



BRIEFING
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Measuring world leadership on renewable energy

“I want Europe’s Energy Union to become the world number one in renewable energies.”

Commission President Jean-Claude Juncker

European Commission President Juncker wants to make the EU the world number one in renewable energy.

Currently, this is far from being the case. In 2015, investments in renewables in the EU fell to their lowest level since 2006. This is due to damaging changes to support schemes for renewables in a number of Member States. And while some Member States continue to install clean energy capacity, growth in many others has stagnated.

To put the EU back on track to becoming the global renewable energy superpower, WWF calls on the EU to:

- Increase its 2030 renewable energy target from 27% to over 40%, and put strong measures in place to ensure it reaches that target
- Develop a comprehensive roadmap for renewables world leadership, including energy efficiency and reduction of fossil fuels
- Invest 1% of GDP in renewables every year from 2017 and doubles investments in clean energy R&D
- Support new major African and Indian initiatives on renewable energy that were announced at COP21

INTRODUCTION

When Jean-Claude Juncker made his goal of having the EU lead the world in renewable energy a pillar of his successful election bid he won the praise of many – including WWF. However, it is vital that this loosely worded commitment becomes a reality. The first step on this important journey might seem prosaic, but it will be impossible to know if the EU takes the top spot without first defining how different countries and regions should be assessed and compared.

However, eighteen months into President Juncker's Presidency, still almost no detail has been given as to how the Commission will evaluate its progress on renewable energy sources (RES) against the rest of the world. In the light of the Paris Agreement, this goal takes on global political relevance, and the need for the EU to deliver on all of its climate promises is pivotal. WWF hereby sets out options for measuring RES performance, while also highlighting some of the challenges inherent in such a task.

THE EU IS NOT THE WORLD NUMBER ONE

As President Juncker's mission statement implies, the EU is not currently the world number one in renewable energy. The EU has less total installed RES capacity (MW) than world leading China (404,281MW compared to 454,835MWⁱ) and the individual EU country with the greatest RES capacity, Germany (97,413MW), lags behind China, the United States (203,467MW), and Brazil (107,488MW). However, **total installed RES capacity reveals little** about the relative importance of RES in a country's energy mix, nor about the efforts being made to boost RES as a key tool for tackling climate change.

In addition, RES deployment and investment are heavily concentrated in a few EU countries, while others lag far behind. This is particularly the case with wind, solar, and geothermal power. A clear difference can be seen between the first 15 EU Member States, where the majority of actions occur, and the newer Member States in Central and Eastern Europe where RES installations are, overall, stagnating. Between 2005 and 2014, Germany, Spain, and the UK were responsible for more than half of the new wind capacity in the EU. Over the same period, Germany and Italy added more than half of all the new solar capacityⁱⁱ.

SOME EU MEMBER STATES ARE MOVING BACKWARDS

Furthermore, recent policy changes by new governments, including retroactive revision of RES support schemes, have negatively and unnecessarily dented hitherto promising RES deployment in such countries. The impact of such changes can be seen in Italy, Spain, Belgium, Denmark and the UK where, in some cases, investments in solar and wind dropped to almost nothing in the last two to three years – with clear implications on future RES deployment. European-wide leadership requires reliability and maintenance of legislative and other support schemes to ensure investor confidence over the lifetime of projects.



North Sea wind turbines, off the Netherlands. © Gunther / WWF

Aspiring to global European leadership on renewables would also require EU Member States to invest more money in RES than other nations. However, while a few individual countries in the EU are still leading on per capita deployment of wind and solar technologies, the overall investments both absolutely and per unit of GDP have been shrinking. Worldwide, developing countries like South Africa, Burundi, Kenya, Uruguay, Nicaragua, Jordan and Chile have invested the equivalent of about 1% and more of their GDP in RES in 2013 and 2014, while the leading EU Member States only spent 0.2%-0.4% of their GDP per year.ⁱⁱⁱ

SNAP-SHOT DATA CAN BE MISLEADING – TRENDS COUNT TOO^{iv}

The increase in RES in the EU between 2002 and 2012 includes 74% average annual growth for solar power, 18.6% growth in wind, and 12.6% growth in biomass. In comparison, China has seen average annual increases (2002-2012) of 174.1% in solar power and 63% in wind power. The United States, an economy with which the EU competes more directly, has seen its solar power increase on average each year (2002-2012) by 34% while its wind power has increased by 30%. While this **trend data gives an important indication as to each nation's speed of change**, it needs to be tempered with an understanding of the amount of RES already in place when counting began. For example, a country can show a high growth rate, but because it started from a lower baseline both its total installed capacity and the amount of capacity it is adding each year can still be much lower than a mature market with more absolute capacity but slower growth.

