



ACCELERATING SDG 7 ACHIEVEMENT

POLICY BRIEF 03

**SUBSTANTIALLY INCREASE THE
SHARE OF RENEWABLE ENERGY
IN THE GLOBAL ENERGY MIX**

7 AFFORDABLE AND
CLEAN ENERGY



POLICY BRIEF #3

SUBSTANTIALLY INCREASE THE SHARE OF RENEWABLE ENERGY IN THE GLOBAL ENERGY MIX

Developed by

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KEY MESSAGES

Status of renewable energy and progress towards achieving SDG 7.2

- The energy sector needs to undergo an accelerated transformation towards a zero-carbon energy system by the second half of this century. Accounting for two-thirds of the world's greenhouse gas (GHG) emissions, the energy sector presents a large opportunity to combat climate change through a shift towards renewable energy. In addition, increasing the share of renewables would lead to US\$ 52 trillion in economic growth (IRENA, 2018). The health, environmental and climate benefits would save up to 2-5 times more than the additional costs associated with reconfiguring the energy sector, while creating millions of jobs in the process, and improving the health and well-being of people, in line with the Sustainable Development Goals (IRENA, 2018).
- The world is currently not on track to achieve the SDG 7 renewable energy indicator 7.2.1 (IEA, World Bank, 2017). Significant additional efforts are needed to achieve the needed acceleration.
- The share of renewables in total final consumption (TFEC) grew marginally in 2015 to reach 17.5 per cent, up from 16.7 per cent in 2010 (IEA and World Bank, forthcoming).
- Renewable energy represented about 22.8 per cent of global electricity generation in 2015, with the rest generated by fossil fuels and nuclear.
- Action on energy use for heating and transport is lagging, with a limited increase in renewable energy shares seen in recent years.

Priority actions over the next four years

- The renewables share in power generation should grow to 60 per cent by 2030. Rapidly declining costs suggest this is an economically and technically feasible task (IRENA, 2017c).
- Efforts must be strengthened in end-use sectors, particularly in buildings, industry and transport. Sector coupling through the increased electrification of these sectors will increase the use of renewables, improve system flexibility, and improve overall energy efficiency.
- Increased focus is needed on enabling technologies, including a major ramp-up in the production of batteries for transport and static storage.
- Energy sector reforms are required to strengthen the role of electricity regulatory agencies, advance flexible financing mechanisms and incentives and promote smart grid technologies.

Priority actions towards 2030

- Energy system integration through direct and indirect electrification should be facilitated through policy and regulatory action. Market design for the power sector needs structural modifications.
- Renewable energy and energy efficiency measures need to be accelerated and pursued in tandem. Together, they will account for 90 per cent of the decarbonization needed to stay within the Paris Agreement boundaries (IRENA, 2017c).
- Higher R&D investment is needed for those sectors where options are currently lacking, particularly for transport, manufacturing and buildings (IRENA, 2017a).
- The sharing of experiences and lessons learned, through regional cooperation and other formats, to facilitate the exchange of lessons learned needs to be expanded and strengthened.
- The progress of renewable energy deployment needs to be continuously tracked while improving the quality of data and indicators.

Renewable energy and the sustainable development goals

The energy sector—largely based on fossil fuels—needs to undergo an accelerated transformation towards a zero-carbon energy system by the second half of this century. The Paris Agreement endorsed the goal of keeping average temperature increases to no more than 1.5 Celsius, and this implies remaining within the limits of the remaining carbon budget. Accounting for two-thirds of the world’s greenhouse gas (GHG) emissions, the energy sector presents a large opportunity to combat climate change through a shift towards renewable energy. In addition, increasing the share of renewables would lead to US\$ trillions in economic growth over the next few decades (IRENA, 2017c). The health, environmental and climate benefits would save up to six times more than the additional costs associated with reconfiguring the energy sector, all while creating millions of jobs in the process and improving the health and well-being of people in line with the Sustainable Development Goals (IRENA, 2017c).

