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GROUNDING GREEN POWER

BOTTOM-UP PERSPECTIVES ON SMART RENEWABLE ENERGY POLICY IN DEVELOPING COUNTRIES

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On the cover: (Left) A man works on power line from a microhydro power source to E Wi Jo village in Thailand. (Right) Tanzanian engineers and policymakers visit a solar farm in central Thailand built using Thai-made solar panels. Photos by Chris Greacen.

Grounding Green Power

Bottom-up perspectives on smart renewable energy policy in developing countries

Climate & Energy Policy Paper Series

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Executive Summary

Case study countries:

- Brazil
- India
- Indonesia
- Kenya
- Mexico
- Morocco
- Mozambique
- South Africa
- Sri Lanka
- Philippines
- Tanzania
- Thailand

DEVELOPING COUNTRIES IN THE RENEWABLE ENERGY TRANSFORMATION

In order to meet the intensifying climate challenge, the global energy system must undergo a fundamental transformation, with a rapid increase of renewable energy worldwide.[1] Developing countries are at the forefront of this challenge, since they are expected to add around 80 percent of all new electric generation capacity worldwide in the next two decades.[2]

The deployment of energy from renewable sources is accelerating in developing countries, and already accounts for a higher percentage of electricity generation than in the developed world. In 2008, non-OECD nations generated 21 percent of their electricity from renewable sources including large-scale hydroelectric power (compared with 17 percent in OECD countries), according to International Energy Agency (IEA) statistics. However, this figure must more than double by 2035, to 46 percent, in order to meet the IEA's "450 scenario," which outlines a climate friendly pathway for meeting global energy demands.[3]

Transforming the energy system on this scale will require significantly increased support from developed countries, channeled through both bilateral assistance and multilateral institutions, as well as philanthropic initiatives. Our conclusions, derived from a series of case studies and a comprehensive review of existing literature, suggest that donors should deploy financial support more effectively by moving beyond a project-by-project approach to one that creates the right environment for investments in scaled-up, nationwide deployment.

This working paper seeks to assist in this process, by identifying key components of smart renewable energy policy in developing countries, focusing on the power sector. It also provides recommendations for maximizing the effectiveness of international support for deployment of renewable energies, drawn from these on-the-ground experiences in developing countries.

ABOUT THIS WORKING PAPER

Chapter 1 introduces the approach and methodology taken in this paper and describes the key concepts we address. The second chapter discusses what developing countries are already doing to deploy renewable energy sources, and how they can be supported in scaling up such efforts. It also introduces a set of principles of smart renewable energy policy to propel such a transformation, developed by the World Resources Institute. These are based on insights drawn from case studies of existing renewable energy policies in 12 countries in Africa, Asia, and Latin America (see sidebar) as well as from existing literature.

[1] The International Energy Agency's "450" scenario describes a pathway to stabilize atmospheric greenhouse gas concentrations at 450 parts per million of CO2-equivalent, which would result in a 50 percent chance of limiting global average temperature rise to 2 degrees Celsius above pre-industrial levels (see IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK: Cambridge University Press, 2007), 801). In this scenario, global electricity generation from renewable sources would have to increase by 285 percent between 2008 and 2035. See International Energy Agency, *World Energy Outlook 2010* (Paris, France: IEA, 2010), 620-21, 652-53.

[2] The International Energy Agency estimates that around 80 percent of global electric capacity additions between 2008 and 2035 will take place in non-OECD countries, i.e. in a group that is rougly the same as the developing world. See International Energy Agency, *World Energy Outlook 2010* (Paris, France: IEA, 2010), 620-21, 652-53.

[3] This point will be further elaborated in chapter 2. In the IEA's "450" scenario (see footnote 1), the share of renewable energy in electricity generation would have to increase from 17 percent in 2008 to 44 percent in 2035 in OECD countries and from 21 percent to 46 percent in non-OECD countries.

The following five chapters each examine one key element of smart renewable energy policy, discuss lessons learned, and identify needs for international support. These cover planning and strategy (Chapter 3), well-designed generation-based incentives (Chapter 4), an enabling policy and regulatory framework (Chapter 5), attractive financing conditions (Chapter 6), and the necessary technical environment (Chapter 7). Our findings and recommendations are summarized in Chapter 8.

Below we define our principles of smart renewable energy policy and then highlight our key findings and recommendations for each of the five key elements of such a policy.

PRINCIPLES OF SMART RENEWABLE ENERGY POLICY

We define smart renewable energy policy as *the set of rules, regulations, and government actions that lead to an increased share of renewables in total electricity consumption in line with a country's development objectives.* Smart renewable energy policy encourages private investment, achieves its objectives in a cost-effective way, promotes continuous innovation, and is designed through transparent, accountable, and participatory processes.

SMART RENEWABLE ENERGY POLICY ON THE GROUND

Successful approaches to renewable energy policy and support vary by country, but there are some common themes and recommendations emerging from the experiences made in case study countries analyzed in this paper. International support can bring the lessons from these experiences to more countries and scale up existing successes. The lessons learned from the case studies are as follows:

Planning and developing a strategy (Chapter 3):

- Official renewable energy targets are a crucial first step.
- Planning can grow more sophisticated as deployment expands; for serious scaling up of renewable energy, long-term planning will be necessary.
- Planning decisions need to be based on a realistic and transparent assessment of the full cost of different options.
- The planning process benefits from transparency, accountability, and stakeholder participation.

Designing generation-based incentives (Chapter 4):

- Policymakers need to choose an appropriate incentive for their context. It is important that incentives reward actual power production, not just installation.
- In many situations, a feed-in-tariff (FiT) is the most appropriate generation-based incentive to encourage private investment in renewable energy.
- Competitive bidding can result in lower prices and be an appropriate incentive mechanism for large-scale projects.
- Governments can increase the cost-effectiveness of renewable energy support by reducing fossil fuel subsidies.
- It is important that incentives reward actual power production, not just installation.
- Deciding how to fund an incentive mechanism raises political and equity challenges that may be more easily navigated with help from the principles of transparency, accountability, participation, and capacity.
- A price premium that decreases over time can drive performance improvement and cost reductions.

- Getting the price right at the beginning, based on an assessment of the technology, market conditions, and resource availability, is critical for the success of a FiT.
- FiTs are most effective if they are set at a technology-specific rate that reflects the cost of generation. However, in order to save scarce resources, they are also sometimes set at a price that only reflects the cost avoided by the utility that didn't have to produce the power itself.
- Caps can be used to control the cost of an incentive mechanism.
- Combining different generation-based incentives can also help control the cost of renewable energy policy.
- Incentives need to be designed in a way that limits speculation by imposing penalties or canceling permits if no generation projects are built.

Creating an enabling policy and regulatory framework (Chapter 5)

- Any generation-based incentive needs to be part of a broader set of power-sector rules and regulations.
- Institutions and procedures for transparent, accountable, and participatory decision-making can lead to better and more cost-effective decisions.
- Processes should allow for periodic review and changes to the generation-based incentives if necessary.

Providing attractive financing options (Chapter 6)

- Preferential financing options complement generation-based incentives by reducing investors' risks and addressing the high upfront capital needs.

Building the necessary technical environment (Chapter 7)

- Developing, installing, operating, and maintaining renewable energy projects all require specific technical know-how.
- The unique challenges renewables pose for the grid infrastructure in terms of transmission and intermittency need to be addressed.
- Scaling up of renewable energy can benefit from the bundling of renewable energy projects into clusters and prioritizing geographic areas for new transmission planning.

INTERNATIONAL SUPPORT FOR SMART RENEWABLE POLICY: RECOMMENDATIONS

Governments in the United States, Europe, and other developed countries, through bilateral assistance and multilateral institutions, can support the transformative renewable energy scale-up in developing countries. This will require the development of country-specific support packages and mixing and matching of a range of finance sources and tools. The balance of evidence presented in this paper suggests that such support packages should include:

1. Technical assistance, capacity development, and institution building to help developing countries develop strategies, targets, and policies;
2. Grant-based international public financing for generation-based incentives to cover additional cost;
3. Subsidized capital and risk mitigation to address incremental investment needs and higher costs of capital; and
4. Technical capacity building.

We hope this guide will assist both developing country governments in designing smart renewable energy policy, and bilateral donors and multilateral institutions in supporting the scaling up of renewable energy in the power sectors of developing economies.

Acronyms

APERC	Andhra Pradesh Electricity Regulatory Commission
BNDES	Brazil National Development Bank
CDM	Clean Development Mechanism
CERC	Central Electricity Regulatory Commission
CIFs	Climate Investment Funds
CTF	Clean Technology Fund
DBCCA	Deutsche Bank Climate Change Advisors
DfID	UK Department for International Development
DTI	The Department of Trade and Industry
EGI	Electricity Governance Initiative
EPPO	Energy Planning and Policy Office, Thai Ministry of Energy
ESMAP	World Bank's Energy Sector Management Assistance Program
EU	European Union
FiT	Feed in Tariff
GEF	Global Environment Facility
GERC	Gujarat State Electricity Commission
GHG	Green House Gas
GNI	Gross National Income
GW	Gigawatt
HPPF	Healthy Public Policy Foundation
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IREDA	Indian Renewable Development Agency
IRP	Integrated Resource Plan
kWh	kilowatt per hour
NAMA	Nationally Appropriate Mitigation Action
NARUC	National Association of Regulatory Utility Commissioners
MNRE	Indian Ministry of New and Renewable Energy
MW	Megawatt
OECD	Organization for Economic Co-operation and Development (OECD)
PIIE	Peterson Institute for International Economics
PPA	Individual Power Purchase Agreement
PROSOL	UNEP Program Solaire
PV	Photovoltaic
RE	Renewable Energy
REC	Renewable Energy Certificates
REED	Rural Energy Enterprise Development
RPS	Renewable Portfolio Standard
SPP	Small Power Producer
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VSPP	Very Small Power Producer
WRI	World Resources Institute

1 Introduction

The purpose of this working paper is to identify some key components of smart renewable energy policy in developing countries, based on on-the-ground experiences. The paper aims to draw recommendations from the analysis of these key components on how international support for deployment of renewable energies can be made most effective. This paper starts from the premise that donors and international institutions need to move beyond the traditional project-by-project approach to a smart renewable energy policy approach that creates the right environment for investments in scaled-up deployment of renewable energy.

We define smart renewable energy policy as *the set of rules, regulations, and government actions that lead to an increased share of renewables in total electricity consumption in line with a country's development objectives.* Smart renewable energy policy encourages private investment, achieves its objectives in a cost-effective way, promotes continuous innovation, and is developed in transparent, accountable, and participatory processes.

The analysis presented in this paper builds on ongoing World Resources Institute (WRI) research on climate finance, electricity sector governance, renewable energy policy, international technology cooperation, and innovation.[4] The recommendations draw heavily on insights from a workshop WRI and the Heinrich Boell Foundation North America convened in November 2010. At this workshop, renewable energy experts from 12 African, Latin American, and Asian countries (see Box 2) discussed their experiences with renewable energy policies and considered how they might be supported internationally. Countries and experts were selected with the goal to achieve a balance between different regions, different country conditions (in terms of size and level of economic development) and different backgrounds (regulators, academics, civil society). The case studies presented at this workshop are listed in the Annex and summaries can be accessed online at www.wri.org/developing-country-renewables.

Using lessons learned from our sample of country case studies, and building upon the wealth of knowledge contained within the broad literature on renewable energy policy, the paper provides recommendations to bilateral and multilateral donors as well as international climate finance and technology institutions on how to support smart renewable energy policies in client countries. Policymakers in developing countries can also directly apply many of the lessons identified in this paper. As a next step building on this research, it would be useful to provide estimates on the needed investment to implement the approach suggested in this paper and to break these down by support phase, country, level of ambition in terms of renewables expansion, etc. This question is, however, beyond the scope of this paper.

We focus on the electricity sector and do not consider energy for transport, heating, or industrial processes. For the purpose of this paper, we define renewable energy as electricity produced from solar and wind power, tidal and wave power, small hydro power, geothermal power, and biomass.[5] We concentrate on the developing world, where the

Case study countries:

Brazil

India

Indonesia

Kenya

Mexico

Morocco

Mozambique

South Africa

Sri Lanka

Philippines

Tanzania

Thailand

[4] This paper is the result of a collaboration between several WRI projects. The Two Degrees of Innovation project works with researchers, engineers, policymakers, and other practitioners to create the conditions for global innovation in clean energy, from research to deployment, see http://www.wri.org/project/innovation. The Electricity Governance Initiative, a joint project of WRI and Prayas Energy Group, works with sector decision-makers and civil society to promote transparency, accountability, and public participation in the electricity sector, see http://www.wri.org/project/electricity-governance. The International Financial Flows and the Environment Project works to improve the environmental and social decision making and performance of public and private International Financial Institutions, see http://www.wri.org/project/international-financial-flows.