NOT ALL RENEWABLE ENERGY CAN BE COUNTED EQUALLY

Renewable energies continue, for most but not all countries, to be primarily electricity generating technologies. The percentage of RES in a country's electricity mix could, therefore, provide another interesting measure of leadership. By this criterion, the EU fares poorly. Only two Member States (Austria with 74.6% and Sweden with 58.4%) are in the global top 20^v. However, this measure is complicated by the dominance of countries that have heavily, and often unsustainably, exploited hydropower resources and/or countries

that have a low overall electricity output, in which a high share of RES can be achieved with relatively little installed capacity.

The sustainability of hydropower is a particular concern given the accumulated pressures on ecosystems from different sectors, including energy, and the need to secure adequate space for nature. Hydropower schemes must, therefore, be subjected to rigorous integrated sustainable energy policy making and planning that evaluates all alternatives, including the maximization of energy savings, other renewable energy sources, refurbishment of existing plants and the designation of no go areas for hydropower. Overall, only renewable energy that meets strict sustainability criteria should benefit from support schemes.

More sophisticated measures are needed. Using figures from a range of sources, WWF has deduced, for example, that Canada leads the way in RES capacity and RES electricity production both in terms of megawatts per million people and megawatts per \$bn of GDP (datasets available on request). However, Canada's RES is dominated by hydropower (86.3% of the total) which is an old technology with a number of serious sustainability concerns^{vi}. Indeed, in most countries leading on RES installations, hydropower accounts for more than half of the total installed capacity, with the exception of a number of EU member states, where other RE technologies dominate^{vii}.

JOBS AND SYSTEM INTEGRATION COUNT TOO

In order to become world RES leader, the EU has to ensure that its strategy harnesses the benefits of renewable energy, including job creation, while also facilitating RES deployment through energy efficiency, improved economic energy intensity, and greater energy system flexibility.

Renewable energy employed 7.7 million people, directly or indirectly, around the world in 2014; an increase of 18% on the previous year (excludes large hydropower). The greatest number of jobs were in China, Brazil, the United States, India, Germany, Indonesia, Japan, France, Bangladesh and Colombia. Broken down by sector, solar PV accounted for 2.5 million jobs, two-thirds of which were located in China. In contrast to global growth, renewable energy jobs fell in the EU. Wind employment crossed the 1 million mark globally, with China accounting for half of these jobs, but the US, Brazil and the EU also saw gains. As the International Renewable Energy Agency (IRENA) makes clear in its 2015 Annual Review of renewable energy and jobs, an array of industrial and trade policies continue to shape RES based employment, with stable and predictable policies favouring job creation.^{viii}

Overall, China has the most renewable energy jobs (almost 3.4 million). However, given China's large population, it is only ranks 4th in terms of RES jobs per 1m inhabitants (2.48 jobs/m). On this measure, Germany leads the way (4.60 RES jobs/m) and the EU beats the US (2.38 compared to 2.27 RES jobs/m)^{ix}.

The weather dependency of key RES technologies such as wind and solar means that a more flexible power system is required for the transition to a low-carbon system^x. The EU is only likely to achieve world leadership on RES if it significantly improves both the physical and market integration for power generation and consumption between Member States. To support this integration, each of Europe's power markets must be reformed to properly

reward flexibility^{xi}. In addition, European-wide cost-effective grid integration is needed within and across Member States to accommodate variable power supply such as wind and solar. Further balancing of variable supply can be achieved with grid integration beyond EU borders, including into the Maghreb region, or nations like Switzerland, Norway and other non-EU states to the Union's east. This is of paramount importance, particularly after the UNFCCC Paris agreement in December 2015.

