THE IMPACTS OF COVID-19 AND THE WAY FORWARD

The onset of the COVID-19 crisis upended economic trends and dynamics around the world, including in the energy sector. To date, renewable energy as a whole has fared better than fossil fuels. Nonetheless, renewables have been affected by temporary disruptions in the supply of equipment, components or raw materials, and more recently by demand-side impacts.

Although the pace of new renewables installations has been slower in 2020 than predicted in pre-COVID forecasts, construction of many large-scale utility projects is proceeding, though with some delays. Jobs appear less affected in the operation of utility-scale wind and solar plants than in solar rooftop installation and off-grid solutions, where social distancing requirements and constrained household budgets have a significant impact (IRENA, 2020c).

An ambitious strategy linking short-term recovery efforts with medium- and long-term strategies to 2030 and 2050 is essential to achieving the Sustainable Development Goals and the Paris Agreement on Climate Change. IRENA's proposed investment and policy package gives the world a chance to accomplish these twin objectives (IRENA, 2020c). Under this approach, annual investment in energy-transition-related technologies[28] would more than double from the 2019 level of USD 824 billion to nearly USD 2 trillion in the 2021-23 recovery phase, before reaching an annual average of USD 4.5 trillion in the decade to 2030.

By 2023, this investment package would create 5.5 million more jobs in energy transition-related technologies than under a business-as-usual approach.

28 Technologies related to the energy transition include renewable energy, energy efficiency and energy system flexibility.

This outcome is the result not only of shifting investment priorities within the energy sector, but also of the greater labour intensity of renewables compared with fossil fuels. Gains in energy transition-related fields would far outweigh the loss of about 1 million jobs in fossil fuels (IRENA, 2020c).

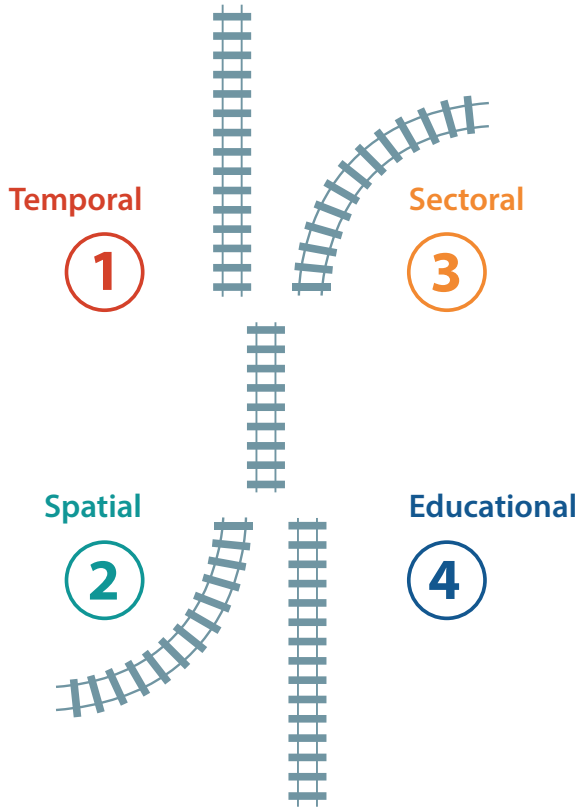
By 2050, IRENA's Transforming Energy Scenario foresees 100 million workers in the energy sector as a whole: 42 million in the renewable energy sector, 21 million in energy efficiency and almost 15 million in power grid and energy flexibility, with the remainder in conventional technologies (IRENA, 2020b). This figure is 62% larger than under the Planned Energy Scenario, which hews to governments' current plans.[29]

To maximise benefits and limit adjustment costs, governments must keep in mind the underlying drivers of the energy transition (investment, trade, fiscal policy, and indirect and induced effects of the transition across the economy) and put in place policies enabling the accelerated deployment of renewables. They must also be alert to potentially significant misalignments between job gains and losses in the transition (IRENA, 2019c). Such misalignments may take any of several forms:

1. **Temporal.** The creation of new jobs does not necessarily take place on the same time scale as the loss of employment.
2. **Spatial.** New jobs are not necessarily being created in the same locations – communities, regions or countries – where losses occur.
3. **Sectoral.** Job gains and losses may affect different sectors of the economy, given different supply-chain structures and diverging sets of inputs between rising and declining industries.
4. **Educational.** The skills associated with vanishing jobs do not always match those required by emerging jobs.

