Policy Brief

The Employment Effects of Renewable Energy Development Assistance

Jobs are the cornerstone of economic and social development.[i] They allow people to earn an income and work their way out of poverty to attain better livelihoods. Emerging and developing economies are home to 81% (163 million) of the 200 million people who are unemployed globally, and 96% of the further 1.4 billion people who are engaged in vulnerable employment.[ii] Consequently, the creation of decent jobs is a priority objective of developing countries and a fundamental element of foreign assistance. However, supporting job creation is a complex task, with a vast number of macro-economic and sector-specific factors influencing the ultimate success of policies and measures.

Access to affordable, reliable, sustainable and modern energy is a United Nation Sustainable Development Goal, SDG7.[iii] Furthermore, providing electricity to the 1.06 billion people currently lacking access[iv] is often seen as a prerequisite for achieving other SDGs, namely SDG1 (poverty eradication), SDG4 (education), SDG5 (gender), and SDG8 (employment).[v]

KEY FINDINGS

- Renewable energy investments generate significant direct employment opportunities, and these are far greater than those of conventional energy sources. This proven benefit is in addition to climate, environment and health benefits.
- Indirect and induced employment effects of renewable energy investments often only become visible over time. Their measurement is more complicated and contentious than that of direct employment effects, and there are important limitations to their assessment.
- If the employment effects of renewable energy ODA are to be measured, their monitoring should be integrated early on into project and programme design. A common methodology is urgently required. And employment effects should be only one of multiple funding decisions.
- Cooperation with educational institutions and skills development are essential for harnessing the full local employment potential of renewable energy investments. Other labour market institutions also need to be developed to ensure the growth of local capacities, skills and knowledge are matched to the demands and opportunities of jobs in renewable energy.
- Electrification is only the first step towards generating jobs, and additional measures to encourage productive use are required.

Programmes promoting access to electricity have long been made under the widely accepted assumption that electricity access provides positive development impacts in job creation, income, and economic productivity. Impact evaluation studies present a more differentiated picture. Thus there is a need to acquire a deeper understanding of the correlations between electrification and employment.

Consideration of the entire spectrum of development impacts from electrification will be a defining feature for the long-term success of support provided by the European Union (EU) and others in this area. This policy brief sheds light on how employment can be fostered through the provision of official development assistance (ODA) for energy.

Approaches and Limitations of measuring Employment Effects

The general level of economic development, market structures, the strength and effectiveness of governmental institutions, a country's demography and educational standards, cultural norms and many other factors must be considered to maximise the development benefits of electrification efforts. There is strong merit in incorporating job creation as a metric for assessing ODA-supported renewable energy projects, given the significance of the role of job creation in development. However, the measurement of job creation associated with specific programmes and projects is complex.

Several studies have been undertaken to measure the job creation effects of renewables at the national level, but fewer assessments exist for individual projects, policies or programmes. This information gap is exacerbated in developing countries, most of which do not have employment offices that can keep track of such data. Available data is mostly sourced from individual, one-time surveys.

There are different levels of employment related to renewable energy projects, and different degrees of difficulty in assessing them:

- *Direct* employment includes employment created by the core activities of a project, but excludes the intermediate inputs necessary for it such as, for example, the manufacturing of renewable energy equipment.

- *Indirect* employment covers traders as well as service and material providers who provide inputs to primary projects. Indirect jobholders may not consider themselves as working in the renewable energy sector.

- *Induced* employment effects occur along value chains other than renewables. They can be associated with the downstream effects of the project and direct and indirect employment. These include, for example, goods and services purchased by those employed directly and indirectly, effects of changes in the consumer tariffs for energy, and the impacts income and tariffs may have on the broader economic situation and development of the job market. Employment effects from productive use of energy are also incorporated in induced employment.

While direct employment effects are calculated relatively easily, the measurement of indirect and induced employment effects[vi] is more difficult, as the isolation and causality between a project or programme, and the resulting job impacts, is not explicit. Several other factors influence the employment potential in a society. Indirect and induced impacts take time before they are fully established and observed, unlike the more immediately visible direct impacts.[vii]

The measurement of employment effects stemming from the access and productive use of electricity is particularly difficult. A review of 50 studies on such induced impacts of electrification found that on average, it leads to increases of around 25% in employment, 30% in incomes, and 7% in school enrolment.[viii]

There is, however, substantial variance across studies. Several find no ultimate proof of significant impacts of electricity access on employment or economic development while it is proven that it has led to better quality of life.[ix] The long duration of effects and the difficulty in exclusively linking the creation of a given job to electricity access add to the complexity of indirect and induced impact measurement.

