ESTIMATING THE SOCIAL AND ECONOMIC DEVELOPMENT IMPACTS OF CLIMATE INVESTMENTS

SCALING UP RENEWABLE ENERGY IN LOW INCOME COUNTRIES PROGRAM (SREP)

Of the Climate Investment Fund's (CIF) USD8 billion in total pledged financing, USD593 million[1] are funneled via the Scaling Up Renewable Energy in Low-Income Countries Program (SREP) — a concessional financing mechanism created to foster the adoption of renewable energy technologies by low-income economies. The program leverages an additional USD3.15 billion in co-financing — a factor of 5.3x of its own-account investment volume — to make up a total portfolio of USD3.75 billion in approved projects, thereby contributing to CIF's total portfolio volume of USD68 billion.

CIF was designed to catalyze green and climate-resilient investments in lower- and middle-income economies. As part of this endeavor, SREP projects have a particular focus on reducing energy poverty and increasing energy security via renewable energy solutions in lower-income states. The program's 48 approved investments vary in approach and focus, from Off-Grid PV-Solar Irrigation in Bangladesh (USD22.4 million) to Rural Hybrid Electrification Systems in Mali (USD15.4 million) and Promoting Sustainable Business Models for Clean Cookstoves in Honduras (USD2.95 million).

As projects are designed primarily to deliver climate impacts, they report annually on one or more of four core impact indicators (Figure 1) selected to allow streamlined aggregable and climate-relevant stock-taking[2].

As SREP investments are configured around a stakeholder-centric approach, often working to enhance energy access for rural or energy-poor populations, investments can also contribute to a host of non-climate economic and social impacts. They may include efficiency and productivity gains for small and mid-size enterprises (SMEs) due to a more affordable and reliable energy supply; an enhanced enabling environment for new investments, as a result of energy security; employment, and livelihood impacts; increased health and social wellbeing, etc. Sometimes called "co-benefits," these wider outcomes are generally difficult to assess, but can

Photo: Menangai Geothermal Field Development in Kenya

QUICK FACTS

DATE
March 2021

PROGRAM
Scaling Up Renewable Energy in Low Income Countries Program (SREP)

CIF FUNDING
USD593 million

EXPECTED PROGRAM CO-FINANCING
USD3.15 billion

LEARNING WORKSTREAM
Social and Economic Development Impacts of Climate Investments

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[1] Data as of June 30, 2019

[2] Refer to the SREP Monitoring and Reporting Toolkit for detailed definitions and methodology.

Figure 1.
CORE INDICATORS OF SREP PROJECTS

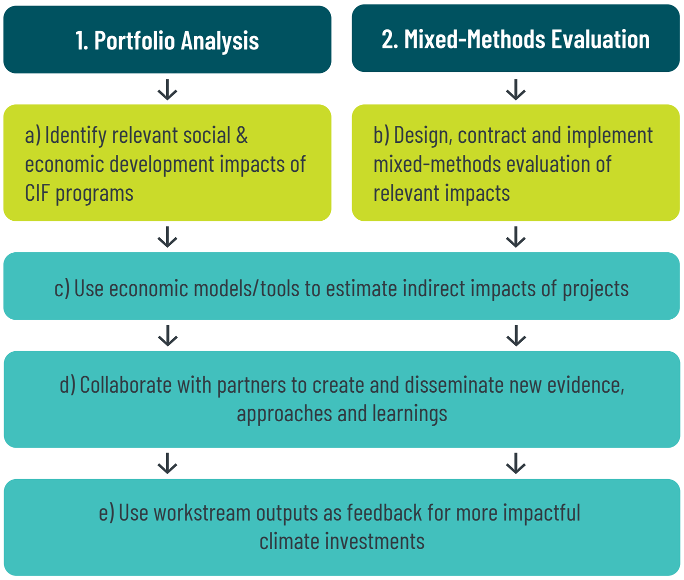
SUPPORT LOW CARBON DEVELOPMENT PATHWAYS BY REDUCING ENERGY POVERTY AND INCREASING ENERGY SECURITY		
Increase supply of renewable energy		**Increase access to clean energy**
• Annual electricity output from renewable energy [megawatt hour/ year (MWh/yr)] • Installed capacity (MW) from renewable energy	• Increased public and private investments in targeted subsectors (USD)	• Number of people, businesses, and community services benefiting from improved access to electricity and other modern energy services fuels

significantly strengthen the case for increased climate finance. Advancing the knowledge base on these types of development impacts can help climate decision-makers, in both the policy and investment spaces, make better-informed and thus, more impactful program choices.