Current status

- Renewable electricity has made significant progress, accounting for well over 50 per cent of global power capacity additions in recent years (IRENA, 2018a). Biomass for power, hydropower, geothermal, solar photovoltaic (PV) and onshore wind technologies can all now provide electricity that largely falls within the range of generation costs for fossil fuel-based electricity, increasingly undercutting these (IRENA, 2018b).
- However, in 2016, over 80 per cent of TFECE still came from fossil fuels. The share of renewables in TFECE grew marginally in 2015 to reach 17.5 per cent, up from 16.7 per cent in 2010 (IEA and World Bank, forthcoming). Within the power generation sector, renewables account for 25 per cent (see figure 3.1).
- Because about half of the renewable energy share is in traditional forms of bioenergy, **modern renewable energy accounts for 10 per cent of TFECE**. Under a business-as-usual evolution, this would grow to a 17 per cent⁴ share in 2030. Traditional uses of bioenergy must be phased out and replaced, meaning that the increase in modern renewables deployment would need to be even higher.
- The results of the 2017 Global Tracking Framework (GTF) report indicate that the world is not on track to achieve the SDG 7 renewable energy indicator 7.2.1 (IEA, World Bank, 2017) and business-as-usual projections suggest limited growth acceleration till 2030 (IEA, 2017a). Therefore, significant additional efforts are needed.

⁴ 3.6 per cent annual growth rate

- Such acceleration is technically and economically feasible but requires strong and concerted action (IRENA 2017c).
- The challenge is to increase the share of renewable energy in the heat and transport sectors, which together account for 80 per cent of global energy consumption.

Figure 3.1:

Renewable power generation (TWh) and share of total electricity



Source: IRENA, 2017f

Projects

The results of the 2017 Global Tracking Framework (GTF) report indicate that the world is not on track to achieve the SDG 7 renewable energy indicator 7.2.1, and most business-as-usual projections suggest limited growth until 2030 (IEA, 2017a).

To substantially increase the share of renewables, growth needs to take place across the spectrum of energy use—not just in the power sector. According to the IRENA Remap analysis, the share of modern renewables in TFECE stood at 10 per cent in 2015 and will increase to around 20 per cent by 2030 under business as usual (IRENA, 2018a). Other analyses show a similar increase to between 18–20 per cent over the period under business as usual (IEA, 2017a).

IEA’s Sustainable Development Scenario (IEA, World Energy Outlook, 2017) illustrates that increasing the share of renewables is a key measure for achieving the three critical energy sector goals: an early peak in energy-related CO₂ emissions, universal access to modern energy by 2030 and improving energy-related air pollution. In this scenario, the share of renewables in TFECE reaches 23 per cent by 2030 and 21 per cent if just modern renewables are considered, significant scale-up compared with the 15 per cent penetration of modern renewables that current and planned policies would achieve. Achieving these levels requires an accelerated penetration of renewables across all sectors of power, modern heat and transport. In addition, delivering universal access to clean cooking by that time would remove the vast majority of traditional biomass.

The highest growth will be seen in the power sector, where renewables would increase from 25 per cent of global electricity generation in 2017, to over 60 per cent by 2030 in a high-renewables scenario (IRENA, 2017c). However, progress on energy consumption for heating and transport is lagging. The share of renewables has increased by half a percentage point over the last five years (2010-2015) in both sectors: From 8.1 per cent to 8.6 per cent in *modern* heat and from 2.6 per cent to 3.1 per cent in transport (IEA, 2017b). A scale-up of the overall renewable energy share in TFEC must also include significant increases in the renewable energy share in the end-use sectors (residential and commercial buildings, manufacturing industry, and transport). Sector coupling through electrification will enable a significant increase in the rate of renewables deployment in these demand sectors, while simultaneously providing the energy flexibility needed to operate the power system with high shares of renewables.