[5] Unless otherwise noted, we do not include large hydropower as a renewable energy source in this paper.

greatest growth in the energy sector is taking place, even though similar transformations are essential in the developed world.[6] The term "developing country" is used with due respect and caution. The authors recognize that this term does not reflect a uniform taxonomy and carries with it certain definitional and conceptual baggage.[7]

The countries typically classified as being "developing" are highly diverse and the cases analyzed reflect some of that diversity. This paper does not attempt to propose a model that would work in all countries, but rather recognizes that all successful policies will have to be context- and country-specific. The authors do attempt to identify some lessons learned from the analysis of successes and barriers in specific countries that could inform policy choices and international support in other countries.

The research presented in this working paper builds on a first analysis of a limited number of cases and should be regarded as preliminary. This paper was published both to inform ongoing discussions about the most effective use of development and climate finance and to expose our thinking to a broader audience. The authors intend to refine the framework presented in this paper further and welcome feedback and suggestions.

Chapter 2 explains key concepts and describes the context for renewable energy policy globally. The next five chapters each look at one key element of smart renewable energy policy, discuss lessons learned, and identify needs for international support. These components are planning and strategy (Chapter 3), well-designed generation-based incentives (Chapter 4), an enabling policy and regulatory framework (Chapter 5), attractive financing conditions (Chapter 6), and the necessary technical environment (Chapter 7). The findings and recommendations are summarized in Chapter 8.

[6] As will be elaborated in the next chapter, the International Energy Agency estimates that around 80 percent of global electric capacity additions between 2008 and 2035 will take place in non-OECD countries, i.e. in the developing world. See International Energy Agency, *World Energy Outlook 2010* (Paris, France: IEA, 2010), 620-21, 652-53.

[7] According to the United Nations Statistical Division, there is no established convention for the designation of "developed" and "developing" countries in the United Nations system. In common practice, Japan in Asia; Canada and the United States in northern America; Australia and New Zealand in Oceania; and the countries of Europe are considered "developed" regions. The World Bank tends to avoid using the term "developing countries" in its classification and prefers instead a four tier scheme divided into income groups. These are low income countries (GNI per capita of US$995 or less); lower middle income countries (GNI per capita of $996 - $3,945); upper middle income countries (GNI per capita of $3,946 - $12,195); and high income countries (GNI per capita of $12,196 or more). The Bank classifies all low- and middle-income countries as developing but notes, "The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status." (Source: World Bank Country Classification - http://data.worldbank.org/about/country-classifications)

2 Context and Concepts

DEVELOPING COUNTRIES IN THE GLOBAL ENERGY TRANSITION

The overwhelming majority of new electric capacity to be added in the next two to three decades will be in developing countries. The International Energy Agency (IEA) has calculated three scenarios for the world's energy future; all three show that around 80 percent of global electric capacity additions between 2008 and 2035 are expected to take place in non-OECD countries, a group of countries roughly equivalent with the developing world (see Table 1). The capacity to be added in non-OECD countries over this period represents more than the entire capacity installed in OECD countries today.[8]

At the same time, the global energy system is in the middle of a transition from a dependence on fossil fuels towards the use of more renewable sources. In 2009, renewables accounted for 47 percent of new power generation capacity worldwide.[9] Developing countries play an important role in this transition, as illustrated by the many capacity targets, strategies, and policies they have implemented in recent years to support renewable energy generation.[10] More than half of the existing renewable power capacity is now in developing countries.[11]

While decision-makers in developing countries recognize the contribution renewable energy can make to combating global climate change, they primarily pursue it for domestic reasons, in the context of national sustainable development strategies.[12] Renewable energy provides countries and people with a range of benefits in a way that simply expanding the traditional fossil fuel-based power supply cannot achieve. These benefits include:

- increased energy access,
- economic development and job creation,
- reduced local pollution and improved health,
- increased energy supply security, and
- insulation from increasingly volatile international fuel prices that are a strain on tight public budgets and countries' balances of payments.

For example, the support for small renewable energy producers in Thailand is driven by a number of policy objectives, including "fostering rural economic development" and "reducing fossil fuel imports." In Tanzania, the policy objectives are described as "addressing challenges related to low generation capacity, expensive emergency generation, blackouts, and low rural electrification."[13] The Indian Ministry of New and Renewable Energy provides the following rationale for pursuing renewable energy: "India's need for secure, affordable, and environmentally sustainable energy has

[8] Authors' calculations, based on International Energy Agency, *World Energy Outlook 2010* (Paris, France: IEA, 2010), 620-21, 652-53.

[9] See REN21, *Renewables 2010 Global Status Report* (Paris: REN21 Secretariat, 2010), 53. The calculation is based on data from the IEA, IAEA, and REN21. Measured in dollars, the investment in new renewable energy generation capacity even surpassed fossil-fuel investment for the second year in a row in 2009, see United Nations Environment Programme and Bloomberg New Energy Finance, *Global Trends in Sustainable Energy Investment 2010. Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency.* (United Nations Environment Programme, 2010), 12-13. Both estimates include large hydro.

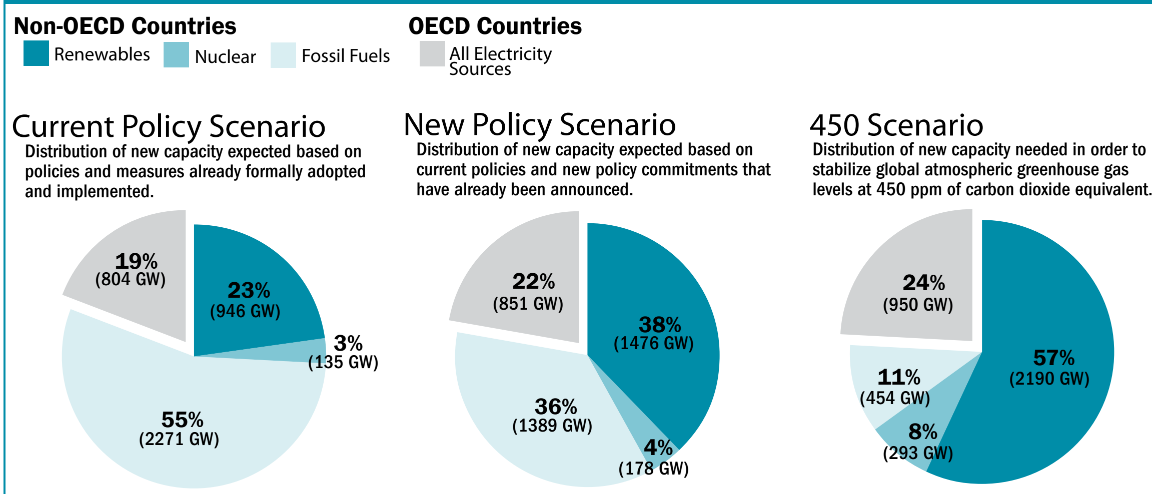
[10] For an overview on existing policies in developing countries, see REN21, *Renewables 2010 Global Status Report* (Paris: REN21 Secretariat, 2010), http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf.

[11] Ibid., 4.

[12] REN21, *GSR 2010.* Nigel Purvis, *Jumpstarting Global Green Growth: International Climate Strategies in the New Transatlantic Context,* GMF Climate & Energy Paper Series (Washington, DC: The German Marshall Fund of the United States, November 2010), http://www.gmfus.org/cs/publications/publication_view?publication.id=1369

[13] Chris Greacen and Anastas Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations* (Washington, DC: World Resources Institute, November 22, 2010), http://www.wri.org/developing-country-renewables.

Figure 1: Projected Growth in Global Electricity Capacity, 2008-2035



Source: International Energy Agency, World Energy Outlook 2010

become one of the principal economic and development challenges for the country. It is also clear that while energy conservation and energy-efficiency have an important role to play in the national energy strategy, renewable energy will become a key part of the solutions and is likely to play an increasingly important role for augmentation of grid power, providing energy access, reducing consumption of fossil fuels, and helping India pursue its low carbon developmental pathway."[14] In South Africa, the Department for Trade and Industry and the Department for Public Enterprises are considering ambitious renewable energy initiatives within the government's Industrial Policy Action Plan. The initiative is driven by the desire to realize a number of economic benefits: "Industrial development … in the industrial value chain supplying the [renewables] industry," "export competitiveness," "regional renewables development … to be a regional hub and catalyst for the development of renewables in sub-Saharan Africa," "medium-term energy security," and catalyzing the "conditions for green growth."[15]

Nevertheless, this transition is not happening at the speed and scale necessary to stabilize global average temperature rise at manageable levels. There is wide scientific consensus, recognized by all countries at the UN climate conference in Cancun in December, 2010, that warming must at least be held to a maximum of 2 degrees Celsius above pre-industrial levels in order to avoid unacceptable climate change risks.[16] However, while it can be assumed that the current greenhouse gas reduction pledges of developed and developing countries submitted to the United Nations under the Copenhagen Accord reflect most of today's renewable energy goals, these pledges would likely set the world on a path

[14] MNRE, *Renewable Energy in India: Progress, Vision, and Strategy* (New Delhi, India: Ministry of New and Renewable Energy, Government of India, 2010), 11, http://www.mnre.gov.in/pdf/mnre-paper-direc2010-25102010.pdf.

[15] DTI, *Unlocking South Africa's Green Growth Potential.* The South African Renewables Initiative, Update Briefing (Pretoria: The Department of Trade and Industry, December 2010), 9.

[16] United Nations Framework Convention on Climate Change, *The Cancun Agreements: Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, Decision 1/CP.16, paragraph 4.

towards global warming of somewhere between 2.5 and 5 degrees Celsius.[17]

The IEA's forecasts show that, without new policies, more than two thirds of the new electric capacity in developing countries would be powered by fossil fuels (the IEA's "Current Policies" scenario, see Table 1). The scenarios also underline that a gradual transition to more renewables is under way in the developing world, but that it happens too slowly to reach the globally agreed climate goal. The "New Policy" scenario, which assumes all recently announced pledges, targets, and policies — many of which are contingent on international support — are implemented in a stringent way, shows a marked increase in renewables compared to "Current Policies." However, a large gap remains compared to the even more ambitious "450" scenario, which describes a pathway needed to stabilize atmospheric greenhouse gas concentration at a level of 450 parts per million CO_2 equivalent necessary to make the 2-degree target attainable. In the latter scenario, the fossil fuel share would only be 15 percent, while renewables would account for three quarters of new capacity.[18]

Many successful examples of good policies and practices to promote renewables already exist in developing countries. This presents the question of whether the seeds for the global energy transformation are already contained within these experiences and whether it is possible to identify lessons learned and needs for additional support, so that these success stories can be scaled up and adapted for other countries.

[17] M. den Elzen et al., *The Emissions Gap Report: Are the Copenhagen Accord pledges sufficient to limit global warming to 2 deg. C or 1.5 deg. C? A preliminary assessment* (United Nations Environment Programme, 2010), 48-50.

[18] Authors' calculations, based on International Energy Agency, *World Energy Outlook 2010*, 620-21, 652-53.

A NEW ROLE FOR INTERNATIONAL SUPPORT

Though developing countries have many reasons to pursue renewable energies in their own right, they will need international support to transition to a low-carbon economy.[19] The cost of this transition and other barriers, such as a lack of capacity, make it unlikely that the transition to more renewable energy will happen quickly enough and at the scale required to limit global temperature rise to two degrees above pre-industrial levels, absent international support.

Through multilateral institutions and bilateral assistance, the United States, European nations, and other developed countries can help make the transformation possible. International public financing already plays an important role in catalyzing renewable energy deployment and diffusion in developing countries. The multilateral development banks, the bilateral aid agencies, the Global Environment Facility, and, more recently, the Clean Technology Fund, have been the main sources. During the period 1997-2005, bilateral and multilateral agencies were collectively investing on average $1.4 billion a year in renewable energy in developing countries.[20]

Currently, the international community is designing new mechanisms to manage climate finance and to improve international technology cooperation while developed country governments are considering their strategic funding decisions over the next years. This presents a unique opportunity to move to the next phase of renewable energy support. This next phase could build on the experiences and momentum in developing countries to focus on building capacity and reliable frameworks — the package of measures we call

[19] Purvis, *Green Growth.*

[20] D. Tirpak and H. Adams, "Bilateral and multilateral financial assistance for the energy sector of developing countries," *Climate Policy 8*, no. 2 (2008): 135–151.

smart renewable energy policy — rather than a simple project-by-project approach.