A first distinction needs to be made between the calculation of employment from on-grid and off-grid renewable energy applications. Another is between providing new energy access where there was none before, and energy transition from conventional to renewable technologies. Such initial premises have enormous effects on the jobs created.

There are various metrics for quantifying the magnitude of job creation. Alternate parameters can be used for the measurement of jobs, such as total full-time equivalent (FTE) jobs, the total number of people employed, job-years, or the number of roles/contracts created. For renewable energy projects, job impacts can be further specified per technology, and by including units of generation capacity installed, (average) electricity generated, or project lifetime.

There are diverse methodologies for the calculation of these indicators. Surveys are a relatively straightforward method and have the advantage of creating a high degree of accuracy because the data comes from people with inside knowledge of the project. However, covering large projects or programmes comprehensively requires qualified staff and significant time and financial resources. It is also difficult to capture indirect and induced employment through first-hand surveys alone, not least when time-lags between a project or programme and further job development are taken into consideration.

Input-output calculations often rely on national census and labour market data for various sectors in the economy. Such **'value chain' approaches** can effectively address direct, indirect, and induced employment effects, where others struggle to do so. However, using more aggregated data comes at the expense of specific, project-level insights. In addition, proxies are necessary to try to disaggregate sector-level data. This method is currently less applicable in developing countries, where accurate statistical data is often simply unavailable.

The **employment-factor approach** calculates the number of FTE jobs per unit of a product or service. FTE jobs in the energy sector are quantified by multiplying a project's or programme's installed capacity or produced energy by specified employment factors, which are calculated based on aggregated data on

the various stages of projects: manufacturing, construction or installation. Once factors are agreed, application of this method is relatively easy, usually allowing for technology specificity

However, this method also has its drawbacks, most importantly the exclusion of indirect and induced jobs. To derive accurate employment FTE job factors is also difficult because employment numbers tend to decrease with technological maturity as well as labour productivity, and the renewables sector changes so quickly. Further, this method assumes labour requirement increases linearly with project scale, which is not necessarily the case. And: Regional scaling factors are often lacking; most employment factors are currently calculated for developed countries, which have different dynamics.

Further research is particularly required on the quantification of indirect and induced employment impacts. Studies on this topic are currently under way.[x]

Adopting a longer-term view to assessment will allow for these impacts to be captured, and refining understanding on the induced impacts associated with the provision of electricity access will also be key.

Direct Employment Effects from Renewable Energy

Despite the challenges in accurately assessing indirect and induced employment impacts in the renewable energy sector, the statistics on direct employment alone clearly illustrate that the sector has become a thriving job engine - and one that continues to grow. In 2016, 9.8 million people worldwide were working in this area, a 1.1% increase from 2015.[xi]

Most renewable energy employment today exists in Asia, which accounted for 4.5 million jobs. In China alone 3.6 million work in the sector, 1.2 million in Europe, 876,000 in Brazil, and 61,000 in Africa. The developing countries with greatest absolute employment numbers in renewable energy today after China are Brazil, India and Bangladesh (see Table 1).

Country	Number of Jobs
China	3,643,000
Brazil	876,000
India	385,000
Bangladesh	162,000
South Africa	30,000
North Africa	16,000
Rest of Africa	15,000
Total	**5,127,000**

Table 1 – Renewable energy jobs in developing countries
Source: IRENA, 2017

The utilisation of renewable energy technologies comes with a higher labour intensity than fossil fuels. An academic review of 15 job studies found that all non-fossil fuel technologies (renewable energy, energy efficiency, carbon capture and storage) create more jobs per energy unit than coal and natural gas.[xii] One study found average employment creation across all sustainable energy technologies to be four to five times greater than that of conventional energy.[xiii] Measured in terms of investment, the fossil fuel industry creates 5.3 jobs per US$1 million, whereas the clean energy sector (renewable energy and energy efficiency) creates over three times this amount — 16.7 jobs per $1 million.[xiv]

Renewable energy technologies tend to be more labour-intensive during the construction and installation phases than traditional fossil-fuel sources[xv] and renewable energy projects are more heavily weighted in the construction, installation and manufacturing phases rather than operation and maintenance.[xvi]

As a result, clean energy spending creates more high-paying jobs than fossil fuels, while it is also better at creating jobs for low skilled workers.[xvii]

