

# GET FiT Plus

## De-Risking Clean Energy Business Models in a Developing Country Context

April 2011



Carbon Counter widget available for download at:  
[www.Know-The-Number.com](http://www.Know-The-Number.com)

**DB Climate Change Advisors**  
Deutsche Bank Group



# Investment Research Team

---

## DBCCA Climate Change Investment Research

**Mark Fulton – Editor**

*Managing Director*

Global Head of Climate Change  
Investment Research

**Bruce M. Kahn, Ph.D.**

*Director*

Senior Investment Analyst: New York

**Nils Mellquist**

*Vice President*

Senior Research Analyst: New York

**Camilla Sharples**

*Assistant Vice President*

New York

**Jake Baker**

*Associate*

New York

**Lucy Cotter**

*Research Analyst*

London

## Deutsche Bank AG, Asset Finance & Leasing

**Silvia Kreibiehl – Lead Analyst**

*Vice President*

Deutsche Bank AG, Asset Finance & Leasing,  
Sustainable Investments

## Deutsche Bank AG, Office of the Vice Chairman

**Mark Dominik**

*Vice President*

Deutsche Bank AG, Infrastructure & Regional Management

## United Nations Development Programme

**Yannick Glemarec**

*Director, Environmental Finance &  
UNDP-GEF Executive Coordinator*

New York

**Adam Shepherd**

*Carbon Legal Adviser*

New York



## Consultants

**Wilson Rickerson**

*Chief Executive Officer*

Meister Consultants Group, Inc.

**Christina Hanley**

Meister Consultants Group, Inc.

**Laura Susie Shuford**

Consultant to DB Climate Change Advisors

---

## Further Perspectives

Inter-American Development Bank

International Energy Agency

International Emissions Trading Association

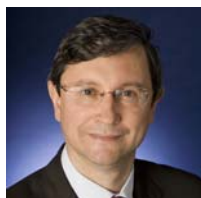
United Nations Environment Programme

United Nations Department of Economic and Social Affairs

United Nations Industrial Development Organization

University of California Berkeley

# Editorial Letter



**Mark Fulton**

Global Head of Climate Change Investment Research

GET FiT was first conceived in January 2010 when the United Nations Secretary General's Advisory Group on Energy and Climate Change (AGECC) invited Deutsche Bank Climate Change Advisors (DBCCA) to present new concepts to drive renewable energy investment in developing regions. DBCCA responded with the Global Energy Transfer Feed-in Tariffs Program or "GET FiT" program, a proposal to support both renewable energy scale-up and energy access through the creation of new international public-private partnerships.

In effect, the goal of GET FiT is to support existing and emerging policy structures that appropriately adapt best practices to specific national contexts and that provide private investors with policy "Transparency, Longevity, Certainty and Consistency" (TLC). The types of support envisioned under GET FiT include a combination of public money for renewable energy incentives, risk mitigation strategies such as international guarantees and insurance, and coordinated technical assistance to address non-financial barriers and create an enabling environment for project development (Exhibit 1). When tailored to meet specific national conditions, this combination of instruments could catalyze the private sector investment necessary to achieve the goals of renewable energy scale-up and energy access.

The strategy outlined by GET FiT could be used to directly support feed-in tariffs in countries that already have them in place or are considering enacting them. For example, according to Bloomberg New Energy Finance, FiTs are linked to 87% of solar photovoltaic deployments and 64% of wind projects globally. However it cannot be assumed that renewable energy policies that have been effective in one environment (e.g. a heavily industrialized developed country) can be similarly effective in another (e.g. a country with low electrification rates and minimal electricity grid infrastructure). In recognition of this, GET FiT proposed to craft programs to support different types of policy models beyond feed-in tariffs, including:

- "Lighthouse" or stand alone power purchase agreements (PPAs) in countries that face grid integration constraints or for technologies that have a limited in-country track record; and
- Mini-grids for off-grid applications in which performance-based incentives support decentralized multi-user energy systems, particularly in rural areas with limited grid infrastructure.

Since April, Deutsche Bank has expanded the GET FiT research partnership to include the United Nations Development Programme (UNDP). Deutsche Bank and its partners have continued to engage stakeholders around the world in order to refine the GET FiT concept. These consultations have reinforced that the GET FiT concept could serve as a template for structuring the transfer of capital and knowledge from the developed to developing regions post-Copenhagen. They have also highlighted opportunities for more in-depth dialogue and research to explore how public sector resources might be realistically mobilized to support renewable energy scale-up, and how GET FiT might be practically implemented. These opportunities have been translated into three key priorities for the GET FiT concept.

A first research priority that emerged from the GET FiT consultations was to better define approaches to creating an effective enabling environment for renewable energy development. With this priority in mind, Deutsche Bank drew upon UNDP's experience building enabling environments for renewable energy markets to deepen the GET FiT analysis. It is useful to outline international financial incentives, but such interventions will not be successful on their own if they do not fit within national regulatory, legal, and policy frameworks. In order to create the conditions where private and public sector financing initiatives can be effective, there is often a need for customized technical assistance, capacity building, planning assistance, or other non-financial support for domestic renewable energy markets.

# Editorial Letter

---

A second research priority was the need to better understand the public sector support that would be required to practically implement GET FiT. It is clear, however, that current available public sector resources have constraints and requirements that would limit the public-private partnerships proposed under GET FiT. Moreover, the optimal mix of mechanisms employed (even with unlimited funds), would vary depending on factors such as national economic conditions, target technologies, the type of resources already deployed, etc.

A third priority that emerged from the GET FiT consultations was the need for public sector, private sector and the NGO communities to engage more directly with each other and coordinate their efforts related to scaling up renewable energy and energy access in developing regions. DBCCA has therefore sought to use the GET FiT concept as a platform for dialogue and idea exchange. To that end, this document also contains a series of short issue briefs and working papers contributed by DBCCA's partner organizations.

A working version of this report was presented at the World Climate Summit and COP 16 Conferences to stimulate and encourage discussion in this area. Following the conferences DBCCA and its partner organizations refined the GET FiT Plus concept to include recommendations as to the optimal mechanisms through which public and private sector funds could be most effectively delivered to support renewable energy scale-up and energy access in developing regions.

# Table of Contents

---

	<i>Page</i>
<b>1 Editorial Letter</b> .....	<b>3</b>
<b>2 Introduction</b> .....	<b>6</b>
<b>3 Establishing an Enabling Environment for Renewable Energy Markets</b> .....	<b>9</b>
<b>4 Appropriate Public Funding Mechanisms for Funding or Reducing the Premium</b> .....	<b>25</b>
<b>5 Source of Public Funds</b> .....	<b>38</b>
<b>6 Possible PPP for Deployment</b> .....	<b>48</b>
<b>7 The Benefits of Clean Energy Access and Scale-Up</b> .....	<b>59</b>
<b>8 Further Perspectives</b> .....	<b>69</b>
Inter-American Development Bank.....	<b>70</b>
International Energy Agency.....	<b>77</b>
International Emissions Trading Association.....	<b>80</b>
United Nations Environment Programme.....	<b>82</b>
United Nations Department of Economic and Social Affairs.....	<b>86</b>
United Nations Industrial Development Organization.....	<b>89</b>
University of California Berkeley.....	<b>91</b>
<b>9 Bibliography</b> .....	<b>93</b>

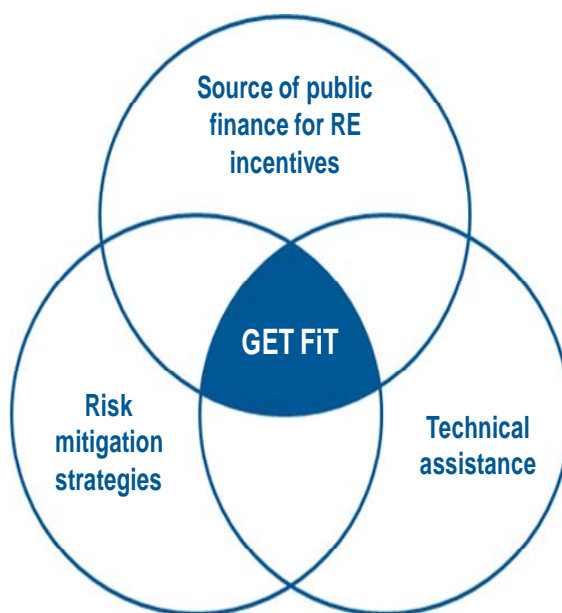
## 2. Introduction

### An Overview of GET FiT

GET FiT was first conceived in January 2010 when the United Nations Secretary General's Advisory Group on Energy and Climate Change (AGECC) invited Deutsche Bank Climate Change Advisors (DBCCA) to present new concepts to drive renewable energy investment in developing regions. DBCCA responded with the Global Energy Transfer Feed-in Tariffs Program (GET FiT), a proposal to support both renewable energy scale up and energy access through the creation of new international public-private partnerships.<sup>1</sup>

In effect, the goal of GET FiT is to support existing and emerging policy structures that appropriately adapt best practices to specific national contexts and that provide private investors with policy “Transparency, Longevity, Certainty and Consistency” (TLC).<sup>2</sup> The types of support envisioned under GET FiT include a combination of public money for renewable energy incentives, risk mitigation strategies such as international guarantees and insurance, and coordinated technical assistance to address non-financial barriers and create an enabling environment for project development (Exhibit 1). When tailored to meet specific national conditions, this combination of instruments could catalyze the supply of, and the demand for, private sector financing of renewable energy projects in both middle- and low-income countries, while also insuring maximum incentive capture at least cost to the funding partners.

#### Exhibit 2.1: Core components of GET FiT



The GET FiT concept was inspired by the theory that feed-in tariffs could serve as an effective policy structure for both public and private investment and knowledge transfer from the developed world. Feed-in tariffs (FiT) are the most prevalent national renewable energy policy globally, and have driven rapid renewable energy scale-up in key markets.<sup>3</sup> Although western European feed-in tariffs receive the most attention, there are also at least 28 national FiTs in place in developing economies. Existing feed-in tariffs can provide a useful starting point for structuring cooperation between developed and developing countries.

<sup>1</sup> DB Climate Change Advisors, “GET FiT Program: Global Energy Transfer Feed-in Tariffs for developing countries,” April 2010.

<sup>2</sup> DB Climate Change Advisors, “Paying for renewable energy: TLC at the right price – Achieving scale through efficient policy design,” December 2009.

<sup>3</sup> DB Climate Change Advisors, “Paying for renewable energy: TLC at the right price – Achieving scale through efficient policy design,” December 2009; DB Climate Change Advisors, “FiTs adjust while delivering scale in 2010,” September 2010.

## 2. Introduction

The strategy outlined by GET FiT could be used to directly support feed-in tariffs in countries that already have them in place or are considering enacting them. It cannot be assumed that renewable energy policies that have been effective in one environment (e.g. a heavily industrialized developed country) can be similarly effective in another (e.g. a country with low electrification rates and minimal electricity grid infrastructure). In recognition of this, GET FiT proposed to craft programs to support different types of policy models beyond feed-in tariffs, including:

- “Lighthouse” or stand alone power purchase agreements (PPAs) in countries that face grid integration constraints or for technologies that have a limited in-country track record
- Mini-grids for off-grid applications in which performance-based incentives support decentralized multi-user energy systems, particularly in rural areas with limited grid infrastructure.

Whether supporting national feed-in tariffs or other policies, GET FiT envisions a customized, rather than prescriptive approach to supporting renewable energy. In each case, public sector resources such as incentive funds, guarantees and technical assistance would be mobilized as appropriate to support new renewable generation. Also in each case, GET FiT support would be structured to create a bridge for renewable energy to reach grid parity by adjusting incentive rates to reflect lower prices over time. In the process, developing countries would gain experience with renewable resources prior to break-even scenarios. A full description of the GET FiT program can be found online at: <http://www.dbcca.com/>.

### GET FiT Plus

The original GET FiT concept was designed with input from over 160 individuals from the renewable energy, financial, and international development communities. The release of the GET FiT report in April 2010 was well received, with over 60 organizations and individuals formally listed on the publication as supporters or reviewers of the concept.

Since April, Deutsche Bank and its partners have continued to engage stakeholders around the world in order to refine the GET FiT concept. These consultations have reinforced that GET FiT could serve as a template for structuring the transfer of capital and knowledge from the developed to developing regions. They have also highlighted opportunities for more in-depth dialogue and research to explore how public sector resources might be realistically mobilized to support renewable energy scale-up, and how GET FiT might be practically implemented.

GET FiT Plus is an effort to capture the key outcomes of the GET FiT consultation process and utilize them to catalyze ongoing dialogue and debate about the future of international support for renewable energy in developing regions. These outcomes have been translated into key research priorities.

A first research priority is to better define approaches to creating an effective enabling environment for renewable energy development. With this priority in mind, Deutsche Bank drew upon the **United Nations Development Programme’s (UNDP)** experience building enabling environments for renewable energy markets to deepen the GET FiT analysis. It is useful to outline international financial incentives, but such interventions will not be successful on their own if they do not fit within national regulatory, legal, and policy frameworks. In order to create the conditions where private and public sector financing initiatives can be effective, there is often a need for customized technical assistance, capacity building, planning assistance, or other non-financial support for domestic renewable energy markets.

A second research priority that emerged from the GET FiT consultations is the need to better understand the public sector support that would be required to practically implement GET FiT. The first report provided a private sector perspective on the types of financial instruments that *could* be used to reduce project development and investment risks. The report, however, did not comparatively evaluate the different types of public finance mechanisms, nor was there an investigation into the availability of international funds to create the support mechanisms envisioned. It is clear, however, that currently available public sector resources have constraints and requirements that would limit the public-private partnerships proposed under GET FiT. Moreover, the optimal mix of mechanisms employed (even with unlimited funds),

## 2. Introduction

---

would vary depending on factors such as national economic conditions, target technologies, the type of resources already deployed, etc. **Deutsche Bank Asset Finance and Leasing** partnered with its **Office of the Vice Chairman** and with **DBCCA** to identify the key public sector financing instruments, outline their potential impacts both quantitatively and qualitatively, discuss their constraints and availability, and consider the potential for hybrid public sector approaches.

A third priority is the need for public sector, private sector and the NGO communities to engage more directly with each other and coordinate their efforts related to scaling up renewable energy and energy access in developing regions. DBCCA has therefore sought to use the GET FiT concept as a platform for dialogue and idea exchange. To that end, this document also contains a series of short issue briefs and working papers contributed by DBCCA's partner organizations. The topics explored include:

- An evaluation of feed-in tariff policies in the Latin American and Caribbean region from the **Inter-American Development Bank**.
- An estimation of the scale of investment required to address energy poverty and expand energy access from the **United Nations Industrial Development Organization**.
- A proposed approach to evaluating whether, when, and how best to support feed-in tariffs in developing regions from the **United Nations Environment Programme (UNEP)**
- A proposed global green new deal for climate, energy, and development from the **United Nations Department of Economic and Social Affairs**
- An overview of Green NAMA Bonds from the **International Emissions Trading Association**
- A model for mitigating carbon emissions while accessing savings and reducing poverty in rural communities from the **University of California Berkeley**

DBCCA also partnered with the **UNEP Finance Initiative** in hosting a workshop on GET FiT as part of the December 2010 World Climate Summit in Cancun, Mexico. The World Climate Summit ran concurrently with the UN Cancun Climate Change Conference (COP-16).

This new GET FiT Plus Report, in the context of these three key research priorities, is organized as follows: Chapter 3 and Chapter 4 discuss the potential role of non-financial and financial instruments to scale up renewable energy deployment in developing countries; Chapter 5 outlines the potential sources of funding for the various public finance mechanisms; Chapter 6 provides an illustrative example of hybrid approaches to combining Public Financing Mechanisms (PFMs) and incentives for RE deployment; Chapter 7 highlights the benefits of providing access to clean energy and scale up of renewable energy technologies; Chapter 8 concludes with a series of short briefs and working papers on renewable energy scale-up, contributed by DBCCA's partner organizations.



### 3. Establishing an Enabling Environment for Renewable Energy Markets

The following section has been prepared by the United Nations Development Programme

Expanding energy access is a crucial step to promote development, alleviate poverty and accelerate the achievement of the Millennium Development Goals. Today, 1.5 billion people do not have access to electricity and an additional 1 billion more have limited access to unreliable electricity networks.<sup>4</sup> See chapter 7 for more details. Many countries with limited access to energy also have strong renewable resources. Yet, despite the potential, a daunting mix of risks and barriers inhibit wide-spread deployment of renewable energy technologies in developing countries.

Strong renewable resources are not on their own sufficient to stimulate a national renewable sector or to reduce the costs of renewable technologies. The inception and growth of renewable energy markets requires an adequate enabling environment and long-term stable comprehensive public policies, with strong political commitment. These policies need to increase profitability, by reducing costs and improving revenues, and reduce risks associated with renewable energy technologies.<sup>5</sup> The responsibility for shaping these policies lies with national and sub-national policy makers.

The chapters below consider options for different public instruments, and sources for their funding, to cover the gap between the levelized cost of electricity (LCOE) of renewable energy and the target LCOE (i.e. through feed-in tariffs) as well as to reduce the gap by lowering the LCOE of renewable energy. This chapter addresses the preceding step, namely the need to establish an enabling environment for renewable energy technologies and the key role that technical assistance plays to support developing country governments' efforts to create such an environment. By providing policy, institutional, financial, legal and project-specific support activities, technical assistance helps governments to remove barriers and create market-enabled environments within which renewable energy markets and private investment can thrive.

This chapter outlines the role that technical assistance plays to support enabling environments within developing countries to:

- (i) Build national renewable energy markets, and
- (ii) Establish and support FIT schemes.

The overall portfolio of UNDP energy-related projects and programs has more than doubled in a decade to some US\$2.5 billion, including funds from its own regular resources, governments, the Global Environmental Facility, GEF Small Grants Programme, bilateral donors and other partners in the private sector and civil society. This chapter will highlight the key components of UNDP's approach to delivering technical assistance activities in support of governments' development and RE priorities.

#### **Technical assistance to create enabled environments for national RE markets**

National strategies to build renewable energy markets need to be holistic and tailored to the unique characteristics of each country. There is no single policy formula, nor incentive instrument, that will achieve market transformation in every scenario. Every country has different opportunities for, and barriers against, scaling up deployment of renewable energy technologies. Incentives, such as FITs, should be considered as just one element within a broader governance framework that needs to be customized to each country.

UNDP proposes a four step approach to support policy makers to create a market-enabled environment within which national renewable energy markets may develop and thrive. Each of the four steps emphasizes the need to tailor actions to each unique national context. The four steps are:

- (1) Defining priority renewable energy activities / technologies

---

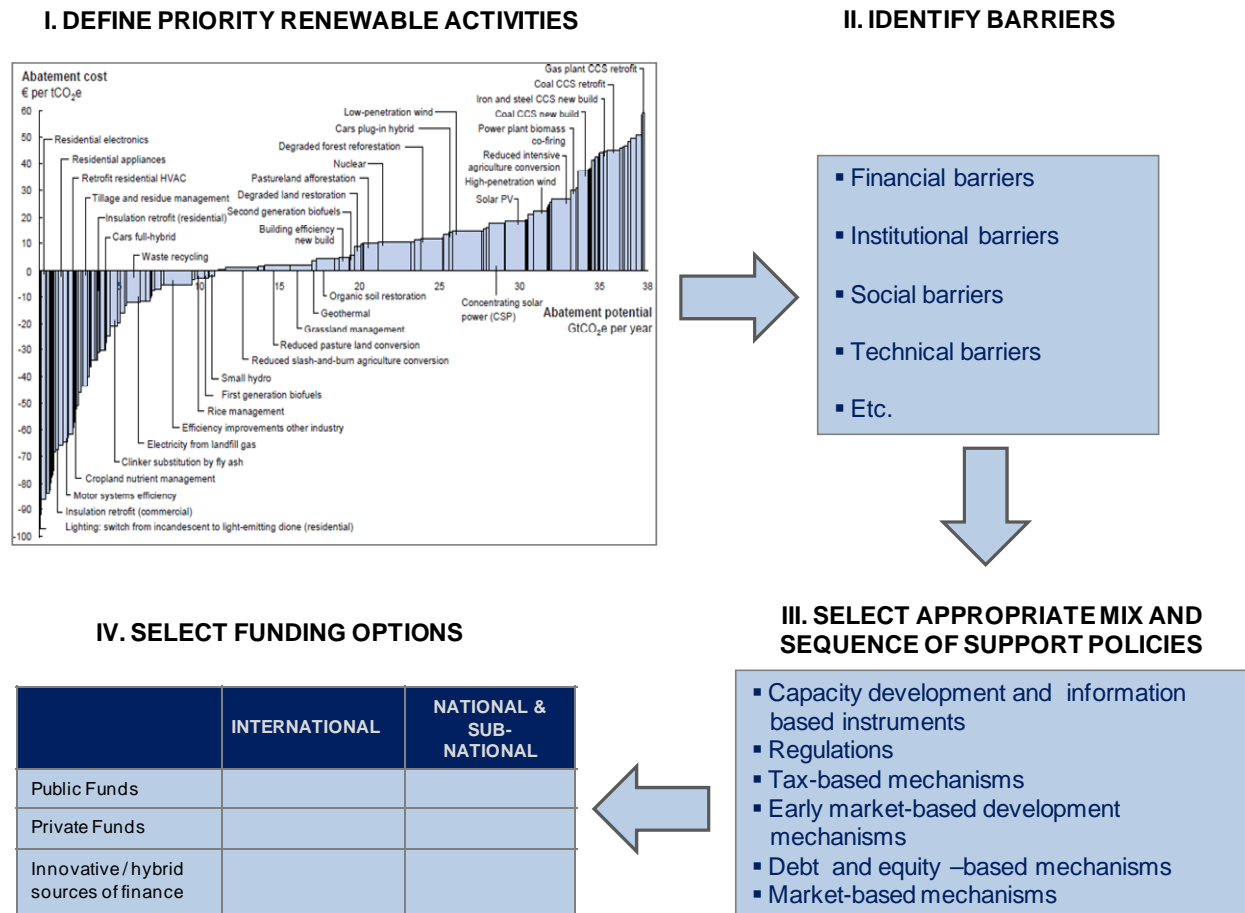
<sup>4</sup> UNDP, UNIDO, IEA (2010). *Energy Poverty: How to make modern energy access universal?*

<sup>5</sup> UNDP, *Promotion of Wind Energy: Lessons Learned from International Experience and UNDP-GEF projects* (2008), pg 6.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

- (2) Identifying barriers to renewable energy markets
- (3) Identifying an appropriate mix of policy instruments to remove barriers
- (4) Identifying and accessing funding options to deploy the selected mix of policies

**Exhibit 3.1: Four steps to design and implement an enabled national renewable energy market**



Source: UNDP, *Engineering Investability* (2010) and McKinsey, *GHG Abatement Cost Curve* (2009)

#### Defining priority renewable energy activities and technologies

UNDP's experience in supporting sustainable development over the past decades shows that the most important factor in determining policy and investment success is alignment of proposed activities with national and local priorities and needs. Policy-makers may choose to develop dedicated renewable energy plans to achieve such an alignment, as set out in the case study below.

Case Study: Technical Assistance to define priority renewable energy technologies BIPV market in Malaysia
UNDP, with GEF financing, is supporting the Malaysian government to expand the distribution of building integrated photovoltaic (BIPV) technologies. The Government aims to increase installed BIPV capacity by 330% thus stimulating a sustainable BIPV market in the country. The program is intended to increase energy access and avoid up to 65,000 tCO <sub>2</sub> e.

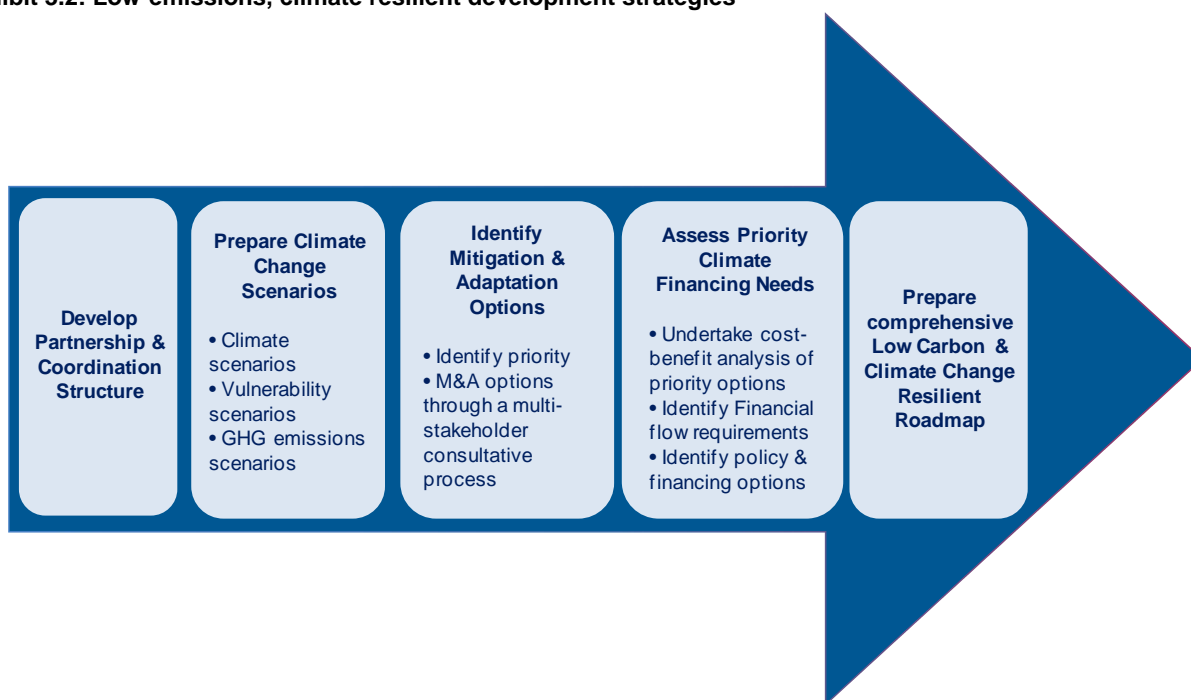
### 3. Establishing an Enabling Environment for Renewable Energy Markets

With the support of the GEF, UNDP is providing technical assistance consistent with the four steps discussed in this paper. In line with step 1, defining priority renewable energy activities, UNDP's support includes:

- Stakeholder consultation. UNDP has hosted seminars, training sessions and project site-visits for policy-makers and BIPV industry participants. A public website dedicated to the project has been established to disseminate news and resources regarding BIPV technologies.
- Defining strategic objectives. UNDP supported the Government of Malaysia to integrate renewable energy policies into two key strategic planning materials: (i) the country's 10th Malaysia Plan published in 2010 which sets a national target of 5.5% of electricity to be generated from renewable energy sources, (ii) a National Renewable Energy Policy and Action Plan issued by the Ministry of Energy, Green Technology and Water.

Having achieved these steps, UNDP is now assisting the Government to identify barriers and design an appropriate policy matrix, including assisting the Ministry to draft a Renewable Energy Bill which will include renewable energy feed-in tariffs, including for BIPV technologies.

**Exhibit 3.2: Low-emissions, climate resilient development strategies**



Source: UNDP, *Charting a new low-carbon route to development*, (2009)

Policy-makers may elect to integrate climate, energy and development objectives into national and sub-national low-emissions, climate-resilient development strategies (LECRDS). UNDP supports developing countries to formulate their LECRDS through various programs, including its 'Down to Earth' LECRDS partnership with UNEP, as well as its assistance to over 100 countries on National Communications to the UNFCCC.

As set out in Exhibit 3.2, UNDP's technical assistance for LECRDS has a number of different components:<sup>6</sup>

- Coordination structures that bring together key stakeholders (government, business, community) and allow for a participatory approach to planning that accounts for synergies and trade offs;

<sup>6</sup> UNDP, *Charting a new low-carbon route to development*, (2009)

### 3. Establishing an Enabling Environment for Renewable Energy Markets

- Planning for both the short term and the long term, up to 50 plus years, to provide the necessary horizon to catalyze certain investment types;
- Climate change vulnerability scenarios that help identify activities resilient to a range of climate outcomes;
- Identification of priority mitigation and adaptation activities to provide order in planning and most efficiently use resources; and
- Initial assessment of financing and policy needs, assessing the order of magnitude in terms of investment size and the need for enabling policy.<sup>7</sup>

Once a suite of objectives has been set, the next step is for policy makers to decide upon a mix of technologies to achieve their goals. The process of selecting target technologies may consider factors like: (i) renewable resource characteristics and availability, (ii) technology options and costs, (iii) status of supporting infrastructure, (iv) peak load and base load needs, and (v) the extent to which the manufacturing chain exists in the country or region. This assessment can be summarized in the form of a GHG abatement cost curve (such as the popular McKinsey GHG Abatement Cost Curve).

The formulation of national planning materials should be a participatory process whereby public and private stakeholders in the renewable energy market give their views. Private sector support is particularly important for renewable energy markets because the bulk of the long-term investment in clean technologies will need to come from the private sector. UNDP hosts industry workshops to communicate renewable energy priorities to renewable energy sector players and to seek inputs and feedback.

#### Identifying barriers to renewable energy markets

Once policy makers have identified renewable energy priorities, the next step is to identify the barriers that impede the successful realization of those objectives. This chapter provides high level summaries of conditions that may shape the extent and type of resources that can be focused to support renewable energy in developing countries.

The summary exhibit below outlines factors that may hinder renewable energy development in developing regions. The summary exhibit also outlines factors that might constrain the development of national renewable energy policy, and specifically that might limit the application of best practices for the development of feed-in tariffs, lighthouse PPAs, mini-grids or similar policies.

#### Exhibit 3.3: Renewable energy market constraints

Constraint types	Constraints	Implications
Electricity Market and Grid Infrastructure	Market structure	Developing countries have pursued power sector reform to different extents during the last 20 years. <sup>8</sup> At present, there is a wide range of electricity market structures in place internationally, from state-owned monopolies, to fully liberalized markets with unbundled utilities <sup>9</sup> , to hybrid structures. <sup>10</sup> Market structure can significantly impact the potential for private sector investment in renewable energy and can also limit the range of available policy options. For example, as discussed above, vertically integrated monopoly utilities that do not purchase power from

<sup>7</sup> Human Development in a Changing Climate: A framework for Climate Finance (2010) United Nations Development Programme

<sup>8</sup> Besant-Jones, J. E. (2006). *Reforming power markets in developing countries: What have we learned?* (Paper No. 19). Washington, DC: The World Bank Group, Energy and Mining Sector Board.; Besant-Jones, J., Harris, C., Stiggins, G., & Townsend, A. (2004). *Public and private sector roles in the supply of electricity services*. Washington, DC: The World Bank Group.

<sup>9</sup> To date, the full suite of power sector market reforms envisioned by organizations such as the World Bank has not been implemented in any developing country (Besant-Jones, 2006)

<sup>10</sup> This is further complicated by the fact that some countries have different market structures at the regional level which may pose challenges for national-level renewable energy policy making. Gratwick, K. N., & Eberhard, A. (2008). *Demise of the standard model for power sector reform and the emergence of hybrid power markets*. *Energy Policy*, 36(10), 3948-3960.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

		<p>independent power producers (IPPs) would prevent private sector investment in power generation. In single buyer markets, meanwhile, the amount of privately-owned renewable generation may be tightly controlled by the utility or capped through formal generation expansion plans, etc. In both of these circumstances, the potential impact of renewable energy policies, such as feed-in tariffs or lighthouse PPAs, could be limited.</p> <p>Markets that have introduced some degree of wholesale electricity competition may also require specific policy considerations. Wholesale electricity markets require a sufficient number of participants in order to assure proper function and depth. Policies that involve long-term contracts for a significant proportion of a country's generation may restrict wholesale market functionality. As a result, some feed-in tariff designs, have allowed generators to sell their power wholesale while also receiving an incentive payment.</p>
	Grid capacity and other issues	<p><b>Grid capacities</b> vary nationally, regionally and locally. In instances of implementing a FIT or lighthouse PPA, the grid may not be large enough to support open ended renewable energy generation (e.g. small country, not well connected internationally, poor transmission). To balance supply with demand, caps and analysis on the extent to which new power is needed may be necessary. Should renewable energy policies use caps as a way to control grid size, grid stability, economic impact, etc., there will need to be a focus on reasonable and effective <b>queuing procedures</b> to determine how generators "get in-line" for tariffs and in order to avoid speculative or strategic behavior. Further, since most renewable energy technologies are intermittent sources, whose electricity generation is dependent on weather rather than consumer demand, <b>curtailment procedures</b> may be necessary, particularly necessary for smaller-scale grids (based on reliability concerns, not economic concerns) which do not have the option to distribute excess power to other grids (e.g. internationally).</p>
	Grid integration	<p>Grids may require strategic integration of renewable resources, especially if a high percentage of generation is intermittent. Policy-makers can identify ancillary services that could or should be provided by generators, grid integration strategies and protocols to be promulgated by regulators, and additional proactive system planning needs (i.e. system reliability studies).<sup>11</sup></p>
<b>Regulatory and Economic Factors</b>	Competing policy priorities	<p>Energy may not be the highest priority for developing countries, and policy-makers may lack the bandwidth or technical know-how to address issues such as energy access or renewable energy scale-up. Balancing competing policies and/or linking renewable energy goals with higher priority policies poses challenges.</p>
	Lack of Information	<p>Lack of awareness of renewable energy technologies and renewable energy policy options among potential IPPs and policy makers inhibits deployment of renewable energy technologies and new generation activities.</p>
	Administration	<p>Multiple restrictions on location and construction for clean energy technologies such as wind turbines due to concerns relating to noise, unsightliness, and safety; or protracted approval delays can cause delays and increase project risks.</p>
	The status of existing renewable energy policy framework	<p>Developing countries without an existing renewable energy policy framework may lack the capacity to evaluate which policy options would most appropriately fit their national context and objectives. However, the lack of existing policy infrastructure makes it easier to adopt policies such as FiTs with a "clean slate." Developing</p>

<sup>11</sup> Woolf, F., & Halpern, J. (2001). *Integrating independent power producers into emerging wholesale powermarkets*. Washington, DC: World Bank.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

		countries with existing renewable energy frameworks may have difficulty determining how to best integrate new policy options. In the case of feed-in tariffs, lighthouse PPAs, and mini-grids, a key question for policy-makers is whether the FITs replace, add on to, or work in parallel with existing policy mechanisms.
	Regulatory capacity	Some countries lack strong, independent regulators, and others lack a regulatory function entirely. <sup>12</sup> The absence of a strong regulatory presence can constrain the development of market structures conducive to private investment, and impede the enforcement of renewable energy policies.
	Currency stability	Currency devaluation concerns may place the electricity purchaser or generator at risk, and currency risks are difficult to hedge. Private investment in the Latin American energy sector, for example, slowed during the past decade because of currency fluctuations. <sup>13</sup> When structuring a FIT, or similar policies, policymakers should take the trade-offs between using hard or local currency into consideration when balancing market function and investment risk.
	Inflation	Inflation or hyper-inflation in developing countries poses a risk to energy project developers, and particularly those with high operating costs. In structuring policies such as feed-in tariffs, lighthouse PPAs, or mini-grids, countries with high inflation rates can consider adjusting the payment rates for inflation.
	Per capita GDP	Depending on national conditions (e.g. low or subsidized electricity prices), renewable energy policies may require a significant premium payment. In many developing countries, policies that increase electricity rates can be economically (or politically) infeasible. Historically, rate recovery for premium IPP rates has been difficult in developing regions. <sup>14</sup> Renewable energy policies may need to incorporate caps to prevent rate shocks and/or exempt low-income consumers from policy-related price increases. In order to improve investor security, utility cost recovery processes should be clearly articulated.
<b>Energy subsidies</b>	Fossil fuel subsidies	Energy subsidies in developing countries can take many different forms, such as fossil fuel subsidies or electricity price caps. Energy subsidies artificially widen the gap between conventional and renewable energy generation and complicate efforts to develop and implement renewable energy policy. Electricity price subsidies can also hinder the development of IPPs and impede private sector investment because they can erode the utilities' creditworthiness. If a utility is unable to recover its costs through its rates because of subsidies, new power sector development may require sovereign or international guarantees.
<b>Local capacity constraints</b>	Lack of Technical Skills	There may be a lack of technical skills to install, operate, and maintain clean energy technologies. This increases project costs (to import skilled labor) and increases risks of delays.
	Domestic banking sector	Domestic financing may be required to support small- to medium-scale projects, and local banks need to gain experience and comfort with renewable energy deals in order to support a sustainable domestic market over time. The development of renewable energy policy targeting smaller or off-grid systems may be predicated on the development of local banking capacity.

