Theory of Change for Renewable Energy

Development Investment Mandate – Background note

Last update: 2024

Contents

1. Introduction

Renewable energy is one of Norfund´s four investment areas. Norfund invests in conventional renewable energy sources, including solar, wind, hydropower, biomass and geothermal energy. Norfund invests in both utility-scale, grid-connected power plants and distributed generation. The latter includes smaller-scale projects and off-grid solutions that supply power directly to the end-user. Additionally, Norfund invests in enabling technologies that have a significant climate impact such as energy storage and transmission.

This document describes the foundation of our theory of change for investments within renewable energy under the development mandate, by describing the problems we are trying to solve, the inputs we provide, and the outputs and outcomes we expect by providing these inputs. The expected outcomes and impact are defined based on literature.

See box 1 for a description of how we are applying the Theory of change concept and framework.

2. The Theory of Change framework

Box 1: Theory of change concept

A theory of change is a comprehensive framework that outlines how and why a desired change is expected to happen in a particular context.

The theory starts with a clear problem statement, identifying the specific issue or challenge that needs to be addressed. Inputs are then detailed, which include the resources, activities, and interventions necessary to address the problem, that Norfund is providing. These inputs might consist of funding, staff, partnerships, and specific actions or programs designed to drive change.

The theory of change then maps out the sequence leading from inputs to outputs, outcomes in the short and longer term, and finally, the desired impact. Outputs are the direct results of the activities and inputs provided by Norfund, such as the increase in staff or increased payment of taxes and fees by the investee.

Outcomes refer to the short- and medium-term changes that result from these outputs, such as expansion of firms in the supply chain or establishment of new firms and increased household consumption and resilience. Finally, the impact is the long-term, sustained change that the investment aims to achieve, such as job creation, economic growth and improved living standards.

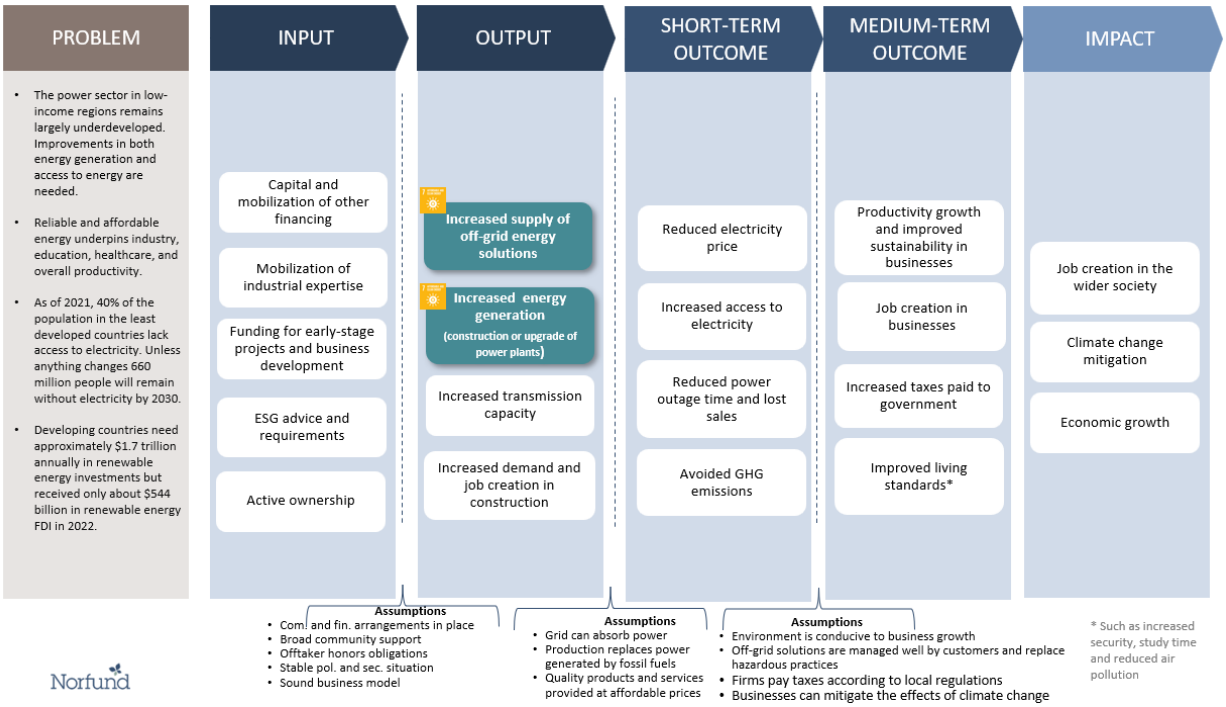
This pathway is mapped out in a theory of change, and helps organizations and stakeholders understand the process of change, measure progress, and refine strategies to ensure the desired impact is achieved.

