

Executive Summary

Derisking Renewable Energy Investment

A Framework to Support Policymakers in Selecting Public Instruments to Promote Renewable Energy Investment in Developing Countries



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This publication builds on a series of prior research. This includes *Transforming On-Grid Renewable Energy Markets* (Glemarec *et al.*, 2012), which synthesises UNDP's experiences with renewable energy market transformation projects, as well as *GET FIT Plus* (DB Climate Change Advisors, 2011), a research partnership with Deutsche Bank on feed-in tariffs. The authors hereby acknowledge the valuable foundations laid by these two reports.

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Acronyms

BAU	Business as usual
CCGT	Combined cycle gas turbine
CDM	Clean Development Mechanism
FDI	Foreign direct investment
FIT	Feed-in tariff
GDP	Gross domestic product
GCF	Green Climate Fund
GEF	Global Environment Facility
GW	Gigawatt
IPP	Independent power producer
IRENA	International Renewable Energy Agency
kWh	Kilowatt-hour
LCOE	Levelised cost of electricity
NAMA	Nationally Appropriate Mitigation Action
O&M	Operations and maintenance
OECD	Organisation for Economic Cooperation and Development
PPA	Power purchase agreement
PRI	Political risk insurance
PV	Photovoltaic
UNDP	United Nations Development Programme
USD	United States dollar



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THE ROLE OF PUBLIC INSTRUMENTS IN REDUCING FINANCING COST OF RENEWABLE ENERGY

Around the world, developing countries are seeking to rapidly scale-up renewable energy investment. This shift to renewable energy is driven by a number of considerations. Many developing countries are struggling to meet fast-growing energy demand. About 1.3 billion people still lack access to electricity and 2.7 billion to modern energy services, with their human development held back through energy poverty (UN, 2011). Meanwhile, rising global fuel prices and resource scarcities are making developing countries increasingly vulnerable to oil prices. Over one-third of low-income countries already pay more than 10 percent of their gross domestic product (GDP) to secure their oil supply (Economy Watch, 2011; Seth, 2012).

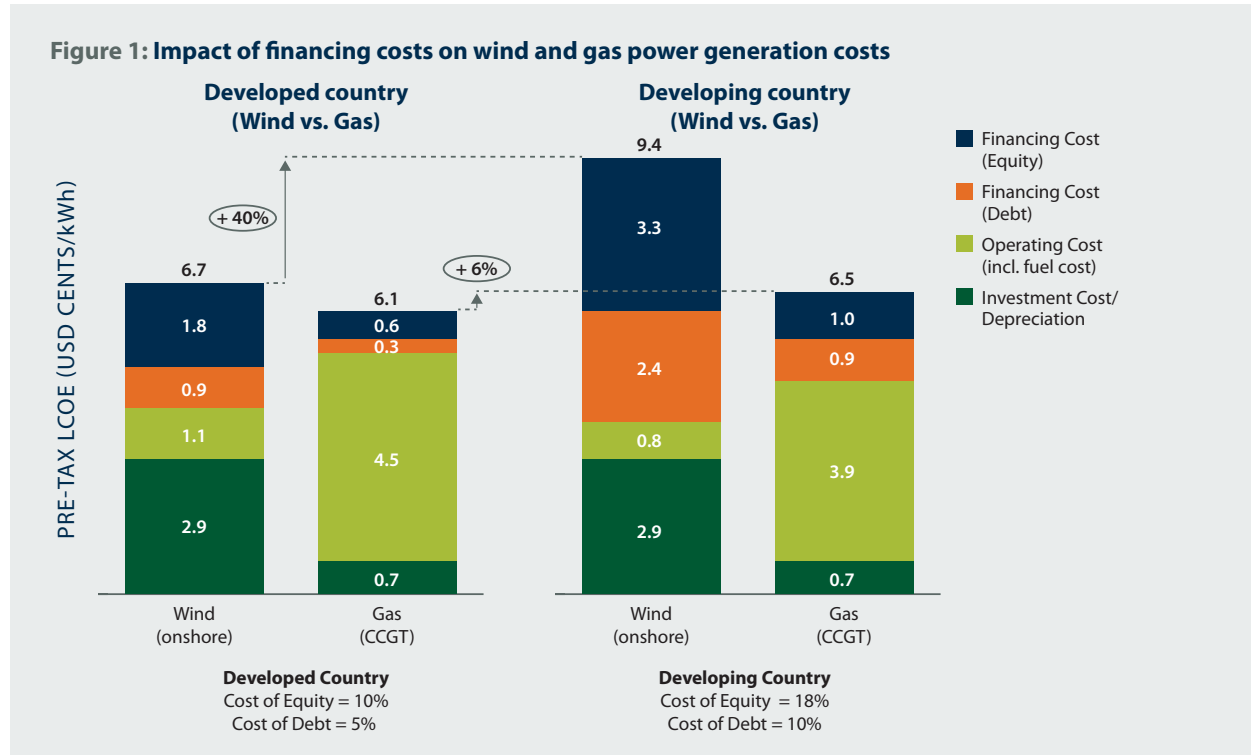
At the same time, the technology cost of renewable energy has been experiencing remarkably steady falls over the past decades (nearly 98 percent for solar photovoltaic (PV) modules since 1979, for instance (IRENA, 2012a)). It has been suggested that a sustained technology push by a few pioneer countries could further reduce technology costs, enabling renewable energy to out-compete fossil fuels by the end of this decade. However, barriers towards a full-scale transition to renewable energy in developing countries lie not just in technology costs but in the challenges of securing long-term affordable finance. Financing cost is the primary determinant of generation cost for renewable sources, as renewable energy (other than biomass and biofuel) has no fuel cost but does have high upfront investment costs.

The financial sums involved in a rapid shift to low-emission energy systems are enormous. According to the Global Energy Assessment (GEA, 2012), global investment in energy efficiency and low-carbon energy generation will need to increase to between USD 1.7–2.2 trillion per year – compared with present levels of about USD 1.3 trillion – over the coming decades to meet the combined challenges of energy access, energy security and climate change. In order to successfully scale-up renewable energy in developing countries, it is clear that private sector investment must be at the forefront. In principle, with enabling policies and investment practice aligned, global capital markets, amounting to some USD 212 trillion in financial assets (McKinsey, 2011), have the size and depth to step up to the investment challenge. However, project developers in developing countries often struggle to access the large quantities of financing they need. When available, the financing cost of this upfront investment is substantially higher than in developed countries, translating into higher power generation costs for renewable energy technologies.