In an effort to map and measure these benefits, CIF is implementing a new workstream titled "Social and Economic Development Impacts of Climate Finance (SEDICI)". It is being implemented in two phases (figure 2), beginning with portfolio data-driven economic modeling for estimating impacts and followed by an in-depth mixed-methods evaluation.

Economic modeling in phase I first focused on CIF's Clean Technology Fund (CTF). Following an exploration of potential outcome pathways and assessment methodologies, three approaches for estimating employment and economic value added (EVA) were chosen: the employment factor approach (EFA), the International Jobs and Economic Development Impacts (I-JEDI) Model, and the Joint Impact Model (JIM). Key findings and takeaways, as related to the CTF portfolio, can be found in the complementary report titled "Estimating the Social and Economic Development Impacts of Climate Investments: Initial Findings from CIF's Clean Technology Fund".

Figure 2.
WORKSTREAM MAP: SOCIAL AND ECONOMIC DEVELOPMENT IMPACTS OF THE CLIMATE FINANCE LEARNING INITIATIVE



Building on the development pathways identified in this process, a comparable analysis was conducted on SREP, utilizing EFA and JIM. The I-JEDI model was not utilized, as the publicly available version of the model only carries country-specific data for five countries (Colombia, Mexico, the Philippines, South Africa and Zambia) and the SREP portfolio has no exposure in these economies. This brief presents the preliminary findings and takeaways of the research.

CIF'S APPROACH TO ANALYZING THE DEVELOPMENT IMPACTS OF CLIMATE INVESTMENTS

Building on CIF's ongoing impact analysis activities, and based on increasing stakeholder interest in the development impacts of climate finance, in 2019 CIF launched a dedicated learning workstream to understand and quantify the social and economic development impacts of CIF's portfolio. This workstream is aimed at: increasing the knowledge base of the development impacts of climate finance; strengthening the investment case for climate programs; and giving decision-makers improved ways of analyzing climate investments for both climate and other development outcomes.

In the first of its two phases (figure 2), the workstream analyzed the potential social and economic impacts of the CTF and SREP portfolios, using existing economic modeling methodologies and tools that are new to CIF. The models utilize macroeconomic and labor market data; as such, they are useful in providing directional portfolio-level insights, without the need for additional data collection from investees or partners. For the mixed-methods evaluation of the second phase, CIF is designing, contracting, and implementing an evaluation, comprising more targeted case studies along with other qualitative and quantitative methods. Throughout implementation, the workstream will include a focus on ongoing and real-time learning to help partners and other stakeholders incorporate lessons into their climate investment decisions.

IDENTIFYING POTENTIAL DEVELOPMENT IMPACTS OF SREP INVESTMENTS

The identification of potential development pathways of clean energy projects, completed as part of the CTF portfolio analysis, was conducted via a review of existing academic and practitioner literature, multilateral development bank (MDB) project documents and reporting, as well as industry research related to renewable energy and energy efficiency. More than

Figure 3.
DEVELOPMENT IMPACT CATEGORIZATIONS

SOCIAL IMPACTS are experienced by people or communities	**ECONOMIC IMPACTS** contribute to economic growth	**ENVIRONMENTAL IMPACTS** conserve or protect natural resources	**MARKETS IMPACTS** contribute to systemic improvements
← Gender dimensions of development impacts → *← Vulnerable populations and local stakeholders' dimensions of development impacts →*			
1. Health and safety	4. Employment opportunities	6. Water	9. Energy sector security and resilience
2. Livelihoods, wealth, and quality of life	5. Economic value added (GDP)	7. Ecosystems and biodiversity	10. Competitiveness and industrial development
3. Access to essentional services		8. Soils and crop productivity	11. Inclusiveness and energy justice

40 potential impact pathways and development outcomes were identified, and thereafter, assigned to four primary impact areas and 11 broad categories of impact (Figure 3)[3]. The effects as relating to gender and as relating to vulnerable populations and local stakeholder engagement were considered cross-cutting impacts across all categories, with each specific outcome expected to have a gender and a local stakeholder dimension.