Based on literature and current knowledge of renewable energy Norfund has developed a Theory of Change (ToC) for how change happens through our investments in renewable energy. The ToC consists of a framework of input, output, short- and medium-term outcomes and impact goals, as described in box 1.

The input is what Norfund provides as an investor, while the output is monitored during annual reporting. The outcomes are generally measured through case studies and other in-depth analysis on a case-to-case basis. The expected long-term outcomes and impacts are demonstrated through literature.

The elements visualized in the ToC are those that are probable based on literature and knowledge of the sector. However, we do not state that these happen in all cases. Central to being able to move from input and through the steps, all the way to the final impact goals are the assumptions we have outlined in section 6 of this document. If these assumptions do not hold, some or all the steps in the ToC might not be realized.

2.1 The theory of change for Renewable Energy – DIM



3. The hypothesis of change

This part explains how our inputs translate through to outputs, outcomes and impacts in renewable energy, under the Development Investment Mandate.

3.1 Input

Norfund provides funding to support the development of new (or expansion of existing) power generation projects, off-grid energy solution projects and transmission projects. This helps finance investment requirements associated with early-stage project development, such as feasibility studies, commercial structuring and environmental impact assessments. In addition, the financing can enable development of, or expansion of socially beneficial operations.

We invest equity, debt or guarantees in power projects depending on their financing needs and mobilise technical expertise and other financiers. Norfund provides advice and requirements to ensure environmental and social risks are properly identified and mitigated prior to construction and operation.

3.2 Output

After financial close is reached, the project enters the construction, business development or expansion phase. Construction activity creates temporary construction jobs and demand for goods and services. The construction or expansion of the project also creates jobs in operations and maintenance upon finalization. The expertise and requirements provided by Norfund help to ensure that the project operates with high technical quality and in compliance with the International Finance Corporation´s Performance Standards on Environmental and Social Sustainability.

Depending on the type of project, the resulting operations provide increased energy generation or increased supply of off gid energy solutions. As we also have projects related to building or upscaling of transmission lines the output could also be increased transmission capacity.

The increased generation of renewable energy and increased access to such energy are both part of Norfund's strategic impact objectives for the sector.

3.3 Outcome

Investing in renewable energy, through off-grid, transmission and power production segments yields several desired outcomes. In the larger-scale power production and transmission sectors, additional capacity and increased stability from renewable energy sources reduce power outages and dependency on costly backup solutions, boosting business productivity and extending operational hours. The outcome is a rise in business output, increased government taxation from these businesses, and savings on peak power costs. Renewable energy sources also have the advantage of lower GHG emissions compared to fossil fuels, contributing to the avoidance of emissions and aiding environmental sustainability.

As businesses increase their profits due to lower prices of electricity and reduced costs of power outages they could increase their demand for labor, leading to job creation. The increased profits and expanded operations result in increased taxes paid to governments. The access to off grid solutions, replacing hazardous and pollutive alternatives, also leads to improved living standards, such as increased security, study time and reduced indoor air pollution.

3.4 Impact

Increased access to renewable energy can foster economic growth, through the various channels outlined in the outcome section. Economic growth contributes to job creation in the wider society, which further increases taxation, improves living standards and the possibility for better educational outcomes. This also contributes to long term economic growth, creating a virtuous circle, where the beneficial effects enhance one another.

Furthermore, generation of power from renewable sources helps mitigate climate change, by avoiding emissions from the sources that would have otherwise been used to meet the energy demands of a growing economy and population.

4. Rationale for investment

Access to energy is a fundamental cornerstone for development in emerging economies, acting as a catalyst for economic growth and a precondition for poverty alleviation (Eberhard & Dyson, 2020). Reliable and affordable energy sources fuels industry, lights up homes, powers schools, and ensures that healthcare facilities can operate effectively.