<sup>12</sup> KEMA (2010). *CARILEC position paper on regulation and renewable energy (minimization of barriers and provision of incentives for renewable energy technologies and alternative fuels)*. Gros Islet, Saint Lucia: Caribbean Association of Electric Utilities

<sup>13</sup> Byer, T., Crousillat, E., & Dussan, M. (2009). *Latin America and the Caribbean region energy sector: Retrospective review and challenges* (ESMAP Technical Paper 123/09). Washington, DC: The World Bank Group, Energy Sector Management Assistance Program.

<sup>14</sup> Woodhouse, E. J. (2005). *A political economy of international infrastructure contracting: Lessons from the IPP experience*. Stanford, CA: Stanford University, Center for Environmental Science and Policy, Program on Energy and Sustainable Development.



### 3. Establishing an Enabling Environment for Renewable Energy Markets

In practice, every country is different and each has its own unique set of opportunities and challenges. The exhibit below illustrates a few practical examples of “deal-breaking” barriers that UNDP has encountered when providing technical support to would-be renewable energy project developers. There is no such thing as an effective standard approach to identify and remove barriers across all countries. Accordingly, the mix of public policies that are implemented to remove those barriers needs to be customized to each particular country context.

**Exhibit 3.4: Examples from UNDP’s experience of renewable energy barriers**

Barrier	Practical examples from UNDP experiences
<b>Access to finance</b>	■ In a Balkan country an independent-power-producer seeking to build small hydro power project has spent two years seeking to secure debt and equity investors.
<b>Inability to secure PPA</b>	■ An independent power producer seeking to build a nation’s first wind farm was unable to secure a Power Purchase Agreement from the state utility (monopoly).
<b>Lack of technical skills</b>	■ A methane capture project in Sub-Saharan Africa suffered serious set-backs when UNDP learned that a feasibility study, drafted by an external consultant, had significant errors regarding data measurements and methodology calculations.
<b>Administrative barriers</b>	■ In South Asia, the developer of one of the country’s first CDM projects complained to UNDP that the project had been required to obtain over 40 domestic permits and approvals.
<b>Import tariffs</b>	■ A project to deploy solar-powered water purification systems faced prohibitive tariffs upon the import of renewable energy technologies.
<b>Political instability</b>	■ A civil uprising in Kyrgyzstan has stalled efforts to develop a bundle of small hydro power projects.
<b>Land title uncertainties</b>	■ A biomass project in Sri Lanka was stalled because of uncertainties regarding land title ownership over the site where the biomass facility was to be located.

#### **Delivering an optimal mix of public policies, financial instruments and pilot projects**

Once renewable energy objectives have been set and the key barriers have been identified, the next step is to implement measures to remove those barriers. The task for policy-makers is to select the optimal mix of policy instruments in order to craft favorable, long-term policy, legal and regulatory frameworks. A wide range of policy instruments and other interventions are possible. The three primary categories are:

- (i) Information and skills-based instruments;
- (ii) Regulatory instruments; and
- (iii) Financial incentives.

Technical assistance has a key role to play to support policy-makers to select and sequence an optimal mix of each of these measures.

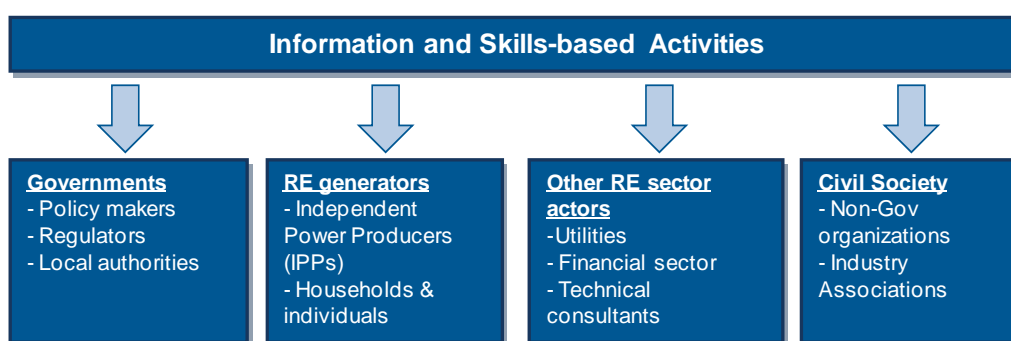
#### **Information and skills-based instruments**

Lack of information and an inadequate supply of technical skills are significant barriers to renewable energy generation activities in developing countries. One cannot regulate or participate in an industry without first understanding its opportunities and limitations. Information and skills-based instruments aim to increase the knowledge and capacities of policy makers, independent generators and other renewable energy sector participants because even within an investment environment of transparency, longevity and certainty, proponents of renewable energy projects often face knowledge and skill barriers. For example, shortages of in-house expertise are aggravated by an insufficient supply of appropriately qualified consultants; and yet international consultants are simply too expensive for renewable energy proponents (particularly given that many renewable energy projects already face high upfront capital costs).

### 3. Establishing an Enabling Environment for Renewable Energy Markets

Technical assistance activities to raise awareness of renewable energy issues and assess renewable energy needs can be targeted to national, sub-national and local governments, as well as the private sector, civil society, communities and households. The level of knowledge of renewable energy matters will vary between countries and between stakeholders. In some cases, awareness raising activities may start with fundamental issues like the benefits of expanding renewable energy generation. In other cases, the will to explore building renewable energy markets already exists and stakeholders are more interested in the technical details, such as: a country/region's renewable resource potential; current state of the national renewable energy sector, including existing renewable energy generation capacity and key industry players; availability and cost of renewable energy technology options; and the impact of the current energy policies on the renewable energy market.

**Exhibit 3.5: Targeting information and skills-based activities**



Source: Shepherd, A., UNDP (2010)

The key outputs that information and skills-based activities may achieve include:

- **Raising awareness of local policy makers:** Providing national and sub-national renewable energy policy, analysis, strategy development and programming support, including by preparing guidance materials with cross-practice perspectives to build capacity on a range of energy and climate related topics.
- **Strengthening public institutions:** Support to set up and strengthen institutions, including establishing or reforming independent energy regulators and building local institutions;
- **Building local financial & technical expertise:** through training for industry actors and the financial sector.
- **Driving industry momentum:** Building renewable energy alliances & industry associations to promote and increase coordination among new or existing RE-related partnerships and alliances between public, private and civil society organizations.

**Demonstration Projects.** A complementary approach to increase knowledge and expand skills is to develop demonstration projects. Showcase projects can have catalytic benefits for a national renewable energy sector. Success stories build market credibility and spur confidence in expanding project pipelines. Demonstration projects also strengthen the capacities of institutions and industry through a “learning-by-doing” approach.

For example in the field of carbon finance, UNDP directly supports the elaboration of pilot projects to demonstrate the viability of new technologies and new sources of finance. Since 2007, the MDG Carbon Facility has performed initial screening assessments on over 200 project ideas and full due diligence and risk analysis on 50 projects, a majority of which involve renewable energy technologies. Through the Facility, UNDP supports renewable energy producers at all stages of the project cycle, although there is a focus on the early stages of project design and implementation because when renewable energy producers face the most critical barriers. Exhibit 6 below sets out various support activities that UNDP delivers to pilot projects.



### 3. Establishing an Enabling Environment for Renewable Energy Markets

**Exhibit 3.6: Project-specific technical support**

	Technical assistance activities
<b>Technical</b>	<ul style="list-style-type: none"> <li>Conduct feasibility studies for renewable energy project ideas</li> <li>Paying for resource and technology-needs assessments</li> <li>Train project staff or local actors</li> </ul>
<b>Management /Partnerships</b>	<ul style="list-style-type: none"> <li>Draft business plans for renewable energy project</li> <li>Structure arrangements with joint venture and public-private partnerships, technology suppliers and service providers</li> <li>Support to engage the government support</li> </ul>
<b>Finance &amp; Legal</b>	<ul style="list-style-type: none"> <li>Analyze and structure project's cash flows and assess financial feasibility</li> <li>Leverage relationships with investors to assist project with financial modeling, preparing investor / donor proposals and marketing materials, and securing investors</li> <li>Support efforts to access FITs, grants other financing mechanisms</li> <li>Review project's legal issues, such as ownership of land and technology systems</li> <li>Support for compliance with environmental and building regulations</li> <li>Assist with negotiation of power-purchase agreements and investment contracts</li> </ul>
<b>Carbon*</b>	<ul style="list-style-type: none"> <li>Assistance to quantify and monitor project's emission reductions</li> <li>Coordinate carbon credit audits (validation, verification)</li> <li>Assist to identify and secure carbon credit buyers</li> <li>Interact with UNFCCC and other bodies (i.e. CDM Executive Board, JI Supervisory Committee)</li> </ul>

\* For renewable energy projects that are seeking to access carbon markets for supplemental financing.

#### Regulatory instruments

The status of the national regulatory environment is crucial to the confidence that investors and other industry participants have in a national renewable energy industry. Rules and regulations specify how something should be done, monitor to check that the rules are followed and, where they are not, enforce them with penalties. Depending on the situation, rules and regulations can be administratively easier to implement and may pose fewer political challenges than direct financial incentives.

National, sub-national and local policy-makers contribute to designing the overall environment within which the renewable energy sector operates. These decision makers may look to multilateral and bilateral agencies for support in their efforts to design attractive legal and regulatory frameworks.

Administrative procedures to develop renewable energy projects and sell their electricity should be clear, simple and efficient. Technical assistance providers may assist developing countries to streamline the rules and procedures which govern renewable energy activities. The number of steps in the approval process should be kept to a manageable limit. In order to install a wind power plant in France, a developer is reported to be required to contact 27 different political authorities.<sup>15</sup> Further, IPPs should be able to obtain licenses and permits within a reasonable time period.

The governing legal framework should also be clear and enforceable. Uncertainties regarding land title rights to a proposed renewable energy project site may deter project activities. The same is true of intangible property rights because technology suppliers seek to protect their intellectual property rights when licensing new technologies. Furthermore, investors, technology suppliers and other actors want the safeguard of an impartial judicial system that will enforce contracts in the event of breaches. For this reason, foreign investors will often engage a local law firm to advise upon enforceability of contracts before making investments.

<sup>15</sup> Mendonca M, Jacobs D and Sovacool B, *Powering the Green Economy: The feed-in tariff handbook* (2010), pg. 136.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

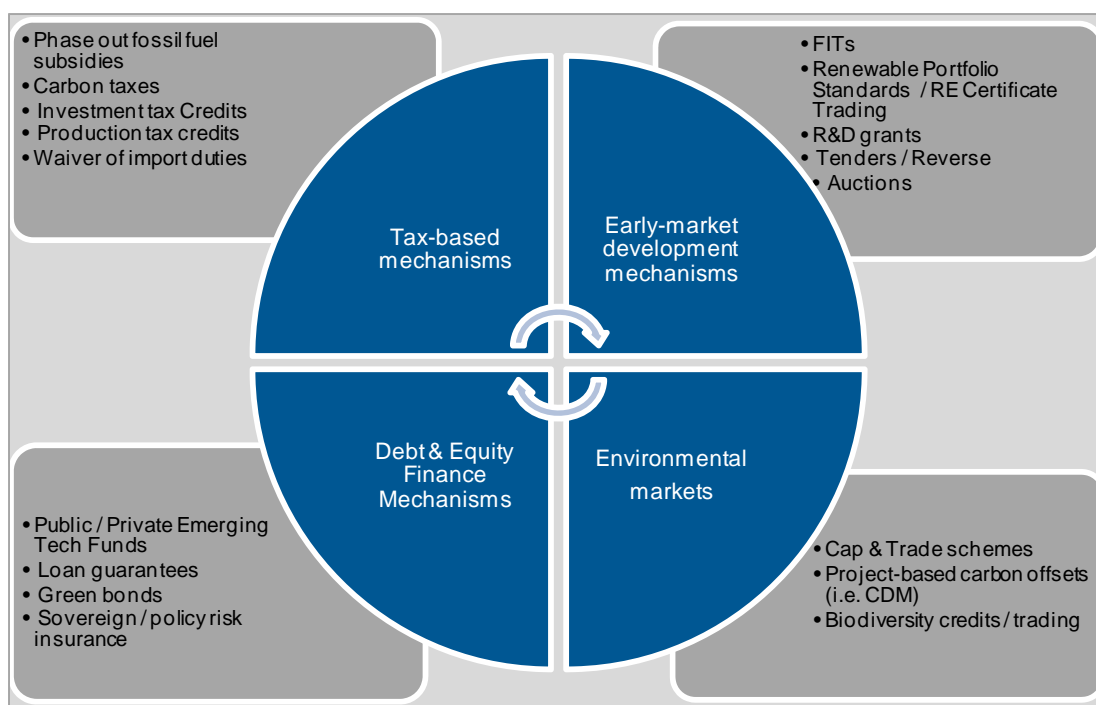
Rules and regulations can be difficult policy tools to use efficiently in a number of situations. First, it is often necessary to have a deep understanding of how an industry works in order to ensure that rules and regulations are fair and affordable. Some manufacturing industries are highly heterogeneous, hence making them difficult to regulate without being too soft or too severe. Even if an appropriate standard can be found at a given moment in time, it might become rapidly obsolete and inefficient as technologies evolve. A complex legislative environment may discriminate against small market players, nationally and internationally, who do not have adequate resources available to comply with legislation and demonstrate compliance to regulatory authorities. Finally, they can prove totally ineffective in countries with weak enforcement capacity and, in some worse case situations, fuel corruption through creating “licensing businesses” for regulatory agencies.<sup>16</sup>

#### Financial incentive instruments

To complement information-based activities and an attractive regulatory framework, decision makers may choose to implement financial instruments that incentivize investments in renewable energy technologies.

As will be described more fully in chapter 4, project developers and investors assess the risk/return profile of potential renewable energy project opportunities. The higher the risk, then the higher the forecast return must be in order to justify the proposed project or investment. Financial instruments can improve the financial analysis of prospective renewable energy projects by increasing returns, either by increasing revenues or reducing costs. Some financial instruments will also incentivize investments by lowering perceptions of risk associated with a renewable energy technology. For example, a FiT lowers perceptions of risk by providing guaranteed grid-access and an electricity purchaser and increases returns by providing long-term premium pricing.

**Exhibit 3.7: Financial instruments to promote renewable energy projects**



Source: Glemarec, Y. & Shepherd, A. UNDP (2010)

<sup>16</sup> UNDP, *Guidebook on matching public policies and financing sources* (2011)

### 3. Establishing an Enabling Environment for Renewable Energy Markets

Categorization of financial instruments could be by funding source (public and private) or by the timing of deployment in the market cycle (R&D, demonstration phase, commercialization). UNDP also frames financial instruments according to the following four categories: (i) Tax-based mechanisms, (ii) Early market development mechanisms, (iii) Environmental Markets, and (iv) Debt and Equity finance mechanisms.

#### Accessing sources of funding

The fourth step is to identify and access sources of finance to fund the policy frameworks, financial instruments and pilot renewable energy projects that developing country governments select and implement.

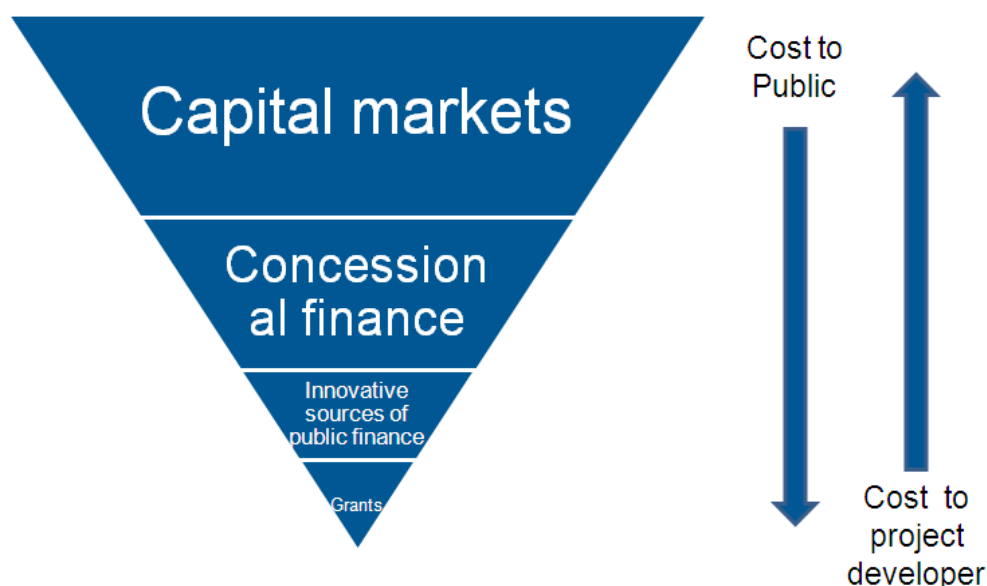
Chapter 5 sets out in detail a broad range of potential sources of funding that developing countries may seek to access to meet the costs of their renewable energy frameworks and activities. UNDP estimates that there may be as high as 50 multilateral and bilateral funds related to climate change, many of which include investment mandates for renewable energies. There is increasing emphasis being placed upon “innovative and hybrid” sources of finance. This term is used to encompass a broad range of non-traditional funding sources, including novel mechanisms to catalyze financial flows, emerging instruments, like NAMAs, and may also refer to steps to re-design or blend existing public-private partnerships.

The preferred mix of financial sources to access will depend upon the unique situation of each country. A combination of domestic and international funding sources is beneficial for reasons of diversification and national buy-in.

- **Domestic sources** include domestic budgetary contributions, revenues from carbon taxes or carbon allowance auctions, and reform of fossil fuel subsidies.
- **International sources** include multilateral and bilateral funds, carbon offset markets (i.e. CDM), international development banks and foreign direct investments.

As a general principle, designing policies should rely upon public money because there are scarce opportunities to fund those activities with private capital. The same is true of institutional strengthening and capacity development activities. Investments in underlying renewable energy technologies and projects should ultimately come from the private sector, although public money may place a role in the early stages of the renewable energy market cycle.

**Exhibit 3.8: Funding sources and targets**



Source: Glemarec, Y. & Shepherd, A. UNDP (2010)

### 3. Establishing an Enabling Environment for Renewable Energy Markets

As the landscape for domestic and international financial mechanisms becomes increasingly complex, developing countries will seek further technical assistance support to access international funding mechanisms. Support activities include:

- **Building awareness:** Raising awareness among decision makers of possible funding options.
- **Selecting sources:** Assisting policy makers to target an optimal mix of funding sources.
- **Administrative access:** Supporting the process of drafting proposals and project documents in order to fulfill application requirements to access funds. In this respect, developing countries may require assistance to devise Nationally Appropriate Mitigation Actions (NAMAs) as a tool to access international climate finance.
- **Blending and sequencing:** Recommending strategies to combine and sequence multiple funding sources to finance priority activities. For example, GEF funds may remove market barriers and build policy makers capacities, a bilateral agency may pay for project-specific feasibility studies, and CDM may then increase revenues for carbon credits and electricity sales respectively.

#### Technical assistance to establish a FIT

Chapter 6 proposes an approach for policy makers to expand deployment of renewable energy technologies. This chapter focuses specifically on the process once decision-makers have assessed their policy options and decided to create a FIT scheme (or have already implemented a FIT). Once the decision is made to create a FIT scheme, then technical assistance services may also help with the next two steps:

- (i) Designing and modeling the FIT, and
- (ii) Considering supplementary policies.

#### Design and model the FIT

Given that designing and implementing a FIT is a complex process, policy makers may look to technical assistance providers for support at each step. Like all policy instruments, a FIT should be customized to the specific goals and the unique context of the host country. This means assessing the range of design options that exist and selecting an appropriate combination of features to create a FIT scheme that is efficient and effective.

There is no single approach to designing an effective FIT. Even design elements that are often cited as being fundamental features of a FIT, such as a guaranteed purchase obligation, may be adjusted or carved out to suit specific circumstances – some FITs do not include a guaranteed purchase obligation for renewable energy that is sold on the spot market).<sup>17</sup> That said, there are certain key features that should be considered when designing a FIT.

**FIT Coverage:** The first step is to decide upon the scope of the FIT, a decision which is informed by policy-makers' goals. Eligibility criteria may be defined according to technology type, installation size and nature of the participant and should take into account a number of factors, including resource potential. A FIT aimed at stimulating a specific technology or installation type, such as the Malaysia BIPV Case Study at page 10 above, may set strict eligibility criteria. Alternatively, a FIT planned to cover a broad range of renewable energy technologies and generators, including independent power producers and state-owned utilities, may set wide eligibility criteria.

**Setting the tariff:** A critical aspect of the FIT design process is setting an appropriate tariff. The tariff rate and duration need to be sufficiently attractive to incentivize new and additional renewable energy generation. Yet, the rate should not be so high as to over-compensate renewable energy producers and create inefficiencies. To set an appropriate tariff, policy-makers should consider:

---

<sup>17</sup> Energy Economics Group, *Evaluation of different feed-in tariff design options 2<sup>nd</sup> Ed.* (2008) Pg. 23

### 3. Establishing an Enabling Environment for Renewable Energy Markets

- **Tariff differentiation:** In order to be effective, a tariff should be differentiated according key characteristics such as technology type, generation capacity and location.
- **Term:** An effective FIT needs to provide renewable energy producers, and their investors, with sufficient long-term price certainty. A FIT may also consider reducing the tariff over time (tariff degression) for new installations to incentivize innovation and generation cost reductions.
- **Fixed vs. Premium:** Is the tariff a fixed rate or is a premium offered above the conventional market price? This decision may be influenced by the power producer's level of sophistication. Small and new installations may prefer fixed tariffs because they are easier to finance and because small plants may lack experience with forecasting and tracking electricity market prices.<sup>18</sup>
- **Calculation Method:** Is the tariff calculated based on an assessment of costs associated with renewable energy generation? These costs may include upfront investment, labor, grid-connection, O&M and permitting. Or does the tariff take into account the external costs that are avoided by virtue of the FIT?
- **Impact of Carbon Finance potential:** Does the FIT tariff take into account the potential revenues for renewable energy operators from the carbon markets (i.e. Clean Development Mechanism)? The decision whether to include carbon finance when setting the tariff will be influenced by decision makers' views on (i) the long-term direction of carbon markets, and (ii) any forecast volatility in CER prices.

**Grid-Access:** Does the FIT offer guaranteed grid access to renewable energy producers? If priority access is secured for renewable energy producers, is the grid-operator equipped to manage grid capacity constraints?

**Administration:** FIT scheme designers should consider the level of sophistication of the intended participants. Ease of participation is important and complicated application processes could exclude or deter certain IPPs, such as non-professionals. Equally, on the administration side, the level of capacity of the host country should be considered when deciding upon the complexity of the scheme, including calculation methodologies.

Case Study: Mauritius Designing a FIT for Small-Scale Distributed Generation
<p>In Mauritius, as part of a GEF funded project, UNDP has supported the government in the development of a local market for small-scale distributed generators (SSDG) to connect PV, wind power and hydro power systems to the low-voltage electricity grid. A draft Energy Efficiency Bill is currently being finalized at the State Law Office (SLO) and enactment is expected by end of 2010. A Grid Code has been developed to facilitate the integration of renewable energy in buildings and focuses on SSDG of less than 50 kW installed capacity.</p> <p><b>FIT:</b> The Government has designed Feed-In-Tariffs for small IPPs with the support of the UNDP and its consultants. While not yet law, the grid code and FiTs are now at the SLO and expected to be enacted later this year. The FITs includes the following design characteristics:</p> <ul style="list-style-type: none"><li>■ Differentiated tariff rate according to technology (wind, hydro, PV) and size (micro, mini, small);</li><li>■ Term of between 10 and 25 years; and</li><li>■ FIT review to be conducted if 200 new installations occur or 2MW is installed, whichever is first.</li></ul>

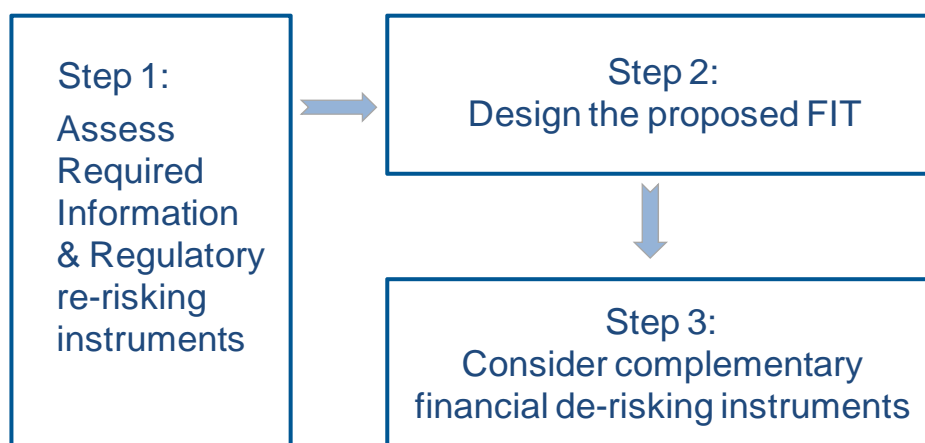
Consider complementary de-risking instruments

<sup>18</sup> *Feed-in Tariffs Go Global: Policy in Practice*, Renewable Energy Magazine, Sept. 2009; <http://www.renewableenergyworld.com/rea/news/print/article/2009/09/feed-in-tariffs-goglobal-policy-in-practice>

### 3. Establishing an Enabling Environment for Renewable Energy Markets

As a policy instrument, the FIT is widely heralded as an efficient and effective mechanism to overcome barriers to renewable energy markets. Yet, a FIT does not operate in a policy or contextual vacuum. In order to create an enabling environment for renewable energy technologies, each FIT should be supported by complementary instruments. Information and skills-based instruments fill knowledge gaps and build essential technical capacities. Regulatory instruments remove administrative and policy hurdles by creating an efficient governing framework. Financial instruments create economic incentives to overcome financial barriers.

**Exhibit 3.9: Steps to implement a domestic FIT**



Source: Glemarec, Y.. UNDP (2010)

Where a FIT is being implemented, policy-makers should consider what other national policy instruments may be useful to make renewable energy generation activities more attractive to producers and investors. A well-crafted suite of complementary instruments lowers investors' perceptions of risk and thus reduces the weighted-average cost of capital (WACC) for renewable energy activities. Chapter 4 explains in further detail how policy instruments to reduce the WACC also lower the price premium required under a FIT, thus making the FIT scheme more affordable.

As discussed in chapter 6, a combination of FITs and public instruments can reduce the levelized cost of energy (LCOE) for renewable energy technologies and assist in overcoming the challenge of high upfront capital costs. Supporting policies that may address this issue include:

- **Grants:** Policy makers can supplement a FIT and support deployment of renewable energy technologies by providing direct grants for R&D, project development or industrial restructuring.
- **Tax incentives:** Governments may deploy tax-based instruments as incentives. Tax credits tied to production or tax reductions or "holidays" will increase forecast return from renewable energy projects.
- **Debt-based instruments** include the provision of credit lines to commercial finance institutions for on-lending to green investors; loan guarantees to cover a portion of the risk of non-repayment of the loan principal; and project loan facilities to provide debt financing directly to projects where conventional CFIs are unwilling or unable to provide such financing themselves; or soft loan programs to provide debt capital at concessional interest rates.
- **Equity based instruments** foster direct investment in companies or projects. They include tax credits and "first loss" equity positions by public investors in private equity funds.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

#### Innovative instruments to complement a FIT

A UNDP-GEF project has supported the Philippines Government to remove barriers and design a policy framework to incentivize national renewable energy markets. In partnership with the Department of Energy, the “Capacity Building to Remove Barriers to Renewable Energy Development (CBRED)” project has supported the design and implementation of the country’s national renewable energy law, implementing regulations and, in August 2010, a FIT.

The project has also supported the following **instruments to complement the FIT**:

- A project preparation fund assists renewable energy project developers in paying for feasibility studies, engineering designs, securing permits and licensing and loan proposal packaging.
- A loan guarantee fund is being used as a partial loan guarantee, and is open to project developers whose loans require a high level of securitization or are not well-capitalized and cannot meet the collateral requirements of financial institutions.
- A microfinance fund is a loan financing mechanism for off-grid, small-scale power projects at concessionary rates or long-term financing. It funds microfinance intermediaries for relending to small-scale projects in remote, off-grid areas.
- A provision in the renewable energy law which provides a seven-year income tax holiday to investors, as well as a fixed five-percent gross income tax thereafter.

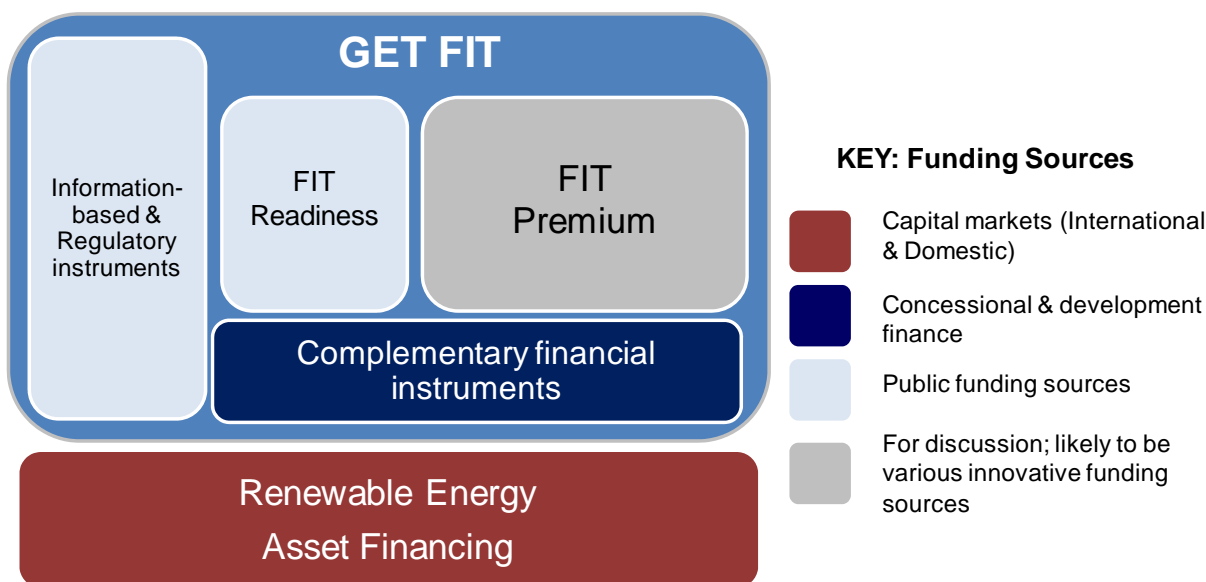
#### A multifaceted funding landscape

There are significant climate and human development achievements to be realized by expanding renewable energy activities in developing countries. As policy-makers increasingly seek to pursue low-carbon growth paths, demand is growing from national and sub-national governments for technical assistance to support these goals. It is clear that for developing countries to stimulate and grow renewable energy markets, technical assistance is required to play a crucial role – raising awareness, building capacities, removing barriers, and supporting the design of policy and financial instruments.

