ACCELERATING SDG 7 ACHIEVEMENT

POLICY BRIEF 13

INTERLINKAGES BETWEEN ENERGY AND JOBS

7 AFFORDABLE AND CLEAN ENERGY

ACCELERATING SDG 7 ACHIEVEMENT

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POLICY BRIEF #13

INTERLINKAGES BETWEEN ENERGY AND JOBS

Developed by

International Renewable Energy Agency (IRENA), The European Commission and International Labour Organization (ILO)

In collaboration with

Norad

KEY MESSAGES

Progress towards employment linked to achievement of SDG 7

- Energy is essential to a well-functioning economy, and the transition to more sustainable energy systems will enhance the socioeconomic resilience of communities around the world.
- The share of renewable energy in total final energy consumption rose to 19.3 per cent in 2015. The number of people employed, directly and indirectly, in the renewable energy sector (excluding large hydropower) rose from 5.7 million in 2012 to 8.3 million in 2016, and that number could expand to 25 million by 2030 with proper policy support. Solar PV has emerged as the single largest employer in the renewable energy sector, followed by liquid biofuels and wind. With manufacturing of renewable energy equipment concentrated in a few countries, employment opportunities in other countries will mostly lie in project development, sales, construction and installations, and operations and maintenance.
- Energy efficiency and renewable energy create more jobs than the fossil fuel industry, enabling net employment gains as the energy transition unfolds. Trends in renewable energy jobs have remained positive, in contrast to traditional energy industries, which have been facing employment cuts due to changing dynamics in the energy sector.
- Available data in the energy access context is still limited, but evidence from Bangladesh and East Africa suggests expanding employment as off-grid solutions become more widely available. The combination of energy access and an enabling environment facilitates rural development.
- Access to energy is necessary but by itself not sufficient for creating productive and decent jobs, and complementary initiatives to stimulate the productive use of energy may be required.

Priority Actions

- Improve data collection, and quantitative and qualitative analysis, regarding employment rates in grid-based and off-grid contexts, including disaggregation by gender and other socioeconomic factors
- Provide an enabling environment with stable and predictable policy support for the expansion of renewable energy and energy efficiency
- To avoid skills gaps, promote coordination between the renewable energy sector and educational/training institutions, with integration of renewables modules into vocational training and technical courses, and find ways to draw on skilled workers from other relevant industries, offering retraining as necessary
- To augment local value creation, governments should adopt policies in support of value chain development, including incubation of new businesses, capacity-building programmes for suppliers, formation of industry clusters, and provision of infrastructure
- To draw on all available talent, governments should develop policies geared towards specific groups. Particular measures are needed to overcome the barriers that women confront, including gender diversity targets, greater workplace flexibility, and sensitivity training, along with mentorship and training programmes.
- Governments and other stakeholders should also put in place policies to support workers who are affected by the transition to renewable energy including through unemployment benefits, relocation grants, job-search assistance and re-skilling programs.
- Efforts are needed to support investments in renewable energy development, and to adopt and update equipment standards and quality-control measures to ensure maximum effectiveness of installed renewable energy capacities.
- Active labour market policies, skills development and social protection strategies can smooth the energy transition for fossil fuel-dependent communities. These include proactive consultations, retraining programmes, social protection measures and investments in support of economic diversification.

Policy Brief on the interlinkages between energy and jobs

Energy is essential to a well-functioning economy, and it must be accessible, reliable and affordable. Absence of these conditions may spell job loss and missed job-creation opportunities. Therefore, SDGs 7 and SDG 8 (Decent work and Economic growth) are linked in important ways, to the extent that in many contexts, achieving SDG 7 can be considered a precondition for achieving SDG 8, in that almost all jobs that are decent and productive also entail access to energy. Where enterprises and households suffer from either a lack of access to modern energy or unreliable and poor-quality energy services, improving access will likely support new opportunities inside as well as outside the energy sector. Where energy access is already a reality, the employment effects of achieving SDG 7 will mainly come from the shift to more sustainable energy sources.