Access to energy enhances business productivity, enables communication and trade, and improves social outcomes (Eberhard & Dyson, 2020). Increased access to electricity is particularly transformative in rural areas, where electrification can lead to greater agricultural yields and access to markets (Falchetta, 2021). Moreover, investments in renewable energy foster sustainable development through the mitigation of climate change and contribution to job creation opportunities. This lays the groundwork for resilient and inclusive economies. Therefore, prioritizing energy access and power generation in

developing countries is not just an investment in infrastructure but an investment in human and economic potential, which is pivotal to achieving the United Nations' Sustainable Development Goals.

The lack of stable and reliable energy in developing countries significantly impacts enterprises by affecting their economic development. As an example, unreliable energy solutions can result in power outages and loss in sales. Data from the World Bank Enterprise Surveys indicate that 72 % of businesses in Sub-Saharan Africa experience electrical outages and most firms (51 %) own or share a generator to fulfil their electricity need. Furthermore, the average losses due to power outages are estimated to 8 % of annual sales in Sub-Saharan Africa (World Bank Group, 2024). Offering increased access to more reliable energy sources therefore affects the growth potential of businesses and contribution to job creation and value creation in the economy.

The lack of access to reliable and clean energy sources not only affects businesses. It is also an important factor in households and the lives of individuals. As of 2021, 40% of the population in the least developed countries still lacks access to electricity. The number of people globally without access to electricity increased during the pandemic but was expected to stabilize in 2023. If the current pace continues, approximately 660 million people will remain without electricity access by 2030, with nearly 2 billion still using polluting fuels and technologies for cooking (International Energy Agency , 2023).

Research suggests that developing countries require about $1.7 trillion annually in renewable energy investments to meet their energy needs, including investments for power grids, transmission lines, and storage. However, developing countries attracted only around $544 billion in clean energy foreign direct investment (FDI) in 2022 (World Investment Report, 2023). Thus, there is a huge gap in financing for energy access in the least developed countries.

Another important consideration is the need for diversification of the energy mix. Many areas in Sub-Saharan Africa, relying on hydropower, have experienced extensive droughts over the past decades. This has highlighted the need for a diversified energy mix, and investments in energy storage options, to ensure energy is available also during times with little rain.

The need for significant investments in power generation capacity remains critical, especially considering the sustained economic growth in many of the regions where Norfund invests. Off-grid solutions, particularly in rural areas where grid connections are often unavailable or too costly, are essential for achieving the Sustainable Development Goal of universal energy access by 2030. Clean energy sources are a priority to mitigate the impacts of climate change and to provide both social and commercial benefits. To this end, the expansion of renewable energy power production and off-grid solutions is crucial, and development finance institutions continue to play a vital role in funding and supporting the initiation and expansion of such projects in markets with high risks.

5. Literature and rational for the steps outlined in the theory

The relationship between access to energy and job creation, improved living standards, climate change mitigation and economic growth in developing countries is multifaceted. However, literature suggests that access to clean and reliable energy sources is a fundamental driver of economic development, impacting various aspects of society and industry.

Literature suggests multiple ways in which access to energy affects individuals, businesses and the economy. Norfund invests in both independent power producers (IPPs), where the aim is to provide more electricity into the grid, and providers of off-grid services, such as lanterns and solar home systems, to enable individuals and small businesses access to electricity.

The first avenue of investments, IPPs, ensures more energy is distributed into the power grid, and mainly benefits businesses by enabling more reliable connections and less power outages, and thereby enhancing productivity.

The second, off-grid solutions, are tailored to enable households and small businesses that are unable to or unwilling to (possibly due to high associated costs) connect to the electricity grid. This avenue of investment enables, among other things, longer study hours, less indoor pollution, higher security and therefore higher household wellbeing. The two types of investment thus enable access to electricity through two different avenues. This chapter will further discuss how increased access to electricity affects individuals and the economy without differing between the two types of investments.

5.1 Economic growth

Access to energy is critical for economic advancement, being the primary input into many economic activities, across sectors and for households. Increased availability of electricity is found to correlate with economic growth, as theory would suggest (Burke, Stern, & Bruns, 2018). However, there are few strong methodological studies that have been able to establish a causal relationship between the two sizes. Economic growth requires that energy is available, but the nature of the relationship is ambiguous.