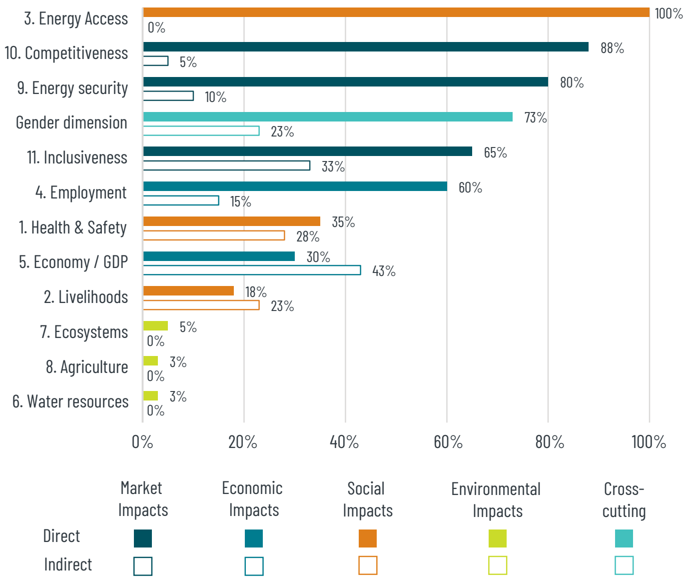
For more details on the selection of impact areas, including methodology and rationale, please refer to pages 3–5 of the complementary report on the CTF analysis. A summary comparison of the modeling approaches used can be found on pages 12–13 of the same document.

To map the development impacts expected at project design and the relative prevalence of each impact category, CIF reviewed all available SREP project approval documents[4]. References to impacts or outcomes were coded and tagged to the 11 categories presented in Figure 3.

Of the 40 SREP projects screened, 88 percent had quantitative targets linked to one or more of their expected non-climate development impacts and 73 percent had a defined gender dimension with direct impacts. The distribution of impact categories is presented in Figure 4, with competitiveness being the most prevalent (referenced in 93 percent of the projects), followed by energy security (90 percent) and inclusiveness (88 percent).

Comparison with CTF. In a similar analysis conducted on the CTF portfolio, the three most prevalent impact categories were competitiveness (63 percent of projects), employment (62 percent), and energy security (58 percent). While both the CTF and SREP portfolios are largely focused on renewable energy (92.1 percent of CTF's exposure), the prevalence of inclusiveness as a key rationale for investment in SREP vs CTF (88 percent of projects vs. 34 percent) is consistent with SREP's greater focus on distributive effects. A greater share of SREP projects also made references to employment effects (75 percent vs. 62 percent CTF); this is consistent with the nature of SREP projects, whose objectives included a focus on the employment-generating effects derived from enhancing energy access for SMEs and local/community services.

Figure 4.
IMPACTS IN MDB PROJECT PROPOSALS TO SREP



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[3] As the development pathways of SREP projects are similar to those of CTF projects, and given that the overall scope of impacts is broad enough to also capture the objectives of SREP projects, the same categorizations were used to map the relative prevalence of each category within the SREP portfolio. The mixed-methods evaluation in Phase 2 will seek to further refine the scope of impacts by also accommodating the development pathways for the Forest Investment Program (FIP) and the Pilot Program for Climate Resilience (PPCR) portfolios.

[4] Including, but not limited to, project appraisal documents, results framework, project proposals, and approval documents.

MODELING TO ESTIMATE EMPLOYMENT EFFECTS AND EVA OF THE SREP PORTFOLIO

From the list of potential impacts and available tools, CIF selected one impact category — economic impacts — and two outcomes — employment and EVA — to begin assessing the potential contributions of SREP. These impacts were selected as they were computable via readily available modeling or estimation tools, utilizing generally accepted methodologies (employment factors and social accounting matrixes) and SREP portfolio data already at hand. The attributes and applicability of the two approaches used — Employment Factor Approach to measure direct employment and Joint Impact Model to measure indirect and induced employment; direct, indirect, and induced EVA; along with the enabled impacts of energy generation — are summarized in Figure 5. Results from the beta testing of each model are summarized in Figure 6 and delved into in detail in the subsequent sections.

It is important to note that CIF is not a direct investment manager; rather, it is a catalytic funder of climate projects, working in partnership with six MDBs and other investors. Therefore, the impact estimation and assessment are considered via a contribution approach, rather than an attribution approach. Furthermore, all estimations of the development impacts in this report constitute the results of the entire investment (e.g., CIF financing blended with other resources including partner MDBs), not only of CIF's funding.

OVERVIEW: ECONOMIC IMPACTS OF SREP

Based on EFA, the SREP portfolio's 826MW of planned capacity could contribute to **42,502 person-years of direct employment in its construction phases** via manufacturing and installation processes. Projects could also contribute to **3,562 jobs in their operational phases**.

JIM estimates that the construction phases of SREP's projects could support up to **122,632 person-years of supply chain jobs**, of which 39 percent will represent female employment, and **60,643 person-years of induced jobs**, of which 41 percent will be held by women. Operational projects could support an **additional 142,681 jobs annually** due to the **enabling effects of additional energy generated on the economy**.