Measures that reflect the job creation potential of renewables, as well as measures to assess the scope for RES integration through system flexibility should be considered when assessing world leadership.

MEASURING INVESTMENT AND THE ATTRACTIVENESS OF A COUNTRY'S RES REGIME^{xii}

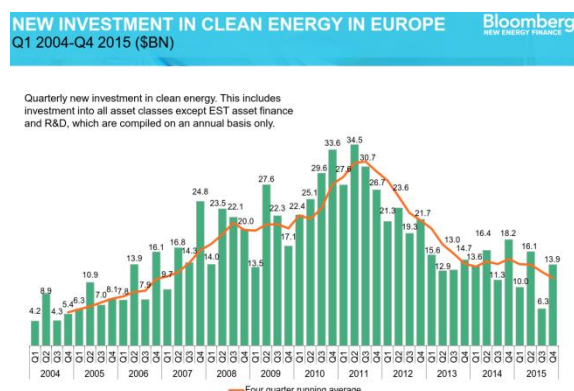
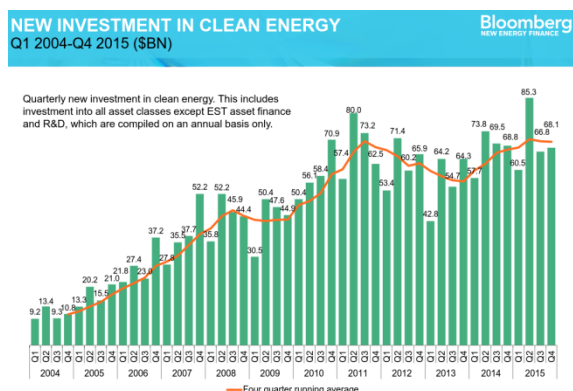
While trends based on confirmed historic data can give a strong understanding of how a country has been progressing on RES, it is also important to assess how well placed a nation is to continue that development into the future. Since 2003, Ernst and Young have produced 45 issues of the 'Renewable Energy Country Attractiveness Index'. The index ranks countries by scoring them on technology specific, energy market, and macro drivers. Examples of each include the 'strength of local supply chain', 'energy market accessibility', and 'political stability'^{xiii}. While the details of these assessments (weightings, etc.) are not public, and the scoring is subjective, the 12 years of comparable data make this a valuable index.

The United States (thanks in particular to action in individual states rather than at the federal level) has led the way, ranking in the top two for all but two of the Ernst and Young quarterly assessments. India's announcements of multi-gigawatt projects and multi-billion-dollar investments have dominated recent headlines, and even though the Ernst and Young index assessment notes the risk of under-delivery in India, it also states that the country has galvanized its market and prompted economic and political reform to create the foundations of an extremely attractive long-term market. As a result, India has moved into third place in the latest assessment, ahead of long-term top five country Germany, where renewable energy deployment has slowed and a new auction regime has raised fears that smaller developers will be squeezed out.

China has shown the most progress over time, climbing from 19th most attractive country for RES in Dec 2004 to commanding a place in the top two from August 2009 onwards. By contrast, the UK has slipped recently, falling out of the top 10 for the first time as a raft of policy measures threaten its historically attractive renewables market. In a further indication of the impact of an unhelpful policy regime, Spain's already battered renewables markets fell to 25th place in the most recent issue. The country's austerity measures, including plans to tax residential solar systems that apply battery storage and preventing these being paid for by selling excess power into the grid are biting hard.

The falling attractiveness of EU Member States for renewables is reflected in the hard investment numbers. Bloomberg New Energy Finance data shows that from a high point in 2010 of \$125.2bn of new investment in clean energy in Europe, such investments have fallen to a total of just \$46.3bn of investment in 2015. Over the same period, global new

clean energy investment has remained steady. 2015 saw the lowest annual new investment in clean energy in Europe since 2006^{xiv}.



New investment in clean energy as measured by Bloomberg globally (left chart) and in Europe (right chart)

Market actors' confidence to invest in renewables, based on a stable and clear policy framework, is the key driver RES growth. The attractiveness of a country's RES regime and the investments they are subsequently able to attract are, therefore, important factors to consider when measuring world leadership.