Wolde-Rufael examined the relationship between energy consumption and economic growth in 17 African countries from 1971 to 2001, in two studies from 2006 and 2009 (Wolde-Rufael & Yemane, 2006 & 2009). The first study found that increased electricity consumption has a positive, causal effect on economic growth in three countries, while the reverse effect, economic growth leading to increased consumption and economic growth, is found in six countries. This means that it is somewhat ambiguous what comes first, increased electricity consumption or economic growth.

However, the later study from Wolde-Rufael from 2009 uses the same data to reexamine the hypotheses. The central finding from this study is that energy influences economic growth, but that the availability of capital and labor are more important to facilitate sustained economic growth.

Further, Eggoh et al. examined the same relationship using data from 21 African countries between 1970 and 2006 (Eggoh, Bangake, & Rault, 2011). The study finds that a change in energy consumption has an impact on economic growth, and equally a change in economic growth has an impact on energy consumption.

The outcomes of these studies of course depend on the country, context and period in which they are performed. However, it seems that while access to energy undoubtedly is an important prerequisite for

improved business productivity and household welfare, the casual link is difficult to establish with certainty. This is mainly due to reversed causality and the difficulty of controlling for all other factors that play an important role in transitioning from increased access through to economic growth.

Therefore, we will now consider the linkages between the access to energy and the availability of energy and other, intermittent steps outlined in the theory of change in part 2.1, such as reduced power outages, productivity growth and improved standards of living.

5.2 Reduction in costs for firms

Considering the effect of increased access of electricity on business productivity, literature and reports highlight how investments in the power sector reduce power outages and reliance on expensive backup solutions, enabling businesses to operate more efficiently, lowering costs, and increase output and government revenue by increasing taxes (Eberhard & Dyson, 2020). This is especially the case for industries that are heavily reliant on power, such as transport, trade and manufacturing services. The reduction of power outages enhances business productivity and the competitiveness of firms particularly by reducing costs related to downtime (Onuonhga, 2020; Akinlo, 2009; Bathia & Angelou, 2015).

5.3 Productivity growth

Reducing power outages, both by increasing the supply of energy to the grid, and by improving the grid capacity therefore has great potential as an enabler of increased productivity in businesses. Andersen and Dalgaard (Andersen & Dalgaard, 2013) assessed the effect of power outages on economic growth in Sub-Saharan Africa from 1995-2007 and found a substantial, negative effect on growth of the economies due to power outages, indicating that limiting such occurrences has a positive effect on productivity of firms.

The effects of unreliable power supply are however shown to differ between countries and contexts. This depends on the business' ability to adapt to unreliable supply, by using generators or by purchasing products that are not as power intensive. A study from Senegal finds that power outages have a negative, significant effect on SMEs, while the businesses which are large enough to afford generators are not affected by the outages (Cissokho, 2019). Nevertheless, investing in IPPs that contribute to the reliability of supply, by increasing the supply to the grid, undoubtedly has positive productivity effects for firms.

5.4 Living standards and education

In addition to the economic impacts on businesses from increased access- and reliability of energy, access to electricity also affects individuals and households, affecting educational, health and gender equality aspects. Norfund contributes to this by investing in businesses that provide off-grid solutions for households and small businesses. In many developing countries diesel lamps or kerosene lamps are used for lighting. A study from Rwanda finds that these usages are up to three times as costly for the households, compared to the use of grid electricity (Luciane, Munyehirwe, Peters, & Sievert, 2017). Thus, enabling better access to electricity for households, through alternative, off-grid solutions, could be cost-saving and therefore allow for an extended use of lighting. This enables children to study longer hours, and the individuals in the household to perform different tasks while at home, not having to be in the room where they would previously perhaps rely on one lamp.

British International Investment performed in 2020 a meta study, on literature linked to the impact of investing in power. One of their central findings was that 83 % of studies in the meta study find a positive impact on the length of study time for children from the increased access to electricity (CDC, 2020). This should have positive, long-term effects on both household wellbeing and economic prosperity.