The energy transition is technically and economically feasible; energy and climate policies have unlocked cost reductions (IRENA, 2018b), and technology improvements have opened the door to an energy transformation that makes economic sense. Over the past seven years, solar PV module prices dropped by over 80 per cent, and wind turbine prices fell by around 40 per cent to 55 per cent depending on the market. The global weighted average levelized cost of electricity (LCOE)⁵ from solar PV fell by 73 per cent between 2010 and 2017 to US\$ 0.10/kWh, while for onshore wind it fell by 23 per cent to US\$ 0.06/kWh. The outlook for solar and wind electricity costs to 2020, based on the latest auction and project-level cost data, points to the lowest costs yet seen for these modular technologies, which can be deployed around the world. As a result, by 2020 all the renewable power generation technologies that are now in commercial use are expected to fall within the fossil fuel cost range, with most at the lower end or undercutting fossil fuels.

How to fill the gap to enable substantial increases in renewable energy share

New challenges and opportunities call for a shift in policy and regulatory focus. Integrating the growing share of variable renewable energy (VRE) requires changes in power system planning and operations, and the rise of distributed generation is challenging conventional actors and business models. To capitalize on the opportunities, adjustments are required in physical infrastructure, power market design, system regulations, and operating procedures (IRENA, 2017e). Furthermore, policymaking should consider the wider ecosystem in order to ensure that the energy transition is a just and timely one. This requires enabling all stakeholders to participate, especially communities.

Deploying in tandem renewable energy (RE), energy efficiency

⁵ All the LCOE numbers in this section exclude the impact of any local or federal financial support policies, are for the year of commissioning and are based on IRENAs Renewable Cost Database, which contains cost and perfor-

and energy flexibility, greatly facilitates this process, reducing the requirements for RE deployment, increasing the rate of RE-share progression, and providing the tools needed to operate a RE-based energy system.

Enabling the transition with the required RE deployment rates requires going beyond the conventional techno-economic context to fully address all the transition's socioeconomic implications. Success in delivering the transition depends on effectively engaging all the stakeholders and society, which requires addressing fair and just transition considerations, holistic and inclusive access, and materializing (and properly sharing) its full welfare potential.

Policy actions

1. Increase substantially the share of renewable energy in power generation, which will also require policy and regulatory actions for end-use sectors (based on IRENA, IEA, REN21 (2018))

In the **power sector**, RE has made significant progress recently and the transformation is well under way. With the right mix of policies, the share of RE-based power generation could increase from the current 25 per cent to up to 60 per cent by 2030. Renewable generation policies aim to translate high-level targets into concrete projects and installations. By 2017, 150 countries had adopted renewable electricity generation targets. Building on these targets, 126 countries had implemented renewable energy policies and regulations in the power sector. Key policies that enable the translation of renewable energy targets into concrete actions range from quotas and mandates (e.g., renewable portfolio standards or renewable obligations), to feed-in policies (e.g., administratively set feed-in tariffs/feed-in premiums, market-set pricing through auctions, and net metering) and fiscal and financial incentives (e.g., tax incentives and rebates).

Choices of policy instruments, and their design, need to be tailored to the specific country context, taking into account the state of the energy market, technology, and specific objectives to be achieved. Over time, policy instruments need to adapt to changing market conditions such as the falling cost of technology and potential challenges related to the integration of variable renewable energy.

However, electricity only makes up 20 per cent of TFEC and to meet the SDG target, substantial efforts are needed to scale-up RE share in **end-use sectors**, particularly addressing the areas of heating/cooling and transport.

In heating, policies to support renewables are country and location-specific. District heating using biomass or geothermal can be incentivized through **public investment in networks** and supported by **heat zoning, taxes on fossil fuels and financial incentives for renewables** (e.g., Denmark). **Grants or tax incentives can help** mance details of 15,000 utility-scale power-generation projects.

bridge cost gaps with gas, where they exist, by **subsidizing the higher capital costs of renewable options** (e.g., UK). **Grants and subsidies** can also support the greater deployment of renewables for industrial heat (e.g., Brazil, India and South Africa). **Carbon taxes** are deployed in some countries, although currently at a low level. Finally, solar water heaters can be incentivized through **rebate programmes with free installations for low-income households** (e.g., South Africa), **mandates and building codes** (India and Brazil) and **financial incentives** (e.g., countries in MENA). (IRENA, IEA, REN21, 2018)