Policies to accelerate the uptake of renewables must go hand in hand with efforts to leverage and enhance local capabilities through industrial policies, building supply chains and developing the available pool of skilled labour, without which the energy transition cannot maximise socio-economic benefits. Therefore, educational and training programmes, labour market measures and social protection policies are essential to match the demand for jobs and skills with supply of the same, to retrain fossil fuel workers and to preserve social equity.

Holistic economic stimulus packages, recovery plans and policy frameworks can drive the wider structural shifts needed in the energy sector, fostering national and regional transition strategies as a decisive step in building more inclusive and resilient economies and thus more just societies.



29 The Planned Energy Scenario is based on governments' current energy plans and other planned targets and policies, including climate commitments made since 2015 in the Nationally Determined Contributions articulated pursuant to the Paris Agreement on Climate Change. The Transforming Energy Scenario entails a more climate-resilient course, with a large-scale shift to renewable energy, electrification and ramped-up energy efficiency in the period to 2050. In this latter scenario, the share of renewables in the power sector increases from 24% today to 86% in 2050 (IRENA, 2020b).

REFERENCES

ABEEólica (2020), *Infowind: Brazil*, no. 15, 26 March, http://abeeolica.org.br/wp-content/uploads/2020/03/Infowind-15_EN.pdf.

ABIOVE (Brazilian Association of Vegetable Oil Industries) (2020a), "Archives with biodiesel research: Brazilian production and deliveries data", 15 April, http://abiove.org.br/en/statistics/.

ABIOVE (2020b), "Biodiesel: Production by raw material", 15 April, http://abiove.org.br/en/estatisticas/biodiesel-production-by-raw-material/.

ABRASOL (Associação Brasileira de Energia Solar Térmica, Brazil) (2020), Communication with experts, May 2020.

ABS (Australian Bureau of Statistics) (2020), "Employment in renewable energy activities, Australia, 2018 19", 6 April, https://www.abs.gov.au/ausstats/abs@.nsf/mf/4631.0.

ABSOLAR (Associação Brasileira de Energia Solar Fotovoltaica) (2020), "Energia Solar Fotovoltaica no Brasil", *Infográfico*, 3 April, http://www.absolar.org.br/infografico-absolar-.html.

Acuña, E., C. Meza, F. Monge, G. Moya, R. Ramírez and K. Tat (2018), "Energía Solar en Costa Rica (2014 2017)", ACESOLAR, May, http://www.acesolar.org/datos-y-estadisticas/.

Alencar, C. A. (2013), "Solar heating & cooling market in Brazil", presentation at Intersolar, September, https://www.solarthermalworld.org/sites/gstec/files/news/file/2013-11-06/dasol_presentation_at_intersolar_2013.pdf.

APEC (Asia-Pacific Economic Cooperation) (2010), *A Study of Employment Opportunities from Biofuel Production in APEC Economies*, Singapore, https://www.apec.org/Publications/2010/02/A-Study-of-Employment-Opportunities-from-Biofuel-Production-in-APEC-Economies-February-2010.

APPA (Asociación de Productores de Energía Renovables) (2019), "Estudio del impacto macroeconómico de las energías renovables en España 2018", Madrid, https://www.appa.es/wp-content/uploads/2019/10/Estudio_del_impacto_Macroeconomico_de_las_energias_renovables_en_España_2018_vff.pdf.

Arora, B. (2019), "Why India's wind turbine makers are in stress?" Bloomberg Quint, 22 August, www.bloombergquint.com/business/why-indias-wind-turbine-makers-are-under-stress.