Some renewable energy jobs come at the expense of jobs in the conventional energy sector. However, job gains in the renewables and efficiency sectors usually greatly outweigh the losses related to conventional energy.[xviii] This is also the case if climate mitigation is driving the energy transition.[xix]

Renewable energy jobs are also more gender-neutral than those in the conventional energy sector, though still lower than the broader economy.[xx]

In terms of technologies, solar photovoltaic (PV) currently has the greatest job engagement, employing 3.09 million people globally and providing on average 0.87 job-years[xxi] per GWh generated, followed by bioenergy (2.74 million and 0.21 job-years per GWh), and wind energy (1.16 million and 0.17 job-years per GWh). [xxii]

Technology	Number of Jobs
Solar	2,897,000
Wind	1,322,000
Biomass	211,000
Small Hydro	38,000
Total	**4,469,000**

Table 2: Potential global employment in off-grid RE
Source: IRENA estimates based on IEA, 2011; MNRE and CII, 2010; and ESMAP, 2007

Looking more narrowly at off-grid renewable energy employment potential – highly relevant to least developed countries – solar again leads, with the potential to create 2.9 million jobs, followed by wind with 1.3 million and biomass with 0.2 million (see Table 2).[xxiii]

Accelerating the Indirect and Induced Job Potential of Renewable Energy in Development

Looking beyond the direct employment effects of renewable energy shows a close interlinkage between the sector's potential to generate indirect employment effects and a country's wider enabling environment. It also sheds light on the limitation of renewable energy investment projects to create, let alone monitor, indirect and induced employment effects.

Renewable energy projects create more jobs during early and temporary phases of projects, most importantly construction, installation and manufacturing. Fewer positions are permanent, creating the incentive for workforce employment planning and coordination. That said, they do create multiple employment opportunities with a long-term benefit for a country and its workforce. These include positions in the areas of development and planning, engineering, financing, instalment, operation and management. An opportunity for accelerating the job potential of renewable energies is to stimulate the generation of a skilled labour force. Importing high-skilled workers from developed countries sustains jobs there – but limits the positive impacts in the implementation country.

Many developing countries are, however, hampered by a widespread shortage of engineers and technicians in all parts of the renewable energy industry: qualified design engineers (civil, mechanical

and electrical) with specific knowledge of particular renewable energy technologies are especially needed.[xxiv] Additionally, sales specialists, inspectors, auditors, lawyers, and those working in investment finance lack specific skills important for the development of renewable energy. An extensive shortage of qualified trainers with these skills has also been identified.

Further, being presented with limited employment opportunities places pressure on individuals to migrate. An estimated 150 million workers worldwide must find work elsewhere than home, with three quarters of them (74.7%) migrating to high-income countries.[xxv] This comes against the backdrop of sub-Saharan Africa's need to ensure that its demographic dividend pays out, and that jobs are created for its large cohort of young people. Migration rates are much higher for the well-skilled and educated, causing a brain drain and the flow of skilled human capital from poor areas to economically advanced regions, where it is often already abundant. Economic globalisation and integration increases this trend. Increased opportunities for skilled employment can lead people to stay in developing countries, generating further business local opportunities and positive payback for the investments in skills and training received.

As employment prospects in the renewable energy sector continue to grow, consideration should be given to creating 'good' jobs – where workers receive fair working conditions and compensation, and social and gender equality is a key feature. Only this will create a 'just' energy transition.[xxvi] There are jobs that can be labelled 'green' but do not constitute decent work. For example, poorly remunerated day labourers on biofuel plantations may be working under hazardous conditions, while still being classified as employed in the clean energy sector.[xxvii]

Examples of decent renewable jobs would, for instance, be unionised wind and solar power jobs. However, since many enterprises in the renewable energy sector are relatively young, the degree of unionisation in the industry still tends to be lower than in other sectors. A challenge to union representation is that workers in the renewable sector are affiliated to a large variety of trade unions because the sector cuts across several conventional sectors such as metal, construction, and services.

Particular attention should be given to displaced workers from the conventional energy sector and work they can find in the renewable sector. This will also greatly enhance the overall support of a population for an ambitious energy transition in its country.

Within the landscape of international cooperation partnerships, it should also be noted that least developed countries (LDCs) require particular focus and approaches, both in general and with a view to renewable energy in particular. Thus the achievement of SDG7 and the multiple other benefits it will create also requires directing more energy ODA to LDCs with low energy access rates. More than US$ 45 billion annually need to be invested to achieve 100% electricity access by 2030.[xxviii] In comparison, less than half of this – an average of US$19.4 billion a year – were committed to electricity in the 20 high-impact countries identified by the SE4ALL initiative, when public, private, international and domestic finance was taken into account in 2013-14.[xxix] Of the eight partner countries that receive the largest share of EU energy ODA, only two, Kenya and India, have an energy access rate of less than 90%. Increasing investment in decentralised energy sources provides an opportunity for at least providing basic electricity services, at relatively low cost.