Compared to just financing an individual wind farm, financing the conditions that incentivize building and operating wind farms will have a more transformative impact.[21] Predictable frameworks will also allow developing countries to better capture the economic benefits associated with increased renewable energy generation, because they attract more investor interest and larger parts of the value chain, which in turn leads to more jobs in manufacturing, for example.[22]

One major barrier to renewable energy deployment in developing countries is the higher cost of these technologies when compared to conventional fossil fuels. In those countries that have successfully deployed renewable energies beyond individual projects, this cost gap has been addressed by public policy.[23] In most developing countries, where domestic financial resources are limited and economic development is the overriding priority, it is difficult to mobilize financial support from domestic sources alone; therefore donor funds would likely be needed to cover some of the additional cost to make a large-scale global transformation away from fossil fuels possible.

However, international funding for development and climate change mitigation is also limited. Well-designed and comprehensive renewable energy policy can help reduce the cost gap, for example by removing fossil-fuel subsidies or by helping to set adequate support levels that are not unnecessarily generous.[24] In this way, smart renewable energy policy can help ensure that public funds — both from within a developing country and from international sources — are used in an effective and efficient way. By encouraging innovation, smart renewable energy policy also has the potential to bring down the cost of renewable energy technologies, so they can become a financially viable mainstream solution.

Donor countries can expect some tangible benefits for their own economies from such an investment. Smart renewable energy policy in developing countries can create export markets for renewable energy technology produced in donor countries. However, it should not be expected that developing countries will import all of the necessary equipment in the long run. The real long-term benefit should be expected from the creation of global markets and the additional opportunities for innovation that emerge when more countries deploy renewables. The addition of large additional capacities provides a chance to quickly test new designs or approaches, to develop better manufacturing, operations, and maintenance processes, and iteratively improve both the technologies and the energy systems of which they are a part.

It can be expected that costs will decrease and performance improve as a result. The size of the market in which firms, including those from donor countries, can participate will grow. The lower

[21] The literature shows that all countries where renewables (excluding large hydro) have reached a significant market share have had renewable energy policy frameworks in place. See REN21, GSR 2010; J. F Kirkegaard, T. Hanemann, and L. Weischer, *It Should Be a Breeze: Harnessing the Potential of Open Trade and Investment Flows in the Wind Energy Industry,* PIIE WRI Working Paper (Washington, DC: Peterson Institute for International Economics and World Resources Institute, December 2009); J. F Kirkegaard et al., *Toward a Sunny Future? Global Integration in the Solar PV Industry,* PIIE WRI Working Paper (Washington, DC: Peterson Institute for International Economics and World Resources Institute, May 2010).

[22] WRI research on the global wind and solar PV industry has indicated that countries with policies creating large and predictable demand have been able to capture larger portions of the value chain and create more domestic jobs as opposed to countries with unstable, on-off demand. See Kirkegaard, Hanemann, and Weischer, *It Should Be a Breeze*, and Kirkegaard et al., *Toward a Sunny Future?*

[23] REN21, *GSR 2010*.

[24] We return to these two key elements of smart renewable energy policy below, in chapter 4.

costs of renewable energy technologies would also benefit donor countries in that it would lower the costs of their own domestic emissions reductions.[25]

PRINCIPLES OF SMART RENEWABLE ENERGY POLICY

We define smart renewable energy policy as t*he set of rules, regulations, and government actions that lead to an increased share of renewables in total electricity consumption in line with a country's development objectives.*

Many developing countries have already experimented with renewable energy policies that go beyond a project-by-project-approach, building the framework that creates the right conditions for transformative deployment at scale. Based on the experiences made in the 12 case study countries that were represented at the Renewable Energy Policy Workshop and in the existing literature, some key principles of smart renewable energy policy can be identified. These key principles are briefly introduced below. The next chapters will then discuss how these principles are applied in practice.

1. **Smart renewable energy policy is a comprehensive package.** Developing country experts participating in the workshop stressed that it is not sufficient to just set a renewable energy deployment goal or add an incentive mechanism. Rather, smart renewable energy policy needs to take into account the broader context renewables operate in. Smart renewable energy policy strives to create an enabling environment including power sector regulations, investment and financing conditions, suitable electric grid infrastructure, and technical capacity.

2. **Smart renewable energy policy is based on clearly defined objectives.** Workshop participants highlighted that smart policy begins with a clear definition of the end in mind. As discussed in the case studies below, objectives are most often defined in terms of added power generation, but can also include technology development, energy access, or economic development goals. A clear articulation of policy objectives can help ensure that smart renewable energy policy contributes to a country's broader development aspirations.

3. **Smart renewable energy policy encourages private investment.** There was broad agreement among the workshop participants, supported by the existing literature on renewable energy policy, that policies will have a more transformational impact if they leverage private investment by promoting attractive and predictable market conditions. The conditions investors look for have been characterized as "loud, long, and legal":

- "Loud — incentives need to be sufficient to make a difference to the bottom line and improve the bankability of projects;
- Long — sustained for a duration that reflects the financing horizons of a project or deal; and

[25] On the benefits of growing global markets for renewable energy technologies, see Kirkegaard, Hanemann, and Weischer, *It Should Be a Breeze,* and Kirkegaard et al., *Toward a Sunny Future?*

Box 1 Transparency, Accountability, Participation and Capacity (TAP-C)

The Electricity Governance Initiative (EGI), a joint project of WRI and Prayas Energy Group, has developed a governance framework organized around the TAP-C principles — transparency, accountability, stakeholder participation, and capacity — that should guide the development of robust policy and planning processes, transparent procedures for the selection of projects and setting of prices, and clear performance metrics for monitoring and evaluation.

Transparency and access to information: the process of revealing actions and information so that outsiders can scrutinize them. Attributes of transparency include comprehensiveness, timeliness, and availability.

Participation: input from diverse stakeholders to help decision-makers consider different issues, perspectives, and options when defining a problem. Forms of participation include technical review processes and public hearings.

Accountability and redress mechanisms: the extent to which there is clarity about the role of various institutions in sector decision-making, there is a systematic monitoring of sector operations and processes, the basis for decisions is clear or justified, and legal systems are in place to uphold stakeholders interests.

Capacity: the capacity of government and official institutions to act autonomously and independently, the institutional ability to provide access to decision-making processes, as well as the capacity of civil society (particularly NGOs and the media) to analyze issues and participate effectively.[1]

[1] Adapted from "The Electricity Governance Toolkit: Benchmarking Best Practice and Promoting Accountabilty in the Electricity Sector" June 2007. EGI is a joint project of WRI and Prayas Energy Group.

- Legal — a legally established regulatory framework, based around binding targets or implementation mechanisms, to build confidence that the regime is stable, and can provide the basis for long-life capital-intensive investments."[26]

[26] The "loud, long, and legal" framework was developed by a group experienced renewable energy financiers of invited to provide input on "good policy" for renewable energy for the Ministerial-level International Conference on Renewable Energies in Germany in 2004. See Kirsty Hamilton, *Unlocking Finance for Clean Energy: The Need for "Investment Grade" Policy,* Energy, Environment, and Development Programme Paper (London: Chatham House, December 2009), 8. Deutsche Bank Climate Change Advisors has proposed a similar set of criteria, summarized as "transparency, longevity and certainty." See DB Climate Change Advisors, *Paying for Renewable Energy: TLC at the Right Price. Achieving Scale through Efficient Policy Design* (New York: Deutsche Bank Group, December 2009), 15.

4. **Smart renewable energy policy is cost-effective.** It was stressed by workshop participants that public money needs to be spent in such a way to ensure that investments — backed by ratepayers, taxpayers, or foreign donors — are efficiently meeting policy objectives. Because objectives could include, for example, driving long-term price reductions or supporting technologies at different stages of development, this principle does not necessarily translate to maximum deployment at minimal cost, but it calls for careful policy design to avoid oversubsidization.

5. **Smart renewable energy policy encourages innovation.** Experts at the workshop agreed

on the need for financial support for renewable energy to be temporary, provided as long as these technologies are not yet competitive with fossil fuel options. There is broad agreement in the literature that further reductions in cost and improvements in performance, reliability, and safety of renewable energy technologies will be needed so these technologies can become a mainstream option replacing more emissions-intensive alternatives. Therefore, investments along the entire innovation chain are needed to create conditions that are favorable to the rapid emergence and diffusion of new ideas and practices for zero-carbon power generation: in research and development, demonstration, deployment, and diffusion.[27] While it is often assumed that innovation mainly happens in the research and development phase, workshop participants stressed the need for innovation beyond the lab, i.e. throughout the life cycle of the products, across the entire supply chain, and throughout the energy system. Our cases studies reveal how innovation beyond the lab can be stimulated by regulatory incentives that drive cost-effectiveness and performance enhancement.

6. **Smart renewable energy policy is designed through transparent, accountable, and participatory processes.** As will be discussed in more detail below, workshop participants conveyed examples where a lack of open, transparent, and accountable decision-making processes has led to less effective and less efficient policy implementation. Conversely, following basic principles of good electricity sector governance has often enabled better decisions. These principles are transparency, accountability, stakeholder participation, and capacity (TAP-C, see Box 1).

[27] Shane Tomlinson, Pelin Zorlu, and Claire Langley, *Innovation and Technology Transfer: Framework for a Global Climate Deal* (E3G and Chatham House, November 2008), http://www.e3g.org/programmes/climate-articles/e3g-report-launch-innovation-and-technology-transfer-framework-for-a-global/.

3 Planning and Developing a Strategy

The following five chapters each look at one area of smart renewable energy policy and discuss lessons drawn from the case studies that show how the principles identified above are implemented on the ground. Each chapter identifies key lessons, each followed by examples from the case studies. In a second step, each chapter discusses how donors and international institutions can support broader application of these lessons.

LESSONS LEARNED: SUCCESSFUL POLICY NEEDS A PLAN

In order to expand deployment of renewables, investors, and technology, providers need to have sufficient confidence that there will be a market. The first steps to providing that predictability are planning processes to define and regularly update a vision for the future of electric power generation, transmission, and distribution in a given country, including an explicit role for renewables.

Official renewable energy targets are a crucial first step. Targets reflect an understanding of the future role that different sources of renewable energy generation will play alongside efficiency and conventional generation in the context of a country's available resources and capacities. Done correctly, targets can provide investors with higher visibility by underlining the political commitments to renewable energy deployment. Many developing countries have set renewable energy targets (see Table 1).[28]

Table 1: Renewable Energy Targets and Payment Mechanisms in Different Countries

Country	Target
Brazil	None
India	15% RE by 2020; 41 GW by 2017, 72 GW by 2022
Indonesia	5% geothermal, 5% biofuels, and 5% other RE by 2025
Kenya	None
Mexico	6.6% RE by 2012
Morocco	2 GW solar and 2 GW wind by 2020
Mozambique	100 MW wind, 125 MW small hydro, 3 bagasse plants, 79,000 small PV systems etc.
South Africa	10,000 MW RE by 2013
Sri Lanka	10% non-conventional RE by 2015
Philippines	Additional 6,972 MW by 2030
Tanzania	None
Thailand	None

Source: Presentations given at renewable energy policy workshop, see http://www.wri.org/developing-country-renewables. Notes: Targets for the Philippines are preliminary. Targets for India are suggested by the federal government, but ultimate implementation lies with the States.

Some countries have chosen to define a renewable energy share in the overall power mix, for instance *India*.[29] Other countries, such as *Indonesia*, set the target share for individual technologies.[30] Yet another approach is to define targets in terms of absolute additional capacity. For example, the *Philippines* are currently considering a target of increasing their renewable energy capacity by adding 6,972 megawatts (MW) between 2010 and 2030. This can again be broken down by technology, for example in the case of the Phil-

[28] It should be noted that some workshop participants expressed concern that the technical basis for these targets is not clear, making it difficult to know whether the targets are statement of political ambition or reference to resource capacity and economic feasibility. In general, more transparency about the assumptions underlying targets was called for.

[29] Suman Kumar, "Country Case Study: India" (presented at the Renewable Energy Policy Workshop, WRI, Washington, DC, November 22, 2010), http://www.wri.org/developing-country-renewables.