5.5 Job creation

By being an enabler of productivity growth in businesses, increased access to energy also increases employment, both directly in the firms receiving a better connection, and in the firm's suppliers in the longer run. In the first stage we foresee that jobs will be created in construction activities connected to construction of- or expansion of a power plant. In the longer run the power plant might not require much employment in operations and maintenance. Therefore, the main effects on employment from the investment are derived through the firms which receive increased access to electricity. A study of the hydropower plant Bugoye in Uganda, which Norfund invested in, demonstrates these effects. This study found that the provision of power to the grid created 8-10 times more jobs than the direct jobs created during the construction phase of the plant itself. Through the project almost 1 100 jobs were created in construction and operations and maintenance, while up to 10 300 jobs were created due to the larger and more reliable power supply to the grid (Scott, Darko, Seth, & Rud, 2013).

5.6 Avoided emissions

As we have seen, energy production, and enabling larger energy consumption is an important enabler of development. At the same time energy consumption is a major contributor to greenhouse gas emissions. Therefore, as the need for energy in emerging markets and developing countries is surging, there is an increasing need to meet this demand by scaling up the use of renewable energy sources. Investing in renewable energy generation and distribution therefore contributes to avoiding emissions, by substituting future pollutive sources of energy[1]. This is done both at the household level, by substituting kerosene lamps and generators by introducing mini-grids and at the business level by substituting pollutive diesel generators. Considering Norfund´s portfolio under the development mandate, we contributed to 6.2 million tons avoided emissions in 2023, from the capacity we have helped finance (Norfund, 2023).

In conclusion, there are many ways in which access to electricity affects individuals, households and the economy. This Theory of Change points out what we see as most plausible and important to highlight as steps to reach the desired outcomes and impacts, based on available knowledge and literature describing the sector, its challenges and its possibilities.

[1] In a few cases current production can also be substituted, but as we operate in growing economies the main part of this is due to avoiding future emissions.

6. Assumptions

Investing in renewable energy is important to facilitate a sustainable future, but for our inputs to translate to outputs, further to outcomes and in the end the desired impact there are many elements that should be in place. This section outlines the assumptions we have underpinning our theory of change.

Not all of the assumptions must hold for the investment to be realized and successful. We acknowledge that several of the outlined assumptions are difficult to achieve in the markets Norfund operates in. However, if the desired outcomes and impacts of an investment are not realized, the lack of one or several of the elements mapped out here might be part of the reason.

6.1 From inputs to outputs

The key assumptions to be able to transition from our inputs to our desired outputs include:

- There are robust commercial and financial arrangements in place
- The project has broad community support
- The political and security situation is stable
- The offtaker honors its obligations
- The business model is sound

Having **robust commercial and financial agreements** in place is important for the outputs to be realized. In the context of developing countries, businesses must navigate complex legal frameworks, manage currency risks, and ensure that the financial mechanisms are resilient to local economic fluctuations and shocks. To do this it is important that the agreements address all aspects of the relationship clearly, including that there is a common understanding of terms of engagement and that the agreements comply with relevant laws and regulations.

Gaining the acceptance and support of the local communities is vital in assuring the success of the investee. To obtain **broad community support** we must understand and show respect to local cultures, traditions, and needs. Ensuring broad community support can mean the difference between the success and failure of an investment, as local communities play a key role in the operations and sustainability of the projects.

Investments in emerging markets are vulnerable to **political and security risks**. A stable political environment ensures that policies and regulations are predictable, which is essential for the viability of long-term projects. Additionally, security is crucial for the safety of the investment, the workers, and the project's assets. If not considered, and mitigated, political instability or security issues can lead to project delays, increased costs, or even failure of the project.

In the context of investments within the energy sector, offtakes are the entities (often local or regional companies or governments) who agree to purchase the output of the project. It is crucial that these **offtakers** are reliable and have a track record of **honoring their contractual obligations**, for the project to be successful.

Lastly, but not exhaustively, having a **sound business model** means the project is economically viable, sustainable, and capable of delivering the expected returns both financially and in terms of impact. In order to ensure this we conduct thorough market research, try to understand local regulations,

adaptions to local market conditions, and we plan for contingencies. A sound business model is adaptable to the challenges that may arise in an emerging markets context, such as fluctuating market demands or changes in regulatory frameworks.

6.2 From outputs to short-term outcomes

For the output to result in the desired short-term outcomes:

- The grid must be able to absorb the power generated by the IPP
- For GHG emissions are to be avoided the production must replace current or future power generated by fossil fuels
- The energy solution provider offers quality products at affordable prices

The capacity of the electrical grid to integrate and distribute the generated power is a critical factor. Often, the markets in which we operate have grids that are underdeveloped or strained by existing demands. For successful implementation, it is essential that the grid can handle the additional load without frequent outages or stability issues. This might involve grid upgrades or the development of localized, off-grid solutions where grid connectivity is not feasible. We also invest in transmission lines, aiming to mitigate this issue but the needs for transmission upgrades are large. There are also markets where the share of the population who have access to electricity is low, while the grid capacity is good. In these instances, the producer must be able to distribute the power in a good way, so that the increased power to the grid results in increased access.