The remaining question then is what sources of funding should pay for renewable energy technologies, FITs and other complementary instruments. As Exhibit 10 shows below, different sources of financing are required depending upon the specific instrument or asset being funded in a developing country’s renewable energy market.

### 3. Establishing an Enabling Environment for Renewable Energy Markets

Exhibit 3.10: renewable energy markets: instruments and sources of funds



Source: Glemarec, Y. & Shepherd, A. UNDP (2010)

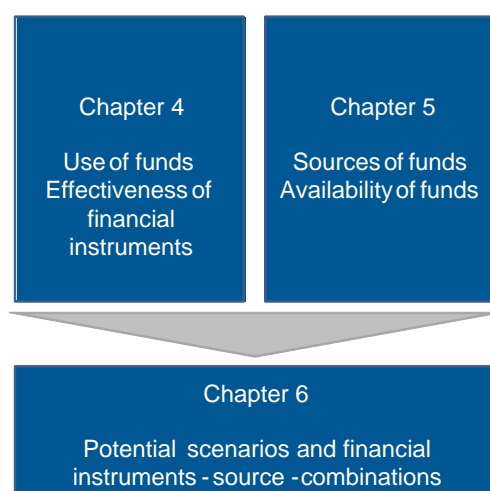
Experience shows that national and international public sources of finance are appropriate to fund information and regulatory instruments aimed at removing administrative and regulatory barriers, creating enabling environments and designing FITs. Complementary financial instruments can be covered by development and concessional financing. And, the bulk of asset financing should come from the private sector.

The financing landscape becomes more complex when considering how to pay for the FIT premium. One of the key benefits of a FIT for renewable energy generators and investors is the promise of long-term certainty for premium payments, often over a 15 to 25 year period. This time frame poses a significant limitation upon the ability for a FIT to be financed by public funds. In reality, FITs will need to draw upon a blending of hybrid and innovative sources of funding, public and private, international and domestic. One possibility is that in time, FIT funds may be a mechanism to pilot innovative sectoral approaches in a few developing countries. If sectoral approach is successful, they could be expanded to a larger number of countries leveraging NAMA finance in the coming decade. While the UNFCCC negotiations on this issue are still inconclusive, it is not unforeseeable that sectoral mechanisms could be eligible as NAMAs. Should this be the case, NAMAs could become a major source of funds for financing sectoral FITs, and abolish the need to prepare different CDM project documents to promote each individual energy efficiency or renewable energy technology project in a given country.



## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

**The outline for chapters 4 – 6 is as follows:** Chapter 4 describes the different public finance mechanisms and highlights the quantitative impact of these instruments. Chapter 5 outlines the potential sources of funding for these instruments describing also the constraints which we see for a rapid implementation. It also flags a number of open questions with regard to the availability of funds. Finally, chapter 6 gives an overview on hybrid approaches combining different public financing mechanisms.



Renewable energy scale-up in developing countries faces two different financing challenges:

- The first is how to bridge the gap between the levelized cost of renewable electricity and that of conventional energy sources in order to create economically viable renewable energy business models with an appropriate risk-reward-profile.
- The second one is how to pay for the high upfront investment costs of economically feasible renewable energy projects.

This report focuses on the first challenge, i.e. how to bridge the gap between the cost of new renewable electricity and the cost of existing generation. The payment of long-term, generation cost-based rates for renewable electricity – such as those envisioned under feed-in tariffs and related policies such as lighthouse PPAs – represents one avenue for closing this gap. The first GET FiT report explored options for using public sector funds to provide all or a portion of rate required by renewable generators above avoided cost. This approach built off of similar models for global feed-in tariff funds proposed by the UN and by NGOs (for a summary exhibit of the different proposals, see Appendix I of GET FiT report).

Providing long-term incentive payments is not the only mechanism through which public sector funds can be deployed to support renewable energy scale up and the expansion of energy access under feed-in tariffs, lighthouse PPAs, mini-grids, or other performance-based policies, however. Other mechanisms include:

- **Concessional financing**, i.e. the provision of low interest debt to project investors, which replaces the need to secure loans at market rates and can also help address the second financing challenge – how to pay for the high upfront costs of feasible projects. Concessional financing represents lending below risk-adequate rates by a supporting entity.
- **Upfront investment grants**, which reduce the total investment that needs to be financed by debt and equity and consequently the cost of capital.
- **Risk mitigating instruments**, e.g. political risk insurance or counterparty guarantees, which improve the risk profile for private sector investors and lower their required return.

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

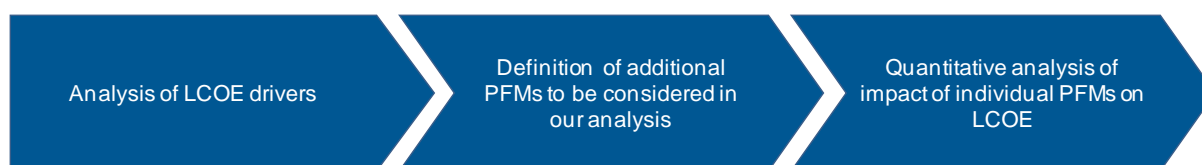
Each of these three public financing mechanisms helps to reduce the LCOE of renewable energy and consequently bridge the gap between renewable and conventional electricity by lowering the payment rate required by generators, and represents an alternative to closing the gap by paying generators a higher rate.

### Approach and Methodology

This chapter focuses on the quantitative analysis of the impact of different public financing mechanisms (PFMs) on the levelized costs of electricity from renewable energy sources.

The considerations for how to bridge the gap to grid parity for feed-in tariffs, lighthouse PPAs, and mini-grids are similar, with only the volume of installed capacity and consequently the amount of public funding required varying substantially. We therefore do not differentiate between these different applications in this chapter.

The structure of the chapter is summarized in the graphic below. First, the components of the levelized costs of energy are identified, followed by a detailed definition of the different PFMs discussed in the chapter above. The chapter concludes with a comparative financial analysis of different mechanisms, based on simplified assumptions developed by Deutsche Bank. The chapters that follow include a more detailed qualitative analysis of the different options, including their availability and constraints and the pros and cons of their application in different circumstances.



Different renewable energy technologies characterized by different levels of capital intensity and proximity to grid parity can have implications for the effectiveness of the PFMs employed to support them. To support future discussions on this topic, this analysis tests the quantitative impact of different PFMs on illustrative projects representing two different renewable energy technologies:

- Onshore wind
- PV

It should also be noted that this analysis focuses only on financial mechanisms. Successful renewable energy policies, such as feed-in tariffs, typically pair financial incentives with suites of enabling regulations such as guaranteed grid access and interconnection, guaranteed purchase requirements, priority dispatch, standard contracts, etc. Even if the required cash premium for renewable electricity can be reduced to zero – i.e. through technology cost declines or through the usage of other PFMs – the implementation of an appropriate enabling environment, such as discussed in Chapter 3 will remain a critical success factor.

### Analysis of LCOE drivers



Calculating the levelized cost of energy (LCOE) can provide a useful basis for comparing the generation costs of conventional energy sources and those of renewable energy. LCOE is an economic assessment that includes all the costs over a plant's lifetime, including: investment (initial capital expenditure and development costs) and the resulting depreciation, financing costs (both, debt and equity), and operations and maintenance (including the cost of fuel for conventional technologies). A net present value calculation is performed and solved in such a way that the project's net present value (NPV) is zero for the value of the LCOE chosen. This means that the LCOE is the minimum price at which

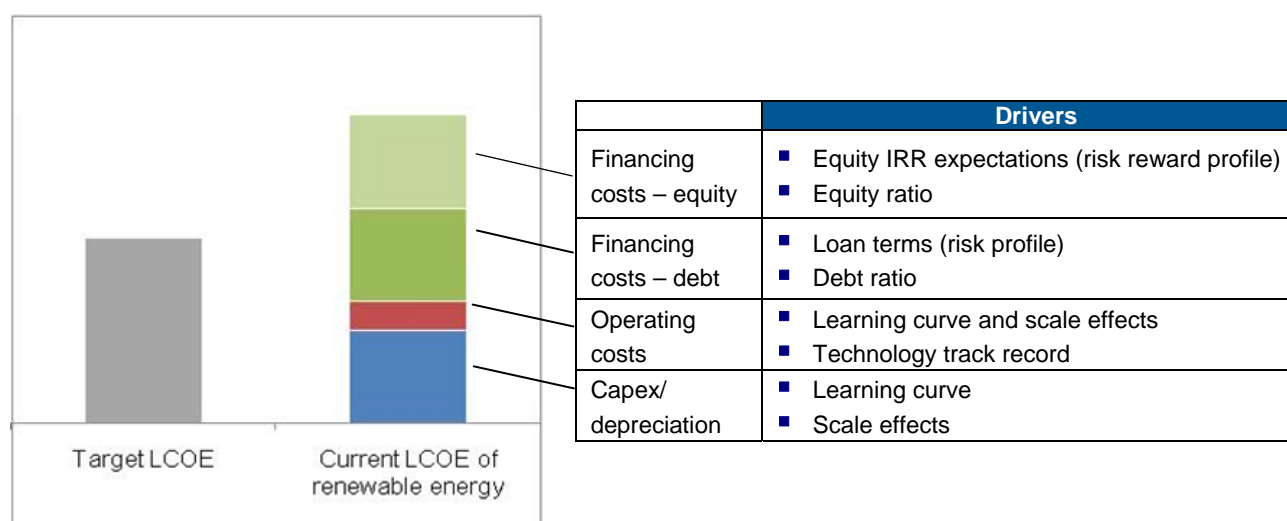
## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

energy must be sold for an energy project to break even. The LCOE for renewable generators can form the basis for calculating a generation cost-based rate for feed-in tariffs, lighthouse PPAs, performance-based payments for mini-grids, or related policies.

A comparison between renewable energies, such as wind and solar, to fossil fuel generators reveals a higher capital intensity for renewable energy projects, which means that capital costs represent a higher proportion total costs, while operations and maintenance costs are comparatively minimal.

The chart below shows the different LCOE components as well as their major drivers. The actual value of the components varies primarily by technology type and by investment risk.

**Exhibit 4.1**



In order to build the analysis in this chapter, it was necessary to identify assumptions for both sides of the “gap”, namely the cost of conventional generation and the levelized cost of the two representative technologies: onshore wind and photovoltaics.

The cost of conventional generation varies widely from country to country because of factors such as domestic fuel resources, energy subsidies, and different approaches to accounting for environmental externalities. For the analysis in this chapter, we assume a range for the LCOE of conventional generation (i.e. “the target LCOE”) of 6-10 US\$cent/kWh.

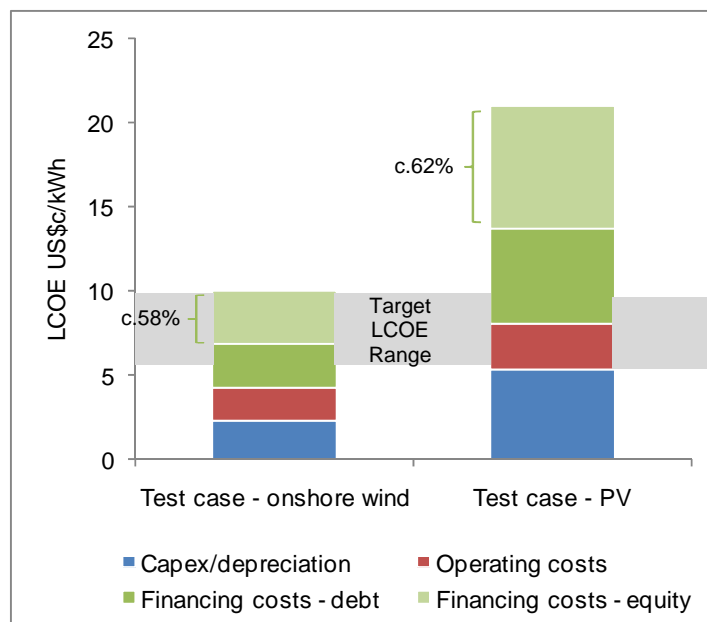
The wind and PV examples developed for this chapter represent in our view reasonable scenarios for an illustrative analysis. We stress here as well, however, that actual costs might differ substantially from country to country and from project to project. With these caveats in mind, the exhibit below contains the LCOEs for large-scale, grid connected wind and solar generation, compared against the target LCOE. As would be expected, wind energy is closer to the target LCOE in the scenario below than PV is because of PV’s higher capital intensity and lower capacity factor (MWh/MW/year).

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

**Exhibit 4.2: Our major assumptions are as follows:**

	Onshore wind	PV (i)
Investment cost per MW	US\$1.6m	US\$2.5m
Operating costs per MW p.a.	US\$56,000	US\$60,000
Tax rate	25%	25%
Yearly output (MWh/MW)	2,500	1,800
Debt/Equity ratio	70/30	70/30
Debt maturity	15 yrs	15 yrs
Debt interest rate	7.5 %	7.5 %
Target equity IRR	11.0 %	11.0 %
Term of performance-based incentive	20 years	20 years

(i) Assumptions for PV minigrid applications vary significantly



**Note:** Our LCOE calculations are based on simplified models for a wind and solar project. To analyze the breakdown of the LCOE we have simulated the reduction of equity financing costs, debt financing costs and finally operating costs to zero to calculate the remaining LCOE. The difference between each step is defined as the contribution of the varied LCOE component. Based on this mechanism the actual “value” of each component also depends on the order of component variation. Therefore, a variation of one parameter on a ceteris paribus basis – as presented in the following paragraphs – can lead to slightly varying figures. The capex/depreciation component is defined as the remaining value after the reduction of capital costs and operating costs to zero. Please note that the simplified calculation of this component – total investment volume divided by kWh produced over lifetime – results in slightly different figures.

### Definition of additional PFMs to be considered in our analysis



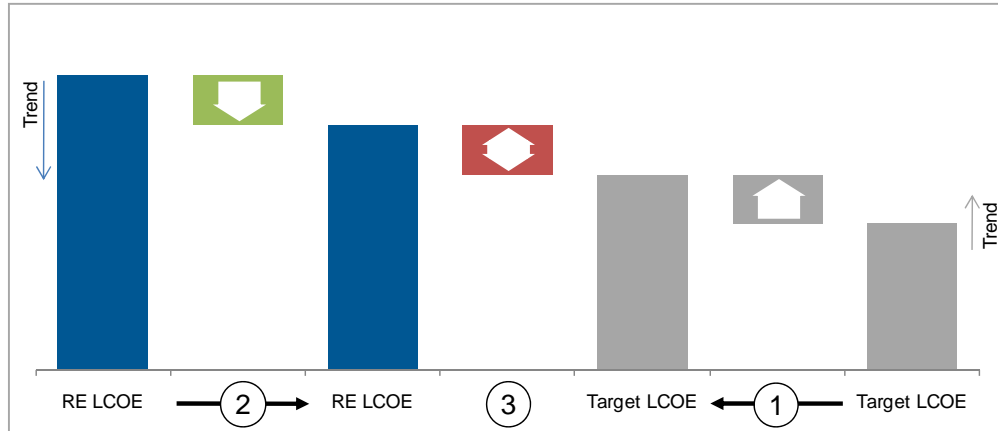
Today, the LCOE from renewable energy sources typically exceeds the LCOE for conventional generation. While we are confident that price trends will lead to grid parity for renewables in the mid-term, various mechanisms should be applied to enable renewable energy scale-up in the near-term. The exhibit below illustrates how price trends and policy interventions can affect a convergence in the LCOE for renewables and the “target LCOE.”

- First, the target LCOE can rise as conventional fuel costs increase as indicated by the trend arrow on the right hand side of the Exhibit.
- The target LCOE can also increase as a result of domestic policy modifications as indicated by (1) in the future. Air emissions controls, for example, may raise the cost of high-emissions generations. Subsidy reform may also raise the cost of generation. Many developing countries have implemented fossil fuel subsidies or electricity price caps which widen the gap between the true LCOE of the existing electricity mix and renewable energies. Removing or reducing these subsidies can shift the target LCOE upward.
- The LCOE of renewable energy can also trend downward as technology costs decline through economies of scale, learning curve effects, and/or commodity price decreases. This is reflected by the trend arrow on the left hand side of the Exhibit.

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

- The LCOE of renewable energy can also be reduced as indicated in (2) in the Exhibit through the implementation of either international or national public financing mechanisms (e.g. grants, concessional loans, and/or guarantees).
- Finally, the remaining gap between the renewable LCOE and the target LCOE could be closed with performance-based payments for renewable energy as indicated in (3) in the Exhibit.

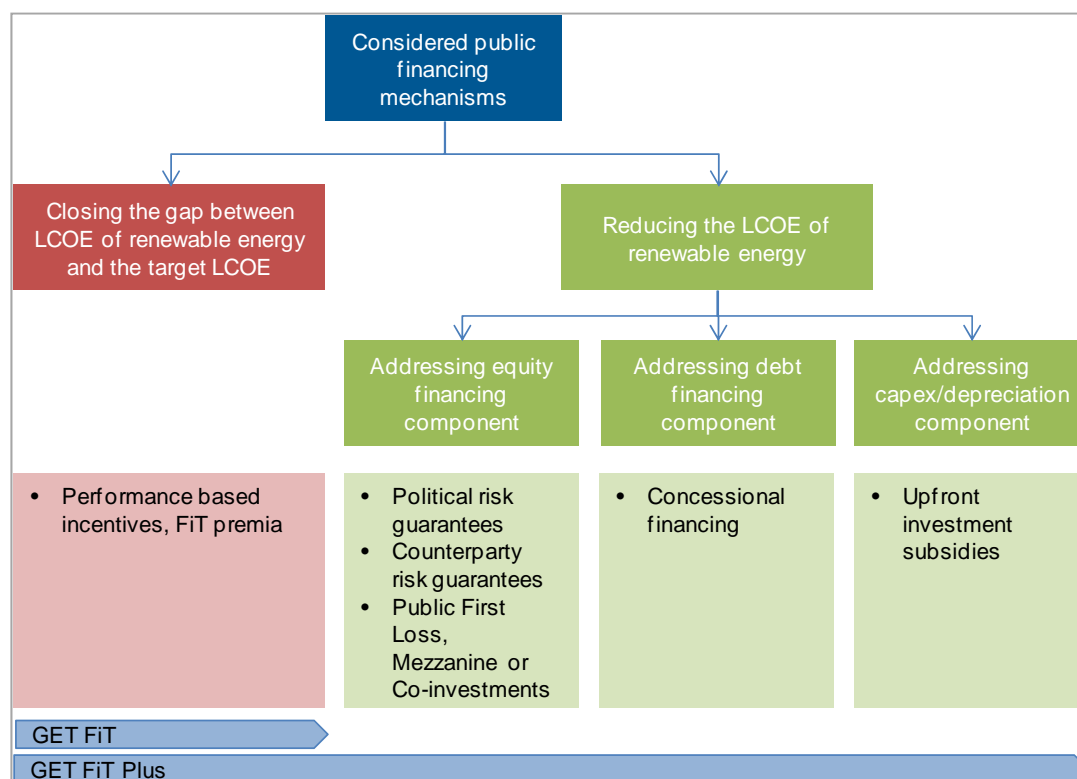
**Exhibit 4.3**



Drawing on the approaches presented above, we turn specifically to PFMs that reduce the LCOE of renewable energy. As can be seen in the graph below, the first GET FiT report focused on performance based incentives as a mechanism for closing the gap between the LCOE of renewables and the target LCOE. GET FiT Plus also focuses on PFMs that reduce the LCOE (and therefore the required FiT or PPA rate) by targeting the equity financing component, the debt financing component, or the capex component of renewable energy project financing.

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

Exhibit 4.4



As can be seen in the Exhibit, this chapter considers a broad range of different PFMs. It is notable that most of these PFMs target a reduction in the cost of capital (i.e. equity or debt financing), while only the upfront investment grant targets the capex/depreciation component.

### Quantitative analysis of impact of individual PFMs on LCOE



Based on the LCOE analysis for wind and solar presented above, this chapter develops a preliminary estimate of the comparative effectiveness of the different PFMs.

The potential impact that each PFM could have on the base case wind and PV LCOE models is examined, and sensitivity analyses are performed by varying the parameters that the PFMs primarily influence (i.e. equity, debt, or capex). The impact of each of these PFMs is then quantitatively compared to the payment of performance-based incentives under a FiT or PPA. In order to simplify the analysis, we assume that the assumptions do not change over the project lifetimes. Also, we do not include impacts on parameters which will be influenced besides the main targeted driver. This chapter focuses exclusively on the different PFMs' quantitative impacts on LCOE. Qualitative considerations are discussed in Chapter 6.

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

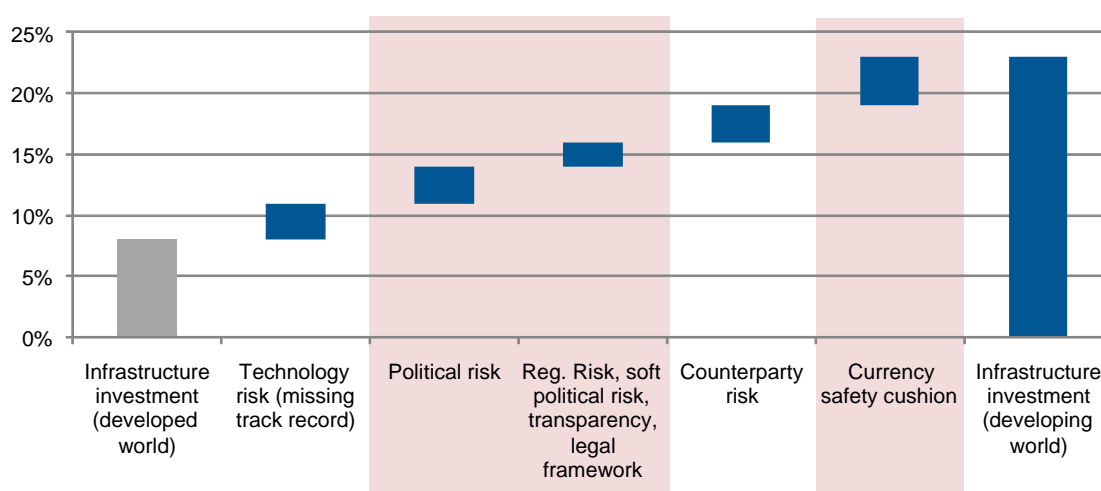
### Addressing equity IRR expectations

Equity investors' return expectations have a substantial impact on the LCOE taking since at least 25-30% of the total investment costs generally needs to be financed with equity. The return expectations depend on the risk profile of the investment. Consequently, any derisking of the underlying project will reduce the equity financing cost component in LCOE. We do not take into account the secondary impact of risk mitigating instruments on other assumptions in our analyses, e.g. the size of the debt component or debt terms and conditions, as a simplifying assumption.

As can be seen in the exhibit below, equity IRR expectations for projects in the developed world can differ substantially from projects in developing regions based on a range of factors that influence risk assessments.

Starting from equity return expectations for infrastructure investments in the developed world – which range around 8% – additional risks (actual or perceived) are added to the risk assessment in the chart. Each additional risk results in a corresponding increase in the expected equity return (or can even lead to a negative investment decision). The lack of an established track record for a given technology, for example, will increase the risk exposure of the equity investor, who will in turn ask for a higher return on investment. As shown in the chart below, the total expected equity return in developing regions can be above 20% at the extreme - more than 12% higher than typical expected returns in the developed world. In less risky countries, this would be closer to 15%.

**Exhibit 4.5**



The areas highlighted in the chart above represent risk positions that will most likely be assessed differently by international and domestic investors. In developing countries that have an established investor community, it may make sense to apportion the risk accordingly in order to reduce risk exposure and/or cash expenses for international lenders. There is a range of available financial instruments to mitigate the risk exposure of renewable energy projects in developing regions, and lower the return expectations of equity investors. These different instruments can either address specific risk positions or reduce the overall risk exposure.

There is a range of financial and non-financial instruments to mitigate the risk exposure of renewable energy projects in the developing world and lower the return expectations of equity investors. Both sets of instruments can either address specific risk positions or reduce overall risk exposure of a project. Political risk guarantees, counterparty risk guarantees, public first loss investments are some examples of financial risk mitigation instruments. Technical assistance, to address policy, administrative and skills barriers, as illustrated in the preceding chapter, is an example of a non-financial

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

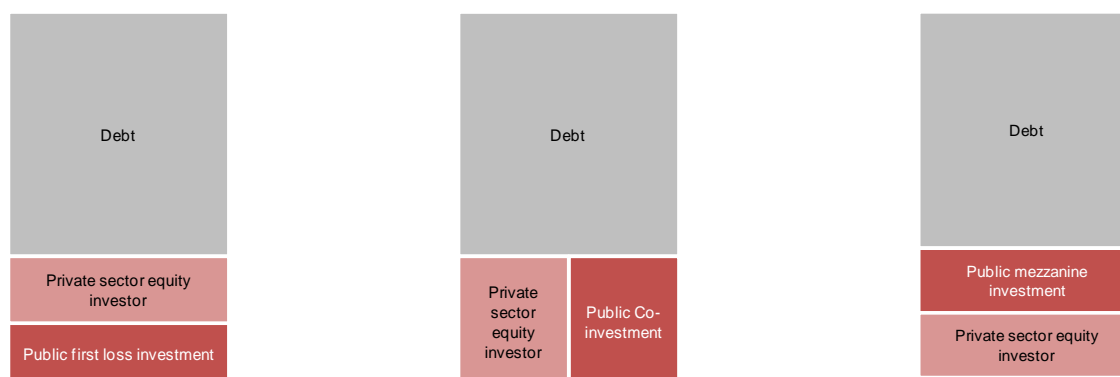
instrument that reduces investment risk by removing barriers to RE investment and creating an enabling policy environment.

*Political risk guarantees* insure investors against loss of both cash flows and assets due to a range of events, ranging from war and civil disobedience, to currency inconvertibility and transfer restrictions. The expansion of political risk guarantees to a broader range of political risks, such as the predictability of local permitting processes during development and construction phase can address specific investor concerns about non-manageable risks.

*Counterparty risk guarantees* address the risk of weak or eroding offtaker creditworthiness. In most cases, the offtaker provides the only revenue source. Against the background of the long-term investment horizons in renewable energy projects and the ongoing privatization processes of utilities in many developing countries, a reliable and meaningful due diligence of offtaker creditworthiness over the full project lifetime is rarely available. Also, the lack of alternative offtakers and/or accessible electricity markets reduces the manageability of this risk for the investor. Counterparty risk guarantees mitigate this risk.

In addition to political and counterparty risk guarantees, public first loss investments, co-investments, or mezzanine investments can reduce the overall risk profile for equity investors and increase their confidence level. Each of these instruments is illustrated in the exhibit below. The vertical positioning of the financing component reflects its subordination to other financing components – in other words, losses will be allocated to the lowest position first.

**Exhibit 4.6**



- A public first loss component substantially reduces the risk exposure of other equity investors. As the name implies, as any losses are first allocated to the first loss tranche, which is subordinated to the remaining equity and the debt.
- The risk mitigation effect depends on size of the first loss tranche.
- In the case of public co-investments, public and private equity are equally ranked and equally exposed to risk and loss.
- Co-investments with international public partners are typically considered less risky than exclusive private sector investments. The relationships between international public sector institutions and national governments can reduce the political and policy risks of the investment.
- Public mezzanine investments reduce the absolute amount of private sector equity required for a project.
- Despite the higher risk exposure for the private equity the perceived advantages of a public co-investment as described at left remain.
- A public mezzanine tranche can help to increase the availability of debt.

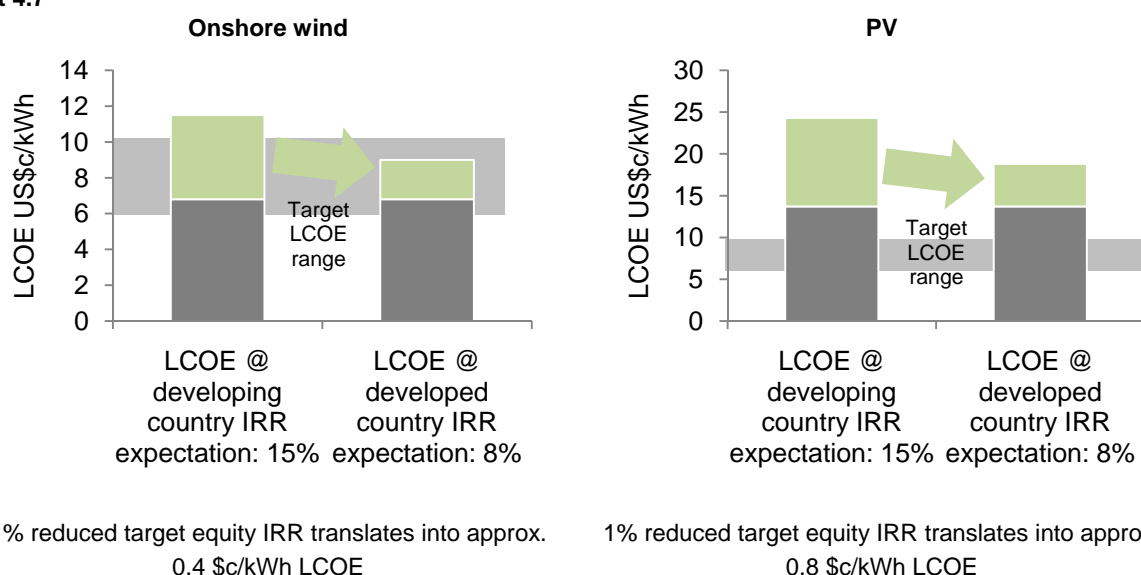


## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

In addition to the impact on IRR expectations of the private sector equity investor, below-market return expectations from public sector investors can also translate into substantial LCOE reductions.

The impact of each of the instruments described above on private sector return expectations will heavily depend on the actual structure and volume of the public investment. The following charts graphically illustrate the impact that reducing the equity IRR from levels typical in developing countries (~15%) to levels typical of developed countries (~8%). The charts also include a calculation of the impact that each 1% reduction in equity financing costs would have on LCOE in our two test cases – independent of the instrument chosen. Besides the direct impact on LCOE, we would expect additional positive impact on the availability of debt and potentially debt terms, which are not included in our analysis.

**Exhibit 4.7**



The charts above underline the competitiveness of wind energy. Addressing the risk positions specific to developing regions, and reducing the equity IRR expectations to developed world levels will substantially reduce the gap to grid parity. It is also evident from the exhibit that, although equity risk mitigating instruments are effective, they may not be sufficient to fully reduce the LCOE of wind to the target LCOE level.

There is a range of financial and non-financial instruments available to mitigate the risk exposure of renewable energy projects in developing regions and lower the return expectations of equity investors. Both sets of instruments can either address specific risk positions or reduce overall risk exposure of a project. Political risk guarantees, counterparty risk guarantees, and public first loss investments are some examples of financial risk mitigation instruments. Technical assistance to address policy, administrative and skills barriers, as illustrated in the preceding chapter, is an example of a non-financial instrument that reduces investment risk by removing barriers to renewable energy investment and creating an enabling policy environment.

For PV, the impact of reduced return expectations is larger in absolute terms because of PV's higher capital intensity. Risk mitigation alone, however, is insufficient to bridge the gap to grid parity.

In the exhibit below, we compare the risk exposure of the international guarantor (i.e. the size of the guarantee) with savings from reducing equity IRR expectations and the performance-based payments required for project viability. The analysis shows, for example, that a US\$24m political risk guarantee for a 50 MW wind project (assuming that the political risk guarantee covers the initial equity investment) would reduce the equity return expectations by 2% from 15% to 13%

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

in our example. Assuming that the international entity would otherwise support the project by paying the FIT or PPA rate, the risk guarantee would reduce the required LCOE by 0.8 cents/ kWh and save a total of US\$11m in direct incentives (if discounted @ 6%).

**Exhibit 4.8: Political risk guarantee**

	Onshore wind (50MW)	PV (10MW)
Assumed investment volume	\$US80m	\$US25m
Equity financing component (= guarantee volume)	\$US24m	\$US7.5m
Assumed equity IRR reduction <sup>(1)</sup>	2%	2%
LCOE reduction	0.8 cents/ kWh	1.8 cents/ kWh
NPV of replaced performance-based payments discounted @ 6% (3%)	US\$11m (US\$15m)	US\$3.6m (US\$4.7)

(1) Assuming reduction from 15% to 13%

In case of a counterparty risk guarantee in the Exhibit below, reducing the equity return expectations a further 3% to (i.e. from 13% to 10%) will save the an additional 1.1 cents/ kWh or US\$16m if discounted @ 6%. This reduction requires a guarantee volume of US\$138m (assuming that the counterparty risk guarantee covers the NPV of the future revenue streams). It must be noted, however, that it is unlikely that the full amount would be lost as electricity volumes could eventually be sold (e.g. as an offtaker's credit rating and/or ability to pay improves) resulting in at least a portion of the projected revenues.

**Exhibit 4.9: Counterparty risk guarantee**

	Onshore wind (50MW)	PV (10MW)
Assumed investment volume	US\$80m	US\$25m
Assumed equity IRR reduction <sup>(2)</sup>	3%	3%
LCOE reduction	1.1 cents/ kWh	2.4 cents/ kWh
NPV of future revenues streams (discounted @ 6%) (= guarantee volume)	\$US138m	\$US42m
NPV of replaced performance-based payments discounted @ 6% (3%)	US\$16m (US\$20m)	US\$5m (US\$6m)

(2) Assuming reduction from 13% to 10%

### Addressing debt financing costs

Interest on debt also represents a major component in renewable energy LCOE, since 70% or more of total investment costs is typically debt financed.