WHAT CONSTITUTES A HEALTHY MARKET FOR RENEWABLES?

Given the role that energy market attractiveness plays in renewables expansion, it is worth looking at in more detail. When releasing its State of the Energy Union (COM(2015) 572) in November 2015, the European Commission also published a Staff Working Document (SWD(2015) 243), conceptualising and providing a first analysis of key indicators for monitoring progress towards the Energy Union objectives. Regarding renewable energy, the Commission appears to favour a high-level, macro indicator of progress, namely the share of renewable energy in percentage of gross final energy consumption. This indicator is to be 'complemented with information regarding RES share developments at sectoral level.' The Commission also proposes to monitor, for example, energy poverty and the energy intensity of the economy in general and of industry in particular.

This Commission staff working document on Energy Union indicators is an improvement on its initial policy proposal for climate and energy in the period 2020 to 2030^{xv} and responds to suggestions for more detailed energy system monitoring in a recently published DNV-GL report for the European Climate Foundation^{xvi}. However, gaps remain to be filled.

The Commission working document itself recognises that a number of monitoring limitations could be addressed. Regarding renewable energy, these include indicators on the cross-border integration of renewable energy, on the local deployment of renewables and self-consumption, and on the sustainability of biomass for energy use. More broadly, the Commission paper also highlights the need to better assess impacts of renewable and energy efficiency policies on net employment, to develop additional and more comprehensive indicators on retail market functioning across EU Member States, and the potential for additional indicators/analysis for a pan-EU assessment of energy poverty.

In order to fully assess its standing as renewables world leader the EU has to understand each of these aspects of its energy system.

WE SHOULD ALSO CONSIDER FOSSIL FUEL AND NUCLEAR TRENDS

We should remember that an increased share of renewable energy is a means to using fewer fossil fuels and nuclear energy, due to all the inherent shortcomings of those incumbent fuels. Therefore, a nation's success on sustainable and clean energy can also be measured by looking at the trends in its fossil fuel use. In this regard, the European Union passed a symbolic milestone in its 2012 electricity production, when for the first time it produced less than half of its electricity (48.4%) from fossil fuel sources.^{xvii} By comparison, East and South East Asian states (including China) generated 79.7% of electricity from fossil fuels, while the Commonwealth of Independent States (including Russia) and North America produced 65.9% and 62.5% of electricity from fossil fuels respectively^{xviii}.



Coal mine & wind turbines in Northwest Czech Rep. © Van Waarden/WWF

In this context energy efficiency and conservation must be boosted as well. It makes a fundamental difference for a given amount of investments into renewables and the consequential share of renewables in the overall energy mix if overall energy consumption rises in the EU or if it continues to decline by way of new and efficient technologies.

The energy transition that leads to RES world leadership will depend on energy efficiency and a reduction in the energy intensity of economies. Europe has historically had low energy intensity, which has boosted its competitiveness in global markets. However, Europe's rivals are catching up. Between 2005 and 2012, China decreased its industrial energy intensity by a quarter^{xix}.

No nation or region can expect to be a world leader in renewable energy without first boosting energy efficiency, and also acting to cut the use of fossil fuel and nuclear power.

THE NEED FOR LEADERSHIP ON SMALL-SCALE AND COMMUNITY RES

Beyond the counting of raw data and assessment matrixes, there are elements of renewables leadership that are more qualitative in nature – such as *who* is producing the renewable energy. Self-production and consumption are key ways to create ownership by citizens of an energy transition. In Germany, electricity produced by individual private households and communities accounts for 46% of renewable energy generation. In the UK, by contrast, this figure stands at just 0.3%^{xx}. The UK has the potential for a further 5GW of onshore renewables if community owned energy is maximized - a 20% increase in total UK renewables capacity^{xxi}.

Policy is crucial to support this development. Currently, the EU has a patchwork of community energy measures. Scotland, for example, has a national target of 500MW of community-owned energy by 2050. Elsewhere, a lack of support and/or retroactive policy changes risk undermining community energy^{xxii}.

The EU-funded Community Power project recommends that **community energy should be explicitly recognised as part of the EU 2030 climate and energy framework**^{xxiii}.