The difference in financing costs (debt and equity) can dramatically affect the competitiveness of renewable energy versus fossil fuel technologies in developing countries. Figure 1 compares the 2012 levelised cost of electricity (LCOE)¹ of a generic onshore wind energy plant and a combined-cycle gas plant in a developed country with those of the same plants in a developing country. In a developed country benefiting from low financing costs, wind power can be almost cost-competitive with gas, despite the present affordability of natural gas. All other assumptions kept constant, in a developing country with higher financing costs, wind power generation cost becomes 40 percent more expensive than that of gas because of the upfront capital intensity of wind technologies.

“In order to successfully scale-up renewable energy in developing countries, it is clear that private sector investment must be at the forefront.”

¹ The levelised cost of electricity (LCOE) is a popular metric to compare different types of systems – from renewable energy projects, where the upfront capital cost is high and the ‘fuel’ cost is near-zero, to a natural gas plant, where the capital cost is lower but the fuel cost is higher. LCOE allocates the costs of an energy plant across its useful life to give an effective price per each unit of energy (for example, USD/kWh).



All assumptions besides the financing costs are kept constant between the developed and developing country. For technology assumptions, see inputs for wind energy and gas (CCGT) in Section A.3 (Annex A); a 70%/30% debt/equity capital structure is assumed; financing costs are based on data in the four country case study (Chapter 3), assuming a non-investment grade developing country. Operating costs appear as a lower contribution to LCOE in developing countries due to discounting effects from higher financing costs.

“The higher financing costs in developing countries reflect a number of perceived or actual investment risks.”

The higher financing costs in developing countries reflect a number of perceived or actual informational, technical, regulatory, financial and administrative barriers and their associated investment risks. A country needs to provide potentially very high return rates to investors to succeed in attracting private investments for wind power development if independent power producers (IPPs) face barriers in access to grids, lengthy and uncertain processes to issue permits, limited local supply of expertise or a lack of long-term price guarantees.

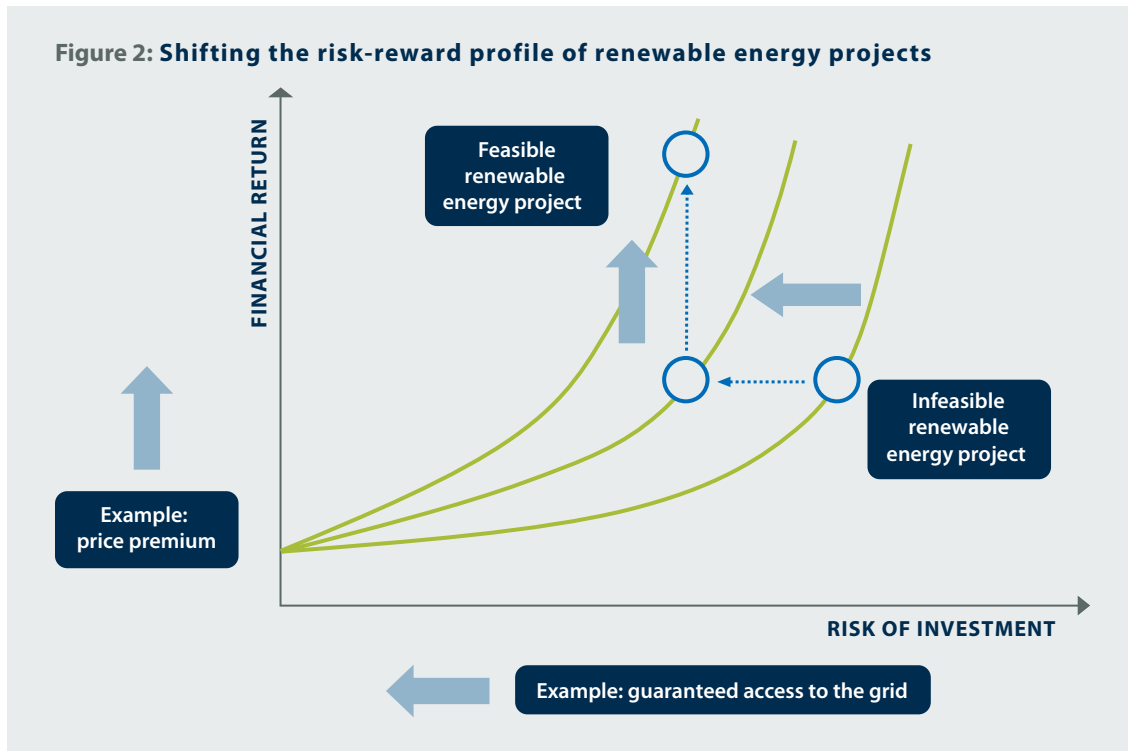
Rather than a problem of capital generation, the key challenge of funding the transition towards a low-carbon energy system is to address existing investor risks that affect the financing costs and competitiveness of renewable energy in developing countries. The task of addressing these investor risks has inspired the development of a wide array of public instruments over recent years. Public derisking measures can broadly be divided into two groups:

- **Policy derisking instruments** seek to remove the underlying barriers that are the root causes of risks. These instruments include, for example, support for renewable energy policy design, institutional capacity building, resource assessments, grid connection and management, and skills development for local operations and maintenance (O&M).
- **Financial derisking instruments** do not seek to directly address the underlying barriers but, instead, transfer the risks that investors face to public actors, such as development banks. These instruments can include, for example, loan guarantees, political risk insurance (PRI) and public equity co-investments.

Recognising that not all risks can be eliminated through policy derisking or transferred through financial derisking, efforts to reduce risks can be supplemented by **direct financial incentives** (price premiums, tax breaks, carbon offsets, etc.) to compensate for residual incremental costs and to thereby increase returns. The overall aim is to achieve a risk/return profile that can attract private sector investment.

Figure 2 provides a conceptual illustration of the approach. The figure illustrates a shift from a commercially unattractive investment opportunity (right) to a commercially attractive one (top). This is achieved through two actions: first, by reducing the risk of the activity, for example, through a regulatory policy such as guaranteed access to the grid for IPPs; and, second, by increasing the return on investment by, for example, creating financial incentives, such as a premium price for renewable energy.

“Public derisking can be supplemented by direct financial incentives to compensate for residual incremental costs.”



Source: Glemarec (2011), adapted.

While policymakers can use a range of different instruments to address renewable energy investment risks and their underlying barriers, certain types of instruments have achieved greater prominence than others and are often referred to as ‘cornerstone instruments’. A cornerstone instrument targets key investment risks and is the foundation upon which all complementary policy and financial derisking instruments are built.