The transition to a more sustainable energy system has important employment ramifications in its own right and enhances the socioeconomic resilience of communities around the world. Unfettered climate change—in the form of extreme weather, rising global temperatures, changes in rainfall patterns, and spreading disease vectors—will increasingly weaken economic activity and undermine livelihoods by disrupting supply chains, destroying productive assets, displacing people and affecting the health and productivity of workers.

New employment opportunities develop from adopting renewable energy sources, and a skilled workforce is indispensable to a successful energy transition. Without well-trained, experienced workers, renewable energy deployment and energy efficiency targets may be missed or the quality of equipment and installations could suffer. Workers and communities whose livelihoods rely on fossil fuel–based industries will be displaced and must be offered protection.

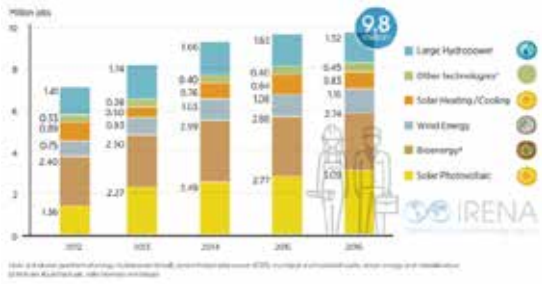
Current status

Most of the investment and analytical attention has gone to grid-connected renewable electricity in urban and industrial contexts. By contrast, available information in the energy access context, especially in rural settings, remains more limited for the time being.

The expansion of installed renewable energy capacity has translated into a growing workforce. According to IRENA, the renewable energy sector worldwide employed 8.3 million people, directly and indirectly, in 2016 (IRENA, 2017a).[1] Direct employment in large hydropower adds another 1.5 million, for a total of 9.8 million (see Figure 13.1). This is up from 7.1 million jobs in IRENA's initial assessment (5.7 million without large hydropower). Solar photovoltaic (PV) employment has more than doubled since 2012. Liquid biofuels, large hydropower and wind power are the next-largest employers.

Figure 13.1

Global renewable energy employment, 2012-2016



Growth in employment has been facilitated by rapidly falling costs, especially for wind and solar PV equipment. Feed-in tariffs provided the initial support for the growth of renewables markets. More recently, auctions are facilitating cost discovery and are bringing about some of the lowest project costs on record. In recent years, these positive developments were somewhat moderated by fluctuating investment levels and by policy changes and uncertainties in some countries, underscoring the continued importance of a stable and favourable regulatory framework.

At present, China, Brazil, the US, India and member states of the European Union (EU) are leading employers in the renewable energy sector. They are the principal manufacturers of solar panels, wind turbines and other equipment, and are home to the largest deployment markets. Recent years have seen a considerable shift towards East Asian countries, spurred by strong policies there to stimulate domestic installations and to support the emergence of globally competitive manufacturing facilities.

Equipment manufacturing is highly concentrated in a few countries, but with adequate policy support, some production and assembly can be localized. Most countries can expect to create employment principally in other segments of the value chain—in project development, sales and distribution, construction and installation, and operations and maintenance (IRENA and CEM, 2014). This is also the case in the energy access context; most of the solar PV equipment used in decentralized applications is produced in China and a few other countries. Inputs needed for small hydropower and biogas projects, on the other hand, are often supplied domestically.

Clean and affordable energy also entails the replacement of fossil fuel energy sources beyond electricity production. It entails increasing the use of biomass and waste in industry, transport and

[1] The estimate is based on an extensive annual review of available databases, studies and estimates. The jobs numbers include direct and indirect employment along the renewables value chain but exclude induced jobs. These are generated when employees of the renewable energy sector spend their salaries on goods and services throughout the economy.

heat generation (IEA, 2015a).

"Another important component of a transition to a low-carbon energy system is greater energy efficiency in the transport sector, industry and buildings, suggesting policies related to mobility, industrial processes, generation, distribution and use efficiency." (IEA, 2015)

Rising employment numbers are important but so is the quality of jobs. The push for continued cost-cutting, and non-standard working arrangements (e.g., temporary or informal work) may affect staffing levels, wages and access to social protection. Yet these factors determine the disposable income available for spending on goods and services and thus influence the extent of induced employment and socioeconomic development

Net employment effects

Studies indicate that renewable energy technologies create more jobs than fossil fuel technologies. For instance, per dollar of expenditure, spending on renewable energy will produce nearly 70 per cent more jobs than spending on fossil fuels (Chen, 2017). Similarly, solar PV could create more than twice the number of jobs per unit of electricity generation compared with coal or natural gas (UKERC, 2014). Biomass and waste as sources of energy can also have important employment implications in agriculture and waste management. In developing countries increased demand for biomass may not necessarily increase employment, as a large share of the population already depends on agriculture but will shift crops and may impact local food prices and food security.