Moreover, JIM's estimates of the total direct and indirect EVA during construction and operations indicate that SREP investments are projected to generate **direct EVA of USD1.4 billion and supply chain-driven EVA of USD613 million during construction phases**. Based on the enabling effects of power generation, **projects, once operational, are expected to generate EVA of USD435 million annually**.

Figure 5.
ECONOMIC IMPACTS: TWO APPROACHES APPLIED TO SREP PORTFOLIO

	A. EMPLOYMENT FACTORS	**B. JOINT IMPACT MODEL**
METHODOLOGY	Analytical using technology-based employment factors	Gross input-output (IO) model & multipliers Energy sector studies
PORTFOLIO ASSESSED	~91% of SREP investment projects* 29 projects 826 MW	100% of SREP investment projects 32 projects 826 MW
SECTORS ASSESSED	Renewable energy	Any
IMPACT RESULTS PRODUCED	✔ Direct jobs (construction + operations)	✔ Indirect and induced jobs (construction + operations) ✔ Direct, indirect and induced value added (construction + operations) ✔ RE [and finance] enabled jobs and value added
USED BY	Researchers, governments, others	CDC Group, FMO, AFDB, Proparco, etc.
DEVELOPED BY	Various public / private sector research	Steward Redqueen & partners

**Eight Technical Advisory projects were excluded in both calculations. Three additional projects were excluded in the workings via EFA, as they did not carry generation targets (two projects in the energy transmission sector and one focusing on cookstoves).*

Figure 6.
SREP ECONOMIC IMPACTS: BETA RESULTS SNAPSHOT

	PROJECT PHASE	IMPACT LEVEL	A. EMPLOYMENT FACTORS	B. JOINT IMACT MODEL
EMPLOYMENT	Construction (temporary, in person-years)	Direct	42,502	
		Supply chain		122,632
		Induced		60,643
	Operations (permanent, in jobs)	Direct	3,562	
		Supply chain		(*)
		Induced		(*)
		Energy enabled		142,681
VALUE ADDED	Construction (temporary, in USD)	Direct		$1.48 B
		Supply chain		$631 M
		Induced		*(included above)*
	Operations (annual, in USD)	Direct		(*)
		Supply chain		(*)
		Induced		(*)
		Energy enabled		$445 M

** The model can generate this impact, but it was not calculated due to an input data gap.*

Findings from the mixed methods evaluation, currently being executed as part of Phase II of the learning stream, will aid in refining the relevance, robustness, and rationales of the findings presented in this document, alongside the exploration of other development impact. Along with building the knowledge base of CIF's learning stream, these findings will also allow CIF and its partners to customize and test the models utilized regularly in portfolio-level development impact estimations.

A. EFA

EFA uses technology- or industry-specific employment factors, multiplied with the respective installed capacity, to estimate direct job impacts during three project phases: manufacturing, installation (construction), as well as operations and maintenance (O&M).

The results for SREP (Figures 7A–7D) represent a planned installed capacity of 826MW, disaggregated by the different types of Renewable Energy Technology (RET) — 267MW of geothermal energy (32 percent); 260MW of solar PV (31 percent); 110 MW of wind (13 percent); 100MW of hydropower (12 percent); and 89MW of biomass-based capacity additions (11 percent) — and by grid access, i.e., the mini-grid.

EMPLOYMENT IMPACTS: UNITS OF MEASUREMENT

Person-year: *One person-year* (or *job-year*) of employment is a unit that stands for one person employed full-time for one year, or two people for half a year, etc. It is often used in manufacturing, installation, and construction employment that may be temporary in nature, though it may also be used for permanent employment.

Job or full-time equivalent (FTE): One *job* is equivalent to one full-time position for the full operational life of the facility, which can vary in length, depending on the technology. It is often used for O&M employment that is considered more permanent.

Note that employment estimates using different units of measurement cannot be summed up or compared, and must be normalized before the total employment benefit may be calculated for an investment or project. Various normalization methods are available in the literature and should be tested for their applicability to the user context and need.

Figure 7A and 7B.