AWEA (American Wind Energy Association) (2020), "Wind is now America's largest renewable energy provider and the top choice for new utility-scale power", press release, 16 April, https://www.awea.org/Awea/media/PA-Press-Kits/AWEA-2019-Annual-Report-Press-Release.pdf.

Balser, M., and M. Bauchmüller (2019), "Der große Blackout", Süddeutsche Zeitung, 8 November, https://www.sueddeutsche.de/wirtschaft/enercon-stellenabbau-krise-windenergie-1.4673755.

BBOXX (2014), "BBOXX Academy: Training and improving our staff", 16 October https://www.bboxx.co.uk/bboxx-academy-training-and-improving-our-staff/.

Bellini, E. (2020a), "Another solar module factory in Algeria", PV Magazine, 9 March, https://www.pv-magazine.com/2020/03/09/another-solar-module-factory-in-algeria/.

Bellini, E. (2020b), "Algeria's first mounting system manufacturer", PV Magazine, 25 June, https://www.pv-magazine.com/2020/06/25/algerias-first-mounting-system-manufacturer/.

Bellini, E. (2020c), "Algeria plans 4 GW of solar tenders", PV Magazine, 29 May, https://www.pv-magazine.com/2020/05/29/algeria-plans-4-gw-of-solar-tenders/.

Bellini, E. (2020d), "Another solar module factory in Algeria", 9 March, https://www.pv-magazine.com/2020/03/09/another-solar-module-factory-in-algeria/.

Bellini, E. (2019), "Seoul launches 1 GW rooftop solar plan", PV Magazine, 18 November, https://www.pv-magazine.com/2019/11/18/seoul-launches-1-gw-rooftop-solar-plan/.

BMWi (Bundesministerium für Wirtschaft und Energie) (2020), "Bruttobeschäftigung durch erneuerbare Energien 2000 bis 2018", 31 March, https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/zeitreihe-der-beschaeftigungszahlen-seit-2000.pdf.

BNEF (Bloomberg New Energy Finance) and BCSE (Business Council for Sustainable Energy) (2020), *2020 Sustainable Energy in America Factbook*, BNEF and BCSE, Washington, DC.

CEC (Clean Energy Council) (2020), *Clean Energy at Work*, June, https://assets.cleanenergycouncil.org.au/documents/resources/reports/Clean-Energy-at-Work/Clean-Energy-at-Work-The-Clean-Energy-Council.pdf.

Chatterjee, A. (2020), "Solar cells import may get costlier; Govt pushes domestic buying amid India-China clash", *The Financial Express*, 23 June, www.financialexpress.com/economy/govt-to-soon-impose-customs-duty-on-solar-cells/2000149/.

CNREC (China National Renewable Energy Centre) (2020), Communication with experts, May 2020.

CNREC (2019), China Energy Policy Newsletter, July 2019, http://boostre.cnrec.org.cn/wp-content/uploads/2019/07/China-Energy-Policy-Newsletter_July-2019.pdf.

Da Cunha, M. P., J. J. M. Guilhoto and A. C. Da Silva Walter (2014), "Socioeconomic and environmental assessment of biodiesel production in Brazil", The 22nd International Input-Output Conference 14 18 July, Lisbon, Portugal, https://www.iioa.org/conferences/22nd/papers/files/1771_20140512071_Paper_Cunha_Guilhoto_Walter.pdf.

Dewan, N. (2019), "Solar revolution? Far from it, says industry", *Economic Times*, 29 October, https://economictimes.indiatimes.com/small-biz/sme-sector/solar-revolution-far-from-it-says-industry/articleshow/71734062.cms.

Diermann, R. (2019), "Der Windkraft geht die Puste aus", *Süddeutsche Zeitung*, 23 October, https://www.sueddeutsche.de/wissen/windenergie-land-ausbau-1.4646266.

Dogger Bank (2020), "Port of Tyne to become base for world's largest offshore wind farm, Dogger Bank", press release, 13 May, https://doggerbank.com/downloads/Port-of-Tyne-to-become-base-for-worlds-largest-offshore-wind-farm-Dogger-Bank.pdf.