To achieve reduction of greenhouse gas (GHG) emissions, it is essential that the **generated power replaces current or future fossil fuel power**. This involves not only increasing the capacity of renewable energy sources but also working to ensure that these sources are reliable and consistent enough to reduce dependence on fossil fuels. This is a significant challenge in emerging markets where fossil fuel-based power generation is often the most established and reliable source, and is especially an issue for solar energy, which is highly dependent on the weather conditions to deliver enough power. We do however assume the introduction of renewable energy will contribute most to reducing future emissions, as reducing dependence on current solutions would require the market to have sufficient power to meet demand already. As this is unlikely to be the case in markets where power needs are increasing, we assume we are contributing to avoiding emissions by replacing future GHG emissions from pollutive energy sources, that would have otherwise been used to meet energy needs.

Furthermore, the success and uptake of any product, especially relating to off grid solutions, relies heavily on **the affordability and quality of the products offered**. The energy solutions provided must be cost-effective and desired by the population for it to be adopted by a broader population. Simultaneously, maintaining high quality is crucial to ensure the longevity and efficiency of the solutions, which is often a challenge given budget constraints and the need for technology that is robust enough to handle local environmental conditions. That the products are adopted is crucial to ensure outcomes are further translated into longer term outcomes and impacts.

6.2 From short-term outcomes to medium-term outcomes

For the short-term outcomes to transition to medium term outcomes we assume that:

- The off-grid solutions must be managed well by customers
- Consumption of off-grid solutions is increased, and hazardous practices are replaced
- The environment in which businesses operate is conducive to growth
- Firms pay taxes according to local regulations
- Businesses are capable of- and able to mitigate the adverse effects of climate change

For the off-grid energy solutions to be successful in improving living standards they should contribute to increased security, study time, reduced indoor air pollution and improved connectedness. This is likely to happen given the available literature. However, for the off-grid systems to result in improved living standards, it is crucial that **customers manage these systems effectively** and can afford the downpayments on the products. Effective use of the systems includes proper maintenance, understanding how to maximize the systems´ efficiency, and integrating them into their daily lives. In the medium term, good management ensures the sustainability and reliability of these solutions, which is especially important in rural areas where access to technical support may be limited.

The transition to medium-term outcomes, such as reduced indoor air pollution, also depends on the uptake of products, such as solar home systems that **replace potentially hazardous energy practices.** Such hazardous practices can include the use of fossil fuels for cooking and kerosene lamps for lightning. Encouraging communities to adopt cleaner, more efficient energy practices not only has environmental benefits but also improves health and safety standards in households. This is especially important where people live close to one another and have homes which can easily burn down in the event of a fire, for instance in low-income areas outside of larger cities.

The success of businesses that receive better access to electricity is dependent on external factors that allow them to increase productivity, grow and thereby increase employment. For this to happen, because of the increase in access to energy and the reduced losses due to less power outages, the **environment** in which they operate should be **conducive to business growth**. This includes predictable government policies, access to financing, market stability, and supportive infrastructure. A conducive environment encourages investment, innovation, and expansion of businesses, which is essential for growth, and eventually the impact goals we envision.

It is also assumed that the businesses who increase their productivity due to increased access energy or reduced costs due to more reliable energy sources, also **increase their payment of taxes to the government**. Some of the businesses we invest in within the renewable energy sector can be exempted from paying taxes for the first operational period, but we maintain that all investees will contribute to the payment of taxes and fees, at least after some time. However, this is the reason why the main effect on taxes from investments within renewable energy are achieved in companies that can increase their productivity because of the increased access to reliable energy, and not in the company in which we invest. Thus, the main effect on taxes is expected to be observed as part of the medium-term outcomes, because of increased productivity and the reduction in losses for firms.