Mechanisms that provide renewable energy generators with a power purchase agreement (PPA), ensuring a fixed long-term price for power and guaranteed access to the electricity grid, are often the cornerstone instrument for renewable energy market transformation efforts. Such cornerstone instruments are often referred to as feed-in tariffs (FiTs), but can also be designed around auctions or bidding processes.² When necessary, FiTs can also include an above-market price premium in order to increase the return on investment. Thus, FiTs are simultaneously both a policy derisking instrument (market access to the grid and must-take requirements) and a financial derisking instrument (guaranteed price over a period of 15-25 years) that can also act, when needed, as a financial incentive instrument (through a price premium), shifting the entire risk-reward profile of a renewable energy investment.

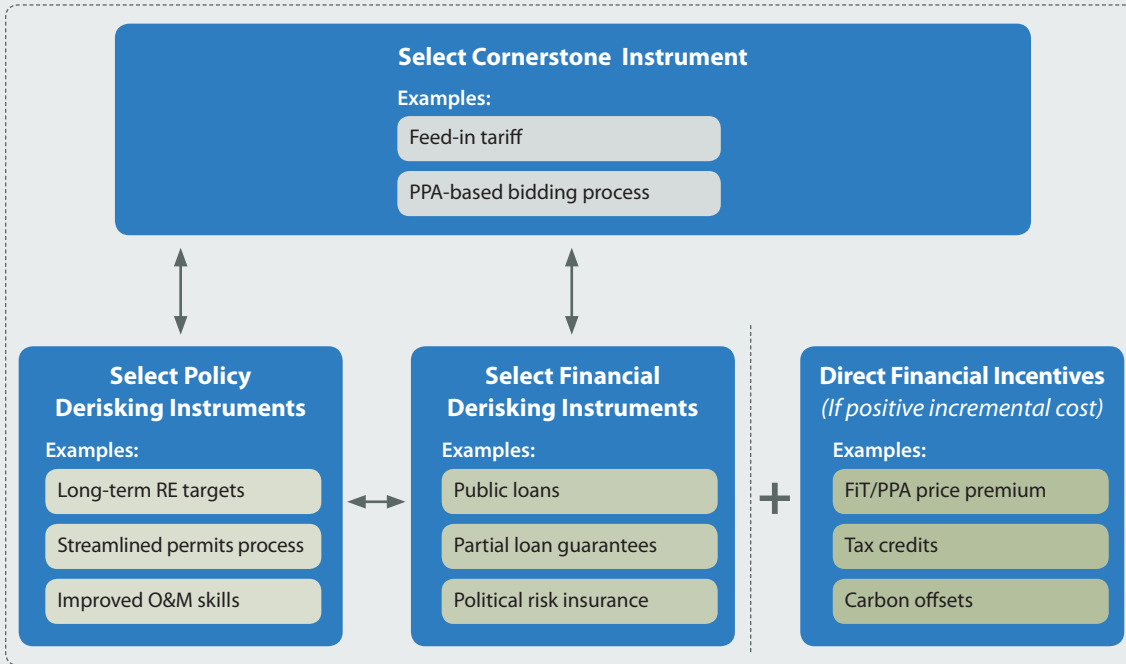
“Different resource endowments, market conditions and national goals mean that there is no one-size-fits-all public instrument mix.”

Usually, cornerstone instruments are supplemented by a number of policy and financial derisking instruments to address residual investment risks. Figure 3 illustrates a typical public instrument portfolio building on a FiT to promote large-scale renewable energy technologies. Identifying an appropriate combination of policy and financial derisking instruments to supplement a cornerstone instrument can prove very challenging in practice. The severity of investment barriers to renewable energy varies between locations and technologies. Different resource endowments, market conditions and national goals mean that there is no one-size-fits-all ‘best’ public instrument mix.

Decision-makers tasked with selecting an optimal instrument mix need to take a wide range of considerations into account. They have to identify the different stakeholders associated with each investment barrier, and closely understand the varying interests that have resulted in the barrier coming about. The appropriateness of different public measures to address these barriers needs to be assessed: some public instruments may be less effective and require a longer amount of time to take effect in some countries than others. For example, institutional strengthening within ministries may be an important precursor to a well-designed FiT regime. While a public instrument may be effective, the public expenditures required to achieve this might be disproportionate and therefore politically unbearable. Determining the ex-ante cost of public instruments involves multiple, complex assumptions (Schmidt *et al.*, 2012). Direct financial incentives for renewable energy are becoming particularly controversial in industrial countries and are likely to prove even more problematic in developing countries (Frondel, 2008; Peters *et al.*, 2012; Hoppmann, 2013).

² Recognising that there are few clear dividing lines between FiTs and PPA-based auctions/bidding processes – both result in project developers entering into long-term PPAs at a fixed price – this report uses the term FiTs at times to cover both types of cornerstone instrument. For a comparative discussion on FiT and auctions/bidding in non-OECD countries see Becker and Fischer (2013).

Figure 3: Public instrument selection for large-scale renewable energy



Source: Glemarec (2011), adapted.

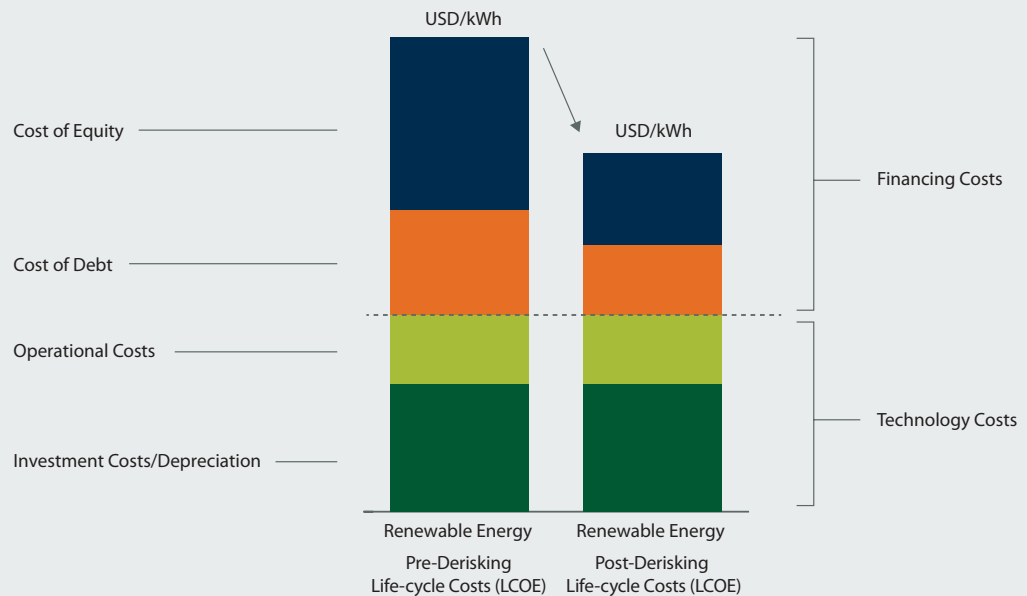
A key constraint for policymakers is that they currently lack a way to quantitatively compare different sets of public instruments. In order to better understand and clearly communicate the impact of different combinations of public derisking mechanisms in a given context, UNDP has developed a framework that enables planners and decision-makers to quantify assumptions.