Dunbar, M. (2013), "Engaging the private sector in skills development", Health and Education Advice and Resource Team, Oxford Policy Management, Oxford, UK.

EIA (US Energy Information Administration) (2020), *Monthly Biodiesel Production Report*, EIA, Washington, DC, www.eia.gov/biofuels/biodiesel/production/biodiesel.pdf.

Epp, B. (2020a), "Ups and downs in the 20 largest markets 2019", Solarthermalworld.org, 21 July, www.solarthermalworld.org/news/ups-and-downs-20-largest-markets-2019.

Epp, B. (2020b), "Chinese market keeps shrinking, but exports on the rise", Solarthermalworld.org, 6 January, www.solarthermalworld.org/news/chinese-market-keeps-shrinking-exports-rise.

EurObserv'ER (2020), *The State of Renewable Energies in Europe*, 2019 Edition, Paris, https://www.isi.fraunhofer.de/content/dam/isi/dokumente/ccx/2020/The-state-of-renewable-energies-in-Europe-2019.pdf.

FA Wind (Fachagentur Windenergie an Land) (2020), "Analyse der Ausbausituation der Windenergie an Land im Jahr 2019", Berlin, https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/Analysen/FA_Wind_Zubauanalyse_Wind-an-Land_Gesamtjahr_2019.pdf.

FEE (France Énergie Éolienne) and Capgemini Invent (2019), *2019 Wind Observatory*, Paris, https://fee.asso.fr/wp-content/uploads/2019/10/2019-wind-observatory-final.pdf.

Foehringer Merchant, E. (2020), "Solar tariffs boosted US-produced modules, but industry remains split on their future", Green Tech Media, 10 February, https://www.greentechmedia.com/articles/read/solar-tariffs-put-wins-on-the-board-for-u.s-produced-modules-but-industry-remains-split-on-their-future.

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/February, pp. 439 447, https://www.sciencedirect.com/science/article/abs/pii/S026499931630709X (behind paywall).

Green Girl Project (n.d.), "About Green Girl Limited", https://greengirlproject.com/, accessed 10 August.

Greenlight for Girls (n.d.), http://www.greenlightforgirls.org/, accessed 10 August.

Gupta, U. (2019), "Indian PV to take off after gloomy 2019", PV Magazine International, 30 December, https://www.pv-magazine.com/2019/12/30/indian-pv-to-take-off-after-gloomy-2019/.

Harsono, N. (2020), "Indonesia working on $1b solar-driven green economic recovery scheme", *Jakarta Post*, 19 June, https://www.thejakartapost.com/news/2020/06/19/indonesia-working-on-1b-solar-driven-green-economic-recovery-scheme.html.

IEA PVPS (International Energy Agency Photovoltaic Power Systems Programme) (2020a), *National Survey Report of PV Power Applications in Malaysia 2018*, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_Malaysia_2018.pdf.

IEA PVPS (2020b), *National Survey Report of PV Power Applications in Thailand 2018*, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_2019_Thailand_draft_Complete.pdf.

IEA PVPS (2020c), *National Survey Report of PV Power Applications in Korea 2018*, https://iea-pvps.org/wp-content/uploads/2020/03/NSR_Korea_2018.pdf.

IEA SHCP (Solar Heating & Cooling Programme) (2016), *Solar Heat Worldwide: Markets and Contribution to the Energy Supply 2014*, 2016 Edition, Gleisdorf, Austria, https://www.iea-shc.org/data/sites/1/publications/Solar-Heat-Worldwide-2016.pdf.

IIGE (Instituto de Investigación Geológica y Energética, Government of Ecuador) (2020), Communication with experts, April 2020.

INEGI (National Institute of Statistics and Geography) (2020), *Communication with experts, May 2020*

IPPPP (Independent Power Producers Procurement Programme) (2020), *Independent Power Producers Procurement Programme: An Overview as at 30 September 2019*, https://www.ipp-projects.co.za/Publications.

IRENA (International Renewable Energy Agency) (2020a), *Renewable Energy Statistics 2020*, Abu Dhabi, https://www.irena.org/publications/2020/Jul/Renewable-energy-statistics-2020.