RENEWABLE ELECTRICITY IS NOT THE END OF THE STORY

In order to achieve the vision of 100% RES by 2050, action will be required outside of the power sector. Renewable heating and cooling, renewable industrial steam and renewably powered transport will all be required. Even if the world produces 100% renewable electricity, this will address only about a third of all energy demand. Transport requires dedicated renewables policies, smart grid regulations and load management policies for the electrification of vehicles supported by an increase in infrastructure for battery charging. Beyond electrification, new transport fuels are also needed, including “power to gas” and hydrogen produced from renewable sources. Such energy sources are capable of replacing fossil fuels in industrial usages, aviation and shipping with the latter sector facing large global growth rates.

IS THE EU DEMONSTRATING GENUINE GLOBAL LEADERSHIP ON RES?

It is clear that every nation must do much more to transition to efficient energy systems based on renewable energy as a core part of the fight against climate change and for sustainable development. Our analysis has shown that, compared to the current efforts of other economies, the EU is doing relatively well.

However, given the EU’s overall historic responsibility with regard to global carbon pollution and its capacity to act as a rich regional bloc, it must shoulder its “fair share” of the action required. Against this measure, the policies proposed in the EU’s 2030 climate and energy framework, including on renewables, are inadequate. WWF has repeatedly called^{xxiv} on the EU to set a target of more than 40% of renewable energy in total consumption by 2030, supported by a strong, transparent and reliable governance system. This would be an adequate contribution to limiting global temperature increases to “well

below 2 degrees” and to driving efforts to limit the temperature rise even further to 1.5 degrees Celsius above pre-industrial levels, as enshrined in the Paris Agreement.

If President Juncker wants to achieve his stated aim of making the EU the world leader in renewable energy, much more is required. One is not only a ‘leader’ by self-declaration or in reference to the efforts of others. Leadership is also earned by the recognition and support of ‘followers’. The EU must, therefore, show solidarity with and support for the global poor who suffer first and most harshly from climate change.

In the wake of the UNFCCC Paris Agreement, it is very clear that nations need to work together. Europe must proactively live up to its global responsibility and strongly increase its long-term commitment to public funding of renewable energy in developing countries in the context of the at least \$US 100 billion annual pledge given by rich nations to counter climate change. It also requires the leveraging of sufficient private capital to assist developing countries in their decarbonisation efforts.

Furthermore, the EU as a bloc should support business community commitments that were announced at COP21 including Mission Innovation^{xxv} and the Breakthrough Energy Coalition^{xxvi}. Mission Innovation aims to reinvigorate and accelerate global clean energy innovation, making clean energy widely affordable by doubling governmental investment in clean energy innovation. Two dozen countries, including Italy, UK, France, Denmark, Germany and Sweden are already signatories. The Breakthrough Energy Coalition is a group of world leading entrepreneurs who are supporting public/private clean energy innovation in conjunction with the Mission Innovation countries.



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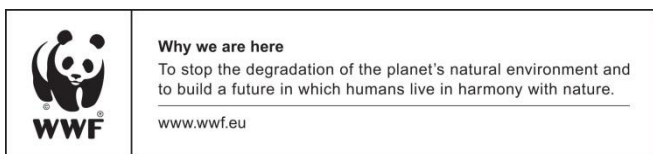
The EU should also provide appropriate resources to proactively support global renewable energy initiatives, particularly the G7-backed Africa Renewable Energy Initiative (AREI) in the framework of which France already committed €2 billion to upscaling renewables by 2020, as well as the India-led Global Solar Alliance focusing primarily on developing nations. Both initiatives include EU Member States among their founding members.

PRACTICAL RECOMMENDATIONS:

To gain credibility to be a “leader” in RES, the EU, as a first step, must identify and produce data against a widely accepted and comparable matrix. This analysis should inform the strategic development of effective EU and national policies. Leading the world on renewable energy requires effective policy and funding, which goes beyond the immediate energy sphere to support and coordinate with policies on digitalisation, growth and employment, as well as research and development. A holistic approach is needed to develop a single unifying strategy of world leadership on renewables. Without transparency and true ambition on this matter, EU citizens will never really know how well their countries are doing and where they are heading – which is likely to be frustrating given the fact that the vast majority of Europeans (91%) supports action to increase renewable energy by 2030, including through the setting of national targets^{xxvii}.