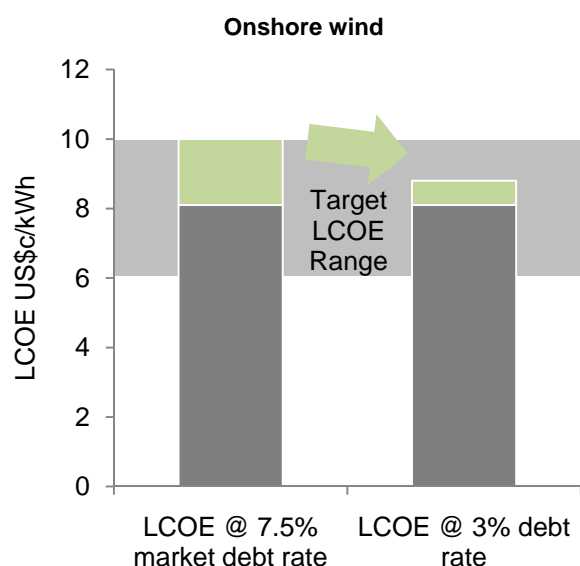
We therefore analyze the impact of concessional financing, i.e. low interest rate financing. We assume that the international lender reduces the cash payment that would otherwise be required under a FiT or PPA by providing financing at their refinancing costs.

In countries where FiTs or PPAs are denominated in local currency, requirements for local currency debt the might reduce the potential effect of concessional financing because of substantial cross currency swap costs, which increase the interest rate for the loan.

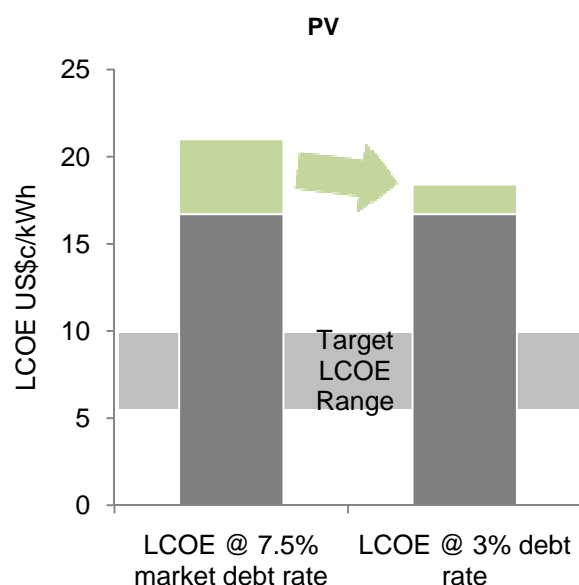
## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

The following charts graphically illustrate the impact that reducing the interest rate from commercial market levels (~7.5%) to concessional levels (~3%) would have on LCOE of the two test cases. The charts also include a calculation of the impact that each have a 1% reduction in interest rate.

**Exhibit 4.10**



1% reduction of interest rate translates into approx. US\$0.3 c/kWh LCOE



1% reduction of interest rate translates into approx. US\$0.6 c/kWh LCOE

While the impact of concessional financing can be substantial, it is worth analyzing the actual loan volumes required and to compare them with cash commitments under a FiT or PPA which they replace. In the exhibit below, a US\$56m loan with a 3% interest rate would reduce the LCOE of wind by 1.2 cents/kWh. This would represent a total savings of US\$17m (discounted at 6%).

**Exhibit 4.11**

	Onshore wind (50MW)	PV (10MW)
Assumed investment volume	US\$80m	US\$25m
Debt financing component (= concessional financing volume)	US\$56m	US\$17.5m
Assumed interest rate	3%	3%
LCOE reduction	1.2 cents/ kWh	2.6 cents/ kWh
NPV of replaced performance-based payments discounted @ 6% (3%)	US\$17m (22m)	US\$5.2m (6.8m)

In this analysis we do not consider the positive effect of concessional loans on financing availability. In emerging markets with a limited renewable energy technology track record, we would expect that the public sector would initially need to play a leadership role in debt financing, with the goal of helping to build confidence among domestic commercial lenders and increasing the pool of available debt.

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

### Addressing capex/depreciation component

Depending in the level of financing costs for both debt and equity, as well as the capital intensity of the respective technology, upfront investment grants could be considered a cost-effective alternative to providing long-term, performance based payments.

We do not include the administrative costs for a FiT regulation in our analysis which we expect to be higher than the administrative costs of upfront investment grants.

The following analysis compares the cost of up-front investment grants and the NPV(s) of required performance-based payments, not taking into account the qualitative characteristics of the different instruments (e.g. grants do not create incentives for performance).

As can be seen in the exhibit below, an upfront grant of US\$18m in a 50 MW wind project would be required to replace the premium payment required above avoided cost. The use of a grant would defer the need for performance-based payments with an NPV of US\$29m.

**Exhibit 4.12**

	Onshore wind (50MW)	PV (10MW)
Assumed investment volume	US\$80m	US\$25m
Assumed performance-based payment required	10 cents/kWh	21cents/kWh
Assumed avoided cost rate	8 cents/kWh	8 cents/kWh
NPV of the required performance-based premium over the avoided cost rate @ 6%	US\$29m	US\$27m
NPV of the required performance-based premium over the avoided cost rate @ 3%	US\$37m	US\$35m
Required upfront investment grant to completely replace required performance-based premium over avoided cost rate (1)	US\$18m (= 23 % of assumed investment volume)	US\$17m (= 68 % of assumed investment volume)

(1) Assuming debt/equity split remaining unchanged @ 70/30

## 4. Appropriate Public Financing Mechanisms for Funding or Reducing the Premium

### “Costs and risks” of the respective public financing mechanisms

The quantitative analyses above provide useful insight into the comparative impact of different PFMs and incentives on the LCOE of renewable electricity. When comparing the quantitative results, however, it is important to explicitly recognize the trade-offs inherent in different mechanisms. The exhibit below summarizes some of these trade-offs, whereas Chapter 6 provides a more in-depth qualitative comparison.

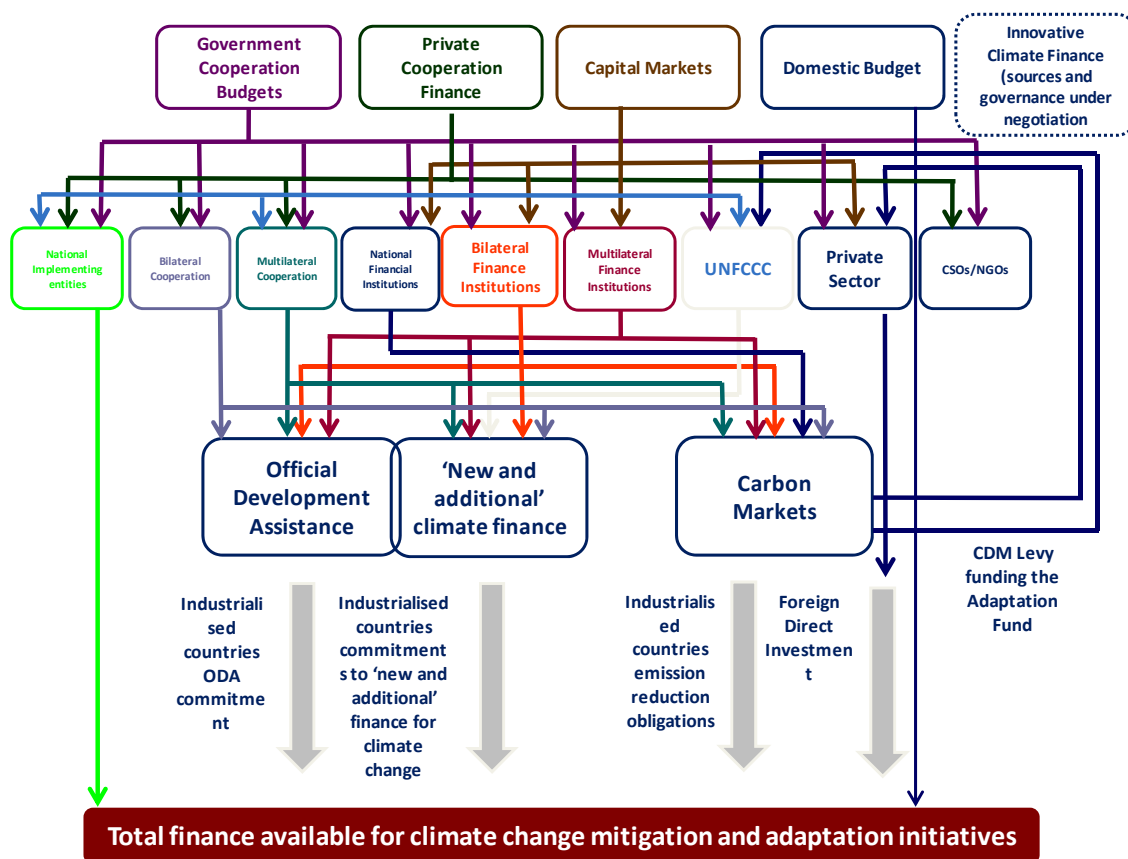
**Exhibit 4.13**

Public Finance Mechanism	Trade-Offs
Political risk guarantees	<ul style="list-style-type: none"> <li>■ The better credit rating of the issuing country/institution is leveraged with no direct costs.</li> <li>■ In doing so, however, the issuing entity is taking on the exposure to the host country's political risk.</li> <li>■ Some issuing entities (e.g. the German government) develop separate agreements with host governments to seek reimbursement in the case that a claim is made on the political risk insurance. In such cases, the risk exposure for the supporting entity is therefore reduced.</li> </ul>
Counterparty risk guarantees	<ul style="list-style-type: none"> <li>■ The counterparty risk guarantee, which would typically be issued by the host country, leverages the credit of the host government with no direct costs.</li> <li>■ The host country government then assumes the risk that the counterparty (e.g. the utility) will pay its contracts.</li> <li>■ The risk exposure for the supporting country is limited to the budget risk of the host country.</li> </ul>
Public investments	<ul style="list-style-type: none"> <li>■ Public sector investments create the prospect of future returns, and there is the potential to subsidize renewable energy projects in the form of below-market return expectations.</li> <li>■ Such investments involve equity risk taking, which carries potentially substantial sector- and country-specific concentration risks.</li> </ul>
Concessional financing	<ul style="list-style-type: none"> <li>■ No direct costs if concessional financing is granted at the lender's refinancing costs.</li> <li>■ There is exposure to individual project risk, and the availability of substantial financing volume may be constrained by substantial country- or sector-specific concentration risk.</li> </ul>
Investment grant	<ul style="list-style-type: none"> <li>■ The cash grant can provide an IRR comparable to that of FITs at a lower NPV.</li> <li>■ The cash grant represents a one-time expenditure, rather than a longer-term, performance-based payment.</li> </ul>

## 5. Sources of Public Funds

Public funds will play an important part in enabling the scale-up of renewable energy in GET FiT schemes, in making renewable energy business models economically viable and in partnering with private sector actors to mitigate key risks. In the green paper on GET FiT published in April, the potential role of different entities in sharing key risks was outlined. This chapter seeks to expand that initial analysis.

**Exhibit 5.1: Public funds landscape**



Source: Adapted by Y. Glemarec from SEI 2009

Use of a range of instruments will be necessary to unlock financing for renewable energy projects in developing regions. These instruments include: risk guarantees, concessional financing, public co-investment, up-front investment grants, performance-based payments, and technical assistance. A number of sources exist to finance the use of these instruments: multilateral funds, bilateral funds and government support, in-country fiscal support, public-private funds, green bonds, and funds that could be generated from reformed and scaled up carbon offset markets.

The sources of funds, their uses (including donor appetite to allocate funds to those uses), advantages and constraints are outlined in Exhibit 1.

## 5. Sources of Public Funds

**Exhibit 5.2: Sources of funds, uses, advantages and constraints**

Source	Use	Advantages	Feasibility and constraints
Multilateral funds	<ul style="list-style-type: none"> <li>■ Grants for FiT premia (moderate appetite)</li> <li>■ Project finance grant (moderate appetite)</li> <li>■ Concessional financing (high appetite)</li> <li>■ Risk guarantees (high appetite)</li> <li>■ Public co-investment (moderate appetite)</li> <li>■ Technical assistance (high appetite)</li> </ul>	<ul style="list-style-type: none"> <li>■ Offers substantial leverage</li> <li>■ Builds on significant MDB experience</li> </ul>	<ul style="list-style-type: none"> <li>■ Requires allocation of additional funding from national budgets, increased headroom at MDBs, or reallocation of existing funds</li> <li>■ Administrative rules may need to evolve to allow funds to flow</li> <li>■ Tenor may be limited</li> <li>■ Concentration risk will limit exposure to any one country</li> </ul>
Bilateral funds and government support schemes	<ul style="list-style-type: none"> <li>■ Grants for FiT premia (moderate appetite)</li> <li>■ Project finance grant (moderate appetite)</li> <li>■ Concessional financing (moderate appetite)</li> <li>■ Risk guarantees (high appetite)</li> <li>■ Public co-investment (moderate appetite)</li> <li>■ Technical assistance (moderate appetite)</li> </ul>	<ul style="list-style-type: none"> <li>■ Allows for rapid implementation within a simplified political structure</li> <li>■ Builds on existing institutional experience and capacity</li> </ul>	<ul style="list-style-type: none"> <li>■ Requires allocation of additional funding from national budgets</li> <li>■ Administrative rules may need to evolve to allow funds to flow</li> <li>■ Tenor may be limited due to budget forecasting horizon, although some countries may be able to work around this by budgeting the entire FiT premia in a single year up-front</li> <li>■ Concentration risk will limit exposure to any one country or technology – especially frontier markets and emerging technologies</li> </ul>
In-country fiscal support	<ul style="list-style-type: none"> <li>■ Grants for FiT premia (low appetite)</li> <li>■ Project finance grant (moderate appetite)</li> <li>■ Public co-investment (high appetite)</li> <li>■ Risk guarantees (moderate appetite)</li> </ul>	<ul style="list-style-type: none"> <li>■ Builds buy-in from the host country</li> <li>■ Allows for relatively rapid implementation</li> </ul>	<ul style="list-style-type: none"> <li>■ Political acceptability will vary by geography</li> <li>■ Tenor may be limited due to budget forecasting horizon</li> <li>■ Administrative rules may need to evolve to allow funds to flow</li> </ul>
Public-private funds	<ul style="list-style-type: none"> <li>■ Grants for FiT premia (low appetite)</li> <li>■ Project finance grant (low appetite)</li> <li>■ Concessional financing</li> </ul>	<ul style="list-style-type: none"> <li>■ Can offer substantial leverage</li> <li>■ Can combine the capacity of the MDBs with the commercial discipline of</li> </ul>	<ul style="list-style-type: none"> <li>■ Requires increased public-private partnership and trust</li> <li>■ Concentration risk may limit exposure to any one country</li> </ul>

## 5. Sources of Public Funds

	(moderate appetite) ■ Risk guarantees (low appetite) ■ Public co-investment (high appetite) ■ Technical assistance (moderate appetite)	the private sector ■ Builds on experience	
Green bonds	■ Concessional financing (moderate appetite)	■ Promotes access to capital markets, facilitating debt finance	■ Cannot fund grant-based components ■ Requires guarantees/credit upgrades from AAA-rated entity
CDM reform	■ Grants for FiT premia (low appetite) ■ Concessional financing (moderate appetite) ■ Risk guarantees (low appetite) ■ Technical assistance (low appetite)	■ Links financing to carbon pricing	■ Will make up a small component of the overall project finance requirement ■ Current uncertainty over future regime limits effectiveness of funding source

The use of public funds to leverage private investment will impact the following components of the financing package:

- The **debt / equity split** of the financing package – in some developing markets, debt has historically accounted for 70% or more of the project financing. This has been possible because of the certainty of cash flows backed by feed-in tariffs, and the credit-worthiness of the sovereign counterparties. As the certainty of payment increases through implementation of GET FiT schemes, the amount of debt that a project can access should increase.
- **Return expectations for equity and debt** – return expectations for equity and quasi-equity products such as mezzanine financing are typically higher than those for debt, because equity and mezzanine financing are less senior in the capital structure and therefore riskier. Return expectations are also significantly higher for projects in riskier frontier markets than for those in middle-income countries due to a number of risk factors, but GET FiT schemes, through a combination of incentives, financial de-risking instruments, and coordinated technical assistance may be able to address some of these risks and lower return expectations.
- The **tenor – or the term length – of the debt**. Longer debt tenor allows NPV-positive projects with a longer payback period to become viable. The tenor will depend on the long-term certainty of revenue streams, which can be increased through GET FiT schemes.
- The **risk insurance** products required to secure financing. In contexts with significant political risk – which could lead, for example, to the withdrawal of public funding – these are often necessary to access financing. GET FiT schemes may be able to fund some of these risk insurance products.

There are a number of outstanding issues that require further discussion. We look for feedback on these and other issues:

- What **concentration risk** constraints face different sources of funding and financing mechanisms, – both with respect to geography, sector, and technology? How will such risks be managed?
- What role does **technology cost and technology risk** play in determining the type of technology funded and the financial instrument used?



## 5. Sources of Public Funds

- What are the **constraints on tenor** for different sources of funds? What budgetary rules do governments and multilaterals face in this area? What tenors are used for different types of financing mechanisms, such as grants, loans, or premium payments?
- What **administrative issues** could stand in the way of using particular sources of funding for specific instruments?
- Can **expensive technologies** like solar be financed principally through feed-in tariffs in GET FIT schemes, or are there other structures that might be more appropriate (e.g. lighthouse PPAs)?
- Are **individual country deals** preferable to global deals/using multilateral funds?
- What type of political risk guarantee should be used to manage risk and in what circumstances would they be applied?
- What is the optimal number of donors and implementing agencies needed to leverage different capabilities and avoid transaction costs that would become a burden or hinderance?
- Are there any other innovative financing mechanisms worth considering in regards to the above?

The rest of this chapter will outline the different types of funding available, some (but not all) existing examples, their characteristics, the constraints they face, and the implications for the five factors outlined above.

### i. Multilateral funds

The World Bank Group, the regional development banks, UN agencies, and other multi-donor institutions such as the European Investment Bank (EIB) have substantial experience managing climate change funds, aggregating technical assistance, and putting in place measures to strengthen the capabilities of private-sector financial institutions. Funds from these sources can be used to finance grants for FiT premia, construction grants, concessional financing, risk guarantees, and technical assistance. These funds often achieve significant leverage of private investment.

#### a. Existing multi-donor trust funds

A number of multi-donor trust funds have been established that pool resources, offer predictable streams of funding, and coordinate the delivery of technical assistance. Key examples include:

- The **Climate Investment Funds (CIFs)**, which are managed by the World Bank. There are two trust funds within the CIFs, which are: (1) the Clean Technology Fund (CTF) for low-carbon technologies, and (2) the Strategic Climate Fund (SCF). The SCF includes three sub-funds: (1) The Pilot Program for Climate Resilience (PPCR), which targets adaptation, (2) Scaling-Up Renewable Energy Program for Low Income Countries (SREP), and (3) the Forest Investment Program (FIP), which raises funds to reduce emissions from deforestation and forest degradation. As of mid-2010, there were 13 plans in place around the world to use CTF funding, with \$4.3 billion allocated to projects ranging from solar power to public transport. It is estimated that these funds will leverage \$36 billion from other sources, bringing the total mobilized to \$40 billion.
- **The Global Energy Efficiency and Renewable Energy Fund (GEEREF)**, which is managed by the European Investment Bank (EIB). GEEREF is a public private partnership drawn from the Patient Capital Initiative, and provides global risk capital through private investments for energy efficiency and renewable energy projects in developing countries and economies in transition. The target funding size for GEEREF is €200-250 million, and as of September 2009, GEEREF had secured €108 million.
- **Forest Carbon Partnership Facility**, which assists developing countries to reduce deforestation and forest degradation and is managed by the World Bank. Fourteen financial contributors have committed about \$165 million, which is divided between a Readiness Fund and a Carbon Fund.
- **The Congo Basin Forest Fund**, which is managed by the African Development Bank. The fund will provide money through open, competitive bidding rounds from eligible partners from the Congo Basin region, including

## 5. Sources of Public Funds

governments, civil society, and the private sector. The fund is initially being financed by a grant of £100 million from the UK and Norway.

- **The Global Climate Change Alliance**, which is an EU fund of approximately €140 million that seeks to: provide a platform for dialogue that will help countries to integrate development strategies and climate change; help countries participate in global climate change mitigation activities that contribute to poverty reduction; and provide technical and financial support around climate change adaptation, reducing emissions from deforestation, enhancing the participation of poor countries in the Clean Development Mechanism, promoting disaster risk reduction, and integrating climate change into poverty reduction efforts.

### b. Existing United Nations funds

A number of United Nations agencies also have significant experience raising, disbursing, and managing climate change funds. These include:

- **The Kyoto Protocol Adaptation Fund**, which is financed by a 2% levy on CER issuance and is managed by the Adaptation Fund board. The fund will support adaptation activities, improving the monitoring of diseases and vectors affected by climate change, supporting capacity building, and strengthening rapid response to extreme weather events. As of July 31, 2010, nearly \$170 million had been deposited into the fund, primarily through CER sales and donations from a number of countries.
- **The Global Environment Facility Trust Fund (GEF)**, which operates in partnership with 10 entities (UNDP, UNEP, the World Bank, the FAO, UNIDO, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, and the International Fund for Agricultural Development) to fund projects that improve the global environment. There are a number of funds that operate under the GEF, including the Strategic Priority on Adaptation (SPA), the Least Developed Countries Fund (LDCF), and the Special Climate Change Fund. Since 1991, the GEF has provided over \$8 billion in grants, leveraging over \$38 billion in co-financing for projects in more than 165 countries. In 2010, the fifth replenishment of the GEF was agreed at \$4.25 billion.
- **The MDG Achievement Fund Environment and Climate Change Thematic Window**, which is an inter-agency UN resource that helps reduce poverty and vulnerability in eligible countries by supporting interventions to improve environmental management and service delivery, promote access to new financing mechanisms, and enhance the capacity to adapt to climate change. The fund is financed by Spain, which initially pledged €528 million with \$89.5 million allocated to the Environment and Climate Change Thematic Window. In November, 2009, Spain pledged an additional €400 million, but has not specified how much of this will be allocated to the Environment and Climate Change Thematic Window.
- **The United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD)** is a collaboration between UNDP, UNEP, and FAO. As of September, 2010, \$106.5 million has been pledged to the fund, which will assist developing countries as they prepare and implement national REDD strategies and support the development of normative solutions and standardized approaches for reducing emissions from deforestation and forest degradation.

A number of constraints exist that need to be addressed in order to scale up multilateral funds. To begin with, while multilateral financial institutions effectively leverage pools of public funds to mobilize much broader flows of public capital, they are not a source of public finance in and of themselves. To increase the size of these funds, public money needs to be allocated from national budgets to multilateral funds or headroom limits at international financial institutions need to be increased.

## 5. Sources of Public Funds

In most cases, money is also allocated to multilateral funds on the condition that it is used for a specific purpose. Fund trustees and the shareholders of the international financial institutions would need to consciously allocate additional funding to facilities that could support feed-in tariff programs in order to promote scale-up.

The scale of grant-based funding is also limited by constraints imposed by donors – who, in many cases, seek repayment of IBRD-style financing.

These three considerations mean that the use of multilateral funds to finance GET FiT schemes will depend on deliberate action on the part of the shareholders of international financial institutions. Shareholders will also need to consider key additional constraints around concentration risk and tenor – which can limit the use of multilateral funds for GET FiT schemes.

### ii. Bilateral funds and government support schemes

A number of countries have created their own bilateral funds to finance climate action. These funds can be used to finance grants for FiT premia, construction grants, concessional financing, risk guarantees, and technical assistance. Bilateral funds can allow for rapid implementation with a simplified political structure. Key existing examples include:

- **The Environmental Transformation Fund International Window**, which is an initiative of the UK government that focuses on poverty reduction, environmental protection, and helping developing countries to address climate change. The UK pledged £800 million to the fund in the 2007 budget, and £100 million was deposited in 2008/09, £200 million in 2009/10, and £190 million in 2010/11.
- **The Fundo Amazônia**, which is managed by BNDES, the Brazilian Development Bank. \$1 billion has been pledged to the fund by the Norwegian government for the period 2009-15, and as of September, 2010, \$110 million had been deposited. The fund will support: the management of public forests; environmental control, monitoring and inspection; sustainable forest management; economic activities created with sustainable forestry; ecological and economic zoning, territorial arrangement and agricultural regulation; preservation of biodiversity; and recovery of deforested areas. Eight projects have been approved as of September, 2010.
- **The Hatoyama Initiative**, a Japanese fund with a total pledged size of \$15 billion (which includes \$4 billion of private money for loans and \$10 billion previously pledged through the Cool Earth Partnership). The fund aims to provide assistance on technology transfer and leverage for the establishment of a fair and effective international climate change framework. To date, over \$5 billion has been disbursed, principally to mitigation projects.
- **The International Climate Initiative (ICI)** is a German fund that has distributed €194 million for 181 projects in the fields of sustainable energy supply, reduced emissions from deforestation and forest degradation, and adaptation. The ICI mobilises funds from compliance buyers under the EU-ETS by earmarking approximately 30% of the revenues from emission permit auctioning for the ICI.
- **The International Forest Carbon Initiative** is a program financed by the Australian government. It aims to increase international forest carbon monitoring and accounting capacity, undertake practical demonstration activities to show how reducing emissions from deforestation can be included in a future international climate change framework, and support international efforts to develop market-based approaches to address deforestation. AUD 273 million (about \$250 million) has been pledged for the initiative from 2007-12, of which about 60% will be allocated to AusAID.

Much of the funding currently available through these funds has already been allocated to specific purposes, making their use for GET FiT schemes difficult. The creation of further bilateral funds will depend on budget allocations from developed countries. Under Fast Start Finance, \$30 billion has been agreed for the period 2010-12 – and some of this may be able to be used in the near-term to fund GET FiT country cases. In the longer term, the UN High Level Advisory Group on Climate Change Financing notes that it is “challenging but feasible to reach the goal of mobilizing \$100 billion

## 5. Sources of Public Funds

annually for climate actions in developing countries by 2020,” but the political commitment necessary to scale up financing to the required level is yet to be reached.

Given the longer-term uncertainty about climate finance and the constrained budgets in developed countries, it will currently be challenging – but possible – to structure large bilateral payments to support GET FiT schemes. However, the tenor of these payments will be limited by the budget forecasting cycle, and the amount of money that can be used for any one country program will be limited by rules on administration and concentration risk.

### iii. In-country fiscal support

Many governments provide funding to companies in their own countries. Such fiscal support ranges from consumer subsidies and tax breaks to loan guarantees and other risk mitigators.

Green stimulus support has been particularly strong over recent years, with approximately \$500 billion dedicated to green measures around the world. Government budgets in the developed world are under significant pressure, but in many developing countries, there remains scope for the smart use of limited pools of public money to unleash further investment.

One source for such support could be the redirection of fossil fuel subsidies. According to the International Energy Agency, in 2009 G20 nations spent approximately \$312 billion on fossil fuel subsidies. These range from tax concessions for offshore drilling upstream to artificially low consumer prices for gasoline, fuel oil, and kerosene. This compares to \$57 billion in support for renewable energy. Redirecting some of the \$312 billion spent on fossil fuel subsidies – while politically difficult – could lead to a material change in the level of support for renewables, while ensuring that price signals more adequately take account of environmental and innovation externalities.

The constraints on in-country fiscal support and their implications on financing will be largely the same as those around bilateral funds, but will also pertain to political acceptability in light of the principle of common but differentiated responsibilities enshrined in the United Nations Framework Convention on Climate Change.

### iv. Existing public-private funds (including carbon funds)

In addition to multi-lateral and bi-lateral funds, a number of public-private funds exist that provide useful experience for financing GET FiT schemes. Many of these funds include a core carbon component that generates revenues based on offset credits from the CDM or JI. These funds include:

- **The Bio-Carbon Fund** is a program that is administered by the World Bank to fund demonstration projects that sequester or conserve carbon in forest and agro-ecosystems. The fund is comprised of two tranches: Tranche one started operations in May, 2004, and has a total capital of \$53.8 million; tranche two was launched in March, 2007, and has a total capital of \$36.6 million. Both tranches are now closed to new fund participation.
- **The Carbon Fund for Europe (CFE)**, which was launched in 2007 with a capital of €40 million and is co-directed by the EIB and World Bank. The CFE purchases greenhouse gas emission reduction credits for projects eligible under the CDM and Joint Implementation (JI) to facilitate the participation of compliance buyers. The fund can also invest up to 20% of its own capital in green investment schemes.
- **The Carbon Partnership Facility** is being designed to develop emission reductions and support their purchase in the post-2012 period. Its objective and business model are based on the need to prepare large-scale, potentially risky investments with long lead times that require durable partnerships between buyers and sellers.

## 5. Sources of Public Funds

- **The Community Development Carbon Fund** provides carbon finance to projects in poorer parts of developing regions. The first tranche of the fund is capitalized at \$128.6, with nine governments and 16 corporations or other organizations participating. The fund is managed by the World Bank.
- **The Danish Carbon Fund (DCF)** was established in January, 2005, with an initial capitalization of €26.4 million, which has subsequently increased to €90 million. The Danish Ministry of Climate and Energy, DONG Energy A/S, Aalborg Portland A.S., Maersk Olie og Gas A.S., and Nordjysk Elhandel A/S are participants in the fund.
- **The Italian Carbon Fund** was established by an agreement between the World Bank and the Ministry for the Environment and Territory of Italy to purchase greenhouse gas emission reductions from CDM and JI projects in developing countries. The fund is open to participation from Italian private and public sector entities and has a total capital of \$155.6 million.
- **The Netherlands CDM Facility** was established through agreement between the Netherlands and the World Bank to purchase greenhouse gas reduction credits generated through the CDM.
- **The Netherlands European Carbon Facility** was established by an agreement between the Netherlands Ministry of Economic Affairs, the World Bank, and the International Finance Corporation. The facility purchases emission reductions from JI projects exclusively.
- **The Prototype Carbon Fund (PCF)**, which is a partnership between 17 companies and six governments, managed by the World Bank. The PCF became operational in 2000, and was the first such fund. It has a total capital of \$180 million.
- **The Spanish Carbon Fund**, which was created in 2004 in agreement between the Ministries of Environment and Economy of Spain and the World Bank. The fund was established to purchase credits from CDM and JI projects, and has a total capital of \$278.6 million.
- **The Umbrella Carbon Facility** was created to manage large volumes of emission reductions for different groups in multiple tranches. The fund has managed the issuances of many of the HFC-23 projects.

Public -private funds that rely on carbon pricing to mobilize flows of investment are not likely to be particularly successful in mobilizing substantial financing for GET FIT schemes, as carbon typically accounts for a small part of the revenue streams for renewable energy projects. More innovative funding structures, including the Global Climate Partnership Fund that the German Environment Ministry has established in cooperation with KfW and the IFC, offer more promise. Together, the German government and KfW have pledged more than \$100 million of funds, which will take first-loss and mezzanine positions. These pledges are meant to leverage about \$400 million of private investment. (N.B. Deutsche Bank has been selected as the manager for this fund.) Fund structures like this one could serve as models for blending public grant-based funding with private investment, unlocking significant potential. Although they often face constraints around administration and concentration risk, they do offer the potential for the longer tenors required to finance FiTs.

### v. Green bonds

To access the debt markets and tap the potential of institutional investors, it is often useful to structure a bond. Debt guarantees and other credit-upgrading instruments can be applied to the bonds to make them more attractive for investors. Some key examples of green bonds include:

- Since the inaugural issue in 2008, the World Bank has issued over \$1.5 billion of green bonds through 22 transactions in 15 currencies. The World Bank Green Bond raises funds from fixed income investors to support World Bank lending for eligible projects that seek to mitigate climate change or support adaptation measures. Eligible projects include solar and wind installations, energy efficiency, reforestation, watershed management, food security improvements, and sustainable forest management. For investors, World Bank Green Bonds offer the opportunity to invest in climate change projects through AAA-rated fixed income products. The credit quality of the bonds is the same as for any other World Bank bonds – repayment is not linked to the credit performance of the projects, and investors do not assume specific project risk.

## 5. Sources of Public Funds

- More recently, the IFC has begun to issue green bonds, with its first released in April, 2010. \$200 million has been issued to create a separate green account for investing exclusively in renewable energy, energy efficiency, and other climate-friendly projects in developing countries.
- The EIB's Climate Awareness Bond offers investors a financial instrument that combines: dedicated use of funds in climate-related sectors; participation in the performance of an equity index that emphasizes environmental responsibility; the ability for investors to reduce their own greenhouse gas emissions; and simultaneous public offering across the 27 EU member states.

Based on the experience of the multilateral financial institutions in issuing green bonds, these present much promise for the funding of GET FIT schemes while taking many of the investment risks off the table.

The grant funding component of GET FIT would, however, need to come from other sources – green bonds will need to be backed by public money to fund any concessionary financing. Allocating this public funding will be vital to unlock financing.

### vi. Potential future sources related to CDM reform

To date, the revenue stream from carbon finance has been unreliable and accounts for a fairly small portion of the revenue streams associated with many renewable energy projects, limiting the use of this source of funding. The value of project based transactions through the CDM totaled \$2.7 billion in 2009. However, significant uncertainty around the post-2012 framework and disruptions arising from concerns about credits originating from HFC-23 projects have contributed to a more than 50% drop in the value of project based transactions when compared to 2008. This constrains the ability to rely on this funding for any financing structure requiring significant tenor.

A number of issues have constrained the scale and the geographical representation of CDM projects to date, including:

- **High operating and capital costs** for projects in less developed countries and a lack of expertise on the part of financial institutions and administrative entities;
- **High transaction costs**, especially for small-scale projects in less developed countries, where low per capita emissions drive up the marginal costs of greenhouse gas abatement;
- **Capacity bottlenecks** and inefficiencies in the regulatory system – it currently takes an average of 3 years to work through the system to the actual issuance of CERs; and
- **CERs are issued ex-post** and are unable to contribute the often significant upfront capital costs and add **registration risk, issuance and carbon price risk** from fluctuating CERs prices.

The working documents released by the UN High Level Advisory Group on Climate Change Financing note that “it is essential to increase the efficiency and effectiveness of carbon offset generation to scale up offset markets to meet future demand.”