IRENA (2020b), *Global Renewables Outlook: Energy Transformation 2050*, Abu Dhabi, https://www.irena.org/publications/2020/Apr/Global-Renewables-Outlook-2020.

IRENA (2020c), *The Post-COVID Recovery: An Agenda for Resilience, Development and Equality*, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Post-COVID_Recovery_2020.pdf.

IRENA (2020d), *Wind Energy: A Gender Perspective*, Abu Dhabi, https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jan/IRENA_Wind_gender_2020.pdf.

IRENA (2019a), *Renewable Energy: A Gender Perspective*, Abu Dhabi, https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf.

IRENA (2019b), *Renewable Energy Auctions: Status and Trends beyond Price*, Abu Dhabi, https://www.irena.org/publications/2019/Dec/Renewable-energy-auctions-Status-and-trends-beyond-price.

IRENA (2019c), *Transforming the energy system – and holding the line on rising global temperatures*, Abu Dhabi, https://www.irena.org/publications/2019/Sep/Transforming-the-energy-system.

IRENA (2018), *Renewable Energy Benefits: Leveraging Local Capacity for Offshore Wind*, IRENA, Abu Dhabi, https://irena.org/publications/2018/May/Leveraging-Local-Capacity-for-Offshore-Wind.

IRENA (2017a), *Renewable Energy Benefits: Leveraging Local Capacity for Solar PV*, IRENA, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Solar_PV_2017.pdf.

IRENA (2017b), *Renewable Energy Benefits: Leveraging Local Capacity for Onshore Wind*, IRENA, Abu Dhabi, https://www.irena.org/publications/2017/Jun/Renewable-Energy-Benefits-Leveraging-Local-Capacity-for-Onshore-Wind.

IRENA and USAID (forthcoming), *Renewable energy auctions in Colombia: context, design and outcomes.*

Islam, S. (2020a), "Grid-connected solar outpacing remote installations in Bangladesh", PV Magazine, 6 January, https://www.pv-magazine.com/2020/01/06/grid-connected-solar-outpacing-remote-installations-in-bangladesh/.

Islam, S. (2020b), "Bangladeshi solar module companies seek Covid-19 stimulus package", PV Magazine, 4 May, https://www.pv-magazine.com/2020/05/04/bangladeshi-solar-module-companies-seek-covid-19-stimulus-package/.

JPEA (Japan Photovoltaic Energy Association) (2020), "PV shipment statistics", accessed 15 May, http://www.jpea.gr.jp/en/statistic/index.html.

Korea Energy Agency (2020), Communication with experts, March 2020.

Lee, C. J., R. Shirley, M. Otieno and H. Nyambura (2020 forthcoming), "Powering jobs: The employment footprint of clean cooking solutions in Kenya", *Energy, Sustainability and Society* (submitted, under review).

Li, X. (2019a), "Growing challenges for western turbine OEMs in the China wind power market", Wood Mackenzie, 16 April, https://power-and-renewables.woodmac.com/reportaction/299149/Toc.

Li, X. (2019b), *China Offshore Wind Power Outlook 2019*, Wood Mackenzie, October, https://www.woodmac.com/reports/power-markets-china-offshore-wind-power-outlook-2019-353525.

Liu, D., and L. Garcia da Fonseca (2020), *2020 Solar PV Operations & Maintenance (O&M) Technologies Outlook*, Wood Mackenzie, June (subscription required).

Maisch, M. (2019), "PV investment confidence continues to slide in Australia", PV Magazine, 29 November, www.pv-magazine.com/2019/11/29/pv-investment-confidence-continues-to-slide-in-australia/.

Malaviya, J. (2019), "Strong vacuum tube collector sales in India", Solarthermalworld.org, 13 April, https://www.solarthermalworld.org/content/strong-vacuum-tube-collector-sales-india.