In the transport sector, the **removal of fossil fuel subsidies** is a prerequisite for decarbonization through greater use of biofuels and electric vehicles (EVs). **The production, distribution and use of biofuels** can be encouraged through **biofuel obligations/mandates** (adopted in 67 countries as of 2017), tax exemptions for biodiesel production (Argentina, Sweden) and R&D and demonstration programmes (e.g., a trial programme for the use of B20 in trucks and B10 for military/government use in Thailand). **Support for the purchase and use of EVs mostly consists of tax incentives and purchase subsidies**. The global EV fleet doubled to 2 million in just one year, 2016 (IRENA, 2017b) and (IRENA, IEA, REN21, 2018).

In addition, the **electrification of other end-use sectors** such as buildings, and various industries offers the potential to further accelerate the pace of RE deployment while also supporting the objective of improving system flexibility (through sector coupling). Buildings will need to become much more energy efficient and rely largely on electricity for heat (IRENA, 2017a). Smart charging technologies and other measures can help limit peak demands on the system through end-use electrification.

2. Market design for the power sector needs to be structurally modified to properly deal with a renewables-based electricity system, including the effective articulation of distributed energy resources

Accelerating this transition requires a rethinking of many aspects of electricity markets. Adjustments are required in power market design, system regulations and operating procedures.

Some of these relate to physical infrastructure, and others are defined by market design and regulation. In particular, markets need to adapt their design and operations to support flexibility measures for storage, demand-side management, and the integration of higher shares of variable renewables, as well as the key role of distributed power generation.

For the integration of renewables, the design of the wholesale markets (day-ahead and intra-day markets), balancing markets, and long-term investment signals should be reinforced. Increasing the time granularity of energy trading and reducing the minimum size of energy products could be some of the options to better represent

variable renewables and increasing flexibility in the system. The balancing market should be designed to provide accurate incentives for renewables and other flexibility service providers. In the context of the long-term support, one of the options could be to incorporate transition-focused capacity mechanisms and/or premium tariffs as potential tools for complementing the energy market revenues (IRENA, 2017e).

Regulators should allow distribution companies to interact more often with distributed energy resources or aggregators to efficiently manage network constraints by facilitating the participation of distributed flexibility resources into energy markets, thereby promoting an increase in RE shares. Regulators should enable new streams of revenue for distribution operators, allowing them to have a more active involvement in the transition while simultaneously introducing performance-based economic regulation addressing total system costs (IRENA, 2017e) and (IRENA, IEA, REN21, 2018).

3. Pursue simultaneous and synergetic deployment of renewable energy and energy efficiency as interrelated technical transition pillars

A holistic approach is required when planning for the energy transition and the increase of renewable energy shares. Policymakers need to pursue renewable energy and energy efficiency in parallel. When both are pursued in tandem and synergies are exploited, the result is a faster decarbonization of the energy system. Greater efficiency is essential because it reduces overall energy demand and therefore the requirements for RE deployment.

In fact, accelerated energy efficiency is expected to raise the share of renewable energy in 2030 by 15 per cent according to one study (IRENA, 2017g). Renewable energy and energy efficiency offer roughly the same amount of carbon mitigation potential through to 2030, but only when in synergy with each other. Policymakers should adopt integrated policies to ensure that synergies between energy efficiency and renewables are maximized and the risk of policies working against each other is avoided (IEA, World Energy Outlook, 2017).

4. Need for a broader enabling environment

Energy policymaking needs to consider socioeconomic dimensions to maximize benefits for welfare and prosperity and to achieve a transition in a just and timely manner. This requires not only **aligning private- and public-sector policies**, but also proper articulation and effective participation of all stakeholders.

The transformation must be aimed at enabling active social involvement in energy system planning and operation, creating new businesses and jobs, pursuing a just transition and helping citizens and industries to flourish by providing additional economic opportunities to increase wealth (IRENA, 2017a), while respecting

climate and sustainability constraints.