EMPLOYMENT FACORS APPROACH: TOP LINE RESULTS

BY TECHNOLOGY TYPE

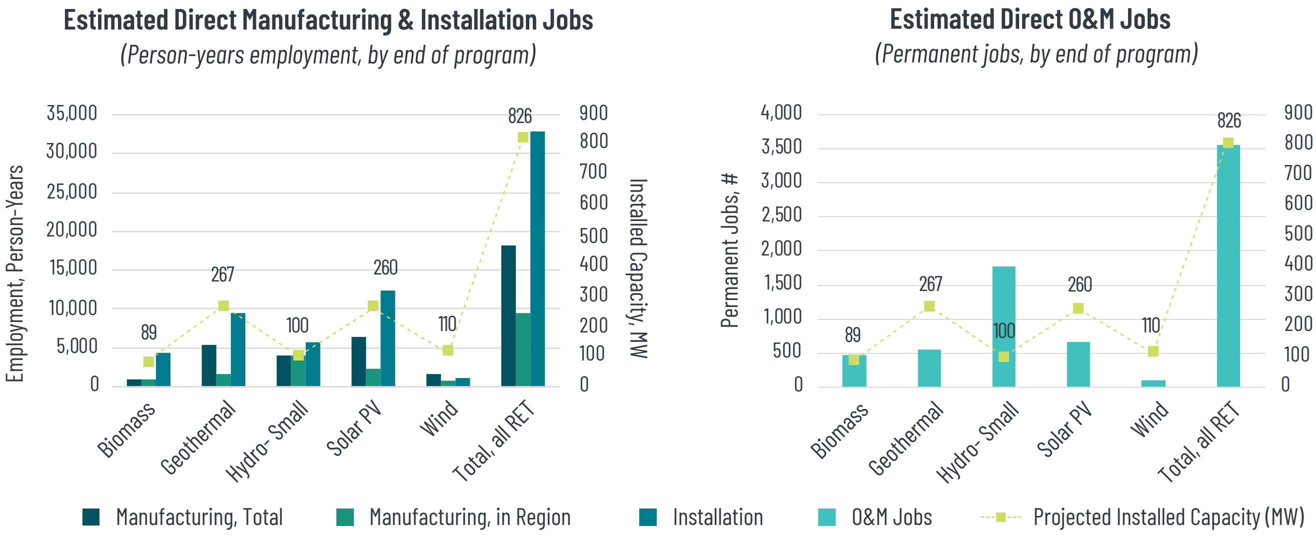
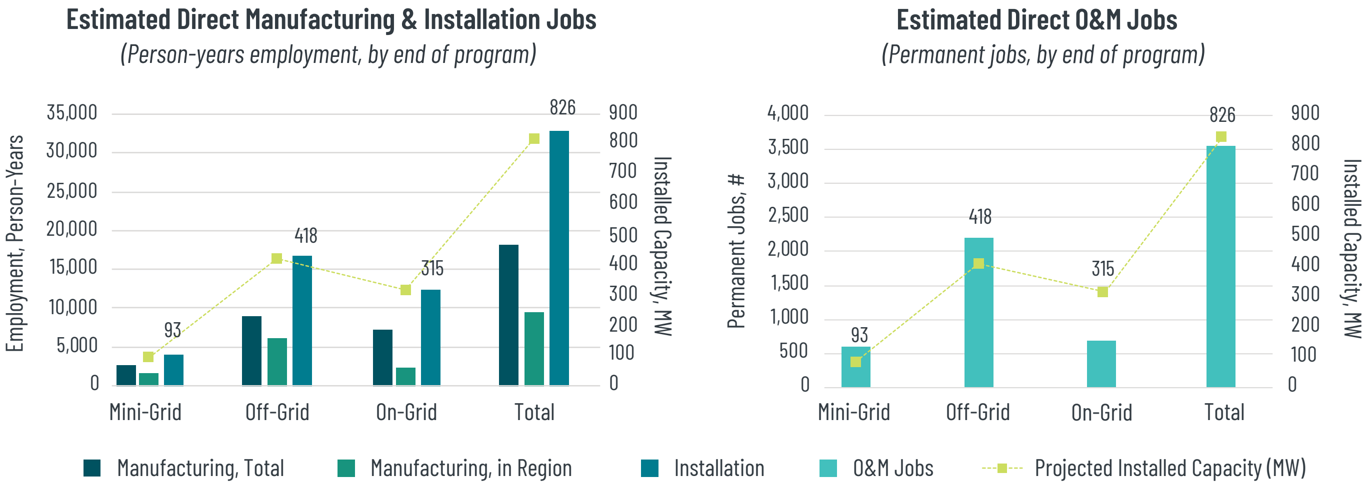


Figure 7C and 7D.

EMPLOYMENT FACORS APPROACH: TOP LINE RESULTS

BY GRID ACCESS TYPE



Employment factors related to the renewable energy technologies were combined with regional multipliers to account for labor productivity differences.[5] Manufacturing employment was estimated in two ways: first, for all manufacturing employment that could take place in any region (e.g., whether local or imported technology); and second, for the proportion of manufacturing employment considered to take place in the same region as the investment (e.g., local technology only).