Maritz Africa (2015), *How We Made It in Africa. Case Study: Finding Success in Africa's Rural, Low-income Market (Cape Town)*, 19 October, https://www.howwemadeitinafrica.com/wp-content/uploads/woocommerce_uploads/2015/10/Case-study-Finding-success-in-Africa%E2%80%99s-rural-low-income-market.pdf.

Meyer, G. (2020), "US offshore wind power spending has oil in its sights", *Financial Times*, 8 July, https://www.ft.com/content/93950d29-fa91-434e-8791-ee2d0d998481.

Ministerio de Energía (Ministry of Energy, Government of Argentina) (2020), Communication with experts, Subsecretaría de Energías Renovables (Undersecretary for Renewable Energy), April.

M-KOPA (n.d.), http://solar.m-kopa.com/about/m-kopa-labs/, accessed 20 July.

Mohanty, S. (2020), "Roof solar capacity growth falls 7% in 2019", *The Economic Times*, 7 August, http://economictimes.indiatimes.com/industry/energy/power/roof-solar-capacity-growth-falls-7-in-2019/msmeday_show/75487196.cms?share1=true.

Molina, P. S. (2020), "Amerisolar plans new 200 MW solar panel factory in Brazil", PV Magazine, 27 April, https://www.pv-magazine.com/2020/04/27/amerisolar-plans-new-200-mw-solar-panel-factory-in-brazil/.

MTE/RAIS (Ministério do Trabalho Emprego, Ministry of Labour and Employment) (2020), "Annual list of social information: Database including active and inactive employments for sugarcane cultivation and alcohol manufacture", in *Relação Anual de Informações Sociais (Annual Report of Social Information)* [Brazil], accessed May 2019.

Muro, M., A. Tomer, R. Shivaram and J. Kane (2019), *Advancing Inclusion through Clean Energy Jobs*, Brookings Metropolitan Policy Program, April, https://www.brookings.edu/research/advancing-inclusion-through-clean-energy-jobs/#:~:text=Workers%20in%20clean%20energy%20earn,per%20hour%20than%20other%20jobs.

Murray, B. (2020), "Trump's solar tariffs turn 2 years old, blistering an industry", Bloomberg, 22 January, https://www.bloomberg.com/news/articles/2020-01-22/trade-war-latest-trump-s-solar-tariffs-turn-2-years-old.

NASEO (National Association of State Energy Officials) and EFI (Energy Futures Initiative) (2020), *2020 U.S. Energy and Employment Report*, NASEO and EFI, Arlington and Washington, DC.

National Grid (2020), *Building the Net Zero Energy Workforce Report*, National Grid, Warwick, January, https://www.nationalgrid.com/document/126256/download.

Nordrum, A. (2019), "Egypt's massive 1.8-gigawatt Benban Solar Park nears completion", IEEE Spectrum, 17 September, https://spectrum.ieee.org/energywise/energy/renewables/egypts-massive-18gw-benban-solar-park-nears-completion.

NREL (US National Renewable Energy Laboratory) (2019), "Beneath solar panels, the seeds of opportunity sprout", https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html.

NSDC (National Skill Development Corporation) (2020), "Who we are", https://nsdcindia.org/about-us, accessed 10 August.

Pek, A. (2020), "Wind turbine sizes keep growing as industry consolidation continues", Global Wind Energy Council blog, 27 May, https://gwec.net/wind-turbine-sizes-keep-growing-as-industry-consolidation-continues/.

Power for All (2019), *Powering Jobs Census 2019: The Energy Access Workforce*, https://www.powerforall.org/application/files/8915/6310/7906/Powering-Jobs-Census-2019.pdf.

Ranjan, R. (2020), "Solar imports declined, exports surged in 2019", Mercom India blog, 12 February, https://mercomindia.com/solar-imports-declined-exports-surged-2019/.

REA (Renewable Energy Association) (2018), *REview Renewable Energy View*, London, http://www.nnebooks.co.uk/REA/REA%20REview%202018/index.html.

Reed, S. (2020), "U.K, finds that green business is good business", *New York Times*, 4 June, https://www.nytimes.com/2020/06/04/climate/uk-wind-renewable-energy.html.