A FRAMEWORK TO SELECT PUBLIC INSTRUMENTS TO PROMOTE RENEWABLE ENERGY INVESTMENT

“One of the main challenges for scaling-up renewable energy in developing countries is to lower the financing costs that affect their competitiveness against fossil fuels.”

The theory of change³ underlying the framework is that one of the main challenges for scaling-up renewable energy technologies in developing countries is to lower the financing costs that affect their competitiveness against fossil fuels. As these higher financing costs reflect barriers and associated risks in the investment environment, the key entry point for policymakers to foster renewable energy technologies is to address these risks and thereby lower overall life-cycle costs. This theory of change draws from UNDP’s experience in renewable energy market transformation in over 80 developing economies (Glemarec *et al.*, 2012) as well as from the findings of a recent UNDP research partnership with Deutsche Bank on feed-in tariffs (DB Climate Change Advisors, 2011). Figure 4 illustrates this theory of change and how public instruments, through addressing barriers to investment, can reduce the financing costs of renewable energy investments and attract capital at scale.⁴

Figure 4: Public derisking instruments can reduce financing costs of renewable energy investments



³ ‘Theory of change’ is an increasingly common concept used in international development (Vogel, 2012). While there is no single definition of the term, it is here used to articulate UNDP’s underlying assumptions of how and why change might happen as a result of a public programme’s actions.

⁴ In this figure, operational and investment costs are shown as remaining constant. There are two main reasons for this. First, it is recognised that barriers to investment can lead to higher operational and investment costs. For example, an investor may incur additional costs in a prolonged attempt to obtain permits if the permits process is poorly designed. Similarly, an investor may incur additional costs in flying technicians from abroad for project commissioning and O&M in the absence of a local supply of expertise. The framework is based on the assumption that the possibility of higher costs brought about by investor barriers are factored into the upfront investment decision and result in the investor demanding a higher return on investment, which translates into a higher cost of capital (McKinsey 2012, DB Climate Change Advisors, 2011). Second, the figure only addresses the role of public derisking instruments. The figure therefore does not include direct financial incentives, such as production tax credits or accelerated depreciation, which do reduce operational and investment costs.

The framework aims to support policy decision making by quantitatively comparing different public instrument portfolios and their impacts. The intent of the framework is not to provide one predominant numeric result, but instead is to facilitate a structured, transparent process whereby key inputs and assumptions are made explicit, so that they can be checked, debated and enriched to strengthen the design of market transformation initiatives for renewable energy.

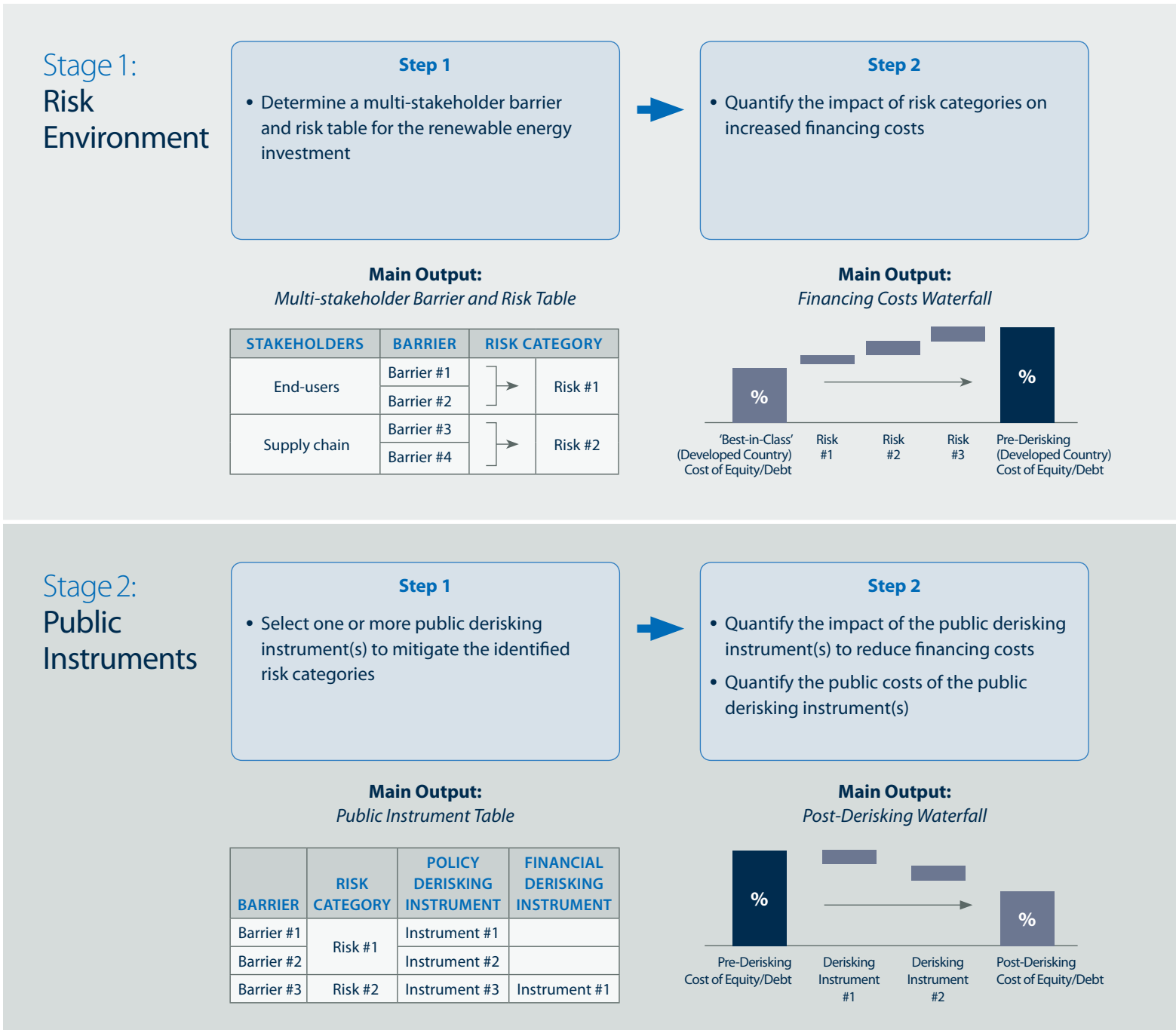
As illustrated in Figure 5, the framework is organised into four stages, each of which is, in turn, divided into two steps. UNDP is also releasing an LCOE-based financial tool in Microsoft Excel, available at UNDP's website (www.undp.org), to accompany the framework. Chapter 2 provides a detailed description of the framework's four stages.

