biomass for power, geothermal and hydropower all contain mature technologies that where unexploited economic resources exist can provide the lowest cost electricity of any source. Their importance, along with that of CSP with thermal energy storage, will grow rapidly as the share of variable renewables increases, for their ability to provide ancillary grid services and shift generation through time.

7. With widely distributed resources, mature, commercially available technology solutions and declining costs; renewables are now an economic solution in a wide range of markets. With continued cost reductions in the future for renewables, and fossil fuel cost for power generation that are unlikely to fall significantly and may grow, there will be a growing wedge opening up between renewables and the now often more expensive fossil fuel options.

8. The increased competitiveness of renewables will require policy-makers to shift their emphasis from individual technology support, to a system-wide approach to the future transition at a power system level where integration issues require forward planning as economies head to 30% variable renewables and beyond. This will often require broader policy changes that also adapt the market structure, align stakeholder incentives to minimise overall system costs and yet still support renewables in an equitable fashion while the externalities and risks of fossil fuels and nuclear are still not adequately priced.

9. Now is an opportune moment to accelerate the deployment of renewables to meet the shared goal of a secure, reliable, affordable and environmentally-sustainable power generation sector. It has never cost so little to do so and it is increasingly the option that will save consumers' money today and in the long-run.

### **III. Guiding questions**

- What are the challenges that Member States are facing in terms of collecting up-to-date cost and performance data to support their domestic policy making, and how can IRENA assist Member States in this task?
- What are the emerging issues around the costs and performance of renewable power generation technologies where IRENA could add value for Member States by conducting analysis or supporting increased dialogue?
- What should be the priority areas for IRENA's forthcoming work on the analysis of the costs and performance of renewable energy technologies?