[30] Fabby Tumiwa and Imelda Rambitan, *Scaling Up Renewable Energy Investments. Lessons form the Best Practice Models in Indonesia* (Washington, DC: Bank Information Center, July 2010).

ippines, 1,420 MW of geothermal, 985 MW of wind, 4,167 MW of hydro, 200 MW of biomass, 80 MW of solar, and 120 MW of ocean energy. Rather than just emphasizing raw numbers, the goals are communicated by stressing that achieving the numbers will make the Philippines the top geothermal producer globally and the top wind producer in Southeast Asia.[31]

Planning can grow more sophisticated as deployment expands; for serious scale up of renewable energy, long-term planning will be necessary. For individual contracts awarded to a first round of small projects or for early stage FiT programs, a detailed strategy that outlines the respective shares of different renewable energy technologies and their integration with the national energy system may not be imperative. In the short run, encouraging the development of easy-to-realize projects and developing first experiences is tempting for governments and investors alike. But even on a small scale, some planning will increase the probability of success of individual projects — for example to ensure that land and water resources, as well as access to the grid, are available. In the long run, integrated resource planning is needed to articulate the relationship between ambitious renewable energy goals and the broader electricity system.

Thailand has implemented successful programs for small power producers (SPP) and very small power producers (VSPP) that allow for the bottom-up development of renewable energy sources and their connection to the grid, even though there was no detailed plan to integrate these new small projects. Integrating SPP/VSPP sources into planning became more important as their numbers grew and they developed the potential to actually displace other, emissions-intensive sources. Thai NGOs worked successfully to have VSPP sources included as a supply option in Thailand's national power development plans beginning in 2007.[32]

In January 2010, the *South African* government began the development of an Integrated Resource Plan (IRP 2010) that will include objectives for renewable energy development for the next 20 years. The South-African IRP is an example of a comprehensive approach considering demand projections, resource availability, and the cost and benefits of different sources of energy, both on the supply and demand side.[33]

Planning decisions need to be based on a transparent and sound assessment of the full cost of different options. Leveling the playing field for clean energy requires new methodologies for determining cost, so that the benefits, risks, and hidden costs of all energy sources are assessed realistically and openly in any planning process. This means, for instance, that supply-side risks such as rising fuel costs and currency fluctuations need to be considered alongside the risks and higher upfront costs of renewable energy. Other examples include the costs of transmission lines for large hydro and potential price increases for fuel transportation for coal and oil, which are not always included in upfront cost estimates. At the same time, current business models provide strong incentives to overestimate future demand, often resulting in excess

[31] Pete H. Maniego, "Country Case Study: Philippines" (presented at the Renewable Energy Policy Workshop, WRI, Washington, DC, November 22, 2010), http://www.wri.org/developing-country-renewables.

[32] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

[33] Hilton Trollip, *Status of renewable energy implementation in South Africa with a focus on the REFIT and the role of Multilateral Development Banks* (Washington, DC: World Resources Institute, November 22, 2010), http://www.wri.org/developing-country-renewables.

capacity.[34] Integrated resource planning tools are useful to optimize the resource mix for realistic levels of demand. They will also help ensure that essential infrastructure is available and send clear signals about market size to investors.

Even after the decision was made to include small renewable energy projects in the Thai power development plans, *Thailand* is still far from fully tapping its renewable energy potential. In part, the adoption of new software that would assess the hidden costs and risks of conventional fuels (fossil, big hydro, and nuclear) would help to level the playing field for new renewable energy.

But progress will require more than new computer programs. The overlapping governance structures of ministries and state-owned enterprises produce conflicts of interest that make it easier for entrenched interests and utilities to resist the displacement of conventional power sources. While the VSP program was successful as a low profile, local approach, scaling up will require a shift in incentives for incumbent political and utility officials as well as for investors in new technologies.

Drawing on the TAP-C concepts, Thai NGOs have developed an "alternative" power development planning framework that advocates new modeling and forecasting methodologies as well as more a transparent decision-making process. With increased public scrutiny of power planning, they hope to prompt a restructuring of governance arrangements in the relevant ministries and state-owned enterprises.[35]

The planning process benefits from transparency, accountability, and stakeholder participation. Public engagement is necessary to determine how to share both the benefits and impacts of a transformed energy system. A transparent, multi-criteria planning framework can help evaluate these tradeoffs, including job creation and environmental impacts. Often, the planning process tends to be shaped by vested interests, as powerful incumbent suppliers defend their relationships with utilities and government officials. It is not uncommon that board members of state-owned utilities are senior government officials, producing conflicts of interest and sometimes corruption in some countries.

Civil society has a significant role to play in demanding transparency for the assumptions that underpin planning decisions (including assumptions about cost, risk, and demand) and the composition of advisory boards. Civil society input should also inform the planning process. Beyond organizations with expertise in energy modeling, groups organized around air pollution, consumer advocacy, and open government have an interest in opening up planning processes to public scrutiny.

34 "Thailand's Electricity Reforms: Privatization of Benefits and Socialization of Costs and Risks," Chuenchom Sangarasri Greacen and Chris Greacen, *Pacific Affairs* Volume 77, no.3, Fall 2004. Andrew Marquard, The Origins and Development of South African Energy Policy, University of Cape Town, Jan 2006. p 168. Also echoed in the comments of former Chairman of the Eskom Board Bobby Godsell to the National Press Club of Cape Town on Feb. 26 2010.

35 Thai NGOs developed a multi-stakeholder advisory committee to select 14 indicators of good governance from the Electricity Governance Initiative's toolkit to apply to the Thai planning process. These indicators were the basis of an assessment that linked weak governance to faulty decision-making, and ultimately to the need for improved transparency and processes for public input. Better decision-making processes ultimately resulted in the inclusion of VSPP as a supply option. The alternate power development plan prepared by Thai civil society argues that a combination of demand-side management, co-generation and renewable energy, and other sector efficiencies could reduce the projected need for new thermal power plants significantly: from 54,005MW to 8,535MW. Presentation by Suphakit Nuntavarakorn, Healthy Public Policy Foundation, at the 14th Annual Anticorruption Conference, Bangkok 2010: http://electricitygovernance.wri.org/news/2010/12/egi-14th-international-anti-corruption-conference

In January 2010, the *South African* government began the development of an Integrated Resource Plan (IRP 2010) that will include objectives for renewable energy development for the next 20 years. IRP 2010 increased the transparency around previously closed electricity planning process and allowed for more robust public engagement. Civil society observers have pointed out the benefits of integrating industrial planning with national energy systems planning. However, they have also identified areas where the IRP methodology needs to be improved to allow for a proper determination of the costs and benefits of the renewable energy technologies in relation to conventional sources. For example, the economic benefits to be gained from the development of local renewable energy equipment manufacturing are not explicitly referred to in IRP 2010.

In South Africa, the government structures in charge of developing renewable energy strategies are in place, but they often lack the necessary capacity and influence within the government to ensure implementation. According to civil society observers, the approach of regulators in the department of energy, which is mandated with renewable energy development, remains dominated by powerful conventional energy (coal and nuclear) and related expertise and capacity. The participation of civil society groups in planning processes meant that voices more favorable to the development of renewable energies were included in the planning process.[36]

Civil society organizations in *Thailand* have also had some success in improving the decision-making process. Thai NGOs have worked to improve both the procedural and substantive aspects of the planning process, drawing on the TAP-C framework. The inclusion of very small power producer (VSPP) generation as a supply option in the Thai Power Development Plan was partially a result of NGO engagement. The groups saw incorporating renewables and energy efficiency as a supply option in the energy planning as a way to cut down substantially on expensive and environmentally damaging thermal power plants. The alternate power development plan prepared by Thai civil society argues that a combination of demand-side management, cogeneration, and renewable energy and other sector efficiencies could reduce the projected need for new thermal power plants significantly, from 54,005 MW to 8,535 MW.[37]

INTERNATIONAL SUPPORT: CAPACITY DEVELOPMENT, INSTITUTION-BUILDING, AND TECHNICAL ASSISTANCE FOR SOUND POWER-SECTOR PLANNING

International donors can provide technical assistance and capacity building to assist countries in developing plans and strategies for their energy sector. For example, the Global Environment Facility (GEF) supported a project in South Africa in 2007 that provided knowledge, hard data, and analysis for developing the country's Integrated Resource Plan targets for renewable energies.[38] Similarly, international partnerships such as the Renewable Energy and Energy Efficiency Partnership have supported governments in Ghana and Mozambique to applying planning and decision-

[36] Trollip, *Status of renewable energy implementation in South Africa with a focus on the REFIT and the role of Multi-lateral Development Banks.*

[37] Presentation by Suphakit Nuntavarakorn, Healthy Public Policy Foundation, at the 14th Annual Anticorruption Conference, Bangkok 2010: http://electricitygovernance.wri.org/news/2010/12/egi-14th-international-anti-corruption-conference

[38] Trollip, *Status of Renewable Energy Implementation in South Africa with a Focus on the REFIT and the Role of Multi-Lateral Development Banks*, 2010; Smita Nakhooda and Athena Ballesteros, *Investing in Sustainable Energy Futures. Multilateral Development Banks' Investments in Energy Policy*, WRI Report (Washington, DC: World Resources Institute, 2010).

making tools such as GIS to analyze renewable sources and data, and tariff-setting tools.[39]

In recent years, the World Bank's Energy Sector Management Assistance Program (ESMAP) has introduced a set of mechanisms, including training and technical assistance, to support low-income countries' to develop plans to diversify their energy supply and switch to zero- and low-carbon technology options.[40]

In addition to providing technical expertise, tools, and data, donors might consider providing more support for the institutions and processes that are necessary for good plans and strategies. As discussed above transparent, accountable, and transparent processes organized by regulatory institutions that have the necessary capacity are crucial. Donors might also consider building the capacity of civil society groups so they can play a more active role in planning processes.

[39] http://www.reeep.org/file_upload/7217_tmpphpwumA8F.pdf

[40] World Bank, http://www.esmap.org/esmap/overview

4 Designing Generation-Based Incentives

SELECTING A GENERATION-BASED INCENTIVE

Targets and integrated planning are not enough to build a market for power from renewable sources. Policymakers need to translate their targets and plans into actual investor interest by setting incentives. Policymakers need to consider several tools at their disposal to create a favorable market environment for renewable power. As our case studies and experiences elsewhere show, a generation-based incentive mechanism is one key component in the broader mix of policy and regulatory instruments. Generation-based incentives will be discussed in this chapter, before we return to the broader policy environment in Chapter 5.

Policymakers need to choose an appropriate incentive for their context. It is important that incentives reward actual power production, not just installation. One crucial component of smart renewable energy policy in both developed and developing countries is mechanisms to guarantee payment to renewable energy producers for their electricity, in order to make their projects commercially viable. These payments are usually at a premium above market rates for conventional sources. It is preferable to choose an incentive that rewards each kilowatt hour produced, because subsidizing the upfront capital cost of an installation only can lead to projects being built without much attention given to optimizing their performance, including through regular maintenance, or even connecting them to the grid.

All of the incentives studied in this working paper that have been successful in triggering additional renewable energy installations are based on actual power produced. This is the case for the FiTs in *India*, the *Philippines*, *South Africa*, and *Sri Lanka* as well as the small power producer (SPP) programs in *Thailand* and *Tanzania*. It is also true for the auctions in *Brazil* and *India*, where power producers bid for the guaranteed price per kilowatt hour they would need to operate a project and not for an upfront subsidy.[41]

Policymakers can choose between several types of generation-based incentives that are summarized in Table 2, along with some of their key advantages and drawbacks.

These mechanisms, whether they are applied in developed or developing countries, often lead to price increases for the electricity consumer, as utilities pass along the added costs. Alternatively, the incremental costs may be covered fully or partially out of a public budget. This can make these mechanisms difficult to implement in countries suffering public budget constraints, and particularly hard to justify in developing countries where adding generation capacity at the lowest cost possible is often the overriding policy priority.

However, 18 developing countries currently have a FiT, 5 have some form of renewable RPS, and 11 use competitive bidding to procure renewable energy. Table 3 summarizes the incentive mechanisms used in our case study countries.

In many situations, feed-in-tariffs are the most appropriate generation-based incentives to encourage private investment in renewable energy. The FiT is the most widely used incentive mechanism globally. Seventy-five percent of global solar photovoltaic capacity and 45 percent of global wind capacity were supported by FiTs in 2008.[42] A review of different incentive mechanisms in the developed world by Deutsche Bank Climate Change Advisors found advanced FiT schemes to be the most appropriate mechanism to provide the transparency, longevity, and certainty at the price that investors are looking for. It is also seen

[41] See the presentations and case studies form the Renewable Energy Policy Workshop, available at http://www.wri.org/developing-country-renewables

[42] REN21, *GSR 2010*, 23.