To some extent this is due to the fact that renewable energy technologies are not yet as fully matured as conventional technologies. Labour productivity in the renewable sector can be expected to rise. The ongoing mechanization of biofuels feedstock harvesting in Brazil is already lowering the requirement for agricultural labourers and is leading to changes in required skills. Production of equipment such as solar PV panels and wind turbines is also subject to increased automation, as are operation and maintenance (O&M) activities.

Still, the energy transition from fossil fuels to renewables will likely be accompanied by net employment gains. In addition to the expansion of renewable energy, jobs will be created through investments in smart grids, modern transmission and distribution networks, storage capacity to help integrate variable renewable energy supplies into the grid, charging infrastructure for electric vehicles and other measures. Important employment gains are expected in the construction sector and R&D as current buildings are retrofitted and transport and production processes altered to be more energy efficient.

Meanwhile, dynamics within the fossil fuel sector (rising mechanization, overcapacities and industry consolidation) are increasingly translating into job losses, especially in the coal industry. Renewable energy employment could expand to around 25 million people worldwide by 2030, outpacing job losses in the conventional energy sector by some 6 million workers (IRENA, 2017a). A key challenge for policymakers will be to ensure that the energy transition is fair, which requires smoothing the adjustment for affected workers and communities.

Greater energy efficiency translates into direct employment opportunities in R&D for energy efficiency technologies, production of materials such as building insulation and of equipment such as more efficient appliances, and finally in the installation and maintenance of such materials and equipment, with strong employment gains expected in the construction sector. Energy efficiency allows for money to be spent elsewhere in the economy. On a job-creation level and considering the economic linkages across industries, each US$ 1 million spent in energy efficiency supports 7.72 jobs, while similar expenditures in the renewable and fossil fuel sectors create 7.49 and 2.65 jobs, respectively (Garret-Peltier 2017). But if overall energy demand continues to increase regardless, greater efficiency will not necessarily entail job loss in extracting, refining and distributing fuels, or in producing electricity.

Other important factors for employment effects are the scale and business models through which the transition will be realized. An energy sector that is dominated by a few large-scale utilities is likely to have a very different effect from a sector where households and small and medium-sized enterprises (SMEs) can be actively involved in aspects of generation, installation, distribution and maintenance, as illustrated in some of the examples below. Ultimately the structure of the renewable energy sector presents countries with an important set of policy choices of how they would like this sector to be structured in terms of ownership, respective roles of public and private sectors, levels of decentralization, roles of households, and the different business models through which energy will be provided. And it is recommended that the different employment effects of these policy choices be explicitly considered in the decision-making process.

Skills requirements of renewable energy

Due to the diversity of technologies, the renewable energy sector requires a wide variety of skills and occupations, ranging from construction workers to plumbers and electricians, and technicians and engineers with various specializations. The bioenergy supply chain also requires people in agricultural occupations for feedstock planting, harvesting and processing. The renewable energy sector spans not only many technical professions, but requires planners and administrators, legal experts and financial specialists. Utility-scale plants require different skill profiles than smaller facilities,

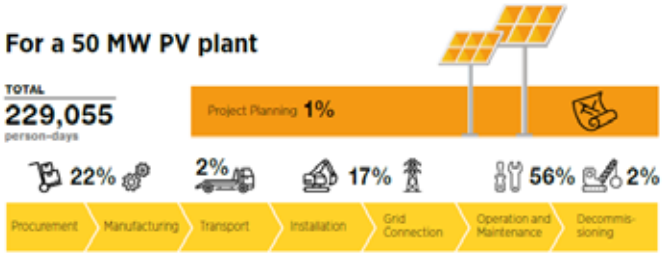
especially deployments in an energy access context.