- **Stage 1: Risk Environment** identifies the set of investment barriers and associated risks relevant to the renewable energy technology, and analyses how the existence of investment risks can increase financing costs.⁵
- **Stage 2: Public Instruments** selects a mix of public derisking instruments to address the investor risks and quantifies how they in turn can reduce financing costs. This stage also determines the cost of the selected public derisking instruments.
- **Stage 3: Levelised Cost** determines the degree to which the reduced financing costs impact the renewable energy's life-cycle cost (LCOE). This is then compared against the current baseline generation costs in the country.
- **Stage 4: Evaluation** assesses the selected public derisking instrument mix using four performance metrics, as well as through the use of sensitivity analyses. The four metrics are: (i) investment leverage ratio, (ii) savings leverage ratio, (iii) end-user affordability and (iv) carbon abatement.

“The framework facilitates a structured, transparent process whereby key inputs and assumptions are made explicit.”

⁵ A key step in Stage 1 is determining a multi-stakeholder barrier and risk table for the particular renewable energy. This table identifies a set of independent risk categories in the investment universe which can subsequently be submitted to numeric treatment under the framework. Independent (i.e., non-overlapping) risk categories are important as strongly correlated risk categories would undermine the framework's quantification process.

Figure 5: Overview of the framework to select public instruments to promote renewable energy investment



Stage 3: Levelised Cost

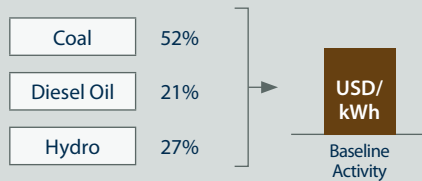
Step 1

- Calculate the levelised cost of electricity (LCOE) for the baseline energy generation mix in the particular country

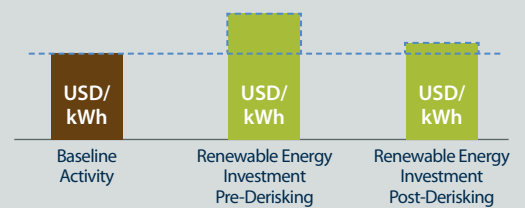
Step 2

- Quantify the LCOE for renewable energy investment in the (i) pre-derisking and (ii) post-derisking scenarios
- Calculate the incremental cost (or savings) by comparing these scenarios vs. the baseline

Main Output:
Baseline LCOE



Main Output:
Incremental Cost (via LCOE)



Stage 4: Evaluation

Step 1

- Analyse the selected public instrument(s) in terms of four key performance metrics

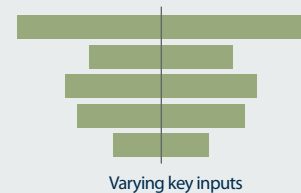
Step 2

- Perform sensitivity analyses on key inputs and assumptions

Main Output:
4 Performance Metrics



Main Output:
Sensitivity Analyses



ILLUSTRATIVE COUNTRY CASE STUDIES

In order to demonstrate how the framework can be used in practice, the report describes a simplified modelling exercise to promote large-scale, onshore wind energy in four selected countries: Kenya, Mongolia, Panama and South Africa.

“The modelling exercise's four countries represent a range of market conditions, reflecting different investment environments and baseline electricity generation costs.”

As set out in Figure 6, the four countries represent a range of renewable energy market conditions, reflecting different investment environments and baseline electricity generation costs. For example, South Africa has a high sovereign rating investment environment, combined with relatively low-cost electricity (where the baseline energy mix is dominated by inexpensive coal). In contrast, Kenya has a low sovereign rating investment environment, combined with relatively high-cost electricity (where the baseline energy mix has a high share of expensive fuel-oil-based generation).

Onshore wind energy is chosen as it represents a mature renewable energy technology with a strong track record and good data availability. All four countries have strong, untapped wind resources and already have guaranteed price and market-access cornerstone instruments for wind energy in place. Kenya and Mongolia have implemented FiTs, while Panama and South Africa have deployed PPA-based bidding.

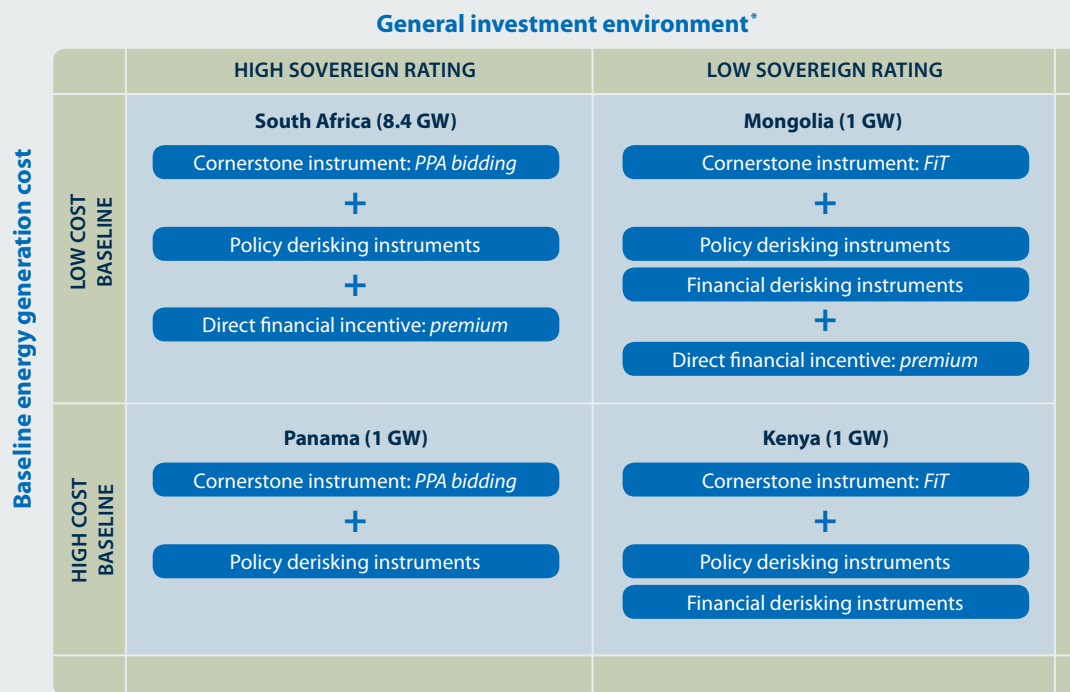
The modelling exercise assumes a long-term, 20-year national target for wind investment in each of the four countries: 8.4 GW in South Africa, and 1 GW each in Kenya, Mongolia and Panama. In South Africa, the Government's announced 2030 target has been used. In the other three countries, the long-term 20-year targets are the exercise's own assumptions. The objective was to create an ambitious vision for wind energy in each country but, at the same time, to cap wind energy's share of the anticipated future generation mix at a level whereby intermittency issues could be managed.