Table 2: Generation-Based Incentives for Renewable Energy		
Incentive mechanism definition	**Advantages**	**Disadvantages**
Individual Power Purchase Agreement (PPA) A PPA is a contract between an electricity generator (often an independent power producer, IPP) and a buyer (grid operator, utility, state, retail electricity supplier), specifying conditions at which the electricity will be bought: start date, price, measuring methodology, financing terms.[1]	• Allows a country to gain first experiences with renewable energies and build capacity.	• Less effective in encouraging investments, as there is less transparency and certainty about the conditions.
Feed-in Tariff (FiT) The government pre-defines a guaranteed rate that a power producer will be paid through a standard PPA for every kilowatt hour of renewable energy fed into the grid. Utilities are legally required to connect any qualifying producer of renewable electricity and purchase the electricity at the set rate. In best-practice FiTs, the rate is usually differentiated by technology, based on the technology-specific generation cost plus a reasonable profit, guaranteed over a long time horizon, and decreases over time, but there have been other models.	• Provides high level of certainty to investors. • Most widely used policy instrument globally to scale up renewables.	• Difficult to determine appropriate rate; must be set high enough to make projects viable and attractive to investors, yet low enough to avoid over-subsidizing.
Renewable Portfolio Standard (RPS) The government sets a target to achieve a certain share of renewable energy, which utilities can meet by their own generation, signing PPAs, or, in many systems, by purchasing Renewable Energy Certificates (REC). In a REC system, renewable power producers sell their power at normal market prices, but on top of that earn credits for each unit of renewable energy produced, which can then be sold for a premium. Those entities that are covered by the RPS buy the certificates as a way to prove compliance with the mandate. *continued next page*	• Avoids difficult rate setting, as premium is determined by the market.	• Provides less certainty to investors. • Unless differentiated by technology, will only favor the least expensive project type and technology from among those eligible (e.g. large onshore wind farms may be developed to the exclusion of more expensive solar generation).

Table 2: Generation-Based Incentives for Renewable Energy (continued)		
Incentive mechanism definition	**Advantages**	**Disadvantages**
Competitive Bidding In a system of Competitive Bidding, a pre-defined project or a certain amount of renewable power purchase is bid off to developers. Whoever meets all the criteria at the lowest price is awarded the contract to develop the project and feed the renewable power into the grid.	• Auction allow easy price-setting and eliminates windfall profits.	• Developers might bid at prices so low that some projects might not be viable and never get built or cease operation.

Source: Literature Review.[2]

[1] It should be noted that an explicit or implicit PPA underlies all of the mechanisms below. Utilities or regulators can negotiate a price in PPAs for individual projects or use a standard PPA, or determine the price following one of the other incentive mechanisms listed in the table.

[2] Our literature review on different generation-based incentives included REN21, *GSR 2010*; K. S Cory, T. Couture, and C. Kreycik, *Feed-in Tariff Policy: Design, Implementation, and RPS Policy Interactions,* Technical Report NREL/TP-6A2-45549 (Golden, CO: National Renewable Energy Laboratory, 2009); IEA PVPS (International Energy Agency Photovoltaic Power Systems Program). 2009. Promotional Drivers for Grid-Connected PV. Paris: International Energy Agency; Haas R. 2001. Review Report on Promotion Strategies for Electricity from Renewable Energy Sources in EU Countries. Brussels: European Commission; Hoff, T. E. 2006. *Photovoltaic Incentive Design Handbook.* Napa, CA: Clean Power Research; Lewis J.I., Wiser R.H. (2007). Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms. Energy Policy 2007;35(3):1844–57; Ragwitz, M., Held, A., Resch, G., Faber, T., Haas, R., Huber, C., Morthorst, P.E., Jensen, S.G., Coenraads, R., Voogt, M., Reece, G., Konstantinaviciute, I., Heyder, B., 2007. Assessment and optimization of renewable energy support schemes in the European electricity market, OPTRES Final Report, Karlsruhe; Morthorst, P.E., Auer, H., Garrad, A., and Blanco, I. (2009). The Economics of Wind Power. Wind Energy: The Facts – Part Three. Available at http://www.wind-energy-the-facts.org/documents/download/Chapter3.pdf.

as a strength of FiTs that they can set technology-specific support levels in line with the respective technology's development stage and encourage distributed generation, as they set standard terms that make it easy for very small producers to benefit from the incentive.[43]

If technology diversity and distributed generation are not primary policy goals — rather, policymakers aim to achieve maximum levels of renewable energy deployment at the lowest cost — then an RPS may be the most appropriate mechanism. However, experience in developed countries has shown that relying on a dynamic REC market to determine renewable energy premiums increases uncertainty, which can increase investment risk and, therefore, lead to higher lending rates for project developers. Empirical evidence from the EU suggests that deployment in countries using a FiT has been faster and, surprisingly, the premium paid per kWh under FiT systems was lower than the price of certificates in RPS systems.[44] However, if policymakers decide to establish an RPS mechanism, Deutsche Bank Climate Change Advisers also found that many of the positive features of an advanced FiT could be reflected in an RPS by the establishment of floor prices and standard contracts.[45]

[43] DB Climate Change Advisors, *Paying for Renewable Energy: TLC at the Right Price. Achieving Scale through Efficient Policy Design.*

[44] Morthorst, P.E., Auer, H., Garrad, A., and Blanco, I. (2009). *The Economics of Wind Power. Wind Energy: The Facts – Part Three.* Available at http://www.wind-energy-the-facts.org/documents/download/Chapter3.pdf.

[45] DB Climate Change Advisors, *Paying for Renewable Energy: TLC at the Right Price. Achieving Scale through Efficient Policy Design.* There are also options for integrating FiTs into RPS schemes, see Cory, Couture, and Kreycik, *Feed-in Tariff Policy.*

Table 3: Generation-Based Incentive Mechanisms in Different Countries			
Country	**FiT**	**RPS**	**Competititve Bidding**
Brazil	No	No	Yes
India	Yes	Yes	Yes
Indonesia	Yes	No	No
Kenya	Yes	No	No
Mexico	No	No	No
Morocco	No	No	Yes
Mozambique	Under development	No	No
South Africa	Yes	No	No
Sri Lanka	Yes	No	No
Philippines	Yes	Yes	No
Tanzania	Yes	No	No
Thailand	Yes	No	No

Source: Presentations given at renewable energy policy workshop, see http://www.wri.org/developing-country-renewables.

FiTs are also the most prevalent mechanism among our case study countries, as they have been used in some form by *India, Kenya, South Africa, Sri Lanka, Tanzania,* and *Thailand* (see Table 3) and are being considered by additional developing countries, for example in Nigeria and Mozambique.[46] At the Renewable Energy Policy Workshop in November 2010, many expert participants from the case study countries expressed a preference for FiTs, because they are an easy-to-understand system that is open to broad participation and they can successfully attract private investment in developing countries. The most frequently raised concerns about FiTs were the difficulty to set the appropriate rates and the potential impacts on rate payers. Below, we discuss options to mitigate these risks.

Competitive bidding can result in lower prices and be an appropriate incentive mechanism for large-scale projects. By its nature, competitive bidding is more appropriate for large scale projects, as opposed to smaller scale distributed projects. Using competitive bidding, some emerging countries have been able to award contracts at very low prices, compared to a FiT regime. There is, however, a risk that project developers bid at prices that they cannot afford in the long term and projects do not get built or cease operation prematurely.

In *Brazil*, wind-only auctions have been successful in the context of the global financial crisis, when sluggish global demand and the resulting oversupply of wind turbines brought capital costs down and these savings could be reflected in the competitive bidding process. The result was a viable price that was lower than the previously fixed prices. The average rate of 7.7 U.S. cents/kWh paid for wind power as a result of the last round of auctions in August 2010 was less than half the tariffs currently paid (14.6 to 16.7 cents) for wind projects developed under Brazil's earlier fixed-price scheme.

But if increased global demand for wind equipment were to lead to higher capital costs in the future, Brazil may not find such attractive pricing in future

[46] See DB Climate Change Advisors, *GET FiT Program: Global Energy Transfer Feed-in Tariffs for Developing Countries,* p. 53-57 for a detailed overview of the features of feed-in-tariffs in Kenya, Sri Lanka, South Africa, Thailand, and Tanzania. The Nigerian Electricity Regulatory Commission issued a Request for Proposals with support from the United States Trade and Development Agency to develop a framework for independent power producers that would include a set tariff and standard PPA for renewable energy projects, see "Nigeria – Renewable Energy IPP Framework," Solicitation Number 2010-11022A, available at https://www.fbo.gov/spg/TDA/TDA1/TDA1/2010-11022A/listing.html, accessed March 26, 2011.

tenders. It remains to be seen if the wind projects developed as a result of the auction can realize a return on investment, given that they assumed very optimistic capacity factors. For example, while the observed capacity factor for projects installed under Brazil's former incentive scheme (PROINFA) was 0.255 in the state of Rio Grande do Norte in 2009, capacity factors between 0.451 and 0.490 were assumed in the auctions. If wind projects are successfully operated at the rates that won the auctions, wind would be fully competitive with fossil fuel generation in Brazil.[47]

In *China*, there have been many cases of developers bidding at prices that were too low, so developers went out of business before projects could be completed. China has struggled with underbidding and the resulting failed wind farms in its auction system and has recently established a FiT for onshore wind that is nearly double the price at which some auction prices were settled at.[48]

LESSONS LEARNED: GENERATION-BASED INCENTIVES CAN BE MADE MORE COST-EFFECTIVE

Renewable energy incentives rely on ratepayers, taxpayers, or international donors for their funding. As such, they need to be as cost-effective as possible both in the short run, by efficiently meeting its objectives of increasing deployment, and in the long run by driving cost reductions. If a generation-based incentive is financially supported by an international donor, that institution will have a clear interest in ensuring that the mechanism was set at the right rate and designed in a cost-effective way. Below, we discuss some options to enhance the cost-effectiveness of performance based incentives. Many of the options identified focus on FiTs, as they are the most widely used form of performance-based incentives.

[47] Soliano Pereira, *Status of Brazilian Renewable Energy Policy.*

[48] Junfeng Li, Pengfei Shi, and Hu Gao, *2010 China Wind Power Outlook* (Beijing: Chinese Renewable Energy Industries Association, Global Wind Energy Council, Greenpeace, October 2010).

Governments can increase the cost-effectiveness of renewable energy support by reducing fossil fuel subsidies. As a complement to the measures discussed below, governments should consider increasing the cost-effectiveness of renewable energy policies. The clearest way to do this is to level the playing field with fossil fuels, by reducing fossil fuel subsidies.

Two central objectives of smart renewable energy policy are 1) to bring the cost of renewable energies down in the long run, so they can compete with fossil fuels, and 2) to begin developing the sector by covering the cost gap in the short run. Yet, this competition in energy markets is distorted by the large subsidies provided to fossil fuels.

The exact amount of those subsidies is not fully known. The IEA estimates that direct fossil fuel consumption subsidies totaled $312 billion worldwide in 2009.[49] Because indirect subsidies are so difficult to calculate, we have no good figures for the actual total of all direct and indirect fossil fuel subsidies is much harder to calculate. Nevertheless, the subset the IEA looked at equals seven times the amount spent on all forms of renewable energy support in 2009.[50]

These subsidies create a number of problems, including putting a double burden on public

[49] International Energy Agency, Organisation for Economic Co-operation and Development, and World Bank, *The Scope of Fossil-Fuel Subsidies in 2009 and a Roadmap for Phasing Out Fossil Fuel Subsidies,* IAE, OECD, and World Bank Joint Report Prepared for the G-20 Summit, Seoul (Paris, Washington, DC, November 11, 2010).

[50] Alex Morales, "Fossil Fuel Subsidies Are 12 Times Support for Renewables, Study Shows," July 29, 2010, http://www.bloomberg.com/news/2010-07-29/fossil-fuel-subsidies-are-12-times-support-for-renewables-study-shows.html. Note that this article claims that fossil fuel subsidies are even 12 times higher, because it is based on IEA data for 2008. Fossil fuel support decreased in 2009; the ratio therefore decreased to 1:7.

budgets in countries that begin to implement renewable energy policies. First, the subsidies themselves cost large amounts of money. Second, they reduce the competitive viability of renewables, so that more money needs to be spent on support to help renewable energies compete. Smart renewable energy policy therefore also needs to consider reductions in fossil fuel subsidies. Renewables would become more competitive and public funding would become available for renewable energy support instead.