There are a number of potential approaches to reforming the CDM, including both project-based approaches and aggregated approaches.

Project-based approaches include simply improving the efficiency of the administrative and governance processes of the current CDM, expanding coverage to new sectors and technologies, adopting a programmatic approach to the CDM, or positive lists where entire project categories on a positive list would be assumed to be additional.

Aggregated approaches include sectoral crediting, sectoral CDM, and sectoral no-lose targets; sectoral trading; and crediting of Nationally Appropriate Mitigation Actions (NAMAs). These approaches share the basic premise that emission-

## 5. Sources of Public Funds

---

reducing activities in developing countries should be defined and measured at a level and a scale well above the project or even programmatic level, and that success in achieving emission reductions at that level should be rewarded by the provision of units with a value in emission reduction compliance schemes elsewhere in the world.

Given the current state of the debate around the CDM – in particular the degree of uncertainty generated by discussions of qualitative restrictions that would be imposed retroactively on investments undertaken – it looks unlikely that in the near term, CDM reform will effectively address the above concerns and become a significant and reliable component of the financing package for GET FiT schemes.



## 6. Possible PPP for Deployment

Following the quantitative analysis of the impact of various public financing mechanisms in chapter 4 and the overview of potential funding sources in chapter 5, this chapter presents a set of strategies to combine different PFMs and incentives in ways that could balance efficient regulatory support, the potential for realistic implementation, and funding constraints. A key open question is whether any single mechanism could optimally provide the support envisioned under GET FiT, or whether it will be necessary to create hybrid approaches.

It should be stressed that the scenarios discussed in this chapter are preliminary and that there are several other open questions that will need to be addressed in other research efforts, including:

- International fund availability and constraints. Chapter 5 began the discussion about the types of international public sector resources that are available, but more research needs to be done as to the volumes of available funding resources and their constraints. The outcome of this research will directly inform and impact the discussions contained within this chapter.
- Burden sharing. This chapter includes a broad theoretical discussion of different combinations of PFMs under different scenarios. From a practical standpoint, however, we acknowledge that appropriately customized approaches will need to be developed for each country. This further raises the question of burden sharing. As discussed in the first GET FiT report (pp. 26-27), we do not assume that developing regions would bear the full burden for bridging the gap between the LCOE of renewable electricity and that of conventional resources. In each case, it is assumed that national ratepayers or taxpayers would pay at least the avoided cost rate for renewable generation. The question of how much (if any) of the premium required above avoided cost would be borne by international donors and how much would be borne by the host country would most likely need to be determined and negotiated on a case-by-case basis.
- Currency risk. Another open question relates to considerations of currency risk. As discussed in the first GET FiT report (pp. 35-38), currency risks can be difficult to hedge in developing regions. In developing the interventions envisioned by GET FiT, it will be important to keep in mind the role that currency risk will play. The interaction between currency risk and GET FiT support will vary depending on wide range of factors, e.g. whether national incentives and international support (i.e. performance-based incentives, grants, etc.) are denominated in hard or local currency. Although we do not treat currency risk in detail in this chapter, we acknowledge that it is a topic that will require more research.

As a first step in this preliminary discussion of how best to deploy PFMs, a qualitative analysis of different potential PFMs from the perspective of different stakeholders is conducted below. This is followed by an initial quantitative evaluation of different hybrid scenarios.

### Qualitative analysis of public financing mechanisms

Building on the quantitative analysis in chapter 4, we acknowledge that there are also qualitative considerations which may influence the choice regarding which PFMs to apply in the target markets. The following exhibit summarizes some of the qualitative arguments that may be relevant to the decision making process. For this analysis we take into account the perspective of the developer/financier, the host country and the international partner.



## 6. Possible PPP for Deployment

Exhibit 6.1

	Perspective of the developer/financier	Perspective of the host country	Perspective of the international partner
<b>Political risk guarantees</b>	<ul style="list-style-type: none"> <li>✓ Strong risk mitigation effect</li> </ul>		<ul style="list-style-type: none"> <li>✓ Very powerful and efficient instrument if the political risk perceived by the private sector investor is substantially higher than actual risk assessed by the public sector partner</li> <li>✓ No direct costs</li> <li>✗ Might require the implementation of complex and generally binding investment agreements between the host country and the issuing country/institution</li> <li>Concentration risk</li> </ul>
<b>Counterparty risk guarantees (issued by the host country)</b>	<ul style="list-style-type: none"> <li>✓ Strong risk mitigation effect</li> </ul>	<ul style="list-style-type: none"> <li>✓ The potential for conflict with ongoing electricity sector privatization processes, where applicable</li> <li>✗ Risk taking</li> </ul>	<ul style="list-style-type: none"> <li>✓ No direct costs</li> <li>✓ Increasing the involvement of the host country and reducing risk taking by the supporting entity; aligning of interest</li> <li>✓ Risk exposure for supporting entity limited to budget risk of host country</li> </ul>
<b>Public First Loss investments</b>	<ul style="list-style-type: none"> <li>✓ Strong risk mitigation effect</li> <li>✓ Reduces the required absolute equity amount</li> <li>✓ Better access to debt financing based on a trustworthy and experienced public co-investor</li> <li>✗ Most likely no general availability for a broad range of projects and therefore limited predictability</li> <li>✗ Most likely not available for projects initiated by the private sector</li> </ul>	<ul style="list-style-type: none"> <li>✓ Potentially very attractive cost-to-impact ratio for host government if no national investment is required (i.e. just international)</li> <li>✗ Complex undertaking if host country should participate in first loss investment jointly with the international sponsor which would, however, be recommendable to align interests</li> </ul>	<ul style="list-style-type: none"> <li>✓ Highly efficient and proven instrument for investments into broad portfolios of small to medium scale projects and to leverage investments initiated by the public sector</li> <li>✓ Amount of first loss investment can be adjusted on project by project basis</li> <li>✗ High risk exposure and the potential to engage in entrepreneurial activity should the project fail and need to be taken over</li> <li>✗ Public sector accepts technology and project risks</li> <li>✗ Resource intense and administratively difficult investment decision making process</li> <li>✗ Potential conflict of interest issues if private sector investor has sole operational management responsibility</li> <li>✗ Limited scalability</li> </ul>

## 6. Possible PPP for Deployment

<b>Public Co-Investments</b>	<ul style="list-style-type: none"> <li>✓ Strong risk mitigation effect</li> <li>✓ Reduces the required equity amount</li> <li>✓ Better access to debt financing based on a trustworthy and experienced public co-investor</li> <li>✓ Strong support in challenging times due to the power of public co-investor and its political network.</li> <li>✗ Most likely no general availability for a broad range of projects and therefore limited predictability</li> </ul>	<ul style="list-style-type: none"> <li>✓ Potentially very attractive cost-to-impact ratio for host government if no national investment is required (i.e. just international)</li> <li>✓ Opportunity for national investment if stakeholding/ voting rights desired</li> <li>✗ Complex undertaking if host country should participate in co-investment jointly with the international sponsor which would, however, be recommendable to align interests</li> </ul>	<ul style="list-style-type: none"> <li>✓ Private sector lead investor remaining in the driver seat, reduced entrepreneurial activity required from the international partner</li> <li>✗ Resource intense and administratively difficult investment decision making process</li> <li>✗ Public sector accepts technology and project risks</li> <li>✗ Limited scalability</li> </ul>
<b>Public mezzanine investments</b>	<ul style="list-style-type: none"> <li>✓ Reduced amount of required debt and better access to debt financing based on a trustworthy and experienced public co-investor</li> <li>✗ Most likely no general availability for a broad range of projects and therefore limited predictability</li> </ul>	<ul style="list-style-type: none"> <li>✓ Potentially very attractive cost-to-impact ratio for host government if no national investment is required</li> <li>✗ Complex undertaking if host country should participate in mezzanine investment jointly with the international sponsor which would, however, be recommendable to align interests</li> </ul>	<ul style="list-style-type: none"> <li>✓ Private sector lead investor remaining in the driver seat, reduced entrepreneurial activity required from the supporting body</li> <li>✓ Potential for attracting private sector debt financing, but not helpful when only public sector debt financing will be used</li> <li>✗ Resource intense and administratively difficult investment decision making process</li> <li>✗ Public sector accepts technology and project risks</li> <li>✗ Limited scalability</li> </ul>
<b>Investment grants</b>	<ul style="list-style-type: none"> <li>✓ Reduced equity and debt exposure</li> <li>✓ No counterparty or regulatory risk</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reduced administrative efforts required (one-time payment vs. regular performance based payments)</li> <li>✓ No involvement of the utility required in the payment processes</li> </ul>	<ul style="list-style-type: none"> <li>✓ Cheaper than FiT subsidies for capex intense technologies in high financing cost environment</li> <li>✗ No incentive for efficient operation of power plants, not a performance-based incentive</li> </ul>

## 6. Possible PPP for Deployment

<p><b>Concessional financing</b></p>	<ul style="list-style-type: none"> <li>✓ Increased availability of debt</li> <li>✗ In case of combination with FiT, dependency on two public financing mechanism rather than one</li> </ul>	<ul style="list-style-type: none"> <li>✗ Reduced involvement of local banking sector</li> </ul>	<ul style="list-style-type: none"> <li>✓ Economically efficient</li> <li>✓ Allows the public sector to play a leadership role in jumpstarting finance for renewable energy technologies.</li> <li>✓ Level of concessional financing can be varied to also allow for commercial banking sector involvement</li> <li>✗ The assumption of individual risk exposure requires due diligence efforts</li> <li>✗ High financing volumes required; exposure to concentration risk/ non-diversified portfolio</li> <li>✗ Potentially not scalable for complete volume of targeted renewable energy scale up</li> <li>✗ Commercial banking sector is marginalized or excluded, which could prevent the development of a track record of lending, and therefore delay the broader entry of private-sector players into renewable energy financing</li> </ul>
--------------------------------------	---	---	---

## 6. Possible PPP for Deployment

### Definition and characterization of the three models: broad FiT environment, lighthouse/PPA environment, access/isolated grids

While the quantitative impact of the various instruments primarily depends on the proximity of technologies to grid parity, we believe that restrictions with regard to the availability of funding primarily result from the required volumes, i.e. volume of targeted installed capacity. We revisit the three policy models envisioned by GET FiT and review the most important drivers and constraints for each in the exhibit below:

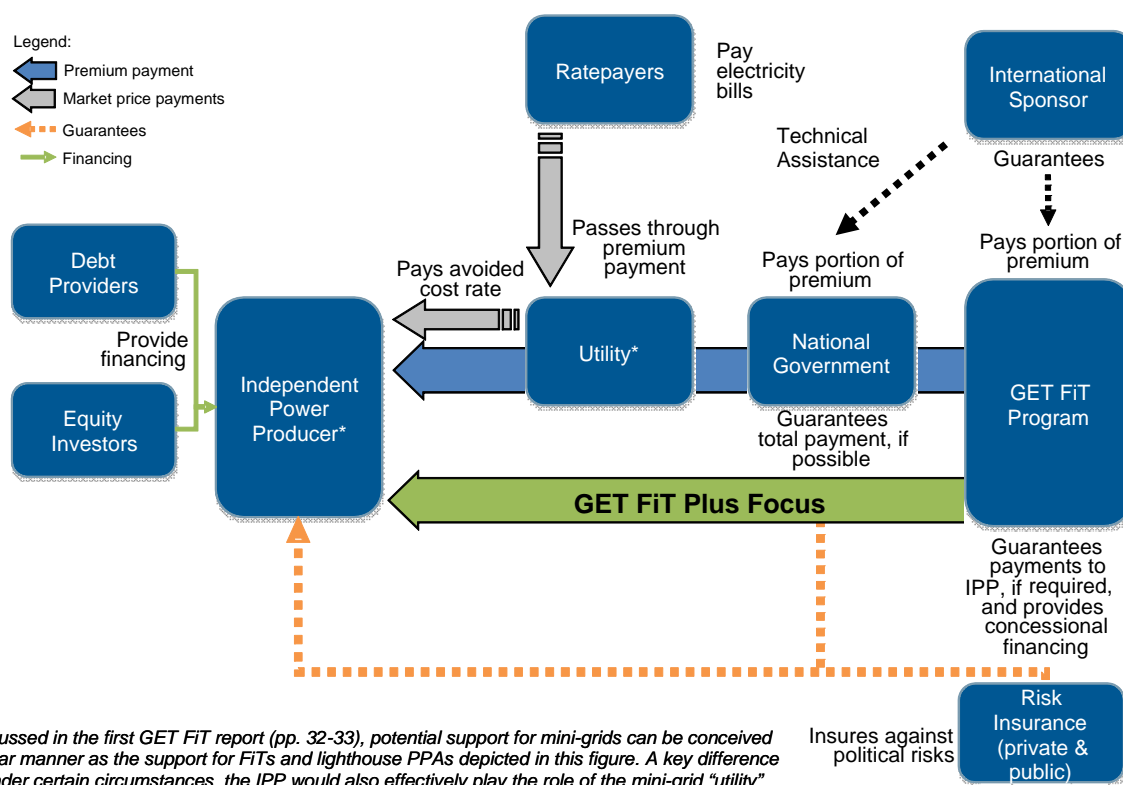
**Exhibit 6.2**

<b>FiT environment</b>	<ul style="list-style-type: none"> <li>■ No major restrictions with regard to the electricity grid</li> <li>■ Rapid scale up of installed capacity targeted with high numbers of projects, GW targets</li> <li>■ Mostly emerging economies with established administrative processes in the electricity sector and a solid financial sector</li> <li>■ Solid industrial activity and domestic resources/activity for project development</li> <li>■ Existing local investor base</li> </ul>
<b>Lighthouse/PPA environment</b>	<ul style="list-style-type: none"> <li>■ Restrictions with regard to the ability of the electricity grid to absorb renewable energy generation capacity</li> <li>■ Very limited technology track record</li> <li>■ Limited number of potential projects</li> <li>■ Project initiated partially by the national government or by international organizations</li> <li>■ Potentially weak utility</li> <li>■ Limited maturity of local financial sector</li> </ul>
<b>Access/isolated grids</b>	<ul style="list-style-type: none"> <li>■ Potential for rural electrification projects in remote areas (access/isolated grid models can occur in combination with both FiT environments and lighthouse/PPA environments)</li> <li>■ Limited scale of individual projects usually does not trigger international private sector investor appetite; local investor appetite might vary substantially</li> <li>■ Disproportionately intense development efforts required to set up solid administrative structure that appropriately reflects the local context and ensures community buy-in; in many cases projects initiated by international development organizations</li> <li>■ Total capacity for projects in the in the low two-digit MW range expected</li> <li>■ Usually high level of subsidization required to allow for prices comparable to a grid-connection scenario</li> </ul>

## 6. Possible PPP for Deployment

In our GET FiT April 2010 report, we set out the basic concept of how we saw the structure of a full FiT model and a lighthouse PPA/mini-grid model. In fact, in terms of payment flows, there was little difference. Below, we reproduce the broader FiT/lighthouse PPA structure.

**Exhibit 6.3**



What we are now looking at is the financing flows in more detail, as indicated by the green arrow.

### Developing potential hybrid scenarios

Taking the qualitative analyses listed above into account, we now turn to an assessment of different potential hybrid scenarios. All of the scenarios listed below assume that a FiT environment would be the end goal of policy development, where possible. Even if the cash premium required under a FiT can be reduced to zero – by technology improvements or the usage of other public financing mechanisms – the implementation of a strong enabling regulatory environment will remain a critical success factor. This regulatory environment will also be required in a grid parity scenario in many markets. As discussed in Chapter 3, risk mitigation through technical assistance aims to achieve this objective by addressing non-financial barriers to renewable energy deploying and by establishing enabling regulatory and policy frameworks with long-term political commitment.

With regard to combining different public financing mechanisms, we believe that non-manageable risks such as political risk or the counterparty risk can be a major hurdle for a positive investment decision from international investors. Higher return expectations might in many cases are not sufficient to attract international investments in the presence of such risk. The availability of political risk guarantees – backed by respective investment agreements with the host country – are therefore an integral component of public financing approaches.

## 6. Possible PPP for Deployment

Depending on the structure of the financial support for the host country (bilateral deal vs. multilateral deal), the issuer of the political risk guarantees might vary. While we could consider the supporting entity issuing the guarantees in a multilateral transaction, the concentration risk might not allow for such a structure in a big bilateral deal. In such cases, political risk guarantee providers besides international donors, e.g. the home country of an international investor, might be the more appropriate counterparties. In addition, host country counterparty risk guarantees for domestic utilities will not only help to attract investments but also to align interest between the supporting entity and the host country. All of the scenarios discussed here assume the availability of both types of guarantees.

As a starting point for further dialogue and research, potential hybrid scenarios for each of the three major policy models envisioned under GET FIT – feed-in tariffs, lighthouse PPAs, and mini-grids – are discussed below. The discussion of hybrid support for feed-in tariffs is accompanied by quantitative analyses that illustrate the combined impact of different PFMs. It should be noted that these analyses assume a base case expected equity IRR of 15% for developing countries, which is a more moderate assumption than the upper extreme value of more than 20% discussed in chapter 4.

Qualitative discussions of hybrid support considerations for lighthouse PPAs and mini-grids then follow the discussion of feed-in tariffs. The illustrative quantitative analyses are not repeated for the other two models, however, but could be revisited in subsequent iterations of this report.

### Potential scenario for the broad FiT model

The focus in countries with a broad FiT environment is likely to be more on financial incentives to make the renewable energy business models economically viable, rather than on the mobilization of capital to finance high upfront investments. Our analysis in chapter 5 highlights a number of open issues which primarily impact the broad FiT model. Two key open questions that would influence an optimal recommendation include:

- the availability of concessional financing in large volumes against the background of risk-taking by the issuing entity (concentration risk), and
- the availability of cash grants a) with long tenors and b) in large volumes for the currently expensive technologies.

In a scenario that would combine FiTs with concessional financing, the economic viability of a project, and consequently the project realization, would depend on access to both instruments. Any procedural or administrative problems with one instrument would consequently cancel the impact of the full package of supporting instruments. It will, therefore, be crucial to avoid long and complicated loan application processes for the concessional financing – this is even more important if the concessional financing is only provided by one specific entity. In particular, the supporting entity must be capable of performing an appropriate project due diligence for a high number of projects as the supporting entity enters into project risks.

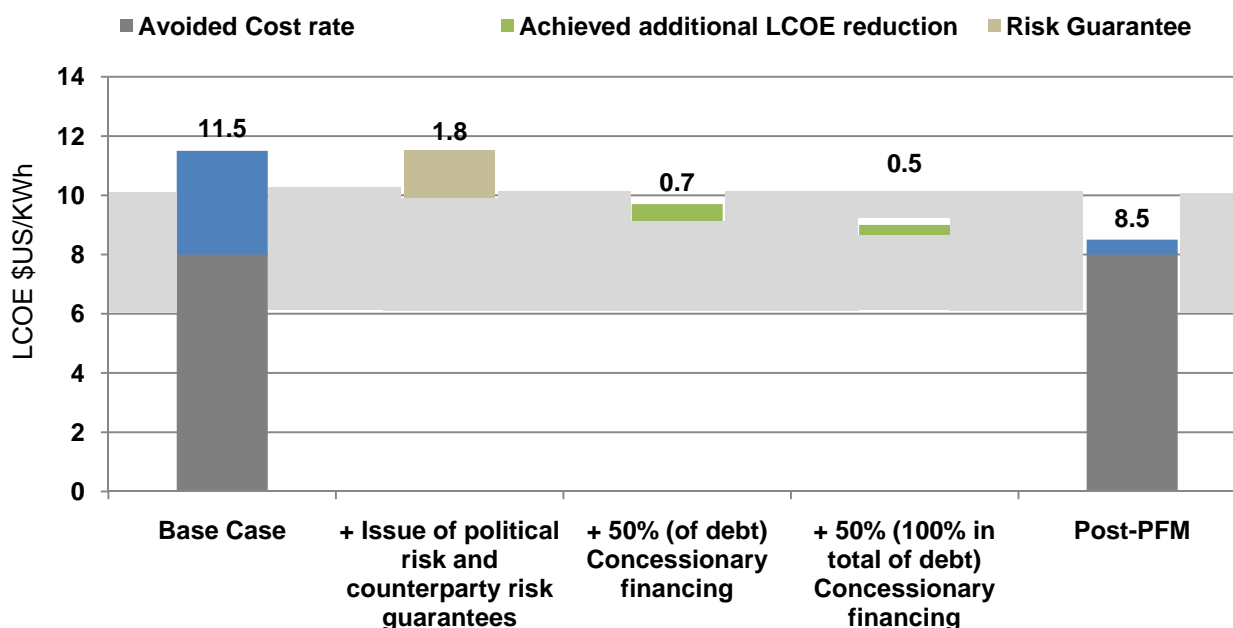
Financial markets in target countries with broad FiT environments are likely to be relatively mature. The local commercial banking sector should therefore not be excluded from financial opportunities. This objective would consequently limit the level of concessional financing to 50% (assuming that such volumes are available from a funding perspective). This would also allow for on-lending structures which could substantially reduce the administrative resource requirements of the supporting entity.

The exhibits below introduce potential hybrid instrument structures. The examples provide quantitative analyses of renewable energy project portfolios of 1 GW each. To keep the analysis simple, the total amount of new installed capacity is considered be installed simultaneously and immediately. Therefore, the positive effects from learning curve effects and resulting reductions in required premium are not considered.

The following chart illustrates potential hybrid scenarios for our wind test case.

## 6. Possible PPP for Deployment

Exhibit 6.4: Illustrative LCOE development wind (will depend on country specific details)



### Required financing for 1 GW of wind capacity

Political risk guarantee volume <sup>(1)</sup>		US\$0.5bn	US\$0.5bn	US\$0.5bn
Concessionary financing volume			US\$0.6bn	US\$1.1bn
Premium to be funded above avoided cost rate <sup>(2)</sup>				
Upper end	US\$0.4bn	US\$0.0bn	US\$0.0bn	None
Lower end	US\$1.6bn	US\$1.1bn	US\$0.9bn	US\$0.7bn

(1) Counterparty risk guarantee volume not shown as maximum exposure not meaningful

(2) LCOE target range of 6 -10 c/kWh, NPV of required FiT premium payments discounted at 6%

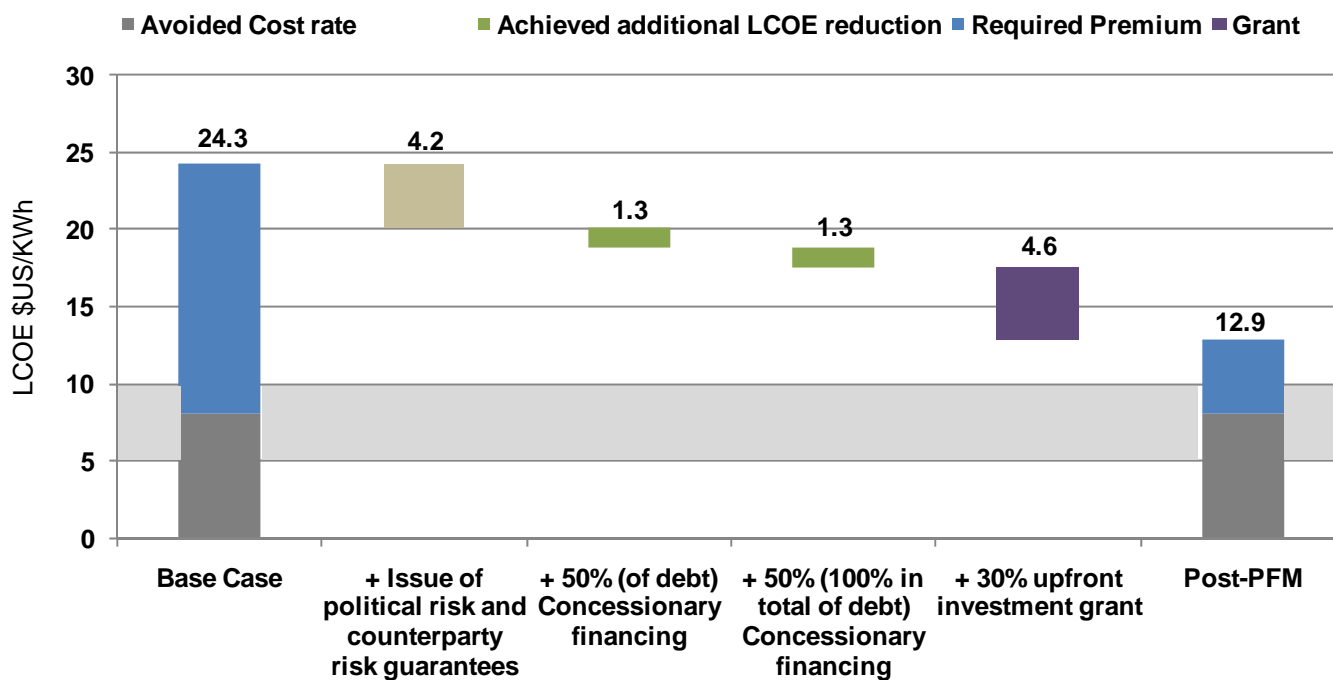
The analysis shows a range of potential hybrid approaches to make wind business model economically viable. Mitigating political and counterparty risk to reduce target equity IRR to 10% (down from 15%) can reduce cash FiT requirements for a 1 GW wind portfolio from US\$1bn to US\$0.5bn (assuming avoided cost rate of 8 c/kWh, mid of our target LCOE range).

Providing additional US\$0.6bn concessional financing will bring the cash FiT requirement down to US\$0.3bn and replacing all project debt with concessional financing (US\$1.1bn) will nearly cancel any cash FiT requirements (US\$0.1bn).

## 6. Possible PPP for Deployment

The following chart illustrates potential hybrid scenarios for our PV test case.

Exhibit 6.5: Illustrative LCOE development Solar PV (will depend on country specific details)



### Required financing for 1 GW of PV capacity

Political risk guarantee volume <sup>(1)</sup>	US\$0.8bn	US\$0.8bn	US\$0.8bn	US\$0.5bn
Concessionary financing volume		US\$0.9bn	US\$1.8bn	US\$1.2bn
Upfront investment grant <sup>(3)</sup>				US\$0.8bn
Premium to be funded above avoided cost rate <sup>(2)</sup>				
Upper end	US\$3.0bn	US\$2.1bn	US\$1.8bn	US\$1.6bn
Lower end	US\$3.8bn	US\$2.9bn	US\$2.6bn	US\$2.4bn

(1) Counterparty risk guarantee volume not shown as maximum exposure not meaningful

(2) LCOE target range of 6 -10 c/kWh, NPV of required FiT premium payments discounted at 6%

(3) Debt/equity split kept stable at 70/30 in upfront investment grant scenario

The analysis for our PV test case demonstrates the stronger reliance on cash grants for technologies with currently very high LCOE. In our base case scenario FiTs with a NPV of US\$3.0 – US\$3.8bn are required to make a 1 GW portfolio economically viable.

- Mitigating political and counterparty risk to reduce target equity IRR to 10% (down from 15%) can reduce cash FiT requirements from US\$35.0bn to US\$2.1bn only (assuming avoided cost rate of 10 c/kWh, upper end of our target LCOE range).



## 6. Possible PPP for Deployment

- Providing additional US\$0.9bn concessional financing will bring the cash FiT requirement down to US\$1.8bn and replacing all project debt with concessional financing (US\$1.8bn) down to US\$1.6bn.
- Upfront investment grants of 30% of the total investment volume – amounting to US\$0.8bn – will bring the required FiTs down to US\$0.6bn.

Comparing the PV figures with the wind test case demonstrates the high dependence of PV on international subsidies.

### Potential scenario for the lighthouse/PPA model

Under the lighthouse PPA model, the host countries have most likely not established a substantial track record with renewable technologies. As a result, access to private sector capital might be constrained by a limited local investor base, and conservative international investors. The focus of any regulatory support would most likely not be only on incentives to make the business models economically viable, but also on the mobilization of financing of the upfront investments. The public sector in this case needs to play a leadership role in addressing both financing challenges.

Taking into account that most of the projects will be initiated or funded by host country governments or by international development organizations (or will at least benefit from their support during the development phase) we believe that public co-investments will be powerful instruments not only to reduce equity return expectations but also to secure access to a sufficient amount of equity.

In addition, we believe that the disadvantages of concessional financing (exclusion of local banking sector and administrative resource requirements) are less weighty in the lighthouse/PPA model. We therefore assume concessional financing to reduce the need for international performance-based incentives as much as possible.

Given the rather limited number of projects and consequently limited funding requirements, we believe that funding sources to finance the described hybrid structures will be available to a sufficient extent. It will, however, be crucial to ensure that also private sector initiated projects have a fair chance to benefit from supporting instruments other than FiTs.

### Potential scenario for the access/isolated grid model

Rural electrification projects are often hindered by the high LCOE which, although the LCOE is in many cases close to conventional alternatives (e.g. small diesel generators). Given the social as well as economic objectives of energy access programs, we continue to recommend<sup>19</sup> incentives which would allow for electricity prices from mini-grids to be set comparable to central grid prices.

Taking into account the wide gap between mini-grids and the target LCOE, we believe that a hybrid approach would consist of:

- Upfront investment grants of up to 50% of the initial investment costs. The remaining equity share appears to be sufficiently large to incentivize the equity investors to ensure proper operation and maintenance. Alternatively, the equivalent of the upfront investment grant could be covered by concessional financing initially and converted into a grant after 5 years of appropriate operation.
- Up to 100% concessional financing. The availability of commercial lending to mini-grids is expected to be limited. Ideally, a local commercial bank could be encouraged for on-lending based on concessional refinancing through the supporting entity.
- Remainder to be paid as performance based grant to fund the premium.

---

<sup>19</sup> This topic was also discussed in the first GET FiT report

## 6. Possible PPP for Deployment

---

Given the small absolute financing volume, we believe that funding sources will be available to finance the required instruments as shown above. Also, the assumed lifetime of rural electrification projects of 10 years will partially address the constraint of cash grant funding tenors.

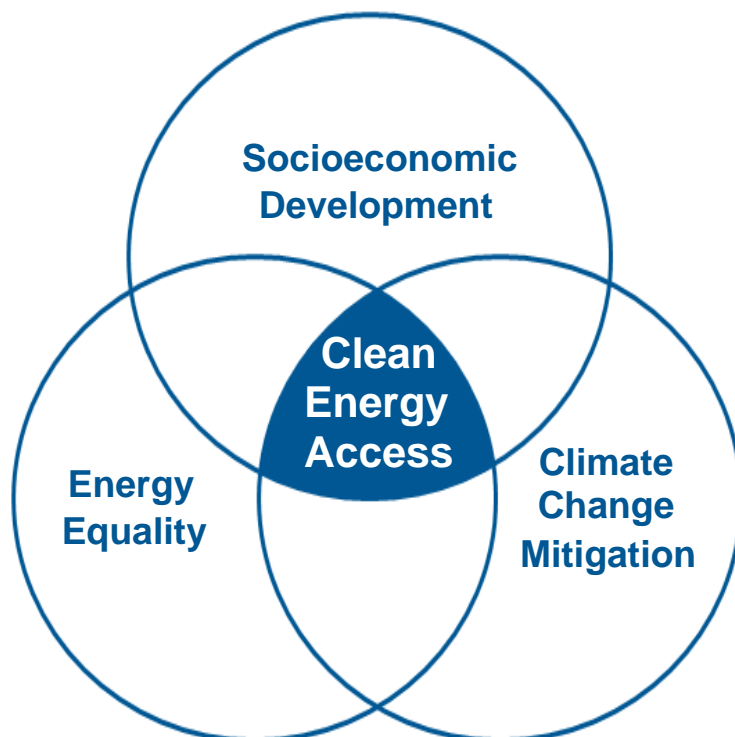
In order to facilitate and encourage private sector development activity, we believe that a standard and transparent regulatory environment should be established, rather than incentives for selected projects only.

## 7. The Benefits of Clean Energy Access and Scale-Up

### Socioeconomic development, energy equality and climate change mitigation

The three dimensions of sustainable development: economic, social and environmental, are directly tied to modern energy access, especially that provided by sustainable energy sources.

**Exhibit 7.1: The three dimensions of sustainable development**



Recognizing the need to address human health, climate change, and socioeconomic development, it is imperative that developing regions secure universal energy access and scale up that is reliable, sustainable, and long-lasting.<sup>20</sup> To date, economic and market barriers - in particular a lack of an appropriate policy and finance mix that matches local market conditions - have been identified by developing countries as the biggest obstacles to renewable energy (RE) technology transfer and scale up. With little or no access to energy services for cooking, heating, lighting and communications, these regions face energy poverty more than any other. Effective rural and peripheral urban electrification programs shine a light on these fragmented regions, and foster socioeconomic development that carries with it numerous environmental benefits. Aware that there is no “one solution fits all” technological option, regulatory, institutional and capacity frameworks and constraints must fit local needs and conditions to ensure clean energy access is provided and the Millennium Development Goals (MDGs) are met.<sup>21</sup>

<sup>20</sup> Energy access also includes energy efficiency, however for brevity and subject intent it has been omitted from this discussion.

<sup>21</sup> The United Nations Millennium Declaration was established in September of 2000 at the United Nations Headquarters, New York. The eight Millennium Development goals contained within the Declaration call for a global partnership in eradicating extreme poverty by 2015.

## 7. The Benefits of Clean Energy Access and Scale-Up

### Trends in Energy Access – a call for financial, social and technical private-public innovation

There are 1.5 billion people around the world today (or over 20% of the global population) without access to electricity, of which 85% reside in rural areas.

- A billion more have limited access to unreliable electricity networks. Some 2.7 billion people (or 40% of the global population) rely solely on solid fuels (traditional biomass and coal) to meet the most basic living requirements for heating and cooking.