The two-by-two instrument matrix illustrated in Figure 6 above provides an organising basis with which to select a plausible set of policy and financial derisking instruments to complement the existing cornerstone instrument in each country.

- Financial derisking for wind energy, a relatively mature renewable energy technology, is assumed not to be required in countries with high sovereign ratings (South Africa, Panama). Financial derisking instruments are assumed to be a requirement in countries with low sovereign ratings (Mongolia, Kenya).
- A direct financial incentive, in the form of a price premium in the tariff, is modelled when the LCOE of wind energy is higher than the baseline electricity generation costs (in South Africa, Mongolia). No price premium is assumed necessary in cases where wind power is less expensive than the baseline generation costs (in Panama, Kenya).

The use of the framework requires the collection of a large amount of data and many assumptions. Over 30 investors and other wind energy stakeholders in the four countries were interviewed for the modelling exercise. However, in order to keep the overall exercise manageable, several modelling simplifications have been adopted. Many input parameters, such as wind technology costs, have been standardised across all four countries. Actual costs might differ considerably from country to country and project to project. A number

Figure 6: The four country case studies and their illustrative combinations of public instruments



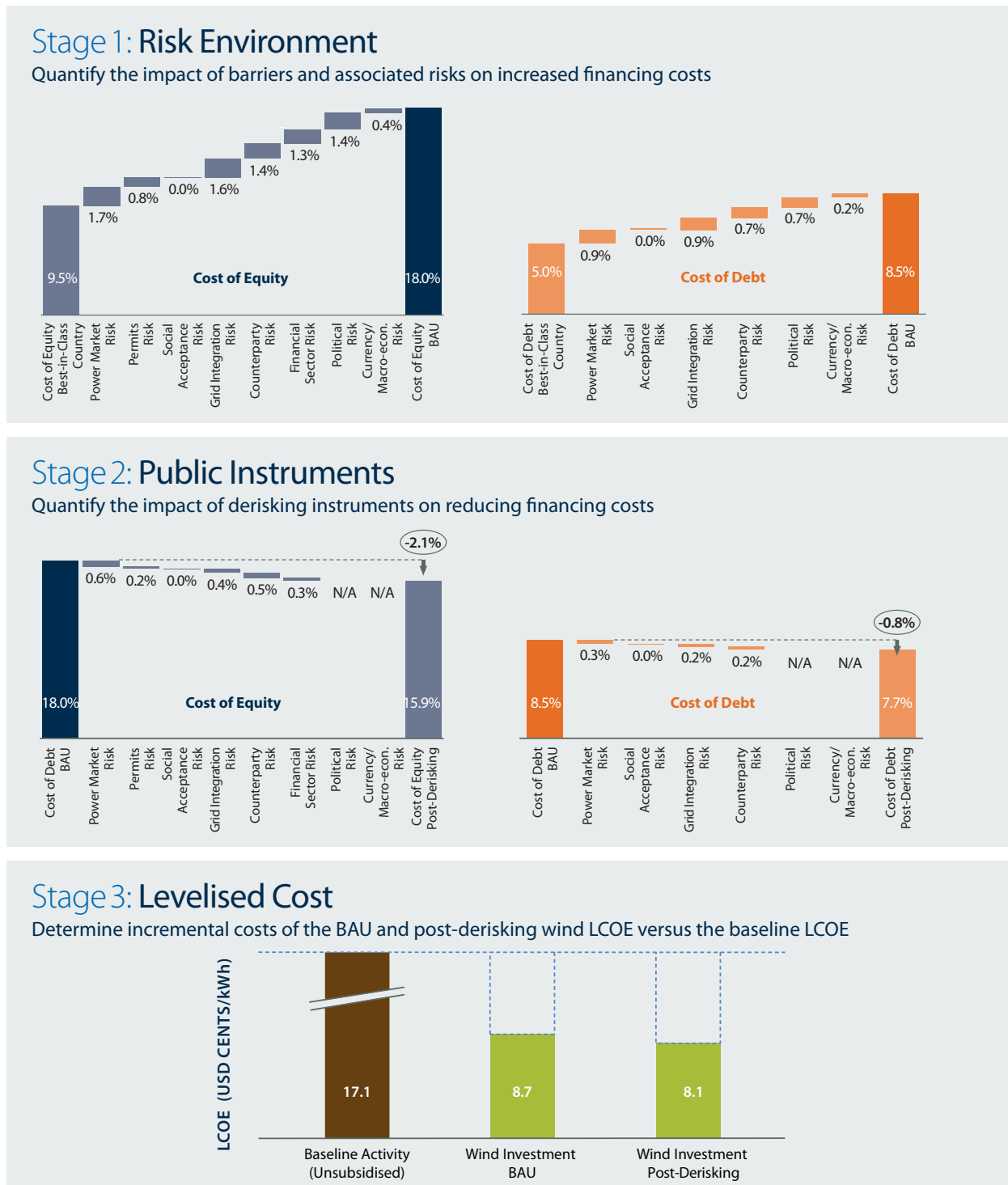
* For the modelling exercise, the investment environment is classified using sovereign ratings from credit rating agencies as a general indicator. High reflects a sovereign rating of BBB- or above (commonly referred to as "investment-grade"); low reflects a sovereign rating below BBB- ("non-investment grade")

of key assumptions on the scope of the modelling exercise have also been made regarding: intermittency, where balancing costs are not factored into the study; the cost of the transmission grid, which is effectively excluded from the analysis; and, with regard to the cost of fossil fuels, unsubsidised fuel costs have been used in order to remove the distortive effects of subsidies and to allow for comparison between the four countries.