However, as with many energy policy decisions, the distribution impacts need to be carefully considered. While many studies have shown that the bulk of fossil fuel subsidies disproportionally favor the upper middle classes, some are effectively targeted at providing for the basic energy needs of the poor.[51] According to research by the Global Subsidies Initiative, fossil fuel subsidies reform will be more successful if it takes these impacts into account and, among other things, "includes complementary policies that offset any undesired secondary impacts (such as welfare support for the poor, programs to help industries restructure, or longer-term strategies to diversify the national energy supply), develops a communications strategy to assure stakeholders that their interests are being respected, and creates mechanisms to ensure transparency regarding subsidies and the reform process."[52]

Deciding how to fund an incentive mechanism raises political and equity challenges that may be more easily navigated with help from the TAP-C principles. When a premium is provided to renewable energy producers through a generation-based incentive, someone has to pay that premium. It can either be passed through to electricity consumers, be paid out of the public budget, i.e. by taxpayers, or funded through some combination of these approaches. International public finance could also pay parts of the premium, as discussed above. The distributive impacts of different options need to be carefully considered. This issue is particularly important in developing countries, where there is a risk that electricity tariff increases will prevent the poor from accessing basic energy services. As the experiences with increasing tariffs to recover costs in the 1990s have shown, there is a potential for social unrest if the expansion of renewable energy is financed through rate increases. The distributive impacts on the poor can be mitigated, for example, by using inclining block rates where the premium is passed through only in the higher block tiers, and therefore only to consumers with a higher levels of electricity consumption.[53]

In the case study countries, a number of design options have been used to avoid negative impacts on the poor. As we will discuss in Chapter 5, transparent and accountable procedures for determining the premium and the mechanisms to fund can help achieve outcomes that are accepted as equitable.

When *Brazil* was using a generation-based incentive similar to a capped FiT, prior to its current bidding approach, the program was financed by a levy only on those consumers with a monthly consumption above 80 kilowatt hours.[54]

In the *Indian* state of Maharashtra, it was found that the impacts on household budgets were much lower

[51] International Energy Agency, Organisation for Economic Co-operation and Development, and World Bank, *The Scope of Fossil-Fuel Subsidies in 2009 and a Roadmap for Phasing Out Fossil Fuel Subsidies.*

[52] Tara Laan, Christopher Beaton, and Bertille Presta, *Strategies for reforming fossil-fuel subsidies. Practical lessons from Ghana, France, and Senegal* (Winnipeg, Manitoba: International Institute for Sustainable Development, 2010), 8.

[53] Navroz Dubash, *Power politics: equity and environment in electricity reform,* WRI Report (Washington DC: World Resources Institute, 2002); Smita Nakhooda, Shantanu Dixit, and Navroz K. Dubash, *Empowering people: a governance analysis of electricity,* WRI Report (Washington D.C., Pune, India: World Resources Institute, Prayas Energy Group, 2007).

[54] Soliano Pereira, *Status of Brazilian Renewable Energy Policy.*

Table 4: Wind project developers cost submissions before the Electricity Regulatory Commission in the Indian state of Andhra Pradesh

Client	Submission Date	Cost per MW (in million Rs)
Gujarat Alkalies and Chemicals Ltd.	March 2007	51.4
Chennai Port Trust	April 2007	53.6
Rajasthan State Mines & Minerals Ltd	April 2007	51.6
ONGC Gujarat	June 2007	60.8
Bharat Electronics Ltd	June 2007	74.5

Source: InWEA

if the premium for renewable energy was recovered through the electricity tariff for industrial customers rather than the household tariff.[55]

In *Thailand*, customers who consume less that 90kWh per month have a "lifeline" rate and receive electricity free of charge. Price impacts are distributed amongst the remainder of the consumers, equally, on a per Kwh basis. The Thai Ministry of Energy's Energy Planning and Policy Office (EPPO) analyzed the impact of the VSPP & SPP adder-on rate payers as follows:

- $0.00233/kWh for years 2010–2011
- $0.00894/kWh for years 2012–2016
- $0.00710/kWh for years 2017–2022

Thus far, heavy impacts, particularly on the poor, have been avoided in Thailand. However, lifeline subsidy programs (such as the one in Thailand) accumulate debt, which will eventually have to be repaid, probably through tariff increases.[56]

A price premium that decreases over time can drive performance improvement and cost reductions. The ultimate goal of renewable energy policy is to make these energy sources cost competitive with conventional energy sources. Therefore, the level of premium offered to new projects should decrease over time. For example, in Germany and California, the FiT payment locked in for a project placed into service this year will be lower than the FiT offered to projects installed last year.[57] This declining premium seeks to take advantage of the expected learning, market changes, and technological development that increased deployment brings. If the decline is transparently set far in advance, then it can serve to provide valuable investment foresight, while helping to drive improvements in cost and performance — rather than only passively capturing improvements. However, the further out a schedule is set, the greater the risks of over-subsidization or underpayment.[58] So far, there are no examples of such decline schedules set in advance in the developing world, but as FiTs become more popular, policymakers can consider them to reduce the cost of the program and drive innovation.

55 Narasima Rao, *Distributional Impacts of Climate Change Mitigation in the Electricity Sector: Case Study of Maharashtra, India,* Dissertation Working Paper (Stanford, CA: Stanford University, 2010).

56 Authors' personal communication with Chris Greacen and Chuenchom Sangarasri Greacen of Palang Thai, March 2011.

57 For the German rate schedule, see BMU, *2009 EEG Payment Provisions* (Berlin: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, August 16, 2008), http://www.erneuerbare-energien.de/files/english/pdf/application/pdf/eeg_verguetungsregelungen_en.pdf. For the Californian rate schedule, see California Public Utilities Commision, "Feed-in Tariff Price," *Feed-in-Tariff Price,* n.d., http://www.cpuc.ca.gov/PUC/energy/Renewables/Feed-in+Tariff+Price.htm.

58 For a discussion of pre-defined declining rates and their effects, see Kirkegaard et al., *Toward a Sunny Future?*, 13-14.

Getting the price right at the beginning, based on an assessment of the technology, market conditions, and resource availability, is critical for the success of a FiT. A particular challenge of FiTs is getting the price right, so that there is less need for later budgetary infusions or consumer price hikes later on.

At the Clean Energy, Good Governance, and Regulation Forum co-convened by WRI, Idasa, and Prayas Energy Group (Prayas)[59] in Cape Town in May 2010, regulators from South Africa, India, and Mexico discussed their need for access to databases on resource availability and technology performance that can help them to set feed-in tariffs at the right level and duration.

In India, the state regulatory commissions rely on the cost information submitted by various project developers when setting FiT levels. However, in many cases, this information varies widely, in spite of limited variability in the equipment providers. Table 4 shows the capital costs submitted by five different wind project developers to the Andhra Pradesh Electricity Regulatory Commission (APERC) within a time period of four months. The highest submitted cost is 45 percent higher than the lowest submitted cost. This example highlights the information asymmetry that the electricity regulatory commissions need to grapple with while setting FiTs.[60]

Similarly, the Central Electricity Regulatory Commission (CERC), as well as several other State Electricity Regulatory Commissions in India, has recently announced FiTs for solar PV. In 2010, the FiT set by the CERC was 18 percent higher than that set by the state regulatory commission in Gujarat. Yet Gujarat was successful in attracting 500MW of solar capacity at the lower price (see Table 6).[61]

FiTs are most effective if they are set at a rate that reflects the cost of generation of the specific renewable energy technology. In order to save scarce resources, they can also be set at a price that only reflects the utility's avoided cost, but this will limit the FiT's impact. Incentives should reflect the objectives defined in a country's strategy or planning documents — if the objective is to increase the share of a certain technology, then the support should be technology specific.

In *Thailand* and *Tanzania*, Small Power Producer (SPP) regulations provide streamlined arrangements for grid interconnection, as well as standardized power purchase agreements. These practices allow small renewable energy and cogeneration facilities to connect and sell electricity to the grid. Tanzanian rates are based purely on the utility's avoided cost and have led to the development of predominantly biomass and some small hydro plants. On the other hand, Thailand pays a technology-specific rate and has seen the development of a more diverse set of technologies.

In *Tanzania*, the tariff paid to SPPs is based on avoided cost of generation of the utility. Tanzania has frequent power shortages, especially when there is drought, due to its high dependence on hydroelectric generation. To help meet demand, the Tanzanian utility purchased generation capacity and associated energy through emergency procurements, or from thermal plants that use expensive fossil fuel. For SPPs connected to the main grid, the tariff is lower than emergency energy costs, but sufficient for biomass to be profitable. Only about 2 percent of the rural population of Tanzania has grid

[59] Prayas is an independent research advocacy institute based in the state of Maharashtra, India. Idasa is an African democracy institute based in Cape Town, South Africa.

[60] Ranjit Deshmukh, *Renewable Electricity and Governance – Cases from India* (Washington, DC: World Resources Institute, November 22, 2010), http://www.wri.org/developing-country-renewables.

[61] Ibid.

Table 5: Renewable energy online or with PPAs signed under the Thai VSPP and SPP programs, as of October 2010						
	VSPP (MW)		SPP (MW)		Total (MW)	
	PPA signed	Generating	PPA signed	Generating	PPA signed	Generating
Solar	2,020	16	90	-	2,110	16
Biogas	85	69	-	-	85	69
Biomass	2,108	710	70	583	2,178	1,293
Municipal Waste	95	32	-	-	95	32
Mini/micro hydro	6	1	-	-	6	1
Wind	67	0	-	-	67	0
Total	4,381	830	160	583	4,104	1,364

electricity. Some of the larger towns are served by 11 diesel mini-grids owned by the national utility. In this case, the SPP tariffs are set slightly lower than what the utility has to pay for diesel generation, but high enough to be attractive to small biomass and micro-hydro developers. Already, PPAs for four power plants have been signed, including power plants powered by wood waste, coconut husks, micro-hydropower, and bagasse from sugar processing plants. The current tariff is not based on generation cost for renewable energy technologies and is too low to develop projects other than biomass and hydro.[62]

Thailand's SPP and Very Small Power Producer (VSPP) regulations came into effect in 1992 and 2002 respectively and have been successful in adding over 1,300 MW of renewable energy generation capacity (See Table 5).[63] Since December 2006, the programs also guarantee a FiT subsidy on top of avoided costs, called the "feed-in adder," differentiated by technology type and by generator size. Additional per-kWh subsidies are provided for projects that offset diesel-powered electric generation in remote areas, and to offset political risk in southern provinces that have suffered in recent years from violent conflict. The feed-in adder is provided for seven to ten years depending on technology type. Prior to the feed-in adder, there was very little VSPP generation on-line even though the VSPP program was in operation since 2002. Because the program used to be based on avoided cost, nearly all projects were larger biomass projects, using bagasse, paddy husk, or wood chips. The technology-specific feed-in adder has created technology diversity in the pipeline.[64]

Caps can be used to control the cost of an incentive mechanism. FiTs in developing countries are very often capped. The caps do not necessarily reflect optimal levels of deployment, in terms of cost or of grid stability, but rather reflect the limited available financial resources. Caps also reduce the level of investor certainty; without knowing whether a project they consider will fall under the cap or end up outside of the cap, inves-

[62] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

[63] The Very Small Power Producer (VSPP) program applies to generators up to 10 MW of electricity export. The Small Power Producer (SPP) applies to generators from 10 MW to 90 MW.

[64] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

Table 6: Different rates for solar PV in India under FiTs and competitive bidding in Gujarat and at the national level				
Commission	**Date**	**Levelized Cost per kWh (US$) without tax benefits**	**Levelized Cost per kWh (US$) with tax benefits**	**Discrepancy**
Gujarat State Electricity Commission (GERC) — solar PV FiT	January 2010	-	0.28	-
Central Regulatory Commission (CERC) — solar FiT	March 2010	0.40	0.33	18 percent higher than GERC
Central Regulatory Commission (CERC) — competitive bidding NSM	November 2010	0.27 (average)	-	32 percent lower than FiT set by the same Commission

tors cannot calculate their projected revenues. If additional public resources became available, for example from donor contributions, existing capped FiTs could be scaled up by either increasing or completely removing the cap.

Caps on overall capacity to be supported are in place, for instance, in *India* and the *Philippines*; caps on the maximum allowable project size are used in, for instance, *Sri Lanka, Thailand, Tanzania,* and *India* for its National Solar Mission.

Combining different generation-based incentives can also help control the cost of renewable energy policy. There might be good reasons to use different generation-based incentives for different technologies and project types. For example, a FiT might be most useful to encourage broad application of certain technologies through many distributed projects. But a country might at the same time use RPS or competitive bidding for other technologies, for example if its strategy for a certain technology aims for a small number of larger scale projects or if certain types of projects generate so much project developer interest that a FiT might become difficult to manage and to fund.