- 1. The EU must review and considerably strengthen its INDC, in particular with regard to its RES targets^{xxviii}.**
- 2. President Juncker has set out the challenge and the EU must deliver. The stated aim of being ‘world number one in renewable energies’ must be more than mere rhetoric and should incorporate actions to boost energy efficiency and reduce fossil fuel use.**
- 3. For the ‘world number one’ goal to have real value, it must be definable, measurable, and comparable against other countries and regions.**
- 4. Measuring RES leadership must also take account of qualitative aspects of deployment, such as RES investor attractiveness and market health, the sustainability of RES deployed, and the ownership of RES generation by communities.**
- 5. The Commission should consider a matrix of measures to assess renewables world leadership and should deliver a comprehensive roadmap on how to achieve this.**
- 6. The status of the ‘world number one in renewable energies’ goal should be reported on in the annual State of the Energy Union report, with EU Member States reporting their progress through National Climate and Energy Plans.**
- 7. WWF urges the EU as a whole to invest every year from 2017 at the latest the equivalent of 1% or higher of its GDP in RES. Investments in energy efficiency should be raised to a similar level.**
- 8. WWF urges the EU as a whole to support the ‘Mission Innovation’ target of doubling public clean energy R & D innovation budgets on renewables, energy efficiency & conservation, smart grids and related technologies by 2020.**
- 9. WWF urges the EU as a whole to proactively support, with resources, know-how and by leveraging private capital, the two large Renewable Energy Initiatives led by Africa and India for sustainable development, meeting relevant aspects of the Sustainable Development Goals and the UNFCCC Paris Agreement.**
- 10. The increase in EU RES ambition that goes with the goal of being world number one in renewables should be reflected in other policy files, particularly given the EU’s support of the Paris Agreement’s aim to hold global temperature increases to well below 2°C and to pursue efforts to limit temperature increases to 1.5°C.**

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 - ii Eurostat data, http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources
 - iii Global Status Reports on Renewables 2014; 2015; REN21 – The Renewable Energy Policy Network for the 21st Century, <http://www.ren21.net/>
 - iv All data from the 15th Inventory (2013 Edition) of the Worldwide electricity production from Renewable energy sources, <http://www.energies-renouvelables.org/observ-er/html/inventaire/Eng/sommaire.asp>
 - v <http://www.energies-renouvelables.org/observ-er/html/inventaire/pdf/15e-inventaire-Chap03-3.1-Intro.pdf>
 - vi WWF international position on the use of dams and hydro-power, http://wwf.panda.org/what_we_do/footprint/water/dams_initiative/
 - vii Germany leads the way with 1207.91MW of RES per 1m people but Spain overtakes when it comes to installed RES and RES produced per \$bn of GDP with 35.77MW and 0.06tWh respectively.
 - viii 2015 Annual Review of renewable energy and jobs, International Renewable Energy Agency, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2015.pdf
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 - xi Ibid.
 - xii All findings deduced from an evaluation of data from the 45 Issues of the Ernst and Young ‘Renewable Energy Country Attractiveness Index’, published since 2003: <http://www.ey.com/GL/en/Industries/Power---Utilities/Renewable-Energy-Country-Attractiveness-Index>
 - xiii Ernst and Young Renewable Energy Country Attractiveness Index, <http://www.ey.com/GL/en/Industries/Power---Utilities/Renewable-Energy-Country-Attractiveness-Index--Methodology>
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 - xix IEA, World Energy Outlook 2013, page 240.
 - xx The Community Renewables Economy, Respublica, 2013, <http://www.respublica.org.uk/our-work/publications/community-renewables-economy-starting-scaling-spinning/>
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 - xxv <http://mission-innovation.net/>
 - xxvi <http://www.breakthroughenergycoalition.com/>
 - xxvii Special Eurobarometer 435, Climate Change, November 2015, http://ec.europa.eu/clima/citizens/support/docs/report_2015_en.pdf.
 - xxviii Based on research by ECOFYS, WWF maintains that the EU should achieve a more than 40% share of renewable energy in total consumption by 2030, supported by a strong, transparent and reliable governance system.



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