None of the above simplifying assumptions undermines the integrity of the modelling exercise. However, should policymakers wish to use the framework for detailed policy analysis, additional in-depth country consultations would be required to collect empirical data to fine-tune the input parameters and modelling assumptions. The framework allows for the degree of complexity used to be tailored on a case-by-case basis.

A presentation of the results of the four country case studies is given in Chapter 3. The full data-sets and assumptions for the modelling exercise are set out in Annex A. As an illustration, Figure 7 shows some of the key framework outputs for Kenya and the case study's 1 GW 20-year target for wind energy investment. The figure shows outputs for the modelling exercise's business-as-usual (BAU) scenario, where Kenya's FiT is complemented only by financial derisking instruments, and for a post-derisking scenario, where Kenya's FiT is complemented by both policy and financial derisking instruments.

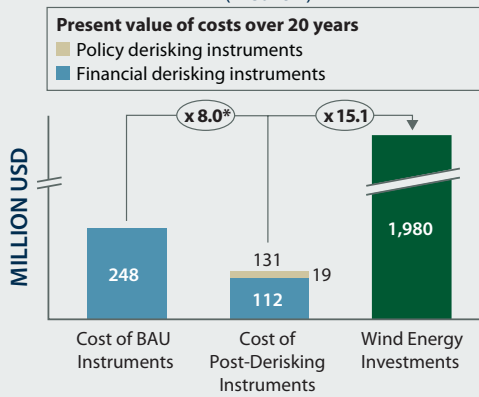
Figure 7: Illustrative modelling exercise for Kenya (Wind, 1 GW): selected results



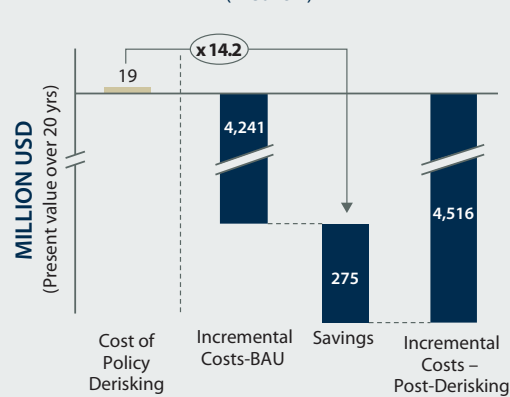
Stage 4: Evaluation

4 Performance Metrics

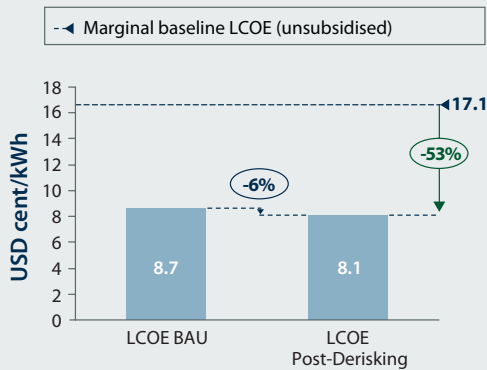
INVESTMENT LEVERAGE RATIO
(Metric 1)



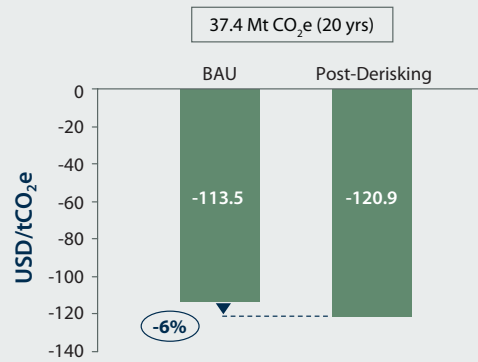
SAVINGS LEVERAGE RATIO
(Metric 2)



END-USER AFFORDABILITY
(Metric 3)



CARBON ABATEMENT
(Metric 4)



Source: interviews with wind investors and developers; modelling exercise; see Table 5, Table 17 (Chapter 3) and Annex A for details on assumptions and methodology.

For Stage 1: the cost of debt and equity assume supporting financial derisking instruments are in place. The cost of debt shown is the commercial rate assuming financial derisking is in place.

For Stage 2: the impacts shown are average impacts over the 20-year modelling period, assuming linear timing effects.

* In the BAU scenario the full investment target may not be met.

IMPLICATIONS FOR PUBLIC FINANCE TO PROMOTE RENEWABLE ENERGY AT SCALE

A number of practical findings emerge from a comparative analysis of the illustrative results across the four case study countries. While a more detailed modelling exercise may substantially refine the figures obtained, it is likely that the overall implications will stay the same.

In analysing the results, each of the framework's four performance metrics provides a different perspective for the policymaker seeking to promote renewable energy at scale.

Public Finance Effectiveness (Metric 1: Investment Leverage Ratio)

“Policy and financial derisking instruments target the residual risks that a FiT alone cannot address and which can otherwise suppress investment.”

A fundamental goal of the policymaker is to catalyse concrete private sector investment. A finding of this illustrative modelling exercise is that the presence of a cornerstone instrument, such as a FiT or PPA bidding process, by itself does not guarantee this investment. Instead, the results show that there is a role for complementary policy and financial derisking measures to target the residual risks that a cornerstone instrument alone cannot address and that can otherwise suppress investment.

This point is particularly well illustrated by the case study of Panama. Despite the country having a PPA bidding process in place, an attractive investment climate and low wind power generation costs when compared to an existing high-cost baseline, financial closure with banks for the first wind licences awarded has yet to occur. The financing cost waterfall for Panama clearly shows that a number of non-price barriers remain and that additional derisking efforts are required to complement the existing PPA bidding process. The modelling exercise shows that the impact of such additional derisking efforts could be dramatic. With Panama's unique combination of favourable factors, a relatively small amount of policy derisking could catalyse 100 times its cost in private investment.

More broadly, these findings illustrate that renewable energy market transformation takes time. Despite the fact that a FiT or PPA bidding process has been in place in the four case study countries for several years, it may not be immediately effective. Barriers to renewable energy investment are often deeply embedded, reflecting long-held practices centred on fossil-fuels and monopolistic market structures. A cornerstone instrument, such as a FiT, complemented by policy and financial derisking, can therefore be seen as the starting point on a longer path to transforming a market for renewable energy investment.