It is quite common for REC trading to co-exist with FiTs, giving power producers the flexibility to choose the system that they believe will be more profitable. Such a model exists in *India* and is currently under consideration in the *Philippines*.[65] In the Philippines, it has also been suggested that REC trading be used only for those renewable energy sources that are not covered by the FiT, such as geothermal.

After a FiT generated more project developer interest than necessary to reach solar energy targets, *India* used a bidding mechanism to mitigate the cost of renewable energy expansion. As part of the National Solar Mission, a capacity target of 500 MW was defined for the first round of projects that were to be approved at the solar FiT rate set by the CERC. Due to the large response from project developers, the CERC pursued a reverse auction

[65] Kumar, "Country Case Study: India."

mechanism and procured bids at 32 percent lower than the FiT they had previously set (see Table 6).[66]

Incentives need to be designed in a way that limits speculation by imposing penalties or canceling permits if no generation projects are built. Mechanisms where the number of those that can benefit from an incentive are limited can lead to speculation and limit the success of a program. For example if the total amount of capacity to be supported is limited and potential producers need a permit to qualify, some companies or individuals might apply for permits without the intention to actually develop projects and rather speculate on the rising value of the permit. If this happens, licenses might be blocked and less than the intended capacity actually be installed. Well-designed rules can help limit speculation, for example by imposing financial penalties if projects do not begin operations within a specified time-frame.

In *Thailand*, some companies applied for power purchase agreements under the VSPP program without any intent to develop generation projects. Instead they acquired PPAs in the most attractive location only to sell them to project developers. This created uncertainty about the impacts on the grid and on ratepayers. This problem was later addressed by a change in the regulations. A bid bond for projects over 100 kW is now required, and projects must produce power within one year of the scheduled date of commissioning to receive the technology-specific feed-in-tariff premium. Otherwise they forfeit the bond.[67]

[66] Deshmukh, *Renewable Electricity and Governance – Cases from India.*

[67] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

INTERNATIONAL SUPPORT: CAPACITY-BUILDING AND INTERNATIONAL PUBLIC FINANCE TO ADDRESS INCREMENTAL COSTS WITH PREDICTABLE GENERATION-BASED INCENTIVES

As policy environments, incentive mechanisms, and markets for renewable energies in developing countries evolve, so will the role of international public finance. If donors move towards supporting smart renewable energy policies, they will have to consider ways to support performance-based incentives. This would involve both capacity building and technical assistance for the design of performance-based incentives as well as funding for the additional cost of the incentive itself. As more and more experience with the design and implementation of a FiT exists in the developing world, South-South exchange may be an appropriate mechanism to build capacity in additional countries (see Box 2).

Providing international public funding for the additional cost of an incentive mechanism would involve significant amounts of finance over long periods of time. It would be a new approach for donors, but one that could have a transformative impact for scaling up renewable energies in the developing world.

Mechanisms that provide investors with a guaranteed market for more expensive solutions — such as the generation-based incentives discussed in this paper — can be very effective in driving innovation or the transformation of a sector. The High Level Advisory Group for Long Term Financing created by the UN Secretary General found that such advanced markets commitment mechanisms are efficient tools to attract private capital by ensuring investors of a minimum market demand and a guaranteed return upfront.[68] Several organizations have proposed to link FiTs in developing countries

[68] High Level Advisory Group for Long Term Financing, *Report of the Working Group 7*, p. 21

Box 2: South-South exchange of experiences between Thailand and Tanzania[1]

There has been a South-South exchange of ideas and experiences between Thailand and Tanzania, focused on the Thai experience with small and very small power producer (SPP/VSPP) programs. This has helped Tanzania develop its own SPP regulations appropriate for its context. There are a lot of similarities among the power sectors of Thailand and Tanzania — in finance, in applicable technologies, in institutional arrangements, and in power sector priorities. SPP legal documents from developed countries with a more litigious legal culture, such as the United States, are often cumbersome documents that try to anticipate and cover every possible situation that might arise. Being able to access SPP legal documents developed in other developing countries has allowed Tanzania to develop regulations that address key issues and are more nimble.

In March 2010, the World Bank helped provide funding to bring a Tanzanian delegation to Thailand for a week to meet with counterparts on details of the Thai VSPP program. The delegation was comprised of Tanzanian Ministry of Energy officials, utility engineers, representatives from the country's regulatory authority, financers, and project developers. The engineers got to ask technical questions of Thai counterparts, while regulatory officials got to see what challenges and responses have emerged in regulatory oversight of SPPs. A project developer of a biogas facility in Tanzania was able to learn from field technicians working at a cassava biogas plant north of Bangkok, and learned of new sources for equipment. Financers and Ministry of Energy officials learned how small ($1.6 million) low-interest loans from a tranche of government money managed by commercial banks helps jumpstart the lending process by commercial lenders.

An exchange like this not only helps renewable energy in Tanzania. Within Thailand — and especially within the Thai utility that hosted the tour — the profile of the VSPP program was highlighted and raised in stature. Thai utility people now recognize that their VSPP program and FiT is an international success. As a follow up, three Thai utility officials have been hired to assist Tanzania's national utility in setting up an "SPP cell" to provide efficient and focused support for SPPs that wish to connect to the national grid.

— Chris Greacen, Palang Thai

[1] For a more detailed version, see Chris Greacen, *South-South Policy Transfer: Thailand & Tanzania* (Washington, DC: World Resources Institute, November 22, 2010), http://www.wri.org/developing-country-renewables.

to a global support mechanism. The rationale is that, as investors are reluctant to invest in renewable energy in developing countries because they perceive the risk as too high, a FiT could be a tool help lower those risks. However, while ambitious FiTs can be an important component of smart renewable energy policy and could lead to rapid deployment of renewable energies with all its carbon and development benefits, ratepayers or taxpayers in developing countries are not able to shoulder the full cost of the mechanism. An international public finance mechanism would therefore provide all or some of the price premium. One of the most elaborate proposals, the GET FiT concept, was developed by Deutsche Bank Climate Change Advisors (see Box 3).

Box 3: The GET FiT Program

The Global Energy Transfer Feed-in Tariffs Program (GET FiT) was first conceived by Deutsche Bank Climate Change Advisors (DBCCA) in January 2010 in response to an invitation from the United Nations Secretary General's Advisory Group on Energy and Climate Change (AGECC) to present new concepts on how to drive renewable energy investment in the developing world.[1] DBCCA responded with GET FiT, a proposal to create new international public-private partnerships to support both renewable energy scale-up and energy access.

The GET FiT concept builds upon previous global feed-in tariff proposals and interviews with 160 experts to incorporate a bottom-up, private sector perspective on renewable energy finance and development risks.[2] It does this by exploring the barriers to program implementation in detail, and by highlighting the instruments available that could efficiently spur development of renewable energy.

The GET FiT envisions include three types of support: 1) a source of public finance from different sources for renewable energy incentives, 2) risk mitigation strategies such as international guarantees and insurance, and 3) coordinated technical assistance to address non-financial barriers and create an enabling environment for project development.

Since renewable energy policies need to be adapted to the local developing country context, GET FiT proposes three programs to support different policy models beyond feed-in tariffs (Figure 2).

Targeted GET FiT Support	GET FiT Solution
Advanced Feed-in Tariffs	Provide supporting payments for above-market premiums for renewably produced energy through advanced feed-in tariff designs that target on-grid, commercialized, renewable resources.
Lighthouse Power Purchase Agreements (PPAs)	Use power purchase agreements as a pre-FiT regulatory mechanism in countries that face grid integration constraints, or for technologies that have a limited in-country track record.
Mini-grids for Off-Grid Applications	Adapt FiT design principles to create performance-based incentives for decentralized multi-user energy generation, especially mini-grids, in rural areas with limited grid infrastructure.

Figure 2: Project types addressed under GET FiT.[3]

In each of the three cases, GET FiT would contribute public sector funds to share the above-market costs of renewable electricity with partner countries, while utilities would commit to purchasing electricity from generators at market price. This stabilization of revenue streams could attract signifi-

[1] For the full proposal, see DB Climate Change Advisors, *GET FiT Program: Global Energy Transfer Feed-in Tariffs for Developing Countries,* available online at www.dbcca.com.

[2] GET FiT builds upon proposals such as those developed by: Ad Hoc Working Group on Long-term Cooperative Action, European Commission Joint Research Centre, UN Department of Economic and Social Affairs, European Renewable Energy Council and Greenpeace, World Future Council, World Wind Energy Association, International Renewable Energy Alliance, and Project Catalyst.

[3] DB Climate Change Advisors, *GET FiT Plus: De-Risking Clean Energy Business Models in a Developing Country Context,* Forthcoming Report (New York: Deutsche Bank Group, 2011).

Box 3: The GET FiT Program (continued)

cant amounts of private sector capital from both domestic and international sources to build renewable energy projects.[3] In addition to providing direct financial incentives, the GET FiT concept identifies a series of guarantees and mitigation strategies to address financial risks beyond those that derive from policy structure.

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. The GET FiT concept is intended as a template which could be flexibly adapted to specific national contexts and could be launched on a bilateral, regional, or global basis.

— Christina Hanley, Meister Consultants Group

[3] For a detailed chart of the payment and guarantee structure, see: DBCCA (2010), *GET FiT*, p 18.

While no international funds or programs to finance FiTs exist to date, there are a few existing mechanisms donors could learn from. The Clean Development Mechanism (CDM), a carbon-market mechanism created under the Kyoto Protocol, offers an example of a performance-based funding source that rewards the private sector for taking risks and provides it with a return (in this case, the difference between the cost of generating offset credits and the prevailing market price).[69] Carbon offset development has stimulated private-sector investment for renewable energies in developing countries. In 2009, investments in renewable energies (wind, biomass, and hydropower) counted for 23 percent of the CDM market.[70]

[69] High Level Advisory Group for Long Term Financing, *Report of the Working Group 8*.

[70] World Bank, *State and Trends of the Carbon Market*, 2010; High Level Advisory Group for Long Term Financing, *Report of the Working Group 8*, p.20. It should be noted that assessing the "additionality" of emissions reductions — and thus the performance of any given CDM project— has been a big hurdle for CDM project developers. A number of proposals to reform the CDM put forward models based on sectoral performance rather than individual projects performance, for example sectoral crediting performance, where credits are created if the overall sectoral performance exceeds an agreed performance. In this case, the additionality assessment would be improved by adopting standardized approaches to baseline-setting instead of a project-by-project basis as is the case now.

The creation of specialized trust funds within the multilateral development banks dedicated to support climate change initiatives present some valuable lessons on how provision of concessional finance could help facilitate deployment of low-carbon technologies. The Climate Investment Funds (CIFs) are one of the most cited "live experiments" undertaken by governments to help developing countries "bridge the gap between conventional dirty and clean technology." These $6.3 billion funds were established in January 2008 to operate until 2012, and are channeled through the World Bank and other multilateral development banks. Their creation was prompted by a joint commitment from the governments of the United Kingdom, the United States, and Japan. As of May 2011, 14 donor governments have pledged funds to the CIF. The bulk of these funds ($4.76 billion) are dedicated to support the deployment of clean energy technologies and make transformative reductions in greenhouse gas (GHG) emission trajectories in developing countries.[71]

[71] Polycarp, C et al. *Learning from the Climate Investment Funds, World Resources Institute*, November 2010, http://www.wri.org/stories/2010/11/learning-climate-investment-funds

Through one of the CIFs, the Clean Technology Fund (CTF), countries obtained support to develop clean investment plans that contain the major opportunities for greenhouse gas reductions in different sectors and detail those requiring international support. Many of these plans outline possible options for structuring financial support so that grant-based and/or highly concessional financing mechanisms could be blended with private sector investments to help buy down the high-cost of specific technologies and the costs associated with renewable energy policies (such as a national FiT program) in a developing country.

In addition, the World Bank's ESMAP has also introduced a set of innovative financing mechanisms, as well as training and technical assistance to support low-income countries' ambition and plans to diversify energy supply and switch to zero-carbon technology options.[72] In less developed markets in Africa for example such mechanisms could help finance the upfront cost of a national FiT program.

Providing additional funding to existing FiT schemes in the developing world could be an attractive way for donors to leverage their funds for maximum impact. FiTs in the developing world may differ from what is considered best practice in the developed world, where noncapped, technology-specific, generation cost–based FiTs provide very high certainty for investors. Because of limited technical and financial resources, developing countries often have to limit the ambition of their FiT programs.