Business models must therefore be tailored to ensure the fair sharing of benefits and responsibilities among different stakeholders. Regulations also need to enable small and distributed power generators to be able to participate in the power market.

However, beyond the design of business models, direct and effective social involvement is a cornerstone for successful energy system transition, substantially increasing the shares of renewables, and we are lagging well behind in this dimension.

Community-based direct participation in the energy system, both through the deployment of distributed generation and its contribution to sourcing the required energy flexibility, holds a huge potential for increasing renewables shares.

Social financing can also play a major role in renewables deployment by aligning economic resources with the transition requirements, facilitating energy access, and articulating compensatory mitigation contributions to address the fair share of transition burdens.

5. Technological R&D funding and technological improvement

- Innovation has played a critical enabling role in progress towards the SDG 7 targets, by reducing costs and enhancing the capabilities of technologies such as solar, wind and energy storage. Significant further innovation is needed, however, in many aspects of the energy system if we are to markedly accelerate the energy transition.
- As the technology to drive the transformation in the energy sector develops and reaches commercialization, the next stage to scale-up renewable energy shares requires the integration of these technologies in dynamic energy systems. Technology innovation needs to be complemented by innovation in systems design, processes, market design and business models in order to accelerate the diffusion and broaden the uptake of innovations.

Interlinkages with other SDGs

With a holistic approach to policymaking, the global energy transition will fuel economic growth, create employment opportunities, enhance welfare benefits, and help achieve a number of other SDGs. Global GDP could be boosted around 1.4 per cent in 2030 (US\$ 1.7 trillion), with the cumulative gain from now to 2030 adding up to US\$ 10.3 trillion (IRENA, 2017c). Renewables also improve welfare in ways that are not captured by GDP (almost 5 per cent welfare improvement, compared to reference case, such as reduced health impacts from fossil fuel combustion (IRENA, 2017c) (IRENA, 2016b). Increased energy access enables additional gains, including sustainable livelihoods, social inclusion, gender

equality and better quality of life. To achieve universal electricity access by 2030, the pace of expanding access needs to at least double, and estimates suggest that off-grid solutions, for which renewables are increasingly the most cost-competitive option, will provide roughly 60 per cent of the additional generation needed (IRENA, 2016a).

The transformation to a sustainable energy system with a high share of renewables would meet climate goals, and also significantly reduce local air and water pollution. Health, environmental and climate benefits would offer a savings equivalent up to as much as six times the additional costs associated with reconfiguring the energy sector, all while creating millions of jobs in the process (IRENA, 2017c; IRENA, 2017d). Renewable energy also reduces the pressure on water and energy resources. Its use can stimulate economic activity along the agri-food supply chain, reduce losses and enhance food productivity, and provide the energy needed for water pumping and distribution, and food storage and processing (ESCWA, 2016).

Boosting the share of renewables thus holds great potential for addressing the climate and environmental challenge. Doing so not only promises economic gains, but would also help the global community to translate several of the SDGs into reality and thus secure a broad range of important socioeconomic benefits.

REFERENCES

- Credit Suisse (2017) *Global Wealth Report 2017*, Credit Suisse Research Institute, Zurich, ECREE (ECOWAS Centre for Renewable Energy and Energy Efficiency) (2015), *West African Clean Energy Mini-Grid Market: Current Situation and Perspectives*, ECREE, Cape Verde, http://www.ecreee.org/sites/default/files/events/west_african_clean_energy_mini-grid_market_current_situation_and_perspectives_-_nicola_bugatti_se_expert_ecreee.pdf.
- ESCWA (United Nations Economic and Social Commission for Western Asia) (2016), *Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving Sustainable Development Goals - Regional Policy Toolkit*, UN ESCWA, Beirut, https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/water-energy-nexus-regional-policy-toolkit-english_0.pdf.
- Frankfurt School-UNEP Centre/BNEF (2017): *Global Trends in Renewable Energy Investment 2017*, <http://fs-unep-centre.org/sites/default/files/publications/globaltrendsrenewableenergyinvestment2017.pdf>.
- IEA (International Energy Agency) and the World Bank, *Global Tracking Framework* (2018 forthcoming).
- IEA (International Energy Agency) and the World Bank (2017), *Sustainable Energy for All 2017—Progress toward Sustainable Energy*, World Bank, Washington, D.C.
- http://gtf.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf.
- IEA (International Energy Agency) (2017a), *World Energy Outlook*,