The portfolio covers 16 countries,[6] with regional multipliers (influencing all three categories of jobs equally — manufacturing, installation, and operation) varying from OECD averages by 2.4x for Asia, 3.4x for Latin America, and 5.7x for Africa.

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[5] This beta test uses methodology and employment factors, regional multipliers, and regional local manufacturing, provided in Rutovitz, J., Dominish, E., and Downes, J. 2015. Calculating global energy sector jobs: 2015 methodology. Prepared for Greenpeace International by the Institute for Sustainable Futures, University of Technology Sydney. Technology decline factors were not considered in this instance.

[6] Armenia, Bangladesh, Ethiopia, Haiti, Honduras, Kenya, Liberia, Maldives, Mali, Mongolia, Nepal, Nicaragua, Rwanda, the Solomon Islands, Tanzania, and the United Republic of Vanuatu

Technology types, as disaggregated above, were also influential in driving differences in results. In manufacturing, the technology-specific multipliers for small-hydro and solar dwarfed those in other RETs, with 1.5–3.8x as many total jobs created per MW in these technology sectors. However, for solar, wind, and geothermal technologies, the model's current coefficients for in-region manufacturing are influenced by the assumption that a large share of these sectors' manufacturing operations are housed in developed economies (and therefore, not in SREP's investee countries). These technologies, therefore, show a significant difference in total vs. in-region manufacturing jobs generated. It is assumed that the entirety of manufacturing for biomass and hydro-based generation occurs in the region.

Installation or construction presents a larger share of temporary job creation than does manufacturing. Here, small-hydro, biomass, and solar sectors are the most labor-intensive, with hydro generating about 2.3x as many jobs per MW as geothermal and 4.9x as many as in wind.

Small-hydro was also the most labor-intensive in O&M (permanent) jobs, with 3.3x as many jobs per MW as biomass, 7x jobs as solar, 12.3x as geothermal, and 16.3x as wind.

Of note: the findings are best viewed as averages at the portfolio level. This is because the use of regional manufacturing capacities can vary vastly, depending on project-specific attributes, and country-specific multipliers may diverge from the regional averages used.

Another point to note is that the off-grid portfolio segment has a lower confidence level for results under EFA, as the employment factors used are relevant to utility-scale projects.

Photo: Rural communities electrified through mini-grids in Naypyidaw, Myanmar

B. JIM

JIM uses labor productivity multipliers and social accounting matrices [input-output (IO) models] to map economic interactions across an economy, thereby estimating the indirect and induced employment effects, along with the direct, indirect, and induced value added of investment portfolios.[7] Using country- and sector-specific data, the model also estimates the share of women's employment in the total employment results. Furthermore, it estimates the enabling effects of additional power generation in country,[8] whereby the availability and reliability of energy access, or reduction in energy costs, translate into higher economy-wide revenues.[9]

JIM was developed by Steward Redqueen in collaboration with several Development Finance Institution and International Financial Institution (IFI) partners,[10] as well as in consultation with CIF. CIF has been part of the latest testing phase of JIM and has recently joined the development committee of the platform, thereby engaging in the further development and customization of the model. This provides the opportunity for enhancing the relevance and reliability of findings when CIF extends the learning stream's portfolio analysis to its Pilot Program for Climate Resilience (PPCR) and Forest Investment Program (FIP) portfolios. JIM was publicly launched in late 2020, which allows for further collaboration with and feedback from the larger development finance and investment community.

Overall findings on employment and value added, as presented below, are disaggregated by the nature of the project (on-grid, off-grid, or mini-grid) in Figure 8, and by technology type (biomass, geothermal, hydro, solar, or wind) in Figure 9.

According to the model, in the sum of the projects' construction phases, the SREP portfolio is projected to support a total of 122,632 person-years of supply chain employment (of which 39 percent represents female employment) and 60,643 person-years of induced employment (41 percent held by women). Once and when operational, the enabling effects on the economy, due to additional power generated, are expected to support 142,681 jobs annually. The model does not, at present, estimate direct employment as these numbers are usually made available to investors via data collected from investees. There is interest in developing the model to estimate direct employment with comparative means in future.