Public Finance Efficiency (Metric 2: Savings Leverage Ratio)

A second key finding from the modelling exercise is that derisking measures can generate significant public savings in all four countries. In low-cost baseline countries, such as South Africa and Mongolia, derisking instruments reduce the price premium required to make renewable energy competitive with conventional energy. In South Africa, with a large 8.4 GW wind target, the modelling finds that an estimated USD 40 million in policy derisking instruments can result in a USD 2.3 billion reduction in the price premium over the 20-year target, a savings leverage ratio of over 50.

Less intuitive but just as critical, derisking instruments can unlock the savings associated with the lower cost of renewable energy in high-cost baseline countries, such as Panama and Kenya. For example, a modest investment in additional policy derisking instruments in Kenya, estimated at about USD 20 million in this simplified modelling exercise, could 'unlock' USD 4.5 billion in negative incremental costs over the next 20 years as compared to an unsubsidised baseline.

For the two low-cost baseline countries (South Africa and Mongolia), wind energy remains more expensive than the baseline even after derisking, and this can result in a net cost to taxpayers or electricity consumers. In such cases, an implication of the modelling exercise is that the ambition of a country's long-term vision for wind energy can be an important factor. Although local content requirements have proven controversial, in South Africa, for example, the ambitious 8.4 GW target for wind energy could provide a solid foundation for the local manufacturing sector. The experience of countries, such as China and India shows that local manufacturing can greatly reduce the total installed cost of wind energy (IRENA, 2012b) and generate foreign direct investment (FDI) and green jobs. In Mongolia, with the modelling assumptions (1 GW, domestic low cost baseline) employed, the economic case in favour of public financial incentives for wind energy is questionable. However, a more ambitious, export-oriented vision for wind in Mongolia, partnering with neighbouring countries with higher baseline costs, could dramatically alter the cost equation and competitiveness of Mongolian wind energy.

Distributional Impact of Public Interventions (Metric 3: End-user Affordability)

Ultimately the generation costs of renewable energy, as well as those of any associated public measures, will be met by the end-user (industry, households) and/or the taxpayer. The results of the modelling exercise show that, if passed on to the consumer, the use of derisking instruments to complement a FiT or PPA bidding process has the potential to increase affordability of the renewable energy technologies in all four countries.

Efforts to promote renewable energy are commonly blamed for causing high energy costs in countries that have adopted ambitious clean energy targets. However, contrary to this widespread belief, the modelling exercise indicates that well-designed and implemented public measures can offer tangible benefits in the form of reduced household energy bills in countries with high baseline power costs. In Kenya, the LCOE of wind energy after derisking (USD 8.1 cents per kWh) is a full 53 percent lower than the unsubsidised baseline cost (USD 17.1 cents per kWh), creating potentially very large benefits for low-income ratepayers.

“Derisking measures reduce the price premium in low-cost baseline countries... and unlock savings in the high-cost baseline countries.”

“Well-designed and implemented public measures can offer tangible benefits in the form of reduced household energy bills.”

The results of the case studies, where fossil fuel subsidies have expressly been excluded, show that renewable energy is competitive against unsubsidised fossil fuel technologies in many developing countries. Globally, subsidies to fossil fuels are at least five times larger than financial incentives to renewable energy technologies (IEA, 2012) and distort the true competitiveness of renewable energy (Schmidt *et al.*, 2012). In low-baseline countries, the most cost-effective means of reducing direct financial incentives for renewable energy is to phase-out or phase-down fossil fuel subsidies. In high-baseline countries, fossil fuel subsidies that are intended to help the consumer may have the perverse effect of preventing investment in far more affordable renewable energy alternatives.

Scaling-Up Climate Change Mitigation Outcomes (Metric 4: Carbon Abatement)

The modelling exercise presented in this publication shows that derisking renewable energy investment can lower the abatement costs of CO₂ emissions in the four countries investigated. For example, in South Africa, meeting the 8.4 GW wind energy target over 20 years could result in emission reductions amounting to 604 million tonnes of CO₂, with derisking measures reducing the cost of abatement from USD 12 to USD 8.20 per tonne of CO₂.

The importance of derisking in reducing abatement costs is applicable to every developing country that has listed climate mitigation pledges under the Copenhagen Accord. It also has significant implications for the design of modalities and mechanisms to scale-up climate mitigation efforts, such as Nationally Appropriate Mitigation Actions (NAMAs), a reformed Clean Development Mechanism (CDM), New Market Mechanisms (NMMs), and public payments from vertical funds, such as the Global Environment Facility (GEF) and Green Climate Fund (GCF). A number of these international mechanisms envisage performance-based payments for emission reductions. The results of the case studies suggest the desirability of incorporating upfront grant-based derisking activities to complement performance-based payments in such mechanisms, thereby reducing the overall carbon abatement cost. Figure 8 below summarises this performance-based payment approach.

“Complementing performance-based payment mechanisms with derisking activities can reduce the overall carbon abatement cost.”

Figure 8: Scaled-up mitigation actions blending derisking instruments and performance-based payments



CONCLUSION

There are many different ways to create markets for renewable energy, and the path each country takes will depend on its specific national context, goals and resource endowments.

A central conclusion of the report is that it is important for policymakers to address the risks to renewable energy investment in a systemic and integrated manner. In all four case study countries, the framework's financing cost waterfalls clearly demonstrate that a range of risks exist in the investment environment. Any isolated, short-term effort focusing on a subset of risks and relying on a subset of instruments is unlikely to sustainably transform renewable energy markets.

A complementary conclusion is that investing in derisking measures, bringing down the financing costs of renewable energy, appears to be cost-effective when measured against paying direct financial incentives to compensate investors for higher risks. Instead of using scarce public funds to pay higher electricity tariffs, it can be advantageous to first reduce and manage typical renewable energy risks (for example, those associated with power markets, permits, and transmission), and thereby change the fundamental risk reward trade-off that energy investors face in a given country.

The framework introduced in this report can help to estimate the costs of derisking instruments and the amount of upfront grant required. It can also help to assess the direct financial incentives required to meet the derisked incremental costs of renewable energy and calibrate a performance-based payment scheme accordingly.

However, it is important to be realistic about the difficulties associated with modelling derisked incremental costs in the absence of what is often scarce historical empirical data and when confronting long-run uncertainties, such as those relating to technological evolution. The sensitivity analysis conducted for the four country case studies shows that relatively small changes in key model input parameters can result in major variations. The framework can support, but not substitute for, in-depth policy decision-making and consultation processes involving all key stakeholders.

“Any isolated, short-term effort focusing on a subset of risks and relying on a subset of instruments is unlikely to sustainably transform renewable energy markets.”



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