

# CLIMATE INVESTMENT FUNDS

Joint CTF-SCF/TFC.22/4.3

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Joint Meeting of the CTF and SCF Trust Fund Committees

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Agenda Item 4

## **INTEGRATION OF RENEWABLE ENERGY INTO POWER SYSTEMS PROGRAM (SUMMARY)**

## 1. Overview

1. **Global Program for Large-Scale Integration of Renewable Energy:** Investment pathways consistent with a 2°C warming scenario will require the urgent and scaled demonstration of renewable energy (RE) integration solutions into power grids in a manner that maintains safety, reliability and security of supply. This program will deploy scaled concessional resources to support first-of-its-kind investments in enabling technologies, infrastructure and other emerging innovations to achieve this.

## 2. The Challenge

2. Global energy consumption grew by 2.3% in 2018, nearly twice the average rate of growth since 2010 (IEA), driven by both a robust global economy (3.7%) as well as extreme weather conditions. Nearly 70% of the total energy demand growth was met by fossil fuels, for a second year running. Despite double-digit growth, renewables did not grow fast enough to meet the increase in demand for electricity around the world.
3. Driven by higher energy demand in 2018, global energy-related CO<sub>2</sub> emissions rose 1.7% to a historic high of 33.1 Gt CO<sub>2</sub>, with the power sector accounting for nearly two-thirds of emissions growth. CO<sub>2</sub> emissions had stagnated between 2014 and 2016, even as the global economy continued to expand. This decoupling was primarily the result of strong energy efficiency improvements and low-carbon technology deployment, leading to a decline in coal demand. But the dynamics changed in 2017 and 2018. Higher economic growth was not met by higher energy productivity and lower-carbon options did not scale fast enough to meet the rise in demand. This is a strong warning for global efforts to combat climate change and demonstrates that current efforts are insufficient.
4. Under the International Energy Agency's Sustainable Development Scenario to meet long-term climate goals, global emissions need to peak soon and decline steeply to 2020. The share of low-carbon energy sources would need to increase by 1.1 percentage points every year, more than five-times the growth registered in 2017. In the power sector, generation from renewable sources would need to increase by an average of 700 TWh annually in this scenario, 80% higher than the 380 TWh increase registered in 2017. On the other hand, the share of renewables in the power mix needs to rise from one-quarter today to two-thirds in 2040. In terms of heat provision, renewables need to rise from 10% today to 25%. In transport, renewables need to rise from 3.5% today to 19%, including both direct and indirect use, e.g. renewable electricity for heating and electric vehicles.
5. The integration of RE into the grid however poses unique challenges, key amongst which include:
  - Output variability, leading to increased reserves/ramping requirements, or curtailment of RE;
  - Location dependence, requiring upgrades to distribution/transmission power transfer capabilities to accommodate RE;
  - Changes to voltage, frequency, reactive power and/or fault current performance, leading to the grid operating close to or outside established operating parameters;
  - A general increase in price volatility, for countries with spot markets, otherwise lower marginal costs resulting in impacts on the revenue stream of existing generation assets.

### 3. The Solution

6. There is an urgent need to demonstrate, at scale, the integration of high volumes of renewable energy in flexible grids, in a way that maintains safety, reliability and security of supply, to establish alternative investment pathways that are consistent with a 2C warming scenario. Concessional finance will be critical in helping address the key barriers faced by public and private actors in scaling-up RE deployment, namely:
  - **Policy and governance barriers:** including long-term planning, well-designed and implemented regulatory frameworks;
  - **Economic barriers:** such as a clear pricing strategy, human capital development;
  - **Commercial and financial barriers:** a solid business model for technologies that support RE integration (energy storage, demand side management tools, reactive support), high average capital costs and financing charges.;
  - **Social barriers:** public opposition due to lack of stakeholder engagement and insufficient social awareness;
  - **Technology barriers:** such as those related to advanced metering and control communications, conversion and connection infrastructure, innovation gaps and lock-in inertia.

### 4. The Program

7. The Climate Investment Funds<sup>1</sup> and its implementing partners propose the establishment of a Global Program to Support the Large-Scale Integration of Renewable Energy. This program would utilize scaled concessional finance to accelerate total investments in enabling technologies, infrastructure, electrification and demand management as well as market design and system operations improvement for scaled-up RE integration.
8. While most existing initiatives focus on accelerating the deployment of RE generation itself, this proposal responds to the growing need to deal with underlying technical, operational, regulatory and financial barriers relating to the integration of that RE generation into power grids. Experience in countries with growing shares of RE generation show that unless these barriers are tackled, they can inhibit and discourage investment into RE generation at the speed needed to achieve global climate change goals.
9. The majority of the funding will be deployed to support the following investments:

#### **Scaling up RE enabling technologies**

- New technologies for real time grid management that enhance electricity system flexibility and facilitate distributed generation, such as advanced metering systems, wireless network control and demand side management. Technologies that enable electrification of other sectors, such as electric vehicle charging infrastructure, opening doors to new markets for renewable generation as well as new ways to store the generation surplus.

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<sup>1</sup>Working through six Multilateral Development Banks (AfDB, ADB, EBRD, IDB, IFC, World Bank), the \$8.3 billion Climate Investment Funds (CIF) accelerate transformations in clean technology, energy access, climate resilience, and sustainable forests in developing countries: <https://www.climateinvestmentfunds.org/>

### **Supporting RE innovation**

- Business models that empower men and women consumers, turning them into active participants in demand-side management.
- Innovative schemes that enable renewable energy supply, in both off-grid and connected areas.

### **Enhancing infrastructure to be RE-ready**

- Grid interconnection to integrate regional markets increasing their flexibility.
- New and smart grids, both large and small-scale, that complement each other and enable new ways to manage RE generation.
- Changes in the operation of existing hydropower plants to accommodate more penetration of VRE.

### **Enhancing System and Market Design and Operation**

- New regulations in the wholesale markets that encourage flexibility from market participants and adequate remuneration of grid support services.
- Design and regulatory change in the retail market that stimulate flexibility on the consumer/prosumer side including on pricing structures.
- New operation procedures that improve predictability of RE such as advanced weather forecast procedures.