REMB DOE (Renewable Energy Management Bureau – Department of Energy, Philippines) (2020), Communication with experts, March 2020.

REN21 (Renewable Energy Policy Network for the 21st Century) (2020), *Renewables 2020 Global Status Report*, Paris, https://www.ren21.net/gsr-2020/.

RSPO (Roundtable on Sustainable Palm Oil) (2015), "Growth of certified palm oil smallholders in Thailand showing no signs of slowing down", 29 September, www.rspo.org/news-and-events/news/growth-of-certified-palm-oil-smallholders-in-thailand-showing-no-signs-of-slowing-down.

Saha, D., and J. Jaeger (2020), "America's new climate economy: A comprehensive guide to the economic benefits of climate policy in the United States", WRI working paper, World Resources Institute, Washington, DC, www.wri.org/publication/us-new-climate-economy.

SCGJ (Skill Council for Green Jobs) (n.d.), "Certified participants", http://sscgj.in/affiliation/certified-participants/, accessed 30 July.

Schneider Electric (n.d.), "Access to energy for everyone", https://www.se.com/ae/en/about-us/sustainability/access-to-energy/, accessed 30 July.

SEDA (Sustainable Energy Development Authority, Government of Malaysia) (2020), Communication with experts, April 2020.

SEIA (Solar Energy Industries Association) (2019), "The high cost of tariffs", December, https://www.seia.org/sites/default/files/2019-12/SEIA-Tariff-Impacts-Factsheet-Dec2019.pdf.

SEPSE (Secretaría de Planificación Subsector Energía, Government of Costa Rica) (2020), Communication with experts, April 2020.

Simas, M., and S. Pacca (2014), "Assessing employment in renewable energy technologies: A case study for wind power in Brazil", *Renewable and Sustainable Energy Reviews*, Vol. 31/ March, pp. 83 90.

Skills Development Scotland (2019), "Transition Training Fund", https://transitiontrainingfund.co.uk/.

Solar Foundation (2020), *National Solar Jobs Census 2019*, Washington, DC, February, https://www.thesolarfoundation.org/national/#:~:text=As%20of%202019%2C%20the%20National,nationwide%20from%202018%20to%202019.

SREDA (Sustainable and Renewable Energy Development Authority) (2020), "Renewable energy installed capacity", updated 12 May, http://www.renewableenergy.gov.bd.

Stoker, L. (2020), "India outlines 20% customs duty on solar modules, cells and inverters from August 2020", PV Tech, 24 June, www.pv-tech.org/news/india-outlines-20-customs-duty-on-solar-modules-cells-and-inverters-from-au.

Stromsta, K.-E. (2020), "US may host first factory for Siemens Gamesa's 14 MW offshore turbine", Greentech Media, 26 May, https://energycentral.com/news/us-may-host-first-factory-siemens-gamesa%E2%80%99s-14mw-offshore-turbine.

TERI (The Energy and Resources Institute) (2019), "Policy paper on solar PV manufacturing in India: Silicon Ingot & Wafer PV Cell – PV module", TERI, New Delhi, https://www.teriin.org/sites/default/files/2019-08/Solar%20PV%20Manufacturing%20in%20India.pdf.

Termmahawong, W. (2014), "Oil palm production in Thailand – with a special focus on small scale producers", Japan International Research Centre for Agricultural Sciences, 28 June, www.jircas.affrc.go.jp/program/proD/english/files/2014/07/fanglei/Thai-oil-palm-report-28-06-2014.pdf.

Teush, S. (2020), "Ukraine Government presents FIT cuts and new auction rules to parliament", PV Magazine International, 16 June, https://www.pv-magazine.com/2020/06/16/ukraine-government-presents-retroactive-fit-cuts-to-parliament/.

UNIAN (2020), "Renewables: 25,600 Ukrainian households install PV systems as of July 1", UNIAN, 22 July, https://www.unian.info/economics/renewables-25-600-ukrainian-households-install-pv-systems-as-of-july-1-11084093.html.