JIM estimates that the portfolio's EVA during construction phases would total USD2.0 billion, of which USD1.38 billion is direct EVA and USD613 million would be via supply chain

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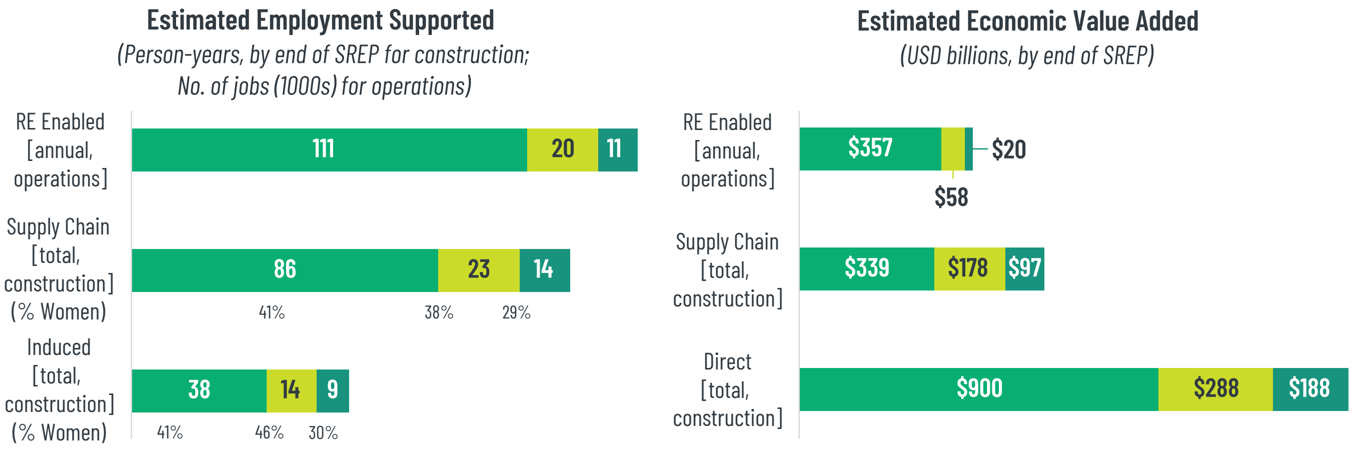
[7] Direct employment is not modeled by JIM, as this data point is collected by other Self-Reporting Questionnaire tool users from their portfolio companies.

[8] Sometimes referred to as 'second order' or 'forward effects'

[9] A full methodological description of the tool is forthcoming; visit www.jointimpactmodel.com for updates.

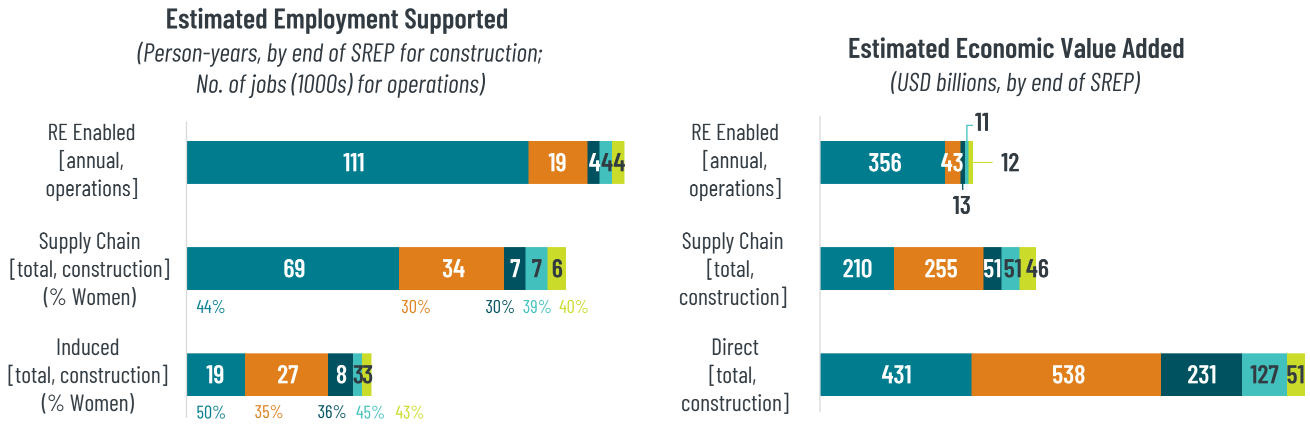
[10] BIO, Proparco, FMO, CDC Group, FinDev Canada, and the African Development Bank

Figure 8.
JOINT IMPACT MODEL: TOP LINE RESULTS



	🟩 On-Grid	🟩 Off-Grid	🟩 Mini-Grid
% Project Value	58%	30%	12%
% Number of Projects	37%	38%	25%

Figure 9.
JOINT IMPACT MODEL: TOPLINE RESULTS BY TECHNOLOGY TYPE



	■ Geothermal	■ Solar	■ Wind	■ Hydro	■ Biomass
% Project Value	28%	39%	15%	9%	9%
% Number of Projects	10%	46%	15%	13%	15%

effects.[11] Once the generation capacity is online, the portfolio's power-enabling effects on the wider economy is expected to generate an additional USD435 million in EVA per year of operations.