- OECD/IEA, Paris, https://www.iea.org/bookshop/750-World_Energy_Outlook_2017.
- IEA (International Energy Agency) (2017b), *World Energy Statistics and Balances*, 2017, www.iea.org/statistics/.
- IRENA, IEA, REN21 (2018), *Renewable energy policies in a time of transition* (forthcoming).
- IRENA (International Renewable Energy Agency) (2018a), *The Energy Transition: View to 2050* (forthcoming).
- IRENA (International Renewable Energy Agency) (2018b), *Renewable Power Generation Costs in 2017*, IRENA, Abu Dhabi, <http://www.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017>.
- IRENA (International Renewable Energy Agency) (2017a) *Accelerating the Energy Transition through Innovation*, IRENA, Abu Dhabi, <http://www.irena.org/publications/2017/Jun/Accelerating-the-Energy-Transition-through-Innovation>.
- IRENA (International Renewable Energy Agency) (2017b), *Electric Vehicles technology brief*, IRENA, Abu Dhabi http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/IRENA_Electric_Vehicles_2017.pdf.
- IRENA (International Renewable Energy Agency) (2017c), [Executive Summary/Chapter [3/4]] of *Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System*, IRENA and International Energy Agency (IEA), Abu Dhabi, www.irena.org/DocumentDownloads/Publications/Perspectives_for_the_Energy_Transition_2017.pdf.
- IRENA (International Renewable Energy Agency) (2017d), *Renewable Energy and Jobs: Annual Review 2017*, IRENA, Abu Dhabi, <http://www.irena.org/publications/2017/May/Renewable-Energy-and-Jobs--Annual-Review-2017>.
- IRENA (International Renewable Energy Agency) (2017e), *Adapting market design to high shares of variable renewable energy*, IRENA, Abu Dhabi, www.irena.org/publications/2017/May/Adapting-Market-Design-to-High-Shares-of-Variable-Renewable-Energy.
- IRENA (International Renewable Energy Agency) (2017f), 'Global Overview on Renewable Energy Capacity and Electricity Generation'. IRENA, Abu Dhabi. <http://resourceirena.irena.org/gateway/dashboard/?topic=4&subTopic=17>.
- IRENA (International Renewable Energy Agency) (2017g), 'Synergies between renewable energy and energy efficiency'. IRENA, Abu Dhabi. <http://www.irena.org/publications/2017/Aug/Synergies-between-renewable-energy-and-energy-efficiency>.
- IRENA (International Renewable Energy Agency) (2016a), *Innovation Outlook: Mini-grids*, IRENA, Abu Dhabi, <http://www.irena.org/publications/2016/Sep/Innovation-Outlook-Renewable-mini-grids>.
- IRENA (International Renewable Energy Agency) (2016b), *Renewable energy benefits: measuring the economics*, International Renewable Energy Agency (IRENA), Abu Dhabi, <http://www.irena.org/publications/2016/Jan/Renewable-Energy-Benefits-Measuring-the-Economics>.
- REN21 (2017), *Renewables 2017 Global Status Report*, REN21 Secretariat, Paris, http://www.ren21.net/wp-content/uploads/2017/06/17-8399_GSR_2017_Full_Report_0621_Opt.pdf.
- SE4All (Sustainable Energy for All—The Africa Hub) (2017), *Green Mini-Grids Market Development Programme*, <https://www.se4all-africa.org/se4all-in-africa/regional-initiatives/green-mini-grids/>.
- IRENA (2018) *Global Energy Transformation: A Roadmap to 2050*, <http://www.irena.org/publications/2018/Apr/Global-Energy-Transition-A-Roadmap-to-2050>.

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**HIGH-LEVEL POLITICAL FORUM
ON SUSTAINABLE DEVELOPMENT**