**Exhibit 7.2: Number of people without access to electricity and relying on the traditional use of biomass, 2009 (million)**

	2009			Number of people relying on the traditional use of biomass for cooking
Africa	466	121	587	657
<i>Sub-Saharan Africa</i>	465	120	585	653
Developing Asia	716	82	799	1,937
<i>China</i>	8	0	8	423
<i>India</i>	380	23	404	855
<i>Other Asia</i>	328	59	387	659
Latin America	27	4	31	85
Developing Countries*	1,229	210	1,438	2,679
<b>World**</b>	<b>1,232</b>	<b>210</b>	<b>1,441</b>	<b>2,679</b>

\*Includes Middle East Countries. \*\*Includes OECD and transition economies.

Source: IEA databases and World Energy Outlook analysis of electricity access and use of biomass

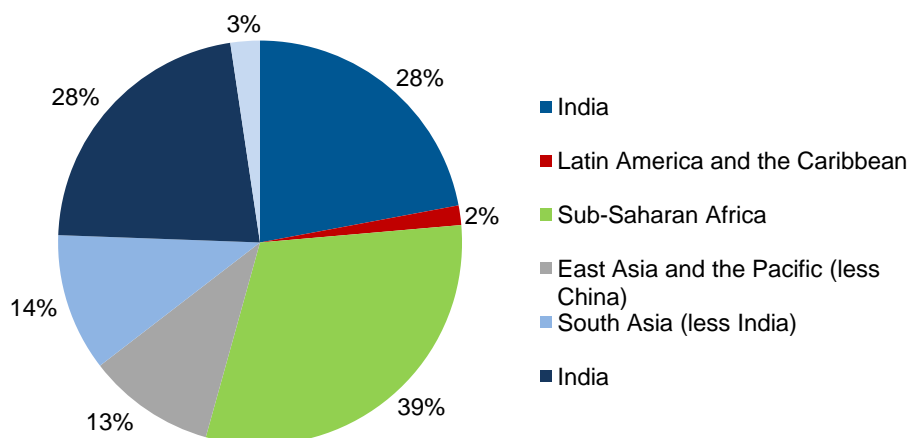
### A large portion of those lacking access to electricity reside in the Least Developed Countries (LDCs)

Out of the total number of those lacking electricity, 80 percent of people live either in sub-Saharan Africa or in South Asia.

- While sub-Saharan Africa makes up about 14 percent of the total population of developing countries, it accounts for almost 40 percent of the population without electricity access.

## 7. The Benefits of Clean Energy Access and Scale-Up

**Exhibit 7.3: Distribution of people without access to electricity by developing regions (2008)**



Source: UNDP

World electricity demand is expected to double between now and 2030, with most of this stated growth occurring in developing regions where population growth is outpacing that of electrification rates.

- Taking into account present national and global policies, the number of people lacking access to electricity is expected to drop only slightly to 1.2 billion by 2030 (or 15% of world's population), with 87% residing in rural areas.
- With this scenario, the number of people relying on traditional use of biomass for cooking increases to 2.8 billion in 2030. Most of these people will be residing in Sub-Saharan Africa, India, and other developing Asian countries with the exception of China.

### The call for Universal Energy Access

In April of 2010, The United Nations Secretary-General's Advisory Group on Energy and Climate Change (AGECC) ambitiously proposed the goal of universal access to modern energy services by 2030.

- Incorporating access and scale up to clean and reliable energy sources is crucial to helping meet this goal.
- Public-private-partnerships (PPPs) can catalyze success through leveraging private capital and utilizing carbon markets to scale up funding for research, development and commercial demonstration of low-carbon technologies that could be deployed to improve energy efficiency and expand energy access.

### Additional generation requirements for universal electricity access by 2030

To meet the stated goal of universal electricity access by 2030 a total incremental electricity output of 950 TWh will be required.

- Different systems for supplying the required electricity must be included, such as on-grid, mini-grid and isolated off-grid connections. Mini-grid and off-grid will play an important role in more isolated rural communities.

## 7. The Benefits of Clean Energy Access and Scale-Up

**Exhibit 7.4: Generation requirements for universal electricity access, 2030 (TWh)**

	On-Grid	Mini-Grid	Isolated Off-Grid	Total
Africa	196	187	80	463
<i>Sub-Saharan Africa</i>	195	187	80	462
Developing Asia	173	206	88	468
<i>China</i>	1	1	0	2
<i>India</i>	85	112	48	245
<i>Other Asia</i>	87	94	40	221
Latin America	6	3	1	10
Developing Countries*	379	3,993	171	949
<b>World**</b>	<b>380</b>	<b>400</b>	<b>172</b>	<b>952</b>

\*Includes Middle East Countries; \*\*includes OECD and transition economies

Source: IEA

- The AGECC has estimated the amount of needed to fund global modern energy access at US\$35-40bn per year in loan capital and subsidies, basing this assumption on the IEA 2009 developing country reference case for universal energy access by 2030.
- The total cost of universal access to modern energy is only 3%, or US\$756bn of the cumulative investment in global energy-supply infrastructure between 2010 and 2030.<sup>22</sup>
- At present there is an investment gap to meet this required upfront capital.
- To address climate change effects and harness the full benefits of energy access, it is crucial that the energy mix provided contain renewable energy sources.

**Exhibit 7.5: Investment requirements for electricity in the Universal Modern Electrical Access Case (UMEAC) (US\$ bn)**

	2010 - 2015	2016 - 2030	2010 - 2030
Africa	81	262	343
<i>Sub-Saharan Africa</i>	80	262	342
Developing Asia	127	214	342
<i>China</i>	1	0	1
<i>India</i>	52	130	182
<i>Other Asia</i>	74	84	158
Latin America	5	3	7
Developing Countries*	210	478	698
<b>World**</b>	<b>223</b>	<b>477</b>	<b>700</b>

\*Includes Middle East Countries; \*\*includes OECD and transition economies

Source: IEA

To address the above mentioned inequalities in both energy access and growing demand the international community must develop and implement new and innovative financial, institutional, and technological frameworks to scale up and deploy clean sources of reliable, cost-efficient, and sustainable energy. The role of capacity building and technical assistance to achieving effective implementation of these frameworks is crucial to their success.

<sup>22</sup> For additional outlooks on required average annual cost for electrification, please see The United Nations Industrial Development Organization's article "The Cost of Universal Energy Access" contained in the International Organization's Perspective chapter.

## 7. The Benefits of Clean Energy Access and Scale-Up

### Building on the benefits of modern energy services

The externalities associated with operating traditional sources fuel such as environmental degradation, increased health concerns, climate change effects, and civil unrest are often left uncalculated and overlooked.

- It is widely accepted that in addition to catalyzing achievement of the MDGs, incorporating clean energy in developing regions offers numerous benefits, including energy security through the diversification of energy sources and substitution of imported resources with local ones; addressing grid issues through the implementation of mini-grids and off-grid systems; curbing greenhouse gas emissions to mitigate against climate change; spurring socioeconomic development; and job creation.

### Fostering fiscal stability and energy security

By improving supply efficiency and sectorial governance through clean energy developing and transition economies can better cope with concerns about energy security. Due to their typically high dependence on imported fuels, changes in conventional fuel prices have a higher impact on developing countries fiscal budgets, in particular those highly indebted countries (of the World's 47 poorest countries, 38 are net importers of oil and 25 are fully dependent on imports).

- Net oil importers in developing regions in the Middle East and Northern Africa region were negatively impacted by the 2008 -2009 increases in the prices of energy and food. This unneeded fiscal burden could lead to increased production costs for small businesses, and reduce food intake among poor families.
- According to estimates contained in a 2009 press release of the World Bank, the food and energy price hikes in 2007-2008 increased the global poverty headcount by as many as 155 million people in 2008.
- Countries with unreliable energy systems may lose up to 1-2 per cent of their growth potential annually from electrical power outages, over-investments in backup electricity generators, energy subsidies and losses the ineffective and inefficient use of scarce or costly energy sources.
- Unreliable forms of electricity such as petroleum hinder economic growth by burdening the investment climate and operation, only further highlighting the need for secure, reliable sources of clean energy.

### Exhibit 7.6: Indicators in the reliability of developing region's infrastructure services in 2007

	Sub-Saharan Africa	Developing Countries
Delay in obtaining electricity connection (in days)	79.9	27.5
Electricity outages (days per year)	90.9	28.7
Value of lost output due to electrical outages (% of turnover)	6.1	4.4
Firms maintaining own generation equipment (% of total)	47.5	31.8

Source: World Bank

### Contribution to a Green Economy and socioeconomic development

It has been shown that the number of home businesses increases dramatically in communities that have been electrified and the amount of work hours in those businesses and correlative net income gained through those activities.<sup>23</sup>

- Clean and sustainable energy is especially important to curb emissions because an increase in electricity use will foster the growth of businesses and farms that use electricity, and will in turn increase the demand for electricity and lead to a growth profit cycle to electricity providers and rural communities.

<sup>23</sup> United Nations Environment Programme's 2010 Green Economy Initiative

## 7. The Benefits of Clean Energy Access and Scale-Up

Even though the green job contribution of renewables is well-accepted in developed countries, there has been a minimal amount of research which shows a link between renewable energy and green job creation in developing regions, mainly due to the lack of manufacturing centers and market demand that spur green job creation along the renewable energy value chain.

- Job creation outcomes are dependent on market volume: If the volume is high enough, a renewable energy capital production firm would most likely invest in a local production facility. If the market volume is not high enough to render it economically viable, firms will usually opt out of building a local production plant.
- When a localized level of production is involved, some benefits include jobs in installing, operating, and maintaining renewable energy systems. As these activities are localized they benefit the local developing region economies.
- Capacity building is crucial for readying a region to renewable energy capital production in linking green subsidies, tax breaks, and other incentives that would provide companies with job quality and training standards, and most of all provide decent pay, benefits, and a safe work environment.

### Rural Clean Energy and Jobs: Solar in Kenya

- Solar electrification has emerged as the primary alternative to grid based rural electrification in a number of developing countries. The solar market in Kenya is among the largest and most dynamic per capita among developing countries. Cumulative solar sales in Kenya since the mid-1980s are estimated to be in excess of 200,000 systems, and annual sales growth has regularly topped 15% over the past decade. Much of this activity is related to the sale of household solar electric systems, which account for an estimated 75% of solar equipment sales in the country.
- The Kenyan solar market emerged in the mid-1980s and grew rapidly during the 1990s into one of the largest solar markets per capita among developing countries. It is served by a dynamic and highly competitive supply chain that includes more than a dozen import and manufacturing companies, as well as hundreds of vendors, installers, and after-sales service providers. Data from a survey in 2000 conducted by the Tegemeo Institute indicated that 4.2% of rural Kenyan households owned a solar system. The same survey found that 4.3% of rural households were connected to the national electrical grid, and numerous sources indicate that solar sales are growing faster than the rate of new rural grid connections. In other words, solar electricity has emerged in Kenya as a key alternative to grid based rural electrification.
- Job creation and job 'improvement' have been a hallmark of the best parts of the Kenyan solar industry, with business opportunities for importers, distributors, and an ever-widening circle of solar energy installers and market support businesses. Solar energy systems, batteries, and even small wind turbines are increasingly available either directly from designers/developers, or from the array of solar companies that aggressively advertise on TV, in local newspapers, and by radio.

#### References

Acker, R. and Kammen, D. M. (1996) "The quiet (Energy) revolution: the diffusion of photovoltaic power systems in Kenya," *Energy Policy*, 24, 81 - 111.  
Jacobson, A. and Kammen, D. M. (2007) "Engineering, Institutions, and the Public Interest: Evaluating Product Quality in the Kenyan Solar Photovoltaics Industry", *Energy Policy*, 35, 2960 – 2968.



## 7. The Benefits of Clean Energy Access and Scale-Up

### Clean energy access - A valued investment in meeting the Millennium Development Goals (MDGs)

Although there is not a specific Millennium Developing Goal related to it, the international community recognizes that one of the biggest obstacles to socioeconomic development and meeting the UN Millennium Development Goals is access to modern energy services, including that of renewables.<sup>24</sup>

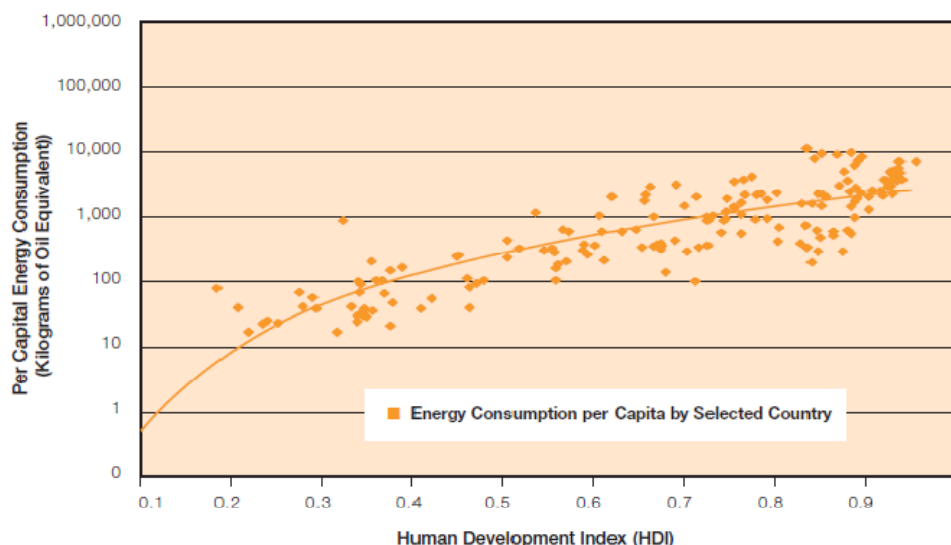
- Clean energy access is directly linked with most, if not all, of the global challenges targeted by the MDGs.
- Clean energy makes a profound positive impact on multiple facets of human development, namely poverty, gender equality, health, food security and climate change.

### Goal 1: Eradicate extreme poverty and hunger

*Increase in economic and social development by attaining more sustainable, cost-efficient, and healthier means to carry out basic household tasks.*

- Electrification enables entrepreneurial opportunities and more waking hours that can be dedicated to home businesses.
- Ensures an energy source to power water pumps for drinking and irrigation, and machinery for agriculture and food production. Solar powered pumps help generate income that can be spent on education, healthcare, and commodity goods.
- The importance of mechanical power for local micro-enterprises, farms, workshops, wells, increasing human and natural resource economic wealth.

### Exhibit 7.7: Energy has a strong link with Human Development



Source: UNDP Human Development Report 2004 database

### Goal 2: Achieve universal primary education

*Children in electrified households have higher education levels than those without*

- Time previously spent collecting biomass and water could be allocated to attending school. Greater communication is gained through information technology.
- Ability to pay for school fees due to an increase in economic activity and daily household income.

<sup>24</sup> UN-Energy, the interagency mechanism on energy, has addressed the importance of access to energy in achieving the Millennium Development Goals.

## 7. The Benefits of Clean Energy Access and Scale-Up

- Increases the quality of schools through the provision of electricity-dependent equipment, lighting in schools, and increasing teacher quantity and quality.
- Increased education leads to an increase in incremental future earnings.

### **Goal 3: Promote gender equality and empower women**

*Gender equality benefits are numerous and extensive*

- Time previously spent collecting fuel and wood, especially among women and children, can be reallocated to education and gainful employment, resulting in a high opportunity cost.
- Street lighting also improves the safety of women and young girls and allows them to attend night schools and community activities.
- A reduction in fertility rates has also resulted from electrification due to an increase in waking hours and leisurely alternatives.

### **Goal 4; 5; and 6: Reduce child mortality; improve maternal health; and Combat HIV/AIDS, malaria and other diseases**

- Improved indoor cooking methods reduces the rates of respiratory infections, chronic obstructive lung disease and lung cancer; the ability to boil water reduces the rates of waterborne diseases, and improved communication and transportation aid in emergency health care response.
- Health care centers and hospitals have increased support and ability to refrigerate vaccines and medicines, and higher household income and ability to pay for doctors and medicine; an increase in health knowledge is also seen with greater access to television and better nutrition from improved knowledge and storage facilities from refrigeration.

#### **The health implications of inefficient cooking stoves and fuels and improvements through renewable energy systems**

According to World Health Organization estimates more than 1.45 million people die prematurely every year from household air pollution from inefficient combustion of solid fuels, burning dung, biomass (wood and crop waste) and coal in unventilated kitchens, and this figure is greater than that of premature deaths from malaria or tuberculosis.

- Some 44 percent of these deaths are in children; and among adult deaths, 60 percent are women. In LDCs and SSA, more than 50 percent of all deaths from pneumonia in children under 5 years and chronic lung disease and lung cancer in adults over 30 years can be attributed to solid fuel use.
- If measures are not taken to provide people with access to clean sustainable energy, the number of premature deaths from inhaling smoke produced by inefficient biomass stoves is expected to increase to over 1.5 million people by 2030.
- Evidence also shows that the pollution these forms of energy produce play a large role in global and regional warming.

#### **Improvements through solar and hybrid systems**

There has been a concerted global effort toward switching to new cooking stoves, especially those which are solar powered or hybrid systems as they reduce the impacts of airborne pollution and reduce soot and smoke.

### **Goal 7: Ensure environmental sustainability**

Beyond climate change mitigation and preservation of resources, other benefits include:

- A transition to renewable energy would reduce the use biomass for heating and cooking, and thus curb land-use changes such as deforestation aggravated by the overuse of biofuels. This has both climate change implications and

## 7. The Benefits of Clean Energy Access and Scale-Up

environmental degradation (loss of habitat, loss of watershed protection, erosion, and reduced agricultural production).<sup>25</sup>

- While land degradation is not one of the designated indicators corresponding to Millennium Development Goal 7A, it is still a strong component.

### Clean Energy Access and Climate Change

Meeting the ambitious goals set forth by the international community for those lacking access to electricity does not mean that climate change mitigation must be slowed. In fact, through the deployment and scale up of clean energy green house gas emissions can be reduced through the displacement of common fuels such as diesel and biomass primarily used in developing regions.

- Increase in CO<sub>2</sub> in 2030 would only be 2.9% higher with universal access to electricity, oil demand would have increased less than 1%, and CO<sub>2</sub> emissions would only be 0.8% higher.<sup>26</sup>
- Clean energy services are especially crucial to those living in climate sensitive zones common throughout developing regions. For example, natural disasters disproportionately affect the poorest countries, especially when measured in relation to the size of their economies.

### Goal 8: Develop a global partnership for development

Goal 8 includes a pledge to foster a global partnership to support country efforts to achieve each of the Millennium Development Goals (MDGs) by 2015, which calls for increased communication and information sharing through clean energy electrification enables greater participation in global partnerships, capacity building and technical assistance. This encompasses the wide network of local, regional, national, and global policies, technology transfer for scale up and deployment (access) of clean and sustainable energy, socioeconomic development, fiscal responsibility, and governance.

### Making Progress for Expanding Clean Energy Access

#### Investment requirements to meet the Goals

To meet the MDG of eradicating extreme poverty by 2015, an additional 395 million people will need access to electricity, and 1 billion provided access to clean cooking facilities. This will require a cumulative investment of US\$223bn dollars in 2010-2015, and another US\$477bn in 2016-2030 for universal access to electricity by 2030. Rural areas make up the majority of additional household electrification in this period.

### The necessity for effective rural and peripheral urban electrification

#### Grid infrastructure, population density, and market conditions

As of 2010, roughly 20% of the world's population is without access to electricity, most of who reside in remote rural and peripheral urban areas (totaling 85% of the total number of people without access to electricity). Due to geographic seclusion and fragmented population rates, current patterns of energy supply and grid extensions prove difficult to electrify to these regions:

- It is more costly to extend electrical grids long distances; they must be backed them up before new connections are made.

<sup>25</sup> For example, Latin America and the Caribbean show positive net emissions from land-use change and forestry.

<sup>26</sup> Based on 2010 World Energy Outlook New Policies Scenario which takes into account policies and measures formally adopted by mid-year 2010.

## 7. The Benefits of Clean Energy Access and Scale-Up

---

- These regions have little or no supported infrastructure, low population densities, and thus providing household level electricity service is typically not economically feasible or reliable.
- For existing grid lines, oftentimes they are already unstable and power supply is limited.

### Possible solution through renewable energy mini-grid and hybrid systems

Renewable energy sources are in many cases the most cost-effective and socially beneficial methods to providing these fragmented and sparsely populated regions with electricity:

- Mini and off-grid renewable energy systems can be operated more cheaply and help to reduce pollution and its related health and regional / global warming implications, as they have a greater potential to displacing the need for expensive diesel-based power generation.
- These systems however require a high up-front investment cost, underlining the importance for innovative financing solution and development of a strong market infrastructure, primarily through public funds. The policy structures will vary from region to region, as rural electrification is formed depending on a region's energy needs, resources, and target groups.

By combining energy generation with storage mechanisms, off-grid communities can run a range of equipment using renewable energy sources. A wide variety of services and innovative products are currently offered by the private sector for off-grid applications, including plant design, production and supply of system components, operation and maintenance, commissioning, turnkey project realization, village electrification, training activities, and so on. As a result, wind, solar, and hydro power systems have been successfully installed in different developing areas, such as China, Ecuador, Mexico, Morocco, Senegal, and many more. Likewise, hybrid village electrification systems have also been implemented in countries ranging from China and India to Ghana, South Africa, and Tanzania.

## **8. FURTHER PERSPECTIVES**

## 8. Inter-American Development Bank

### Inter-American Development Bank (IDB):

#### *Feed-in Tariffs in Latin America and the Caribbean: The Search for Transparency, Longevity, Certainty and Consistency (TLC)*<sup>27</sup>

In order to structure international support for feed-in tariffs in developing regions, as envisioned under GET FIT, it is important to have an understanding of the policy landscape in each potential partner country. This article reviews and compares feed-in tariffs in three countries in the Latin America and Caribbean (LAC) region: Argentina, the Dominican Republic and Honduras, utilizing an analytical approach inspired by Deutsche Bank's Transparency, Longevity, Certainty and consistency (TLC) framework.

The Latin America and Caribbean (LAC) region faces a series of interrelated energy challenges: the region is projected to need to install 60 gigawatts (GW) of new capacity between 2009 and 2015 (Byer et al., 2009), many countries in the LAC region do not have well diversified energy portfolios and are exposed to fossil fuel price volatility (and/or drought in the case of heavy hydropower reliance), and the region is vulnerable to the adverse impacts of climate change.

These energy challenges, among other drivers, have led to an increased interest in developing renewable energy (RE) in LAC countries. In 2002, countries in the region committed to meeting 10% of regional total energy from renewable resources by 2010 as part of the Latin American and Caribbean Initiative for Sustainable Development. Although this goal has been achieved and surpassed on a regional basis (UNEP, 2008), numerous countries have also established their own formal renewable energy targets (Exhibit 1).<sup>28</sup>

#### Exhibit 8.1: LAC renewable energy targets

LAC Countries	Renewable Energy Target
Argentina	8% of electricity by 2016
Brazil	~ 13% of installed electricity capacity to come from NCRE by 2019
Chile	10% of electricity by 2024, excluding large hydro
Colombia	3.5% electricity by 2014 (6.5% by 2020), excluding large hydro
Costa Rica	100% of electricity by 2021 (including large hydro)
Ecuador	80% of electricity from hydro (approx 40-50% currently) and 10% from non-large-hydro renewables by 2020
Jamaica	20% of energy by 2030
Mexico	7.6% of installed electricity capacity by 2012
Peru	5% of electricity by 2013 (excluding large hydro); a new objective is to be set every 5 years
St. Lucia	5% of electricity by 2013, 15% by 2015 and 30% by 2020
St. Vincent & Grenadines	30% electricity by 2015 and 60% by 2020
Uruguay	i) 50% of primary energy, including large hydro; ii) 15% of electricity from NCRE by 2015

A key question for policy-makers is how best to meet these targets while also satisfying national policy objectives. Previous research from the Inter-American Development Bank (IDB) surveyed different types of policy mechanisms and concluded that feed-in tariffs are a promising mechanism for meeting national renewable energy goals in the LAC region

<sup>27</sup> Authors include N. Marzolf and J. Paredes, Inter-American Development Bank, and W. Rickerson, H. Flynn, C. Hanley, D. Jacobs, and M. Solano-Peralta, Meister Consultants Group

<sup>28</sup> This list includes only countries that have established formal targets through legislation or regulation, and does not include draft targets or goals that have been announced, but are not formally a part of official policy. Each of the targets in Exhibit 1 excludes large hydropower unless otherwise noted.

## 8. Inter-American Development Bank

(Arbelaez and Marzolf, 2010). Policy design and national conditions can have significant impact on whether or not feed-in tariff policies will effectively support market growth.

The LAC countries that have experience with FIT implementation include: Argentina, Brazil, the Dominican Republic, Ecuador, Honduras, Nicaragua, and Peru. This article profiles the FIT policies in Argentina, the Dominican Republic and Honduras in order to identify lessons learned.

Each of the profiles in this article:

- Reviews the share of renewable electricity in the overall power mix;
- Summarizes the relevant pieces of national renewable energy legislation<sup>29</sup>; and
- Evaluates the effectiveness of national support and compares the FIT design features with the TLC design.

The article concludes with a summary of key lessons learned in the LAC region and a table of the FIT designs in each country.

### 1.1 Argentina

#### Energy mix and targets

Large hydropower currently supplies 40% of Argentina's electricity demand. The contribution of non-hydro renewable resources has so far been limited, with only 30 MW of wind installed as of 2009 (ECOFYS Germany GmbH, 2009; Piva and Garcia, 2009). Argentina has set a national target to supply an additional 8% of national demand with renewable resources by 2016 (Law 26, 190). According to estimates from the Secretary of Energy, this will require 2,500 MW of new renewable energy capacity to be brought online.

#### Feed-in tariff legislation

Argentina has supported renewable electricity since 1998 through its National Wind and Solar Energy Rules (Régimen Nacional de Energía Eólica y Solar). The law included a premium payment for renewable generators set at 40% above wholesale market price. This law was replaced with the current FIT law in 2006 with the passage of its National Regime of Support of Renewable Energy Sources for Electricity Generation (Régimen de Fomento Nacional para el uso de fuentes renovables de energía destinada a la producción de energía eléctrica). Certain provinces in Argentina, including Santa Cruz and Chubut, offer additional tariff payments. Although the feed-in tariff was passed in 2006, it was not implemented until May 2009 with the National Decree 5620/2009 and no projects have been financed via the Argentinean FIT to date.

#### Feed-in tariff design

The current FIT supports wind, solar, geothermal, hydro, biomass and biogas generators up to 30 MW in size. Eligible generators can receive a fixed premium payment on top of the wholesale electricity price for 15 years. The tariffs are differentiated according to PV and non-PV generators. Non-PV generators can receive a premium payment of \$0.004/kWh (Arg\$ 0.015/kWh), whereas PV generators can receive \$0.242/kWh (Arg\$ 0.90/kWh). Significantly, the tariff levels are defined as maximum payments, rather than minimum payments. In the case of solar PV, for instance, a payment level of "up to" \$0.242/kWh (Arg\$ 0.90/kWh) is guaranteed. Therefore, the legislation creates the risk that project developers will have to negotiate contracts on a case-by-case basis. The feed-in tariff premiums are to be paid through a national fund, which will be managed by the Federal Council of Electricity (Fondo Fiduciario de Energías Renovables). The fund is to be financed via a surcharge per megawatt-hour sold nationally.

---

<sup>29</sup> All monetary figures are cited in \$US and the national currency.

## 8. Inter-American Development Bank

**Exhibit 8.2: Tariffs for renewable electricity in Argentina**

Technology	Max Incentive rate (\$/kWh)
All renewable energy technologies (except solar PV)	\$0.004/kWh (Arg\$ 0.015/kWh)
Solar PV	\$0.242/kWh (Arg\$ 0.90/kWh)

### Feed-in tariff evaluation

Argentina's FIT includes certain low-risk components, such as a long-term payment guarantee. The policy diverges from the design described above (Table 2) in several ways: the incentive is a premium on top of the wholesale electricity price, rather than a fixed price payment, the prices appear not to be generation cost-based, and prices are too low (even given Argentina's strong winds) to provide a reasonable return.

In 2008, the spot price on the wholesale electricity market was \$57.2/MWh (Arg\$180/MWh) and \$52.4/MWh (Arg\$165/MWh) in 2009. At the moment, adding an additional \$3.8/MWh (Arg\$15/MWh) to these rates does not make projects financially viable—recent wind bids under a parallel auction scheme, for example, have been in the range of \$120-\$158/MWh (Arg\$466-614/MWh). The total \$61.00/MWh (Arg\$240.54/MWh) FIT rate<sup>30</sup> would cover only half of these bids. In addition, there is no standard contract since the tariffs are set as a maximum level, rather than a minimum guarantee. Finally, the legislation does not include special provisions regarding grid connection or dispatch. The law only became effective in 2009.

It is not fully clear whether Argentina will continue to promote renewable energy sources under the premium feed-in tariff. In 2009, the government also established a renewable energy procurement program based on competitive bidding, known as GENREN, which has elicited bids from projects that would total 3% of national generation if successfully completed.<sup>31</sup>

### 1.2 Dominican Republic

#### Energy mix and targets

By the end of 2007, Dominican Republic fossil fuel generators provided over 86% of the 3.4 GW of total installed capacity available (fuel oil 61%, natural gas 16%, and coal 9%). Hydro power provided the final 14% of the Dominican Republic's installed capacity. In 2008, total electricity generation was 11,644 GWh. The Dominican Republic has set a target to supply 15% of its electricity from renewables by 2015 and 25% by 2025.

#### Feed-in tariff legislation

In 2007, the Dominican Republic passed the Law No. 57.07 of Incentive to Renewable Energies and its Special Regimes (Ley No. 57.07 de Incentivo a las Energías Renovables y Regímenes Especiales) to support renewable energy generation. The goals of the law are to reduce oil imports, diversify the country's generation portfolio, and attract private investment in renewable energy. The regulatory framework for the law was subsequently established under Decree No. 202-08 in 2008. The law sets forth a broad range of tax incentives and financing programs to support wind (<50 MW), small hydro (<5 MW), PV, solar thermal, biomass (co)generation (<80 MW), biomass, biofuels, and ocean energy systems.

<sup>30</sup> Calculated based upon 2009 wholesale electricity spot market price (\$52.4/MWh) plus the \$3.8/MWh add on.

<sup>31</sup> GENREN, which was launched in May, 2009, is a bidding system administered by the energy company ENARSA. In July 2010, contracts were awarded for a total of 895 MW of capacity. Prices ran from \$120-\$158/MWh (Arg\$466-614/MWh) for wind, \$188-\$194/MWh (Arg\$730-\$753/MWh) for biomass, \$150-\$180/MWh (Arg\$582-699/MWh) for small hydro and \$555-\$636/MWh (Arg\$2156-2471/MWh) for PV (Sciaudone, 2010). The contracts offered include a 15 year power purchase agreement. 895 MW of capacity. Prices ran from \$120-\$158/MWh (Arg\$466-614/MWh) for wind, \$188-\$194/MWh (Arg\$730-\$753/MWh) for biomass, \$150-\$180/MWh (Arg\$582-699/MWh) for small hydro and \$555-\$636/MWh (Arg\$2156-2471/MWh) for PV (Sciaudone, 2010). The contracts offered include a 15 year power purchase agreement.



## 8. Inter-American Development Bank

### Feed-in tariff design

The law defines a FIT premium plus the wholesale electricity price in order to compensate generators for the external benefits (environmental and economic) they provide and to guarantee investor security. The Decree established a premium to be paid over 10 years and also determined a payment adjustment schedule. The payment would increase by 4% in 2009 and 2010, and would then adjust according to the US Consumer Price Index (CPI) through 2018. From 2018 to 2027, the available rate would adjust according to the US CPI minus one percentage point.

The law and Decree establish a 10-year FIT that includes a premium payment on top of the wholesale electricity price. Under the Decree, the payment increased by 4% in 2009 and 2010, and adjusts according to the US Consumer Price Index (CPI) through 2018. From 2018 to 2027, the available rate will adjust according to the US CPI minus one percentage point.

**Exhibit 8.3: Prices and technologies recognized by Dominican Republic's FiT**

Technology	Price (\$/kWh)
Wind generator	\$0.13
Wind self-generation	\$0.05
Biomass electricity generator	\$0.12
Biomass electricity for self-generation	\$0.05
Municipal Solid Waste electricity generator	\$0.09
Photovoltaic generator >25 kW	\$0.54
Photovoltaic self-generation >25 kW	\$0.10
Photovoltaic generator <25 kW	\$0.60
Photovoltaic self-generation <25 kW	\$0.10
Small-hydro generator	\$0.07
Small-hydro self-generation	\$0.05

Decree 208-08 allocates public funds created by a 5% tax imposed to fossil fuels under the Law on Hydrocarbons No. 112-00 to pay for the FIT incentives. The fund is administered by the National Energy Commission (CNE – Comisión Nacional de Energía). Generators are required to contribute 1% of their sales to be split between the CNE (80%) and to the Electricity Superintendant (SIE – Superintendencia de Electricidad) (20%).

In order to be eligible for the FIT, developers must secure a concession to develop the project.<sup>32</sup> Development concessions are granted up to 40 years and allow the developer to receive priority grid interconnection and priority dispatch through the transmission or distribution company. Generators must negotiate a power purchase agreement with the Dominican Corporation of Electric State Enterprises (CDEEE – Corporación Dominicana de Empresas Eléctricas Estatales) on a case-by-case basis.

### Feed-in tariff evaluation

Recently, concessions were granted to three projects which will be the first to take advantage of the FIT rates. While not all of them have yet signed PPAs, the tariff is fixed according to the Law 57-07 and PPAs should look similar for all projects. It is expected, that 110 MW of wind will be commissioned by 2011, and that 250 MW will be commissioned by 2012. The Dominican Republic's feed-in tariff shares some characteristics with the TLC design, including long-term

<sup>32</sup> The regulation specifies the procedures, whereby project developers will initially obtain a temporary concession that allows them carry out techno-economic and environmental feasibility studies in the possible site of development; without the obligation of formulating an offer to the wholesale market. The CNE will limit the maximum installed capacity for temporary concessions once the national target has achieved 80%. After obtaining a temporary concession and carrying out the required studies, the developer must request from the CNE a definite concession with all the outlined documentation and requirements (design, environmental, technical, etc as defined per technology) set in Decree 208-08.