Conclusions and Recommendations for European Development Policy

Assessing the employment impacts of renewable energy development assistance is an emerging field of analysis and action. This presents a number of methodological challenges which need to be addressed – in a harmonised way – if further insights are to be gained about the contribution renewable energy investments make to employment. There are also clear limitations of what can be measured and managed.
Importantly, however, there are clear direct employment effects which investments in renewable energy can make. Additionally, there are a number of indirect and induced employment effects which can help or hinder the employment contribution of renewable energy ODA.

1. Agree on a common (European) set of metrics to measure energy employment effects

To advance job creation through ODA-supported renewable energy projects, a first priority lies in addressing the opportunities for and limitations of measuring employment effects.
Agreeing on the metrics and methodologies for measurement, and gaining a clearer understanding of indirect and induced impacts, are a high priority. This will allow for a transparent comparison between technologies, projects and programmes. Being able to accurately measure the employment effects will enable the design of the most efficient and most effective projects and programmes. It will also enable greater comparative analysis across technologies, countries and donors.

Building on this, awareness of the job impacts of a programme or project needs to be built further, and they should be given due consideration at the earliest possible point in the design of a project or programme. This will allow for the optimal harnessing of the synergies between improved quality of life, the creation of good jobs and subsequent economic development.

Methodological limitations in measuring employment impacts should not, however, hold back the ramping-up of energy ODA in developing countries, where it is needed most. There is a large gap between current and required funding for electricity access, and thus a serious need to expand commitments to increase electrification and achieve SDG7. These are mandated by multiple economic, social, and environmental concerns, independently of their exact employment impacts beyond direct jobs.

2. Coordinate renewable energy ODA with local skills provision

The coordination of renewable energy policy and investment with skills provision is a critical component for maximising local employment impacts. Training and education programmes need to be clearly synchronised with infrastructure development pathways to facilitate the longer-term sustainability and ownership of such projects in developing countries. The EU should enhance its capacity building and educational efforts in the renewable energy sector in developing countries. This might include courses for technicians and skilled craft workers, including technical and vocational education and training (TVET), apprenticeships, and suppliers of renewable energy technologies.

Collaborations between universities and other educational institutions should be established, and already operational local initiatives active in this field should benefit from capacity building and support. This will help ensure that the full direct and indirect employment potential of renewables investments can be capitalised upon and perpetuated. And Europe can play a key role in this area, enhancing its capacity-building and educational efforts in the renewable energy sectors of developing countries.

3. Strengthen labour market institutions as employment develops

Labour market institutions, including employment agencies, statistical offices and others central to monitoring, managing and maintaining the ebb and flow of employment, are needed as the employment landscape of a country and sector develop. They need to (be able to) work hand-in-hand with policy makers, education and training services and employers to ensure the smooth, responsive facilitation of employment.

Europe can claim an important role here, in reinforcing the capacities of labour institutions in developing countries. Assisting with training and support on labour market statistics, founding employment agencies and empowering these to assist in coupling the job demands of renewable energy projects with the supply of domestic labour could greatly enhance domestic employment impacts. And working together with employment agencies and other stakeholders in developing countries can support efforts in ensuring the growth of local education, skills and knowledge commensurate with the increasing demand of jobs as a result of the renewable energy programmes and projects being funded.

4. Augment investments in energy with measures to enable employment

Providing access to modern energy to those who still do not have it should not be seen as a panacea to the array of issues facing developing countries. Rather, it is a necessary input and precursor to fostering economic development. Universal access to electricity is a SDG for numerous reasons, but first and foremost, to give people the chance to improve their qualities of life. Job creation should therefore be an essential consideration of ODA-supported energy programmes and projects, but should be viewed as one benefit, nor as the only objective of such investments.

Importantly, electrification in and of itself is often insufficient for stimulating job creation. This challenge can, however, be overcome through the smart combination of renewable energy investments with additional support efforts to stimulate the productive use of energy. Targeted community support and demonstrations of the potential which productive electricity use offers for employment are essential additional components for energy development projects. Such flanking, augmenting measures help ensure that investments in renewables are able to realise their greatest possible employment effects.