Lastly, under this section, the firms involved in energy production and the businesses who receive better access to energy need to **be capable of mitigating the impacts of climate change**, for longer term outcomes to be realized. This involves designing and implementing solutions in the businesses that are

resilient to extreme weather events and changing climate conditions. As climate change can lead to more frequent and severe weather events, energy systems and other business activities that are affected by the climate must be robust enough to withstand these challenges. This is to ensure consistent energy production and access, as well as the viability of businesses. Building resilient businesses, whether it's through robust physical infrastructure or flexible operational strategies, is critical to ensure that the businesses can withstand and quickly recover from such events. This resilience is key to achieving the set goals and ensuring maintained productivity in the face of climate change.

7. Impact risks

The transition to renewable energy, while beneficial and needed in the long term, carries some immediate risks. Job displacement is a concern given that the industry evolves away from traditional energy sectors jobs to less labor-intensive power plants. If the renewable projects displace jobs in the traditional sector, this raises economic and social challenges that necessitate strategic planning to avoid regional unemployment issues.

Skill mismatch is another risk that can aggravate the potential unemployment issues, as the renewable sector demands a unique set of skills that might differ from those found in the fossil fuel industry. Significant investment in training and education might be required to bridge this gap and ensure a smooth transition.

Initially, renewable energy can be expensive, potentially leading to high energy costs that could burden low-income households and challenge the competitiveness of small businesses, contrary to our objectives for these investments. However, in a market that has lower access to energy than desired the prices would already be high. Thus, ensuring more energy is supplied to the market should reduce prices, given constant demand for electricity. However, the differing price mechanisms of renewable and fossil fuel energy sources is a risk that should be considered.

Renewable energy sources like solar and wind power are associated with intermittency issues, stemming from their reliance on nature to generate energy. Periods during the day with less sunlight or less wind leads to less production. This can lead to reliability challenges for the energy producer and the customers, necessitating investments in energy storage and advanced grid infrastructure to maintain a stable supply to the customers. To mitigate this risk, we also perform investments in transmission and storage, to enhance the stability of the grid and would encourage technology to better store the produced energy.

There are also environmental considerations that need to be accounted for when building out energy infrastructure. While renewable energy is cleaner than fossil fuel options, they are not entirely without adverse effects. For example, the production of solar panels and wind turbines can have adverse ecological impacts and affect biodiversity negatively. Additionally, land use for these projects can create conflicts, particularly over agricultural or indigenous lands. In considering investment opportunities these aspects, and possible mitigation activities, are important to consider.

From a macroeconomic perspective, overreliance on any single sector, including renewables, can create vulnerabilities in the economies where we operate. Diversification of energy sources is essential to mitigate the risks associated with economic downturns or extreme weather events that could affect

power plants or solar panels. Furthermore, geopolitical risks are also a factor to consider, as the supply chain for the minerals used in renewable technologies is concentrated in a few countries, which could lead to new dependencies on single markets and thereby expose the business to vulnerabilities.

Technology obsolescence is another inherent risk that is especially important to consider in a rapidly advancing field, such as renewable energy generation. The infrastructure installed today may become outdated rather quickly, requiring additional investment and potentially leading to economic losses.

Another prevalent risk to account for is that the transition to renewable energy does not encompass well enough the need for a just transition. Ensuring a just transition to renewable energy in developing countries requires an approach that balances environmental sustainability with social equity. The successful approach would emphasize protecting vulnerable communities and workers in traditional energy sectors by ensuring they participate actively in the transition process. This approach would also include ensuring international support and collaboration for technology transfer and financial assistance. Ultimately, a just transition aims to achieve a sustainable energy future that is equitable, inclusive, and capable of addressing both long-term environmental challenges and immediate social needs, while also accounting for historical injustices and ensuring universal access to clean energy.

Lastly, the benefits of renewable energy, such as job creation and improved living standards, must be equitably distributed to prevent exacerbating existing inequalities. The quality and distribution of jobs among different segments of the population therefore need to be considered when considering the projects.

In conclusion, while the shift towards renewable energy is critical for resolving the identified problems and a part of the solution for assuring long-term sustainability, it requires careful planning and risk management. This involves preparing the workforce for new opportunities, ensuring that the initial costs do not lead to economic issues, and planning for an energy future that meets the needs of the population and is environmentally sustainable. With a proactive approach, the potential risks can be managed, and the assumptions underlying the transition to renewable energy can be realized, leading to job creation, economic growth and improved standard of living in the regions we operate.

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