## 8. Inter-American Development Bank

contracts, generation cost-based rates, priority interconnection and priority dispatch. The feed-in tariff diverges from the TLC design in that contracts must be negotiated on a case by case basis, and payments are awarded as a premium on top of wholesale rates.

### 1.3 Honduras

#### Energy mix and targets

In Honduras, a little less than 50% of the total electricity demand is provided by renewable energy sources. As of 2009, hydropower accounted for 43% and biomass for 3%. The remaining 54% was supplied by privately owned thermal power plants that burn fuel oil and diesel (EENE, 2010). The country's large-scale hydro power plants are operated by the former monopoly utility, the National Electricity Company (EENE – Empresa Nacional de Energía Eléctrica).

#### Feed-in tariff legislation

The current legal framework for the Honduran electricity system was established in 1994 by the new electricity law 158-94. The policy enabled third-party access to the grid and initiated (at least in theory) the unbundling of ENEE. The law also set up the National Energy Commission (Comisión Nacional de Energía) to regulate the Honduran power market. Decrees supporting the promotion of renewable energy sources were issued in 1998 (Decrees 85-98 and 267-98) and the current FIT was created in 2007 as part of the Law 70-2007, the Law on the promotion of electricity from renewable energy sources (Ley de promoción a la generación de energía eléctrica con recursos renovables).

#### Feed-in tariff design

Law 70-2007 supports solar, wind, geothermal, tidal, hydro, biomass, biogas and municipal waste generation by enabling several power purchase options. Generators can sell their power directly to large-scale consumers, they can participate in a national auction for renewable power, and they can also sell their power to ENEE under a feed-in tariff. Under the third option, ENEE is obliged to purchase all renewable power. However, Article 3 of Law 70-2007 states that EENE is only obliged to sign a purchase agreement if the project is in line with the National Extension Plan of the Interconnected Electricity System (Plan de Expansión del Sistema Interconectado Nacional). According to the plan for the period from 2008 to 2022, 30.9 MW of new mini hydro capacity are expected in 2010, 100 MW of wind energy and 110 MW of biomass in 2011, 20 MW of hydro in 2014, 358 MW of hydro in 2015 and 173 MW of new hydro in 2016. Consequently, this linkage to the national extension plan creates a de facto cap on capacity supported by the feed-in tariff (ENEE 2008). Generators up to 50 MW in size can receive a 20-year feed-in tariff contract, whereas larger-scale power plants can sign contracts with durations of up to 30 years.

Over the course of the feed-in tariff, power producers are guaranteed an undifferentiated tariff called the Minimum Base Price" (Precio Base Mínimo), which is published annually by the government. The base price can never be lower than the level published in 2007. For the first 15 years of operation power producers receive a premium payment of 10% of this base price on top of the avoided costs. The base price is indexed to the inflation rate in the US CPI. However, the maximum annual increase is fixed at 1.5%. As of 2010, the tariff payment amounted to \$0.1078/kWh (\$0.9796/kWh for the short-term avoided costs plus a 10% premium).

#### Exhibit 8.4: Renewable electricity tariff for Honduras

Technology	Incentive rate (\$/kWh)
All renewable energy technologies	\$0.11 (HNL 1.99)

After 15 years of operation, the remuneration will be lowered to the short-term, avoided costs of the Honduran electricity system. The Decree of 2007 created a national fund for the promotion of renewable energy projects (Fondo de desarrollo de generación eléctrica con fuentes de energía renovable) in order to finance the costs of the FIT. The law required ENEE to draft a standard contract for independent renewable electricity producers. The law also offers priority dispatch

## 8. Inter-American Development Bank

for renewable energy sources and clearly defines grid connection procedures. The law includes a number of additional tax exemptions for renewable electricity producers, including import tax for equipment, revenue tax and sales tax.

### Feed-in tariff evaluation

The Honduran feed-in tariff law of 2007 offers a comparatively high degree of investment security. A large number of technologies are eligible for tariff payment and the law includes detailed provisions regulating grid connection. The law also guarantees priority dispatch and obliges the utility to draft a standard contract. Tariff payments are guaranteed for 20 to 30 years. Although tariff payment is based on the avoided costs of conventional electricity, the tariff payment as of 2010 could be attractive to certain types of generators. However, there is no evidence that the FIT has so far triggered investment in new renewable electricity capacity.

In 2009, the government started auctioning renewable electricity capacity (Proceso de Licitación Pública Internacional No. 100-1293/2009). The tariff offered for renewable electricity producers under the auction ranged from \$0.09/kWh to \$0.11/kWh (Rivera, 2010) —and consequently in the tariff range offered under the feed-in tariff scheme. However, these payment levels were criticized for being too high in light of the fact that they are guaranteed for up to 30 years. In addition, mostly medium-size hydro power projects were selected.

### 1.4 Conclusion

**Exhibit 8.5: Existing feed-in tariff design in LAC countries**

	Argentina	Dom. Rep.	Honduras
<b>Eligible generators</b>	Wind, solar, geothermal, hydro, biomass, biogas	Wind, small-hydro, PV, biomass, biofuels, , tidal, geothermal, and solar thermal	Solar, wind, geothermal, ocean current, hydro, biomass, biogas, municipal waste
<b>Provisions for interconnection and purchase requirements</b>	No	Yes	Yes
<b>Standard contract</b>	No	No	No
<b>Contract length</b>	15 yrs.	10-40 yrs.	20-30 yrs.
<b>Rate setting basis</b>	Avoided cost	Generation cost-based	Avoided cost
<b>Payment structure</b>	Premium FIT	Premium FIT	Fixed
<b>Tariff differentiation</b>	Yes	Yes	No
<b>Type of Purchasing / funding entity</b>	National Government (Fund)	State-owned utility	State-owned utility
<b>Commodities purchased</b>	Not defined	No	Not defined
<b>Amount purchased</b>	100 %	100 %	100 %
<b>Adjusting payment</b>	None	Annually	Yes (inflation indexation)
<b>Plant-size caps</b>	30 MW	50 MW for wind, 5 MW for small-hydro, and 80 MW for biomass cogeneration	No
<b>System size caps</b>	8% of electricity generation from renewable energy sources	15% of electricity generation from renewable energy by 2015 and 25% by 2025	New capacity has to reflect the national capacity expansion plan

A comparison of FIT design in the three countries analyzed reveals certain similarities. First, most include a wide range of eligible technologies under their national support schemes. Second, most guarantee a tariff payment over a long period of time (10 to 40 years). Many of the LAC FITs also include special provisions for interconnection and purchase

## 8. Inter-American Development Bank

requirements. Each country profiled guarantees 100% purchase of the produced electricity. However, the Dominican Republic also offers the possibility to directly consume the renewable electricity producer without feeding it into the grid. In this case, a substantially lower tariff is granted. These features of FITs in the LAC region match the TLC design.

With respect to payment structure, policies are split between the fixed payment option and the premium tariff payment in addition to market sales. This diversity in feed-in tariff policy design can be primarily explained by the differing stages of market liberalization in each country. Countries that have established day-ahead markets may prefer the use of premium options whereas countries with less competitive electricity markets may prefer fixed price options.

The policies have supported only limited renewable energy development to date. Although part of the reason is that many of the policies are fairly new (Dominican Republic), another contributing factor is basing rates on avoided cost (which therefore are too low) and not differentiating rates by technology (Argentina and Honduras). Setting low rates based on avoided cost or other metrics is consistent with the goal of limiting ratepayer exposure to renewable energy policy costs, but it also restricts investment in new capacity. In the past, high prices for IPP contracts have attracted criticism internationally and have sometimes created political pressure that has resulted in attempts at contract renegotiation or abrogation (Woodhouse, 2005).

Setting tariffs based on the avoided costs for conventional power generation can also potentially lead to tariffs that are unnecessary high. In Honduras, remuneration levels of about \$0.10/kWh have been criticized for being too high for small hydro and too low for other renewable electricity technologies. This reveals that a generation-cost based tariff calculation methodology would not only avoid setting tariffs too low but it would also prevent government from paying too much for renewable electricity. If renewable electricity producers can generate electricity at rates lower than avoided costs, the government should take advantage of that. In the end, renewable energy should help to reduce electricity costs in the long-term.

From an investor's perspective, regulatory uncertainties, a lack of standard interconnection procedures, and the lack of standard contracts for power purchasing agreements in some countries poses prolonged project development and create development risk. Additionally, many projects in the LAC region are not bankable because off-takers (e.g. utilities) are not creditworthy, or because of currency devaluation concerns. This limits the applicability and effectiveness of a feed-in tariff.

As this article has illustrated, FITs have not be as effective as anticipated in Argentina, the Dominican Republic and Honduras for the various reasons addressed. These examples provide insight into the challenges countries face as they develop renewable energy markets, and highlight the need for customized international support that combines direct incentives, risk mitigation strategies, and targeted technical assistance

## 8. International Energy Agency

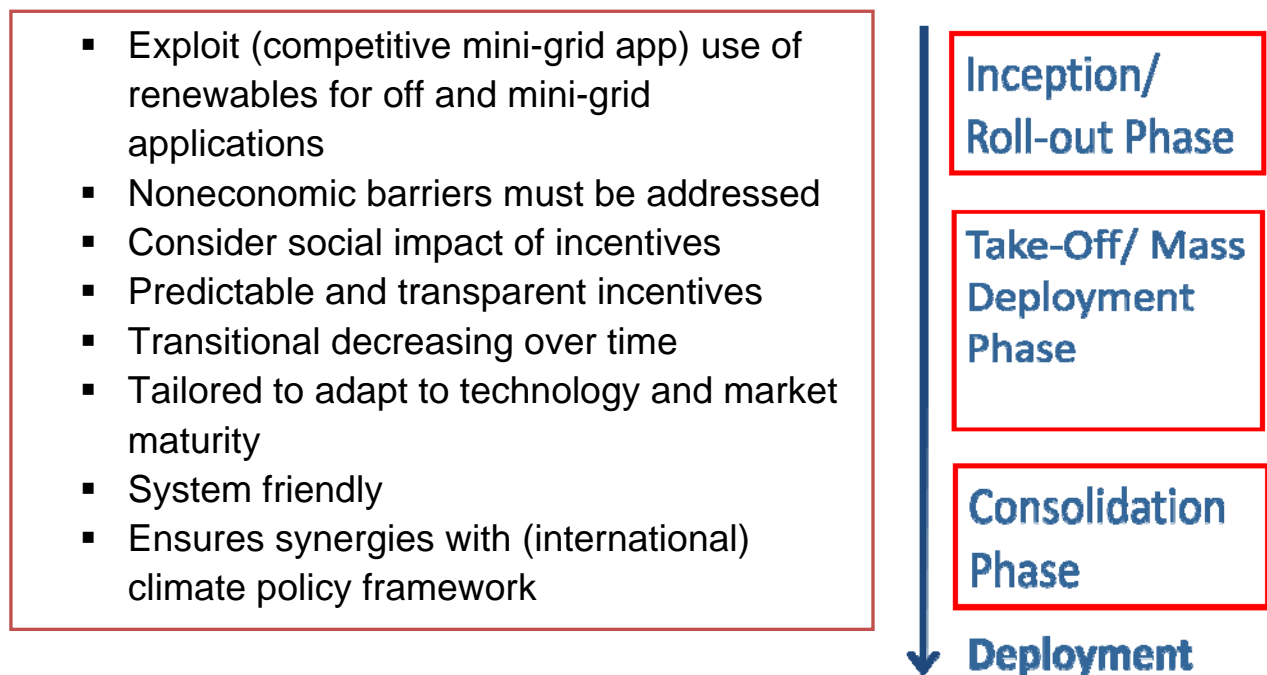
### International Energy Agency:

#### *Deploying Renewables Building on Principles for Effective Policy Design*

Based on its ongoing analysis of global renewable energy markets and policies, the IEA has distilled key principles for designing effective and efficient renewable energy policies<sup>33</sup>. Deutsche Bank's Transparency, Longevity, Certainty and Consistency (TLC) framework is consistent with these policy design principles. As the group of countries investigated has expanded to cover many emerging and developing non-OECD countries in different world regions, the catalogue of design principles incorporates new elements which reflect economic and energy access contexts more specific to low-to medium-income countries.

Exhibit 1 summarises the principles and indicates that the priority of the individual principles in policy-making increases with the penetration of renewable energy technologies (RETs).

#### Exhibit 8.6: Principles for Effective Renewable Energy Policies



Source: Adapted from: IEA (2008). *Deploying Renewables: Principles for Effective Policies*. Paris: IEA/OECD.

To effectively spur as well as sustain the diffusion of renewables, developing countries should progressively:

- **Mainstream** the use of RETs for rural and peri-urban electrification, with the intervention of e.g. hybrid financing approaches as illustrated by Deutsche Bank.
- **Reduce as much as possible non-economic barriers to the uptake of the technologies.** These might include administrative hurdles, obstacles to grid access, poor electricity market design, inadequate information and training, absence of key parts of the supply chain. At the same time tackle social acceptance issues.
- **Remove distortionary subsidies for fossil fuel consumption and production, while ensuring cleaner modern fuels remain accessible to the poor.** Fossil-fuel subsidies often benefit more affluent segments of society

<sup>33</sup> IEA (2008). *Deploying Renewables: Principles for Effective Policies*. Paris: IEA/OECD.

## 8. International Energy Agency

rather than the poor<sup>34</sup>. Nevertheless, low-income households may be disproportionately affected by their removal, as they spend a higher portion of their disposable income on energy<sup>2</sup>.

- **Ensure that renewable energy incentives do not shift a disproportionate share of the additional financial burden to the poorest households.** Adapting policy support to national development objectives can help minimise impacts on wealth distribution; for example, a national renewable energy development fund that is fed by e.g. a GET-FIT structure could foster renewable energy by providing a support mechanism to supplement a regulated end-consumer tariff;
- **Devise renewable energy policies that are predictable and consistent with the overall energy policy framework.** Such measures ensure that potential investors have adequate confidence in the stability of the support system;
- **Introduce transitional incentives**, which decrease over time, to encourage earlier deployment but encourage market competitiveness;
- **Develop a flexible set of policies and incentives tailored to adapt to the maturity of the market** and to the particular suite of technologies considered appropriate to encourage. Different technologies at different stages of maturity need different types and levels of support. A one-size-fits-all approach risks locking out technologies that have long term value;
- **Develop policies** which will be consistent with the country's overall energy system in terms of overall cost and system reliability, when large scale penetration of renewables is achieved;
- Ensure that **renewable energy and climate change policies and measures** are designed to **enhance their respective effectiveness**, considering their possible interaction.

An overall strategic and long-term vision for the role of renewables in contributing to national energy policy should underpin the coherent application of the policy design principles. As many examples from across the world, both from developed and developing countries, show, sustained and affordable deployment of renewables fails in the absence of a supportive and regularly reviewed overall policy framework<sup>35</sup>.

The importance of non-economic barriers on renewable energy investment decisions and of risk reductions through policy improvements is shown in a study commissioned by the IEA<sup>36</sup>, concentrating on wind and solar PV. The study empirically measured the relative importance of different non-economic and other market barriers in private and public renewable energy investment decisions, by establishing investors' "willingness-to-accept" - in other words the "price" of – certain policy risks. Investors identified major risks as being regulatory instability, total remuneration levels and grid access.

Many developing countries are at the initiation or early take-off stages<sup>37</sup> of deploying RETs, where the policy focus is on establishing a low-risk environment for renewables, which is the main focus of the *GET-FIT Plus* concept.

Nevertheless, developing country policy-makers should not lose sight of the later stages of the so-called "policy journey" along the route to market consolidation/stabilisation. This means that, as renewables begin to deploy at a mass-scale, policy-makers will need to structure adaptive economic support frameworks to be able to balance two main objectives: stimulating adequate renewable energy market and industry growth, while containing total support costs. Control and monitoring of overall costs can be problematic, especially with modular and decentralised RET applications, such as solar PV and biogas digesters with a large number of small-scale individual installers. Carefully adjusted capacity addition

<sup>34</sup> IEA (2010). *World Energy Outlook 2010*. Paris: IEA/OECD.

<sup>35</sup> IEA (2010). *Deploying Renewables in Southeast Asia: Trends and Potentials*. Paris: IEA/OECD.

<sup>36</sup> IWOe (2010). *The Price of Renewable Energy Policy Risk: An empirical analysis based on choice experiments with international wind and solar energy investors*. Confidential report prepared for the International Energy Agency, Institute for Economy and the Environment (IWOe). St. Gallen: University of St. Gallen.

<sup>37</sup> Technology deployment can be considered to happen in three phases:

An **inception/onset phase** when the first examples of a technology are deployed;

A **take-off phase**, when the market grows rapidly leading to widespread deployment; and

A **market consolidation phase** where deployment grows towards the maximum practicable level.

## 8. International Energy Agency

---

'corridors' with adaptive degression rate adjustments complemented with transparent procedures for managing grid connection queues are a possible solution, though challenging to implement effectively.

For grid-connected renewables, tenders for a specific capacity volume, which impose a ceiling and floor price, could be a hybrid incentive mechanism, blending a price target with a quantity objective. This would extend the GET-FiT concept to offer a suite of performance-based incentive types which are similarly effective as feed-in tariffs (FiTs) and appeal to countries with different economic models and cultures.

In addition, implementing technology- or resource-specific incentives, which are tailored to the market maturity of the individual RET, may help policy-makers in developing countries control overall support costs more easily. Concretely, this could, for example, mean that the relative weights of upfront investment grants and performance-based generation incentives in the overall financial support provided for a specific RET resource shift towards the latter for more mature technologies.

National circumstances – renewable energy potential, existing policy framework, existence of non-economic challenges, degree of market liberalisation, and energy system infrastructure – will influence the optimal mix of incentive schemes.

The most appropriate policy strategy for fostering renewables will also depend on the fossil fuel import dependence/energy self-sufficiency situation of the country. For example, low-to middle-income net fossil exporters, such as Indonesia, Nigeria and South Africa, may be able to afford to finance RET support and energy access through RETs if their fossil fuel production rent and export revenues are channelled away from heavily subsidising domestic energy consumption. In that case, as host country budgets might be capable of shouldering a larger share of the financial burden, public financing mechanisms might focus more on risk-reduction measures, such as political risk guarantees by multilateral lenders and counterparty risk guarantees offered by the developing country government, and on technical assistance, *e.g.* to enhance the local financial sector's capacity and understanding of renewables, than on explicitly funding the generation-based renewable energy premium payment.

Given the high growth in energy demand projected in many low- and middle-income countries and the necessary capacity expansion, linking any authorisation of new fossil-fuelled capacity to the implementation of the same capacity in non-hydro renewables could help establish sufficient traction for the sustained market growth of renewables



## 8. International Emissions Trading Association

---

### **International Emissions Trading Association (IETA):**

#### ***The Green NAMA Bond Proposal: A Next Generation Green Financial Instrument***

Green NAMA Bonds (GNBs) are a proposed financial instrument aimed at getting the bond market interested in low-carbon investment. The case for finding a means of making low-carbon attractive to mainstream private sector investors is well-known. IEA modeling indicates that more than \$1tr a year of additional, non-economic investment in the energy sector alone is needed to achieve greenhouse gas reduction targets. A very large proportion of this is in developing regions. Most developing countries see no reason why they should pay for the incremental costs of making their development programmes low-carbon. They expect assistance from the developed world, preferably in the form of new dedicated grant aid for investment and capacity-building; but private sector investment and loans at attractive rates will almost certainly ultimately be acceptable.

China and some other developing countries are focusing on the development of low-carbon technologies, hoping to sell to the developed world and prepared to create a home market as a platform. This is creating the impression that low carbon technology will be economic across the world, driven by feed-in tariffs and regulation. Low-carbon investment funds and Green bonds are being created on this basis. Yet most developing countries will not accept that they should pay the cost of these support instruments, without which the investments are mostly unviable. There is a potential investment gap of hundreds of billions of dollars a year. There is no realistic prospect of direct aid from developed countries increasing to fill this gap.

Very substantial new private sector investment, coming from investors who have low appetite for risk and need large-scale opportunities, needs to be leveraged by the support that the developed countries can afford. This support needs to be stretched to the maximum. The scale and useability of the leverage instruments needs to be far, far greater than has been achieved by the Clean Development Mechanism of the Kyoto Protocol, for all its success as a pioneer in global carbon pricing. No coherent plan is on the table for achieving this leverage; there are only vague references to scaling up the carbon market, which in this context means today's CDM.

NAMAs (Nationally Appropriate Mitigation Actions) is a term being used in the UN climate change negotiations to mean greenhouse gas emissions policies or actions, usually large-scale, that will reduce a country's emissions profile below business-as-usual. The expectation is that developed countries will support them – or they will not be done, though in many cases proposals will have considerable ancillary benefits for the country concerned, such as public health or economic development. NAMAs are starting to be collected from developing countries by the UN. At least some of them are capable of being structured as large scale calls for private sector investment. The definition of the term is still wide, and interpretations that are more consistent with a private investment opportunity are possible.

Green NAMA bonds are a vehicle combining:

- Conventional returns from sovereign or quasi-sovereign borrowers,
- the benefit of conditional and limited guarantees from international financial institutions (IFIs) that make developing country borrowers less risky and more acceptable to conventional investors
- underlying project returns expressed in conventional financial terms, and
- returns in the form of carbon units that can be used for compliance by companies or Governments with obligations under carbon trading systems (UN-linked or national) or can fulfill voluntary emissions reduction commitments.

Taking as an example a proposal by a developing country Government or parastatal agency to modernize a part of the country's electricity supply industry, a borrowing proposition would be put to an IFI, which would use a new international assessment organization to estimate the emissions reduction impact as well as the conventional economics of the proposition. If satisfactory, the IFI would authorize the use of part of a pre-agreed but limited guarantee and risk-reduction facility to allow the proposition to be constituted as a bond issued by the Government or parastatal attractive to



## 8. International Emissions Trading Association

---

the bond market at a low coupon reflecting the degree of IFI support. An alternative could be to create an implementation agent as an SPV, receiving the bond proceeds from the Government, managed by Board members including the IFI and perhaps private sector representatives, and distributing the bond funding to the entities involved in the programme to use as part or all of their funding for the specific investments necessary to achieve the NAMA.

The return to bond holders would also include (the form, timing and balance depending on the judgment of the issuer) a share in the underlying – returns from domestic electricity sales, perhaps de-risked, in the example – and some or all of the carbon return, meaning the emissions reduction units or proceeds from the sale of those units to wherever there is demand. The package could be enhanced by export credit support arranged between the borrower and developed country equipment suppliers, for proposals involving major capital investment. Early real-world experiments could be possible making use of some or all of the features outlined above. While the concept is unfamiliar, tricky balances would need to be struck to deal with existing policy or risk parameters of a host country, an IFI or investors, or elements might need to be left out. But this is the case with the birth of any new class of financial instrument.

To begin with, it can be expected that institutional investors would be cautious about the proportion of their return they would accept in carbon reduction units: these are still unfamiliar, and there is political risk involved. The carbon element could be an additional benefit, a “kicker” diversifying the risk and return profile in an interesting way. As familiarity grows and emissions reduction ambition by countries across the world increases, the appetite for a greater share of the return in the form of carbon will increase as well, and major steps will be taken towards the globalization of the idea of a carbon price, without which any effective climate change policy is doomed to failure.

In conclusion, the GNB instrument is a new step for international climate policy and for the carbon market as it is currently known. But without it, or something like it, there is no chance of incentivizing substantial private investment at the necessary scale into technologies and activities that are simply uneconomic without a price on carbon and a reason to invest. The political consequences, as well as the climate change consequences, of failure to meet the expectations of the developing world in this uniquely difficult issue of climate change, could be immense, huge sums of money need to be raised; the private sector must be involved as never before; there are tight constraints on expenditure, borrowing or disguised borrowing by Governments. If there is an alternative to a GNB approach, it is very hard to see what it is.

## 8. United Nations Environment Programme



United Nations Environment Programme (UNEP):

### ***FIT OR NOT? SCALING UP RENEWABLES USING FEED-IN-TARIFFS A UNEP RESPONSE***

#### **Key Messages**

- FIT is one of 10 most common energy policy instruments available to increase renewables deployment. It can complement and support existing energy policy portfolios.
- Lessons learnt from previous FIT schemes in several developed and some developing countries can guide decision-makers on whether, how and when to use FITs.
- FIT design and implementation should be adapted to each country's specific conditions and needs, in particular those of developing countries.
- Proper planning and design, resource and impact assessments, as well as institutional strengthening are needed to optimise development benefits with minimal

#### **CLIMATE, ENERGY, ENVIRONMENT AND DEVELOPMENT**

Climate change is unequivocal and is dramatically accelerating. Deep, urgent and large scale changes in energy generation and use are required if we are to meaningfully reduce global greenhouse gas emissions.

Currently, 80% of global energy needs or 66% of power supply (Exhibit 1) are fossil fuel-based. Global energy systems currently represent some 60% of total current greenhouse gas (GHG) emissions. In a business as usual scenario, the world's energy needs will increase by almost 60% in 2030. Needless to say, this will be accompanied by an equivalent increase in greenhouse gas emissions. Moving away from this alarming future revolves around the rapid deployment of new and renewable sources of energy and demand-side management measures such as energy efficiency.

The global share of renewables in new power capacity added was 47% in 2008-2009 (Exhibit 2) and is growing. Particularly developing countries have large potential for leapfrogging in the area of renewable energies, the main reasons being currently relatively low deployment of conventional energy infrastructure as well as an abundance of varied sources of renewable energy. Still, the current energy markets contain many barriers that hinder the development of renewables, including fossil fuel subsidies and high or higher upfront cost of renewables. These bear the risk that developing countries will be left behind in this 'energy revolution'.

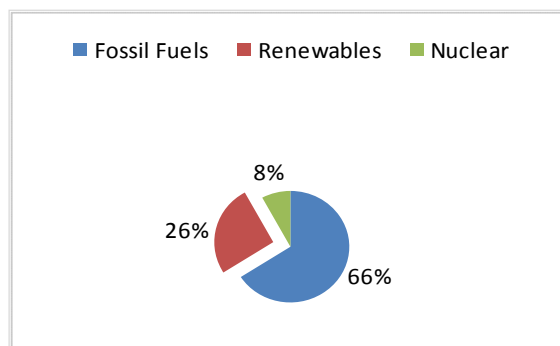
Governments hence need to design and enact policies to spur the uptake of renewables and forge a self-sustaining renewable energy market. They can do this through support for the development of adequate technologies, and the creation of adequate legal and institutional frameworks.

In the renewables sector, large scale financing calls for private investment; and large scale private investment over relatively long-term horizons requires mechanisms to provide investor security. Developing countries face difficulties to provide the appropriate financial guarantees, and to source the incremental funding to encourage renewables investment. This is why the readiness of developing countries needs to be strengthened so that they can put in place policies that favour investment in renewable energy and energy efficiency, overcome transaction costs, as well as choose and adopt new and more efficient energy technologies. This shift from 'old' to 'new' energy presents us with wide-ranging opportunities to invest in a green economy and pursue development goals, the more so in developing countries.

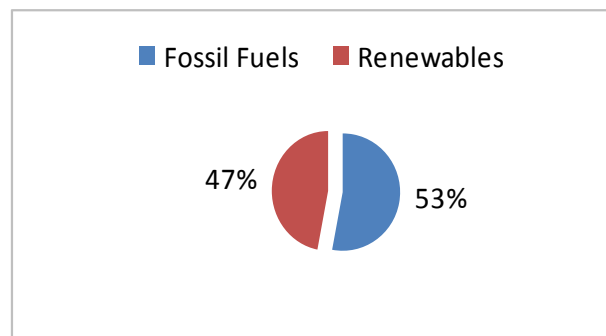
## 8. United Nations Environment Programme

Exhibit 8.7

World generating capacity by source (2009)



New power capacity added worldwide by source (2008-2009)



Source : REN 21 Renewables 2010 Global Status Report

### THE FIT CHALLENGE AND UNEP RESPONSE

FITs have been mostly used in developed countries, with rising interest in FITs on the part of developing countries.

A well-designed, transparent and effectively implemented FIT scheme is a valuable tool to accelerate the deployment of renewables in developing countries, by encouraging the involvement of independent power producers. The underlying rationale is simple economics.

On the other hand, many countries, in particular developing ones, are concerned that they lack the capacity and resources to effectively design and implement energy policies, including FITs. FITs, if chosen, need to be structured so as to complement existing energy policy portfolios, taking into account the country's level of development, social context, geographical location, renewable energy endowment, existing infrastructure and market readiness. Timely and appropriate support to those developing countries interested in devising FITs would enable them to choose whether, how and when to effectively use FITs.

Several studies have been undertaken to analyse the results and success factors of FITs, but with most of them focusing on developed countries, where FITs initially originated. Addressing this knowledge and capacity imbalance, and building on previous experience in policy, technology and financing initiatives in the renewables sector, UNEP is supporting developing countries to make informed policy decisions about the "whether", "how" and "when" of FITs in their endeavour to accelerate the deployment of renewables whilst ensuring their sustainability. This support is structured into two consecutive stages, with resources already available for stage 1 but yet to be mobilised for stage 2:

#### ■ Stage 1: Background Study & Toolkit Development

Building on previous work the background study will complement the knowledge gap on FITs, whilst highlighting the associated environmental and developmental benefits and impacts. The study will analyse the various models used by both developed and developing countries in designing and implementing FITs and carry out a SWOT analysis, within a broader renewable energy policy perspective. Based on the results of this study, a toolkit comprising recommendations on policy and regulatory FIT features specifically targeted to developing country conditions will be developed to guide respective FIT planning process. The outputs (study and toolkit) will be disseminated amongst others through various related capacity building activities organised by UNEP. The study is being initiated and will be delivered during the first half of 2011.

## 8. United Nations Environment Programme

### ■ Stage 2: Capacity Building & Technical Assistance

Using the outputs of stage 1, stage 2 aims to build local capacity and provide advice to selected developing countries in designing and implementing nationally appropriate FIT frameworks. This component will involve building on previous or ongoing projects and complement existing national policy instruments. Upon securing of appropriate funding, this technical assistance programme will be implemented in 2011-2012. Target developing countries will be from Africa, Latin America and Asia. Stage 2 will include country-specific gaps and needs assessments. Based on the assessments, UNEP intends to provide technical assistance to help address identified gaps, draft and amend legal instruments as appropriate, and support countries in designing bridge funding mechanisms whilst they develop the required regulatory, institutional and financial mechanisms for a sustainable FIT policy, once the preliminary support lapses.

### KEY ISSUES DETERMINING THE SUCCESS OF ANY FIT SCHEME

The efficiency and effectiveness of FITs depend on numerous factors and need to be addressed within the broader context of energy policy. Critical components remain capacity, resources, design of payment options and energy subsidies management. The financing framework of FITs is a cornerstone of their effectiveness and the confidence of financiers to invest in renewable energy projects with FIT components needs to be enhanced.

### ■ Under which conditions is FIT an appropriate policy tool?

FITs require grid connectivity, which may not be sufficiently developed in some developing countries. Mini grid application is possible, but needs to be taken into account in the design of the scheme. FITs should always be part of a broader energy policy mix. Linked to this is the issue of how FIT can help increase installed renewable energy capacity as well as improve energy access particularly in rural areas.

### ■ Which renewable energy sources and technologies should be promoted at what level?

These decisions need to be based on solid assessment of energy resources. They also requires assessment of technology absorption capacity, technology transfer opportunities as well as opportunities to set up a domestic industry sector or at least providing higher levels of local content to external renewable energy projects. For example, with GEF support UNEP has undertaken Solar and Wind Energy Resource Assessments in a number of countries, which has helped informed decision making on government side and increased investor confidence in renewable energy projects. UNEP, again with GEF funding, also runs a Technology Needs Assessment Programme which provides support to 45 countries to support country readiness.

### ■ Who pays for the FIT and how?

Current market inequalities, subsidies and diseconomies of scale for renewable energy technologies often result in electricity from renewable sources costing more than conventionally produced power. Most developed country FIT schemes have added a tariff incremental to consumer bills. This may be prohibitive in developing countries where the population already spends a significant amount of their income on energy. External funds guaranteeing the support for the additional cost of the FIT for a sufficiently long period, e.g. 15-20 years, does not seem feasible as they exceed available financing/lending cycles. However, some interesting approaches that UNEP has taken in its finance programmes include using public funding to bridge finance, for a pre-determined period of time, efforts to redirect a) fossil fuel subsidies towards renewables and b) spending for fossil fuel imports to FITs. Identifying the duration and level of support needed requires working with the recipient countries on the macro-economic and financing requirements, alongside TNAs and resource assessments.

## 8. United Nations Environment Programme

Using future climate funds for financing “readiness” costs and removing transaction barriers for the private sector could become an integral part of the investments, with predictable financial support being a mix of public and private finance.

- **What is the appropriate institutional set up and how can administrative burden be reduced on a country?**

The UNEP FIT project will be assessing various FIT schemes in developed and developing countries and develop a decision support tool to enable developing countries to design the framework that would be the most appropriate to their respective specific conditions and needs. Networking amongst developing countries will enable knowledge transfer and the sharing of best practices. Previous work aimed at improving renewable energy legislative frameworks, such as the UNEP Handbook for Drafting Laws on Energy Efficiency and Renewable Energy Resources , will be built upon.

- **How can investor certainty be balanced with policy space?**

Keeping overall costs of FITs under control both for Governments and final consumers, whilst at the same time incentivising renewables investment, are arduous tasks which require robust, transparent yet flexible renewable energy frameworks.