References

[i] World Bank, 2013. “World Development Report.” Pg. 2.
[ii] It was 5.7% in 2016. Both numbers are provided in ILO, WESO Trends 2017.
[iii] https://sustainabledevelopment.un.org/sdg7
[iv] http://www.worldbank.org/en/topic/energy
[v]https://sustainabledevelopment.un.org/?menu=1300
[vi] See Box 2.
[vii] Zeit Online, 2017. “Energie für alle, aber richtig.”
[viii] Inter-American Development Bank, 2017. “Development Effects of Rural Electrification.”p.1.
[ix] Zeit Online, 2017. “Energie für alle, aber richtig.”
[x] One study on indirect and induced job creation currently underway is by the GIZ and the EU’s Technical Assistance Facility (TAF) for sustainable energy.
[xi] 8.3 million excluding large hydropower. IRENA, 2017. “Renewable Energy and Jobs, Annual Review.”
[xii] Wei et al., 2010. Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US? Redirecting US$ 150 billion from the fossil fuels industry to clean energy was found to create a net 1.7 million jobs in the USA (2.5 million in clean energy compared to 800,000 in fossil fuels). U.S. Bureau of Labor Statistics and IMPLAN
[xiii] Renewable energy created 0.65 jobs/GWh, and 0.80 jobs/GWh with energy efficiency included. For conventional energy, 0.14 jobs per GWh were created (coal 0.15 jobs/GWh, gas 0.12 jobs/GWh). U.K. Energy Research Center, 2014. "Low Carbon Jobs."
[xiv] ALT Energy Stocks, 2017. “Not all Green Jobs were Created Equal.” http://www.altenergystocks.com/archives/2009/07/not_all_green_jobs_were_created_equal_1/
[xv] U.K. Energy Research Center, 2014. "Low Carbon Jobs."
[xvi] Wei et al., 2010. Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?
[xvii] ALT Energy Stocks, 2017. “Not all Green Jobs were Created Equal.” http://www.altenergystocks.com/archives/2009/07/not_all_green_jobs_were_created_equal_1/
[xviii] WWF, 2009. Low Carbon Job for Europe – Current Opportunities and Future Prospects
[xix] For example, cutting carbon dioxide emissions by 30 per cent by 2020 in France is estimated to create 316,000 renewables jobs and 564,000 energy efficiency jobs, while 138,000 jobs in the conventional energy sector and 107,000 in the auto industry could be lost. WWF France, 2009. “30% CO2 Off = +684,000 Jobs”
[xx] A survey of 90 renewable energy companies from around the world found that women represented an average of 35% of the workforce. Studies performed in Germany, Spain, and the United States of America also show that the share of women in renewables is greater than in the conventional energy sector (Solar Foundation, 2017; IRENA, 2013).
[xxi] One job-year is full time equivalent employment for one person for a duration of 1 year.
[xxii] Wei et al., 2010. Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?
[xxiii] IRENA estimates based on IEA, 2011; MNRE and CII, 2010; and ESMAP, 2007
[xxiv] ILO, 2011. “Investment in renewable energy generates jobs. Supply of skilled workforce needs to catch up.”
[xxv] ILO, 2015
[xxvi] References to ILO green jobs agenda and FES project.
[xxvii] As just one example, the working conditions of many cane cutters for bioethanol production in São Paulo state, Brazil, are reported to be very poor.
[xxviii] SEforALL, 2015. “Scaling up Finance for Sustainable Energy Investments: Report of the SE4All Advisory Board’s Finance Committee.”
[xxix] This consisted of: Grid-connected renewables ($10 bn); Transmission and distribution ($3.6 bn); Grid-connected fossil fuel power ($4 bn); Market support ($1.6 bn) and Decentralized energy ($0.2 bn). (SEforALL, 2017. “Energizing finance.”)

Imprint

Published by
European Union Energy Initiative
Partnership Dialogue Facility (EUEI PDF)

c/o Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
P.O. Box 5180, 65726 Eschborn, Germany

info@euei-pdf.org
www.euei-pdf.org

Authors
Dean Gioutsos and Alexander Ochs, SD Strategies

This Policy Brief has been drawn up by SD Strategies
on behalf of the EU Energy Initiative

With comments and contributions by
Fiona D. Wollensack, EUEI PDF

Place and date of publication
Brussels, October 2017

The **Partnership Dialogue Facility (EUEI PDF)** is an instrument of the EU Energy Initiative (EUEI). It currently receives contributions from the European Commission, Austria, Finland, Germany, Italy, the Netherlands and Sweden.