For the economic effects of the projects' operations themselves — supply chain and induced employment, as well as the direct and supply chain EVA — values cannot, at present, be modeled for CIF due to data limitations. The results here would be in addition to the numbers presented above.

Photo: SREP Pilot Countries Meeting on progress, bottlenecks, and the articulating of objectives for new countries

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[11] Induced value added is included in the direct and indirect figures, and not calculated separately by the tool.

Photo: Menangai Geothermal Field Development in Kenya

KEY TAKEAWAYS AND NEXT STEPS

The SREP portfolio analysis was an important first step in mapping the impacts of supporting clean energy technologies in nascent renewable energy markets. Both the employment and EVA modeling provide important markers for understanding and comparing the economic impacts of projects. This is particularly important at a time when countries are developing strategies to manage COVID-19 related slowdowns and funnel development financing toward green growth areas with robust and distributive economic effects. The nature of the SREP portfolio, however, raises important questions and opportunities for future learning.

1. **Technology-specific effects.** The models used thus far are designed for use with investments in utility-scale renewable energy projects, and therefore, may not accurately estimate the effects of mini- or off-grid projects, particularly in energy-frontier regions. As such, it may be useful to explore where and how the models may be refined to include improved parameters specific to distributed energy technologies.
2. **Country-specific effects.** There is still a lack of primary data on specific technology markets (e.g., renewable energy, energy efficiency, etc.), energy markets (e.g., prices, supply, demand), and labor markets for many CIF priority countries, as well as some divergence in the literature on agreed datasets. Further workstream activities could focus on helping to fill these data gaps.
3. **Entrant and innovation effects.** SREP projects are often designed to introduce newer technologies to energy-deficient markets or communities. As such, they have significant potential for demonstration effects and the development of new local supply chains, not easily captured by IO models. Working with partner MDBs and thought leaders to map and measure these effects may aid in both targeting and enhancing impacts.
4. **Qualitative impacts.** While modeling techniques are useful for directional, portfolio-level economic impact estimates, there are many development impacts that are qualitative in nature or require more contextual knowledge for accurate reporting. This includes, for example, the impact of CIF investments on health, competitiveness, and energy security or other market-level impacts. The plans for a broader, mixed-methods study can help to fill these gaps in the knowledge base.
5. **Agency and redistribution effects.** SREP projects that often target energy-deficient markets may generate opportunities for human capital accumulation, greater economic agency, the redistribution of economic dividends, or decision-making. While these effects are hard to measure in aggregate for a portfolio of projects with vastly different characteristics, the mixed-methods evaluation referenced above may provide the first steps to determining whether and how these factors can be approached by investors such as CIF.

NEXT STEPS

The learning workstream on development impacts is currently executing following activities:

- Share findings of the CTF and SREP portfolio analyses and modeling with key partners (donor and recipient countries, partner MDBs, and CIF observers), thereby opening avenues for collaboration.
- Carry out portfolio analyses and modeling for the Pilot Program for Climate Resilience (PPCR) and the Forest Investment Program (FIP).
- As part of Phase II of the workstream (Figure 2), contract a mixed-methods evaluation, currently in the final stages of design. The evaluation will focus not only on economic impacts, but also on other social, environmental, and market impacts of the CIF portfolio, which have been identified as potentially significant in the literature and tools review. This will also enable the qualitative impacts of the portfolio to be studied.
- Introduce learnings and ex-ante modeling approaches to the design and implementation of prospective new CIF programs dealing with renewable energy integration into power systems, climate-smart urbanization, climate-smart land use, and low-carbon industry transition. This can increase stakeholder ambitions that are derived from improved estimates of future co-benefits of climate investments.
- Continue the learning agenda throughout the workstream, with dissemination via publications, webinars, and other channels.

CIF is keen to work with partners, stakeholders, and thought leaders on enhancing the accuracy, relevance, utility, and usage of the workstream's outputs, as well as engage in collaboration or discussion.

Photo: Menangai Geothermal Field Development in Kenya

The Climate Investment Funds (CIF) accelerates climate action by empowering transformations in clean technology, energy access, climate resilience, and sustainable forests in developing and middle-income countries. The CIF's large-scale, low-cost, long-term financing lowers the risk and cost of climate financing. It tests new business models, builds track records in unproven markets, and boosts investor confidence to unlock additional sources of finance.

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