- **How can FITs further development goals?**

FITs, by enhancing the deployment of renewables, is meant to have an overall sustainable development dimension: economic through the attraction of investment, and creation of or support to local technology development; social through job creation and energy access; and environmental through reduced greenhouse gas emissions and reduced air pollution.

### **CATALYSING PUBLIC-PRIVATE PARTNERSHIPS**

UNEP, with its environmental protection mandate, its experience in renewable energy activities in developing countries and its history of optimising networking and multistakeholder processes, stands ready to address this knowledge imbalance towards developing countries as well as to launch South-South cooperation through knowledge transfer in FITs.

UNEP recognises that quicker progress can be made by valuing and mainstreaming the contribution of expert partners in its activities and in-country interventions. This project will seek to establish long-standing and fruitful partnerships with countries, regional and national institutions and other partners such as the private sector, centres of excellence and civil society.

## 8. United Nations Department of Economic and Social Affairs

### **A Global Green New Deal for Climate, Energy, and Development<sup>38</sup>**

United Nations Department of Economic and Social Affairs

Recent research by the United Nations and others (see, e.g., United Nations 2009, Birdsall and Subramanian 2009, Jacobsen and Delucchi 2009) has focused on ways to drive down the price of renewable energy in the near term, accelerate its spread globally, improve the economies of both the developed and developing world, and end energy poverty. This genuine "win-win" strategy carries with it another extremely important benefit: it makes possible the attainment of critical emission reduction targets, and thus reduces the risk of dangerous climate change.

The "Global Green New Deal" (GGND) brings the different components of the strategy together into an integrated program: international goal-setting, limited-time subsidies, targeted investments, coordinated national development policies, and comprehensive extension systems. Together these can accelerate the global economy's arrival at a "positive tipping point" in the spread of renewable energy. Pushing down the price of renewables and removing the barriers to their adoption will accelerate the process of industrial scaling-up in that sector – a process which is already under way. Expanded markets for renewable energy, and faster growth rates in production, will lead to faster technology improvement, which will further lower costs and thus prices. The result will be a "virtuous cycle" of expansion, learning, and cost reduction. Within a relatively short period of time – between 10 and 20 years, depending on how quickly the world ramps up – prices will have fallen to the point where subsidies for renewable energy are no longer necessary.

The strategic objective of the GGND is to make proven renewable technologies universally affordable, so that renewable energy becomes the default choice for the world as a whole. Making renewable energy affordable directly addresses the needs of developing countries and emerging economies, where the demand for new energy services is most acute, and where the vast majority of new energy development is expected to occur in the coming decades.

#### **Investments, whose returns at the global scale include:**

- **Employment:** Millions of new "green jobs" in a rapidly expanding renewable energy sector in both developed and developing countries. (Investments in renewable energy have been shown to create two to three times as many jobs as investments in conventional energy development.) (Pollin and Garrett-Peltier, 2007)
- **Energy Security:** Increased geo-political stability, improving the conditions for trade and exchange of all kinds. (As nations become less dependent on the production and importation of fossil fuels, they will have less reason for conflict over the sources of both energy and emissions.)
- **Reduced Climate Risks:** A significant reduction in costs associated with the expected damages from accelerated global warming. (As the Stern Review and others have noted, inaction on global warming could result in costs as high as 20% of world output in the coming century.) (Stern, 2006)
- **International Cooperation:** A clear pathway for multiple actors to channel international finance for mitigation, as well as a mechanism for phasing out such financing within one to two decades. (In recent work, Stern et al. note that a well-structured finance scheme will create aligned incentives, encourage governments and private sector actors to work together, and create the virtuous cycle of investment and development that is the essence of this strategy.) (Stern, 2009)
- **Greenhouse Gas Mitigation:** The contribution of this investment to greenhouse gas mitigation consists of two components: direct and indirect. The direct component is the avoided emissions due to the substitution of a new renewable energy plant for a conventional energy alternative, most likely coal. In this case, this works out to the

---

*For details, please see UN-DESA (2009), "A Global Green New Deal for Climate, Energy, and Development". New York: United Nations: [http://www.un.org/esa/dsd/resources/res\\_pdfs/publications/sdt\\_cc/cc\\_global\\_green\\_new\\_deal.pdf](http://www.un.org/esa/dsd/resources/res_pdfs/publications/sdt_cc/cc_global_green_new_deal.pdf)*

## 8. United Nations Department of Economic and Social Affairs

---

avoidance of between 2.5 and 3.5 billion tons of carbon dioxide per year by 2025 and every year thereafter. Assuming an investment life of 40 years, the cumulative emission reduction would be between 100 and 140 billion tons of carbon dioxide at an incremental cost of up to \$1,500 billion, in other words, between \$15 and \$11 per ton of carbon dioxide. However, this is only a part of the story. Once the cost of the renewable energy becomes competitive and affordable, it will become the default option for future power sector investments. This means that between 2025 and 2050, the initial investment of \$1,500 billion will continue to produce additional offsetting of carbon dioxide. If power sector capacity continues to grow at historic rates and in accordance with rising demand from developing countries, this will result in the avoidance of an additional 8 billion tons of emissions per year at no additional cost.

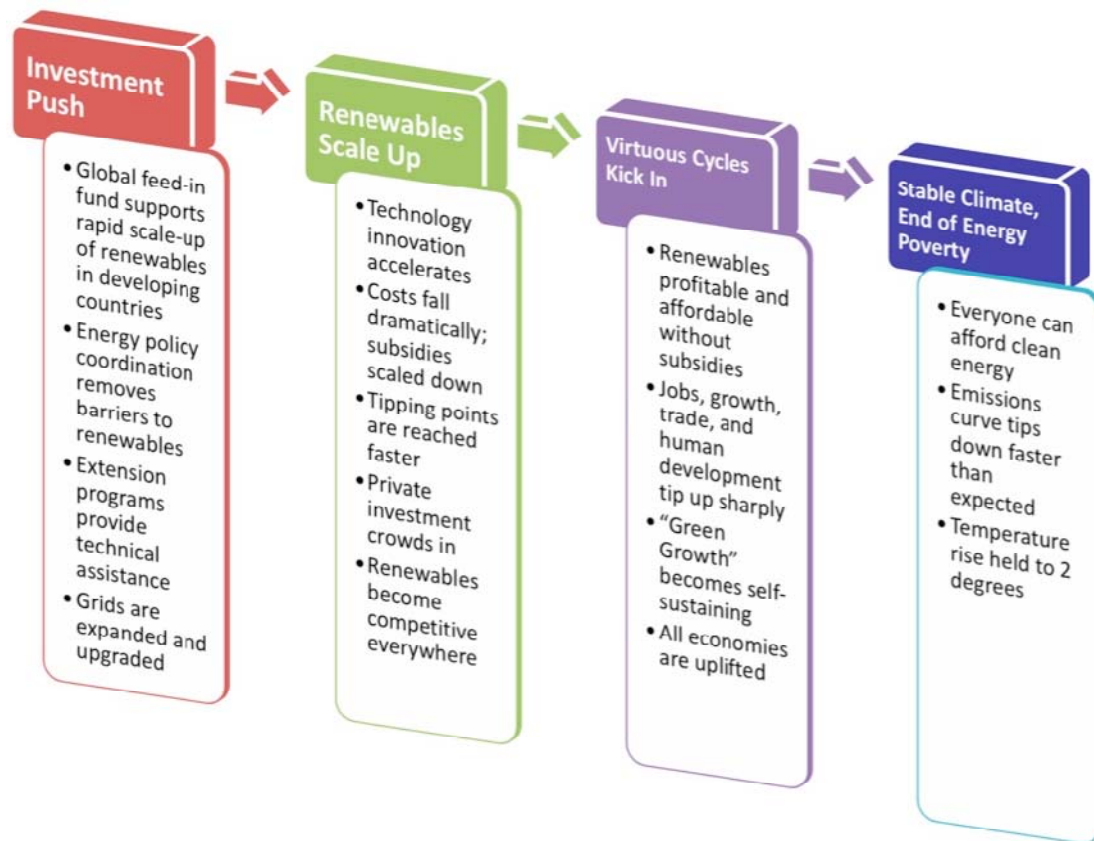
The “big push” to realize the GGND cannot be implemented by any country alone. In the first decade and a half, it will require globally funded guarantees, or price supports (e.g., through a global “feed-in tariffs” program), to subsidize investment. Where feed-in tariffs have been employed in developing countries, they often have to be accompanied by government budgetary allocations to cover the differential between the guaranteed price that the utility pays to the renewable energy suppliers, and the average rate that it is allowed to charge consumers for each kilowatt hour of electricity. This dependence on national budgets to cover the difference places a cap on the total expansion of renewable energy that can take place in a developing country, and thus creates a disincentive for expanded renewable energy investment. International financing to support the tariff, or price guarantee, will remove this constraint and create highly favorable conditions for accelerating renewable energy investment and development.

In practical terms, the GGND involves linking the demonstrated favorability and effectiveness of feed-in tariff policies with the rapidly growing energy needs of developing countries, offering suitable mechanisms for finance, policy, and technical support for rapid scale-up. It delivers the right mix of policy and market stability that, according to recent research summarized by Stern et al., can create the highest possible leverage for public financing, mobilizing up to 15 times the original investment in additional, follow-on funding.

## 8. United Nations Department of Economic and Social Affairs

From forward-looking firms in the energy sector, to individual householders in the world's poorest countries, to skilled workers and experts in all countries, a Global Green New Deal creates many winners in the global economy. Implementing the GGND will lay the foundation for a new, self-sustaining cycle of green growth globally, while steering the world on a course to end the scourge of energy poverty and avoid the threat of dangerous climate instability (see Figure below).

**Exhibit 8.8**





## 8. United Nations Industrial Development Organization

**United Nations Industrial Development Organization (UNIDO):**  
**Morgan Bazilian and Patrick Nussbaumer**

### ***The Cost of Universal Energy Access<sup>39</sup>***

Understanding the overall scale of spending required to address energy poverty is crucial to support political decision-making and inform the design of policy and appropriate financial instruments. We have made a new estimate of the total cost to provide universal access to modern energy services by 2030; a goal put forward by the United Nations Secretary-General's Advisory Group on Energy and Climate Change.

The literature on the subject, based on either modeling work (see the recent IEA WEO 2010) or extrapolation from project experience, provides a wide variety of estimates at the global, regional, national, and project levels. Our analysis begins to “unravel” those figures in order to increase transparency by evaluating the various estimates through comparable metrics. The results show average per capita annual capital cost estimates for electrification ranging from US\$ 5-40 (with a median at US\$ 25). The cost for clean cooking is significantly (an order of magnitude) less.

Most estimates, with few notable exceptions, consider solely capital costs, and focus primarily on the supply-side; less attention is paid to recurrent costs, such as those related to operation and maintenance (O&M) or fuel use. In modern energy systems, experience shows that the cost of fuel is a significant share of the total cost. Similarly, O&M costs can represent between a few percent of the total cost for electricity generation from fossil fuel to as much as a fifth in the case of renewables. There is therefore a strong case to include recurrent costs in the estimates so as to provide a more accurate picture.

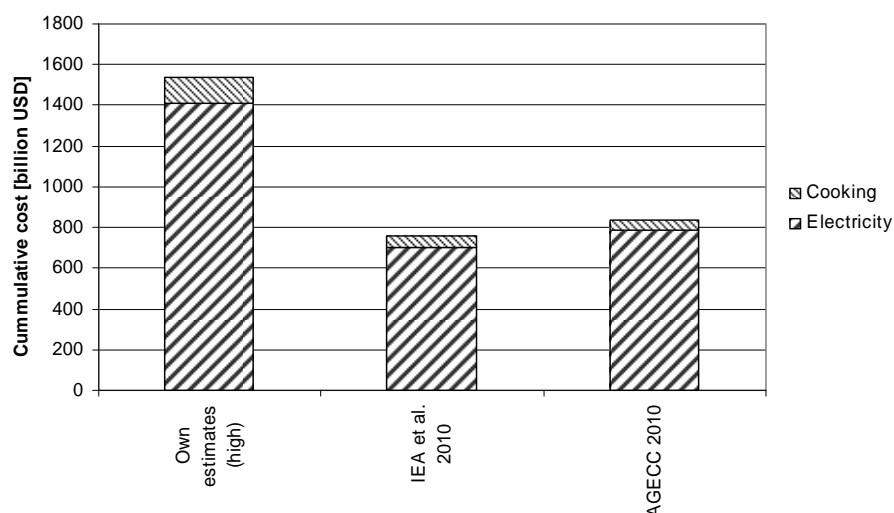
To address some of those shortcomings, we used levelised costs of electricity generation to capture dimensions that are absent from other analyses. Three scenarios were created to investigate a range of assumptions, and sensitivity analyses was used to prioritise key elements such as fuel prices and generation portfolios. Our estimate of the total cost of reaching universal access to modern energy services is significantly higher than the most oft-cited figures. An average annual cost well in excess of US\$100 billion for electrification and over US\$ 2 billion for clean cooking - roughly 1.5 trillion in total to 2030 - is likely to be realistic.

---

<sup>39</sup> For more detailed information on our literature review, cost comparisons, new methodology and scenario results, see: Morgan Bazilian, Patrick Nussbaumer, Erik Haites, Michael Levi, Mark Howells, and Kandeh Yumkella. 2010. *Understanding the Scale of Investment for Universal Energy Access*. *Geopolitics of Energy* 32, no. 10: 19-40.

## 8. United Nations Industrial Development Organization

**Exhibit 8.9: Comparison of the cumulative cost estimates for universal access to electricity and clean cooking by 2030 between various recent studies**



Provided that adequate incentives and conditions are in place, investments to promote energy access will bring about a number of associated developmental benefits. An accurate understanding of the cost associated with universal energy access is a prerequisite to the development of strategies to deal with this pressing issue.

## 8. University of California Berkeley

### Mitigating carbon emissions while accessing savings and reducing poverty in rural communities

Christian E. Casillas<sup>1</sup> and Daniel M. Kammen<sup>1,2</sup>

<sup>1</sup> Energy and Resources Group, University of California, Berkeley, CA, USA

<sup>2</sup> The World Bank, Washington, DC USA

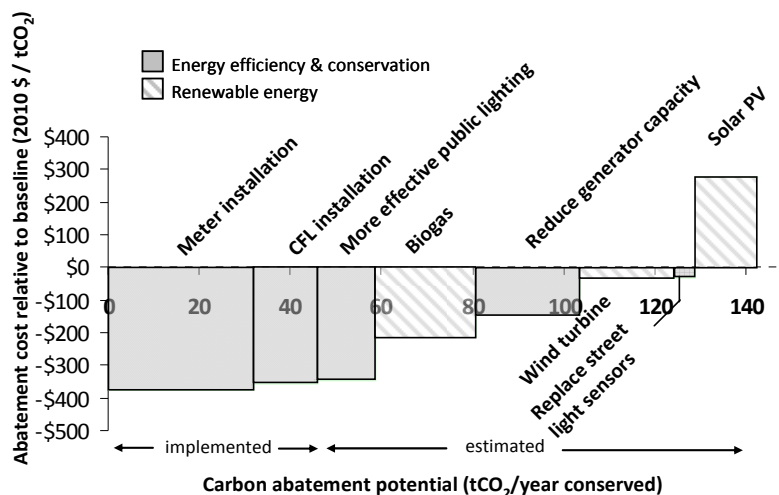
Two-thirds of the world's poorest people live in rural areas. Lack of access to improved energy services and worsening environmental shocks due to climate change both add to the challenge of mitigating rural poverty. We find, however, that energy services can be provided in cost-effective manners, offering potential to address aspects of rural poverty, while also transitioning away from climate damaging fossil fuel dependence.

With 1.5 billion people without access to electricity, combustion-related emissions from the rural power sector are expected to grow in the coming decades. Due to the low capital costs and large network of suppliers, diesel generators are often the technology of choice in rural areas, without placing sufficient consideration on the volatility of fuel prices or the low loads, and thus low efficiencies, at which they are often operated, resulting in expensive generation costs. Every dollar spent on the transition to more efficient low-carbon energy systems in rural areas has the potential to produce greater human development benefits, financial savings, and larger carbon mitigation returns than in more industrialized ones (if economies of scale do not dominate).

A marginal abatement cost (MAC) curve is a useful tool for quantifying the emissions potentials and costs for various changes to local, national, or international economies and infrastructure. A MAC curve typically shows the annual carbon abatement potential for an intervention, and the cost per quantity of carbon emissions abated, relative to the emission costs for a baseline case. A community-level MAC curve derived from ongoing research on the Atlantic Coast of Nicaragua demonstrates that low-carbon rural energy services can be delivered at cost savings in cases where communities utilize diesel powered generation, isolated from the national grid (i.e., a micro-grid). In partnership with the Nicaraguan government and a local non-government organization, several energy efficiency measures were implemented in two villages in 2009. A MAC curve for the electricity sector of these communities was developed (Fig 1)<sup>40</sup>. The first two efficiency measures in the curve (installation of conventional electricity meters and compact fluorescent lights (CFLs)) were actually carried out, while impacts of subsequent measures are based on estimations. The majority of the abatement measures in Fig 1 can be achieved at negative costs relative to the diesel baseline (i.e., costs are outweighed by savings).

**Fig 1: Rural village MAC curve.**

Abatement cost is with respect to a baseline diesel carbon price of 397 \$ per metric ton CO<sub>2</sub> (tCO<sub>2</sub>). Abatement cost is due to the reduction of diesel use, relative to each previous measure. Multiplying abatement potential and abatement cost gives total annual costs relative to baseline, and assuming the previous measure was implemented.



<sup>40</sup> Adapted from Casillas, C. and Kammen, D. M. (2010) "The energy-poverty-climate nexus," *Science*, **330**, 1182 – 1182.

## 8. University of California Berkeley

---

The combination of the meter and CFL installations led to both a daily savings in diesel fuel consumed and an increase in the daily operation of the micro-grid, *increasing* household access to electricity services.

Using MAC curves in conjunction with a clear understanding of how various measures will support community development goals insures that climate change dollars also address the most pressing challenges of the poorest communities. Integration of development agendas into climate change frameworks has been limited, in part, by a lack of both easy-to-understand metrics and systems-level planning tools necessary for prioritizing the allocation of limited capital. Using MAC curves, it is apparent that increasing access to energy services can both reduce carbon emissions and monetary expenditures, with great potential to impact development and reduce poverty.

## 9. Bibliography

Alliance for Rural Electrification (2009). Green light for renewable energy in developing countries. Brussels, Netherlands: Alliance for Rural Electrification.

Arbelaez, J. P., & Marzolf, N. C. (2010). Incentives for adopting renewable energy in Jamaica. Washington, DC: Inter-American Development Bank.

Business News Americas. (2005, March 24). BNDES eases Proinfra financing rules - Brazil. Business News Americas.

Byer, T., Crousillat, E., & Dussan, M. (2009). Latin America and the Caribbean region energy sector: Retrospective review and challenges (ESMAP Technical Paper 123/09). Washington, DC: The World Bank Group, Energy Sector Management Assistance Program.

Capacity Development for Scaling Up Decentralized Energy Access Programmes (2010) United Nations Development Programme and Alternative Energy Promotion Centre, Charting a new low-carbon route to development (2009) United Nations Development Programme

Climate Funds Update, Amazon Fund, <http://www.climatefundsupdate.org/listing/amazon-fund>

Climate Funds Update, Environmental Transformation Fund International Window, <http://www.climatefundsupdate.org/listing/environmental-transformation-fund>

Climate Funds Update, Global Climate Change Alliance, <http://www.climatefundsupdate.org/listing/global-climate-change-alliance>

Climate Funds Update, Hatoyama Initiative, <http://www.climatefundsupdate.org/listing/hatoyama-initiative>

Climate Funds Update, International Climate Initiative, <http://www.climatefundsupdate.org/listing/international-climate-initiative>

Climate Funds Update, MDG Achievement Fund – Environment and Climate Change Thematic Window, <http://www.climatefundsupdate.org/listing/mdg-achievement-fund>

Climate Funds Update, UN-REDD Program, <http://www.climatefundsupdate.org/listing/un-redd-programme>

Climate Investment Funds, CIF Partnership Forum 2010, Climate Investment Funds set to mobilize US\$40 billion for country-led low carbon growth, [http://www.climateinvestmentfunds.org/cif/pf\\_2010\\_pressrelease\\_03\\_19](http://www.climateinvestmentfunds.org/cif/pf_2010_pressrelease_03_19)

Congo Basin Forest Fund, <http://www.cbf-fund.org/>

CTV, IEA urges G20 to end fossil-fuel subsidies, <http://www.ctv.ca/generic/generated/static/business/article1792514.html>

Dalbem, M. C., & Gomes, L. L. (2010). Wind energy in Brazil: Analysis of incentive policies and the new rules adopted in 2009. Proceedings of the International Association for Energy Economics 33rd International Conference, Rio de Janeiro, Brazil.

Dutra, R. M., & Szklo, A. S. (2007). Incentive policies for promoting wind power production in Brazil: Scenarios for the Alternative Energy Sources Program (PROINFA) under the New Brazilian electric power sector regulation. Renewable Energy, 33(1), 65-76.

ECOFYS Germany GmbH. (2009). Energy-policy framework conditions for electricity market and renewable energies: 16 country analysis. Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Division Environment and Infrastructure, TERNA Wind Energy Programme.

Economic Commission for Latin America and the Caribbean, & Inter-American Development Bank. (2010). Climate change: A regional perspective. Santiago, Chile and Washington, DC.

Energy Efficiency News, <http://www.energyefficiencynews.com/i/3554/>

Engaging private sector capital at scale in financing low carbon infrastructure in developing countries (2010), Murray Ward, Global Climate Change Consultancy, Auckland, New Zealand.

European Investment Bank, Carbon Fund for Europe, [http://www.eib.org/projects/publications/carbon\\_fund\\_for\\_europe\\_brochure.htm](http://www.eib.org/projects/publications/carbon_fund_for_europe_brochure.htm)

European Investment Bank, Climate Awareness Bond, <http://www.eibclimatebond.eu/>

Evaluation of different feed-in tariff design options 2nd Ed. (2008), Energy Economics Group

Feed-in Tariffs – Boosting Energy for our Future (2007), World Future Energy Council: [www.worldfuturecouncil.org](http://www.worldfuturecouncil.org)

Feed-in Tariffs Go Global: Policy in Practice, Renewable Energy Magazine, Sept. 2009

GEEREF, What is GEEREF, <http://geeref.com/posts/display/1>

Global Environment Facility, About GEF, <http://www.thegef.org/gef/whatisgef>

Human Development in a Changing Climate: A framework for Climate Finance (2010) United Nations Development Programme, New York,

## 9. Bibliography

IFC, IFC Issues Inaugural Green Bond to Invest in Climate-friendly Projects, <http://www.ifc.org/ifcext/media.nsf/content/SelectedPressRelease?OpenDocument&UNID=1991E8717A1A273A8525770600605493>

KEMA. (2008). CARILEC position paper on energy policy. Gros Islet, Saint Lucia: Caribbean Association of Electric Utilities.

Martinot, E. (2005). Renewables 2005 global status report. Washington, DC: Worldwatch Institute.

Melo, E., de Almeida Neves, E. M., & da Costa, A. M. A. (2009, June 21-24). The new governance structure of the Brazilian electricity industry: How is it possible to introduce market mechanisms? Proceedings of the 32nd International Association for Energy Economics (IAEE) Conference - Energy, Economy, Environment: The Global View, San Francisco, CA.

Piva, S., & Garcia, A. T. (2009). Argentina. In World Wind Energy Association (Ed.), Wind energy international 2009/2010. Bonn, Germany: World Wind Energy Association.

Rivera, M. Á. F. (2010, August 24-25). Marco legal de energía renovable en Honduras y perspectivas de desarrollo. Proceedings of the National Association of Regulatory Utility Commissioners - Promoting Renewable Energy Development: An Introductory Workshop for Energy Regulators 2010, San Jose, Costa Rica.

Sawin, J., & Martinot, E. (2010). Renewables 2010: Global status report. Paris: REN21 Secretariat.

Scaling up Renewable Energy in Developing Countries: finance and investment perspectives (2010) Kirsty Hamilton, Associate Fellow, Renewable Energy Finance Project, Chatham House

Sciaudone, C. (2010). Argentine tender hailed, but finance questions remain. Recharge.

The Forest Carbon Partnership Facility, About the FCPF, <http://www.forestcarbonpartnership.org/fcp/node/12>

The Role of Feed-in Tariff Policy in Renewable Energy Development in Developing Countries: A Toolkit for Parliamentarians (2009), AFREPREN/FWD

The World Bank and Independent Evaluation Group (2009). The Welfare Impact of Rural Electrification. Washington DC: The World Bank Group

UN AGECC (2010). Energy and the Secretary-General's Advisory Group on Energy and Climate Change Energy for Development: Towards a Sustainable Global Energy Future. New York, NY: United Nations.

UN High Level Advisory Group on Climate Change Financing, Report of the Secretary-General's High-Level Advisory Group on Climate Change Financing, [http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF\\_reports/AGF\\_Final\\_Report.pdf](http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/AGF_Final_Report.pdf)

UN High Level Advisory Group on Climate Change Financing, Workstream 7 Paper: Public Interventions to Stimulate Private Investment in Adaptation and Mitigation, [http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF\\_reports/Work\\_Stream\\_7%20Public\\_Private.pdf](http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/Work_Stream_7%20Public_Private.pdf)

UN High Level Advisory Group on Climate Change Financing, Workstream 8, Carbon Markets: Benefits to Developing Countries and Options for Expansion, [http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF\\_reports/Work\\_Stream\\_8\\_%20Carbon%20markets.pdf](http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/Work_Stream_8_%20Carbon%20markets.pdf)

United Nations (2009). Bridging the Divide between Poverty Reduction and Climate Change through Sustainable and Innovative Energy Technologies. New York, NY: United Nations.

United Nations Development Programme & the World Health Organization (2009). The Energy Access Situation in Developing Countries. United Nations. New York, NY: United Nations.

United Nations Development Programme (2009) Charting a new low-carbon route to development, New York.

United Nations Development Programme (2010). Ambitious but achievable: Universal Access to Energy by 2030. New York, NY: United Nations.

United Nations Development Programme, (2008), Promotion of Wind Energy: Lessons Learned from International Experience and UNDP-GEF projects. New York.

United Nations Development Programme; United Nations Industrial Development Organization; International Energy Agency (2010). Energy Poverty: How to make modern energy access universal? New York, New York: United Nations; International Energy Agency.

United Nations Environment Programme (2008). Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World: Policy Messages and Main Findings for Decision Makers. New York, NY: United Nations.

United Nations Environment Programme. (2008, January 27-February 1). Report on the Latin American and Caribbean Initiative for Sustainable Development (ILAC): Five years after it was adopted. Proceedings of the Sixteenth Meeting of the Forum of Ministers of Latin America and the Caribbean, Santo Domingo, Dominican Republic.

## 9. Bibliography

---

Woodhouse, E. J. (2005). A political economy of international infrastructure contracting: Lessons from the IPP experience. Stanford, CA: Stanford University, Center for Environmental Science and Policy, Program on Energy and Sustainable Development.

World Bank, Carbon Finance Unit, BioCarbon Fund, <http://wbcarbonfinance.org/Router.cfm?Page=BioCF>

World Bank, Carbon Finance Unit, Carbon Partnership Facility,  
<http://wbcarbonfinance.org/Router.cfm?Page=CPF&FID=41756&ItemID=41756>

World Bank, Carbon Finance Unit, Community Development Carbon Fund, <http://wbcarbonfinance.org/Router.cfm?Page=CDCF>

World Bank, Carbon Finance Unit, Danish Carbon Fund, <http://wbcarbonfinance.org/Router.cfm?Page=DCF&ItemID=9713&FID=9713>

World Bank, Carbon Finance Unit, Italian Carbon Fund, <http://wbcarbonfinance.org/Router.cfm?Page=ICF&ItemID=9710&FID=9>

World Bank, Carbon Finance Unit, Netherlands CDM Facility,  
<http://wbcarbonfinance.org/Router.cfm?Page=NCDMF&ItemID=9711&FID=9711>

World Bank, Carbon Finance Unit, Netherlands European Carbon Facility,  
<http://wbcarbonfinance.org/Router.cfm?Page=NECF&ItemID=9712&FID=9712>

World Bank, Carbon Finance Unit, Spanish Carbon Fund, <http://wbcarbonfinance.org/Router.cfm?Page=SCF&ItemID=9714&FID=9714>

World Bank, Carbon Finance Unit, Umbrella Carbon Facility,  
<http://wbcarbonfinance.org/Router.cfm?Page=UCFT2&ItemID=53224&FID=53224>

World Bank, Green Bond Fact Sheet

World Energy Outlook, International Energy Agency (2010), Paris

# Disclaimer

DB Climate Change Advisors is the brand name for the institutional climate change investment division of Deutsche Asset Management, the asset management arm of Deutsche Bank AG. In the US, Deutsche Asset Management relates to the asset management activities of Deutsche Bank Trust Company Americas, Deutsche Investment Management Americas Inc. and DWS Trust Company; in Canada, Deutsche Asset Management Canada Limited (Deutsche Asset Management Canada Limited is a wholly owned subsidiary of Deutsche Investment Management Americas Inc); in Germany and Luxembourg: DWS Investment GmbH, DWS Investment S.A., DWS Finanz-Service GmbH, Deutsche Asset Management Investmentgesellschaft mbH, and Deutsche Asset Management International GmbH; in Australia, Deutsche Asset Management (Australia) Limited (ABN 63 116 232 154); in Hong Kong, Deutsche Asset Management (Hong Kong) Limited; in Japan, Deutsche Asset Management Limited (Japan); in Singapore, Deutsche Asset Management (Asia) Limited (Company Reg. No. 198701485N) and in the United Kingdom, RREEF Limited, RREEF Global Advisers Limited, and Deutsche Asset Management (UK) Limited; in addition to other regional entities in the Deutsche Bank Group.

This material is intended for informational purposes only and it is not intended that it be relied on to make any investment decision. It does not constitute investment advice or a recommendation or an offer or solicitation and is not the basis for any contract to purchase or sell any security or other instrument, or for Deutsche Bank AG and its affiliates to enter into or arrange any type of transaction as a consequence of any information contained herein. Neither Deutsche Bank AG nor any of its affiliates, gives any warranty as to the accuracy, reliability or completeness of information which is contained in this document. Except insofar as liability under any statute cannot be excluded, no member of the Deutsche Bank Group, the Issuer or any officer, employee or associate of them accepts any liability (whether arising in contract, in tort or negligence or otherwise) for any error or omission in this document or for any resulting loss or damage whether direct, indirect, consequential or otherwise suffered by the recipient of this document or any other person.

The views expressed in this document constitute Deutsche Bank AG or its affiliates' judgment at the time of issue and are subject to change. This document is only for professional investors. This document was prepared without regard to the specific objectives, financial situation or needs of any particular person who may receive it. The value of shares/units and their derived income may fall as well as rise. Past performance or any prediction or forecast is not indicative of future results. No further distribution is allowed without prior written consent of the Issuer.

The forecasts provided are based upon our opinion of the market as at this date and are subject to change, dependent on future changes in the market. Any prediction, projection or forecast on the economy, stock market, bond market or the economic trends of the markets is not necessarily indicative of the future or likely performance.

## **For Investors in the United Kingdom:**

Issued in the United Kingdom by Deutsche Asset Management (UK) Limited of One Appold Street, London, EC2A 2UU. Authorised and regulated by the Financial Services Authority. This document is a "non-retail communication" within the meaning of the FSA's Rules and is directed only at persons satisfying the FSA's client categorisation criteria for an eligible counterparty or a professional client. This document is not intended for and should not be relied upon by a retail client.

When making an investment decision, potential investors should rely solely on the final documentation relating to the investment or service and not the information contained herein. The investments or services mentioned herein may not be appropriate for all investors and before entering into any transaction you should take steps to ensure that you fully understand the transaction and have made an independent assessment of the appropriateness of the transaction in the light of your own objectives and circumstances, including the possible risks and benefits of entering into such transaction. You should also consider seeking advice from your own advisers in making this assessment. If you decide to enter into a transaction with us you do so in reliance on your own judgment.

## **For Investors in Australia:**

In Australia, Issued by Deutsche Asset Management (Australia) Limited (ABN 63 116 232 154), holder of an Australian Financial Services License. This information is only available to persons who are professional, sophisticated, or wholesale investors under the Corporations Act. An investment with Deutsche Asset Management is not a deposit with or any other type of liability of Deutsche Bank AG ARBN 064 165 162, Deutsche Asset Management (Australia) Limited or any other member of the Deutsche Bank AG Group. The capital value of and performance of an investment with Deutsche Asset Management is not guaranteed by Deutsche Bank AG, Deutsche Asset Management (Australia) Limited or any other member of the Deutsche Bank Group. Deutsche Asset Management (Australia) Limited is not an Authorised Deposit taking institution under the Banking Act 1959 nor regulated by the Australian Prudential Authority. Investments are subject to investment risk, including possible delays in repayment and loss of income and principal invested."

## **For Investors in Hong Kong:**

Interests in the funds may not be offered or sold in Hong Kong or other jurisdictions, by means of an advertisement, invitation or any other document, other than to Professional Investors or in circumstances that do not constitute an offering to the public. This document is therefore for the use of Professional Investors only and as such, is not approved under the Securities and Futures Ordinance (SFO) or the Companies Ordinance and shall not be distributed to non-Professional Investors in Hong Kong or to anyone in any other jurisdiction in which such distribution is not authorised. For the purposes of this statement, a Professional investor is defined under the SFO.

## **For Investors in MENA region:**

This information has been provided to you by Deutsche Bank AG Dubai (DIFC) branch, an Authorised Firm regulated by the Dubai Financial Services Authority. It is solely directed at Market Counterparties or Professional Clients of Deutsche Bank AG Dubai (DIFC) branch, which meets the regulatory criteria as established by the Dubai Financial Services Authority and may not be delivered to or acted upon by any other person.

I-020110-1.3