Analysing the occupational patterns and skills needs of a typical 50 megawatt (MW) solar PV project, IRENA's *Leveraging Local Capacity for Solar PV* (IRENA, 2017b) found that a total of 230,000 person days are needed along the value chain (see figure 13.2). Operations and maintenance account for 56 per cent, manufacturing for 22 per cent, and construction and installation for 17 per cent. Construction workers (35,500 person days) and factory workers and technicians (32,000 person days) are the most numerous occupations.

Figure 13.2

Employment impacts in the solar PV value chain source: IRENA, 2017b.

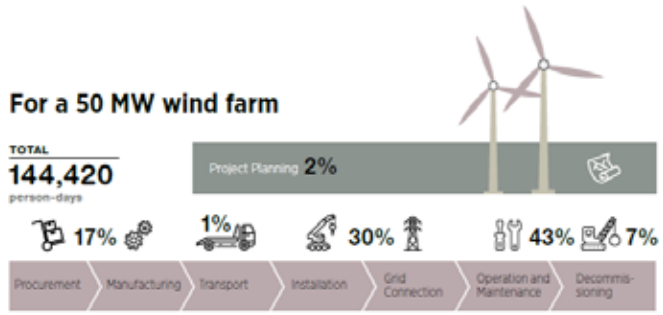
Similarly, for onshore wind, IRENA found that a typical 50 MW



project requires a total of 144,000 person days (see figure 13.3). Operations and maintenance represent 43 per cent of the total, construction and installation 30 per cent, and manufacturing 17 per cent. Construction workers (26,600 person days) are the single largest occupational contingent, followed by factory workers (close to 12,500 person days).

Figure 13.3

Employment impacts in the onshore wind power value chain. Source: IRENA, 2017c.



For a given project, the duration of different types of jobs along the value chain varies, but a steady pipeline of projects blurs distinctions between limited-duration jobs and permanent ones. Construction and installation typically lasts a few weeks or months. Manufacturing jobs (and related occupations such as in procurement and transportation) depend on the pace and degree of fluctuation in the demand for equipment over time. Operations and management jobs are quasi-permanent in that a given renewable energy power plant can have a lifetime of up to about 20 years.

Employment through reliable energy access

Measuring the employment effects stemming from energy access is difficult due to lack of data, the informality of many of the jobs, the complexity of the energy access landscape across a multitude of actors and initiatives, varying technologies, and scales of deployment. Electricity access can be provided through grid extension, mini-grids and stand-alone devices. Boosting access to cooking fuels entails the manufacture and distribution of improved cookstoves, for which very limited employment information is available (IRENA, 2012; ILO, 2017).

In addition to projects intended to improve energy access, there are also large-scale wind, solar and bioenergy facilities that are located in rural areas but whose output is destined for grid-connected communities. Many of the inputs come from abroad, so local employment is mostly created in construction. Absent dedicated community development and skill-building efforts, lasting socioeconomic benefits may be scarce.

The potential for job creation through decentralized renewable energy solutions for electricity and modern fuels is enormous. Some experience has been gathered on the ground, with regard to small-scale solar (also see Policy Brief #1):

- Bangladesh's rural solar programme, based on a microfinance model, has succeeded in installing more than 4 million solar home systems to date. In the process, more than 100,000 jobs were created. This includes more than 80,000 jobs in installations and in the value chain, and 30,000 jobs in manufacturing and assembly (Barua, 2015). Training and quality control are important dimensions of this programme.
- The spread of the "pay-as-you-go" model in East Africa is creating additional employment, though still at a relatively small in scale for the time being. Start-up companies like M-KOPA, Off-Grid Electric, Azuri, BBOXX, or Mobisol are the main exponents of a business model that has so far created thousands of jobs in the sale, distribution and installation of decentralized solar panels but carries the potential for much larger impacts.

As the cost of renewables has come down, one of the last remaining hurdles in this area is linked to distribution, and in particular to the "last-mile" connections, which often still remain costly or require too large an upfront investment. In addition, as renewables substitute for conventional energy such as kerosene, charcoal or

firewood, net employment effects, job quality and other benefits must be considered. Charcoal production, transport and trading are labour-intensive, providing livelihoods for millions of people (Openshaw, 2010). Rough estimates available for replacing kerosene lamps with solar lanterns (UNEP, 2014) suggest that the net balance can be positive.