Urbanchuk, J. M. (2020), "Contribution of the ethanol industry to the economy of the United States in 2019", prepared for the Renewable Fuels Association, ABF Economics, Doylestown, PA, https://files.constantcontact.com/a8800d13601/9e769376-3aef-4699-b31f-3c6415b8fa63.pdf.

USDA-FAS (US Department of Agriculture, Foreign Agricultural Service) (2019a), *Indonesia Biofuels Annual Report 2019*, 15 July, https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Biofuels%20Annual_Jakarta_Indonesia_8-9-2019.pdf.

USDA-FAS (2019b), *Malaysia Biofuels Annual Report 2019*, 6 November, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biofuels%20Annual_Kuala%20Lumpur_Malaysia_10-28-2019.

USDA-FAS (2019c), *Brazil: Biofuels Annual Report 2019*, 9 August, https://www.fas.usda.gov/data/brazil-biofuels-annual-5.

USDA-FAS (2019d), *Colombia Biofuels Annual Report 2019*, 11 July, http://agriexchange.apeda.gov.in/marketreport/Reports/Biofuels_Annual_Bogota_Colombia_7-11-2019.pdf.

Vestas (2020), "Vestas becomes first wind energy supplier to set long-term safety targets, along with high ambitions for employee diversity", https://www.vestas.com/en/media/company-news?n=3548418#!%21, accessed 27 January.

Wang, X. and Tao, Y. (2020), "2019 China Wind and Solar PV Overview", China National Renewable Energy Centre, Energy Research Institute, and Danish Energy Agency, http://boostre.cnrec.org.cn/wp-content/uploads/2020/03/ERI-DEA_2019-China-Wind-and-Solar-PV-Overview_revised.pdf.

WEAMEC (West Atlantic Marine Energy Community) (2020), "What is WEAMEC?", https://www.weamec.fr/en/, accessed 12 July.

WEAMEC (n.d.), "The world's most powerful offshore wind turbine: GE Haliade-X", https://www.weamec.fr/en/synthesis/ge-haliade-x/, accessed 12 July 2020.

Wind Europe (2020), *Wind Energy in Europe in 2019: Trends and Statistics*, Brussels, https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Statistics-2019.pdf.

World Bank (2019), *Vietnam Solar Competitive Bidding: Strategy and Framework,* World Bank, Washington, DC, http://documents.worldbank.org/curated/en/949491579274083006/pdf/Vietnam-Solar-Competitive-Bidding-Strategy-and-Framework.pdf.

WWF (World Wide Fund For Nature) (2012), *Profitability and Sustainability in Palm Oil Production*, WWF, https://wwf.panda.org/?204548/Profitability-and-Sustainability-in-Palm-Oil-Production. http://awsassets.panda.org/downloads/profitability_and_sustainability_in_palm_oil_production__update_.pdf.

Xu, M., and D. Stanway (2019), "China solar exports hit 58 GW in first three quarters of 2019", Reuters, 9 December, https://www.reuters.com/article/us-china-solarpower-idUSKBN1Y906Z.

Yamamoto, S. (2020), "Reflexión desde el sector privado: Generación de empleos y reactivación económica", ABEEólica presentation at Inter-American Development Bank webinar, "La Reactivación Económica después del COVID-19. El Papel del Sector Energético", 7 May, https://blogs.iadb.org/energia/es/sector-energetico-reactivacion-economica-despues-del-covid-19/.

Yian, T. T. T., and J. Park (2018), "Technology-enhanced TVET delivery for improving access, relevance and inclusion in Asia and the Pacific", in *Skills and the Future of Work: Strategies for Inclusive Growth in Asia and the Pacific, ILO Regional Office for Asia and the Pacific*, Bangkok, pp. 281 307.

Zarco, J. (2019), "4,057 GW: Récord en la capacidad instalada de Energía Fotovoltaica en México", PV Magazine Mexico, 18 June, https://www.pv-magazine-mexico.com/2019/06/18/4057-gw-record-en-la-capacidad-instalada-de-energia-fotovoltaica-en-mexico/.

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