Consumptive and productive uses of energy

Beyond the jobs created by energy access, there are broader employment and development opportunities. Consumptive uses of energy reduce household drudgery such as gathering of fuelwood, freeing up time that may be spent on education and income-generating activities. Access to cleaner energy also permits improvements in education (electricity boosts study hours) and health (reduced exposure to indoor air pollution from traditional biomass) and increases disposable household income (where clean energy sources are cheaper than conventional polluting sources), resulting in economic gains at the local level.

Meanwhile, productive uses of electricity or mechanical power can help small and medium-sized enterprises improve their productivity, raise the quality of their goods and services, and increase sales. Agriculture (irrigation, agro-processing, etc.) is a primary beneficiary, but light manufacturing, commercial activities and communications also benefit (ILO, 2017). A review of 50 studies from Africa, Asia and the Americas on impacts of electrification at the household and enterprise level found that, on average, access leads to increases of 7 per cent in school enrolment, 25 per cent in employment (with particular benefits accruing to women), and 30 per cent in incomes (Jimenez, 2017).

Even so, access to energy is generally understood to be a necessary but insufficient condition for economic development. Among the additional enabling factors are availability of finance, knowledge and skills, managerial capacity, access to markets (roads, infrastructure, social networks) and a conducive regulatory environment (Practical Action Consulting, 2012).

Gender as a central factor for success

Employment in the energy sector as a whole is traditionally male-dominated. However, findings from an IRENA survey (IRENA, 2016) suggest that at 35 per cent of the labour force, the share of women in modern renewable energy is higher than in conventional energy. The specifics vary from country to country and from one renewable energy technology to another. In the US, for instance, the share of women in the solar industry rose quickly from 19 per cent of the workforce in 2013 to 28 per cent in 2016 (Solar Foundation, 2017).

An online survey with focus on the Middle East and North Africa region (BNEF, CEBC and IRENA, 2017) confirmed findings from other parts of the world that women continue to face challenges owing to a range of attitudinal obstacles and structural barriers. These include a lack of background in the STEM (science, technology, engineering and mathematics) fields but also dated perceptions of gender roles, discrimination in pay and a persistent glass ceiling for managerial positions. Redressing the situation will require a number of initiatives, including offering greater flexibility in the workplace and greater support for women through mentorship and training. In the energy access context, female entrepreneurs also need better access to finance.

Supporting displaced workers and communities

As the energy sector transitions away from fossil fuel–based sources and into renewables and greater efficiency, workers and communities relying on fossil fuel–based industries will lose out. Employment in the extraction of petroleum, mining of coal, petroleum refinery and electricity production from coal—among other industries—will decrease. These workers and the related communities will need to transition to new economic activities to sustain their livelihoods, prompting support from governments and other stakeholders in the form of social protection, re-skilling programs, relocation grants, entrepreneurship, job search assistance, industrial development and other forms of support (ILO, 2015).

Policy implications/recommendations

The ILO's Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for all (2015) provide a comprehensive policy portfolio to advance the transition towards clean and affordable energy but also to ensure it promotes decent work and protects workers, individuals and communities who may lose out as a result. This policy package includes macroeconomic and growth policies, industrial and sectoral policies, enterprise policies, skills development, occupational safety and health, social protection, active labour market policies, rights and social dialogue. The following are some of the key recommendations:

Improve data

Available information in both on- and off-grid environments remains uneven, underscoring the importance of more systematic collection of quantitative and qualitative data at sufficiently disaggregated levels. The need for better data is particularly strong in the context of rural energy access and with regard to working conditions.

Avoid skills gaps

Some skills gaps already exist for technical and engineering positions and could grow as the renewable energy sector continues to expand. Unalleviated, this could hinder a smooth energy

transition, contributing to project delays or even cancellations, cost overruns and faulty installations. Improved monitoring of labour market dynamics and projections of likely skills needs are critical tasks. Better coordination between the renewable energy sector and educational institutions is essential for developing renewable energy curricula, integrating renewables modules into vocational training courses, supporting apprenticeships, and establishing common quality standards.

Retrain workers and retain expertise

Part of the challenge is to find ways to draw on skilled personnel from relevant other industries and to undertake retraining efforts as necessary (IRENA, 2017d). Ensuring the retention of skilled and experienced workers is also critical, and this requires adequate wages, decent job conditions and clear opportunities for career advancement (ILO, 2015).

Mainstream gender

Governments and the private sector need to work on removing barriers to entry for women's employment in the renewable energy sector and to better include gender perspectives in policy-formulation, education and training measures, access to finance, and various support services. The benefits are twofold—creating equal opportunities for women and reducing the risk of a growing skills gap.

Develop local supply chains

To maximize socioeconomic benefits, countries seek to localise portions of the value chain (and the associated jobs) by leveraging domestic content (IRENA, 2017a). To be successful, however, such policies need to be part of a broader effort to develop viable domestic supply chains (incubating new businesses, building up the know-how and capacities of enterprises, providing supportive infrastructure, encouraging industrial clusters, etc.). They also need to be linked to training and skill-building efforts.

Support workers and communities who may lose out

Generating a smooth energy transition path requires addressing the fear that communities, now reliant on the fossil fuel industry, will lose jobs, incomes, and economic vitality. This creates political resistance to an accelerated transition, but can be addressed through just transition strategies. These include retraining programmes, relocation grants, social protection measures, proactive consultations with communities, incubation of new businesses, and investments in support of economic diversification (ILO, 2015).

REFERENCES

BNEF (Bloomberg New Energy Finance), CEBC (Clean Energy Business Council) and IRENA (2017), Women in Clean Energy. Middle East and North Africa Survey 2017.

Chen, Y. (2017), *Renewable Energy Investment and Employment in China*, PERI Working Paper Series Number 439, Political Economy Research Institute (PERI), University of Massachusetts, Amherst, MA.

ILO (International Labour Organization) (2017), Rural Renewable Energy Investments and their Impact on Employment, STRENGTHEN Publication Series, Working Paper No. 1, Geneva.

Garrett-Peltier, H. (2017). "Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model", Economic Modelling, Vol. 61, pp. 439–447.

Jimenez, R. (2017) Development Effects of Rural Electrification, Inter-American Development Bank, Policy Brief No. IDB-PB-261.

IEA (International Energy Agency) (2015). Energy Technology Perspectives 2015, Paris.

ILO (International Labour Organization) (2015). *Guidelines for a just transition towards environmentally sustainable economies and societies for all,* Geneva.

IRENA (International Renewable Energy Agency) (2017a), Renewable Energy and Jobs—Annual Review 2017, Abu Dhabi.

IRENA (2017b), Leveraging Local Capacity for Solar PV, Abu Dhabi.

IRENA (2017c), Leveraging Local Capacity for Onshore Wind, Abu Dhabi.

IRENA (2017d), Renewable Energy Benefits: Understanding the Socioeconomics, Abu Dhabi.

IRENA (2016), Renewable Energy and Jobs—Annual Review 2016, Abu Dhabi.

IRENA (2012), Renewable Energy Jobs and Access, Abu Dhabi.

IRENA and CEM (Clean Energy Ministerial) (2014), The Socioeconomic Benefits of Solar and Wind Energy.

Openshaw, K. (2010), "Biomass Energy: Employment Generation and its Contribution to Poverty Alleviation," Biomass and Bioenergy, Vol. 34, pp. 365–378.

Practical Action Consulting (2012), People's Energy Outlook 2012: Energy for Earning a Living, Rugby, United Kingdom.

Solar Foundation (2017), National Solar Jobs Census 2016. A Review of the U.S. Solar Workforce, Washington D.C.

UKERC (2014), Low Carbon Jobs: The Evidence for Net Job Creation from Policy Support for Energy Efficiency and Renewable Energy.

UNDP (United Nations Development Programme) (2012), Integrating Energy Access and Employment Creation to Accelerate Progress on the MDGs in sub-Saharan Africa, New York.

UNEP (United Nations Environment Programme) (2014), Light and Livelihood: A Bright Outlook for Employment in the Transition from Fuel-based Lighting to Electrical Alternatives, Nairobi.

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