For example, the current Tanzanian SPP tariff is not based on generation cost for renewable energy technologies and thus appears too low to develop projects other than biomass and hydro. Tanzania is considering adopting technology-based rates in its SPP program in the near future, but would likely need some form of international support to be able to do so.[73]

In such cases, the cost of the program would be shared between a developing country that pays the cost of the more modest original program and donor funds that would support scale-up in one of the following ways:

- FiT restricted to certain technologies → donor funds to add more technologies
- FiT rates based on utilities' avoided cost → donor funds to shift to rates based on technology-specific generation cost
- Cap on the capacity supported by a FiT → donor funds to increase or remove cap

72 World Bank, http://www.esmap.org/esmap/overview

73 Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

5 Creating an Enabling Policy and Regulatory Framework

LESSONS LEARNED: SMART RENEWABLE ENERGY POLICY NEEDS STRONG INSTITUTIONS, SOUND PROCESSES, AND WELL-DESIGNED REGULATIONS

Simply providing a generation-based incentive to cover the incremental cost of renewables as compared to fossil fuels is not sufficient to spur renewable energy deployment. A broader set of rules and regulations governing power production and grid operation are needed.

In a previous report, WRI has developed a framework for enabling sustainable energy investment that summarizes the different elements policymakers need to consider when designing energy policy.[74] Based on an examination of policies, regulations, and institutional capacities in the electricity sector that direct both public and private investment in sustainable energy options, the elements proposed in the framework are intended to help any country consider the options for how best to provide electricity services in light of intertwined economic, social and environmental considerations (see Box 4).

Any generation-based incentive needs to be part of a broader set of power sector rules and regulations. For example, interconnection rules may establish a legal requirement for grid operators to connect new renewable energy projects to the grid. This is crucial because a generation-based incentive may guarantee a power producer a certain price if he feeds power into the grid, but that is of little help if the project cannot get connected. Another example is the necessity of established and regular avenues for community engagement and free, prior, and informed consent when siting renewable energy projects.

[74] Nakhooda and Ballesteros, *Investing in Sustainable Energy Futures. Multilateral Development Banks' Investments in Energy Policy*.

In *Thailand*, the SPP/VSPP program includes interconnection rules. They stipulate that utilities may only reject applications if the applicant's facility is not in compliance with published technical guidelines. This is seen as an important factor in the success of the program, because it has provided a predictable and easy to navigate way for small independent power producers to ensure their electricity will be bought by the utility.[75]

Determining where exactly renewable energy projects will be located can benefit from consultation with affected communities. Experiences with community opposition in *Mexico* demonstrates that advance planning for wind farms, early community involvement, and the provision of tangible local benefits has avoided project delays and political tension.[76]

Institutions and procedures for transparent, accountable, and participatory decision-making can lead to better decisions and improve public support for renewable energy programs. Good governance is a critical aspect of smart renewable energy policy. When policymakers and regulators design and implement policies, they are faced with many questions. For example, when establishing a generation-based incentive, they may ask: Which technologies and types of projects should be encouraged? What is the capacity target? Which is the most appropriate mechanism? Which selection criteria are to be applied in order to determine eligible projects? If a FiT is used, how can the appropriate rate be determined? Who pays?

The availability of good data and access to knowledge and experiences made in other countries can help regulators make decisions. In addition, our case studies reveal that transparent, accountable,

[75] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

[76] Peter Banner, *La Ventosa Mexico Wind Case Study* (Washington, DC: USAID, September 2009).

Box 4: WRI's 11 Point Framework on Enabling Investments in Sustainable Energy

Policies & Regulations

- Long-term integrated energy planning.
- Policies and regulations encouraging energy efficiency.
- Policies and regulations promoting renewable energy.
- Access to electricity for the poor.
- Pricing structures encouraging efficiency and reducing consumption.
- Subsidy reforms to reveal true costs of fossil fuels and promote the viability of sustainable energy options.

Institutional Capacity & Governance

- Executive agencies' capacity for sustainable electricity.
- Regulatory agencies' capacity to oversee implementation of sustainable electricity policy.
- Utilities' capacity to promote energy efficiency and renewables.
- Transparency of policy, planning, and regulatory processes for electricity.
- Stakeholders' engagement in policy, planning, and regulatory processes.

and participatory processes are needed to find satisfactory answers to the many questions related to smart renewable energy policy design.

As the comparison of FiTs for solar PV and wind power in India above has illustrated, there is a risk that support levels are set higher than need be, because regulators are dependent on project developers for information about costs and do not have the capacity to cross-check them. Civil society organizations have played an important role in reducing information asymmetry about the cost of renewable energy and in increasing the percentage of renewable energy in long-term power development plans.

Yet the potential of civil society to participate in decision-making processes about the price and impact of renewable energy is far from realized. According to an international survey by the U.S. National Association of Regulatory Utility Commissioners, there are two main reasons for this. First, civil society organizations often lack the necessary capacity, resources and data access to engage in the regulatory process in a meaningful way. Second, they perceive the regulatory process as driven by investor needs and therefore lose interest.[77]

There have been some examples demonstrating the value of civil society participation in our case study countries. With additional support for capacity development and institution building, these could

[77] NARUC, "The Role of Consumer Organizations in Electricity Sector Policies and Issues: Results of NARUC's Global Survey," 2006. Fifty-two organizations in 38 countries responded to the NARUC Global Survey.

be replicated in other contexts. Analysis produced by the Healthy Public Policy Foundation (HPPF), Palang Thai, and other NGOs in *Thailand* have been instrumental in the decision to include the output from the VSPP program in the national power development plan. These groups are continuing to press for more energy efficiency to be included as a supply option as well.[78]

In *South Africa*, Idasa, Green Connection, Sustainable Energy Africa, and other NGOs have similarly opened up the process for integrated resource planning to public consultation, creating space for a larger range of perspectives in an industry dominated by coal interests.[79]

Prayas' study "Clean Energy Regulation and Civil Society in India" documents the poor public response to the renewable energy tariff orders issued by *Indian* state regulatory commissions.[80] The study, which reviewed regulatory proceedings and conducted stakeholder interviews in five Indian states, concluded that there are two main reasons for this. First, the lack of reliable data about renewable energy, including resource availability, costs, and performance means that only a handful of technically sophisticated civil society organizations are able to properly analyze regulatory decisions and the data that underpin them, and this work depends on the availability of adequate resources. The second reason is that regulatory bodies tend to focus on investor issues and do not recognize the role of civil society participation, creating the perception of regulatory capture. For most civil society organizations, the focus on investor issues has meant that the regulatory process is of little value to them. Thus begins a cycle of nonengagement, for when civil society organizations stay away from regulatory proceedings, the perception that the process has been captured by project developers is reinforced, and has the potential to build popular suspicion of renewable energy generation rather than a constituency that demands more ambition.

Processes should allow for periodic review and changes to the generation-based incentives if necessary. Institutional capacity and procedures for monitoring, evaluation, and enforcement will be crucial.

The wide divergence of tariff levels under similar circumstances in *India* points to the need for a robust regulatory process for technical review. For instance, Prayas' comparative analyses of wind, solar, and biomass in different Indian states have been helpful in providing insights into problems of information asymmetry. As the policy environment matures and the information asymmetry is rectified, Prayas hopes periodic reviews will result in more cost effective policies.[81]

INTERNATIONAL SUPPORT: BUILDING POLICY, REGULATORY, AND INSTITUTIONAL CAPACITY

While historically, the bilateral and multilateral institutions have focused on reforming the electricity sector to improve competitiveness and encourage private investments more broadly, they have recently started to pay greater attention to creating enabling environments specifically for

[78] Presentation by Suphakit Nuntavarakorn, Healthy Public Policy Foundation, at the 14th Annual Anticorruption Conference, Bangkok 2010: http://electricitygovernance.wri.org/news/2010/12/egi-14th-international-anti-corruption-conference

[79] Trollip, *Status of Renewable Energy Implementation in South Africa with a Focus on the REFIT and the Role of Multi-Lateral Development Banks*.

[80] Prayas Energy Group, "Clean Energy Regulation and Civil Society in India: Need and Challenges to Effective Participation," October 2010 , http://electricitygovernance.wri.org/files/egi/Clean_energy_regulation_csos_india_peg_oct10.pdf

[81] Prayas Energy Group, "Clean Energy Regulation and Civil Society in India: Need and Challenges to Effective Participation," October 2010.

promoting private investment in cleaner energy alternatives, including renewable energy.[82]

Some of the international financial institutions are responding to the need for effective enabling environments. For example, the Global Environment Facility (GEF) supported a project in South Africa in 2007 to assist with drafting laws, regulation, and regulatory instruments for promoting renewable energy, including an exploration of the level of FiTs necessary to encourage private investment in renewable energy.[83]

Similarly, in Central America, the Inter-American Development Bank has provided technical assistance support for Guatemala, Costa Rica, Panama, and others to develop policy and regulatory measures, while the Asian Development Bank has supported similar activities in Pakistan, Samoa, and India.[84] Bilateral agencies have also supported similar activities, such as the French Development Agency's support for energy sector reform to promote renewable energies in Mauritania.[85]

In recent years, the World Bank's ESMAP has introduced a set of innovative mechanisms, including training and technical assistance, to support low-income countries' to develop plans to diversify their energy supply and switch to zero- and low-carbon technology options.[86]

Nevertheless, in 2010, a WRI study of support provided by the multilateral development banks found that there remains a need for more support to create enabling environments, including the institutions and policies that will encourage further private investments in renewable energy technologies. This also includes support for civil society organizations to participate in and contribute to the policymaking and planning processes.

Although multilateral development banks are already supporting a few enabling activities, the study found that, for example, out of the 79 development policy loans made by the World Bank, the Inter-American Development Bank, and Asian Development Bank between 2006 and 2008, only eight projects addressed seven to ten elements of the 11-point framework for enabling sustainable energy investments (see Box 4).[87]

More support in this area could also include support for civil society organizations to participate in and contribute to the policymaking and planning processes. In order for public constituencies for renewable energy to be built, additional resources would need to be provided for deeper and broader participation. Access to analytic resources would deepen the pool of civil society organizations with technical capacity. Those groups could also be resourced to reach out to a broader range of organizations to build a network of civil society organizations whose interests in clean and equitably priced energy could be represented. There is a need, then, for institution building to enable regulatory commissions and other government departments to properly support civil society participation and to increase the capacity of civil society to participate.

82 Dubash, *Power Politics: Equity and Environment in Electricity Reform;* Nakhooda, Dixit, and Dubash, *Empowering People: A Governance Analysis of Electricity.*

83 Trollip 2010; Nakhooda and Ballesteros, 2010

84 Nakhooda and Ballesteros, 2010

85 http://www.ubifrance.fr/electricite-energies-renouvelables-nucleaire/001B1005261A+mauritanie-20-m-eur-de-l-afd-pour-la-reforme-du-secteur-de-l-electricite.html?SourceSiteMap=1190

86 World Bank, http://www.esmap.org/esmap/overview

87 Nakhooda, Ballesteros.

6 Providing Attractive Financing Options

LESSONS LEARNED: BETTER FINANCING CONDITIONS ARE CRUCIAL

Preferential financing options complement generation-based incentives by reducing investors' risks and addressing the high upfront capital needs. The countries that have been most successful in deploying renewable energy both in the developed and the developing world have not only implemented a mechanism to cover the incremental cost of renewable energy, but have also taken other steps to increase the financial viability of projects. These steps can include tax incentives as well as easy access to capital at preferential conditions.

These two approaches are interrelated: The lower the cost of capital, the less the gap to be covered by a generation-based incentive. As discussed above, it would be unwise to encourage renewable energy deployment by subsidizing capital cost alone, as this would shift the incentive away from the key objective of actual power production. Therefore, the two approaches must be carefully balanced to complement each other.

In *Thailand*, in addition to the SPP/VSPP programs, the government loaned 4 billion baht ($133 million) to 13 commercial banks at 0.5 percent interest under the condition that the capital was used to provide loans of up to 50 million baht ($1.6 million) to small power projects at preferential 4 percent interest rates.[88]

The *Indian* Renewable Development Agency (IREDA) has provided long-term credit of up to 70-80 percent of the project cost. This is offered to project sponsors with competitive interest rates and has contributed to the nearly one-third of India's renewable power generating capacity over two decades. IREDA was able to tap the domestic capital markets by issuing bonds in order to provide this financing. Over time, IREDA has demonstrated the financial viability of renewable energy projects in India, which has encouraged the commercial banking sector to increase financing of new renewable energy projects.[89]

In *Brazil*, the National Development Bank (BNDES) offers special financing conditions for renewable energy projects, under the condition that they use 60 percent of domestically produced equipment.[90]

INTERNATIONAL SUPPORT: SUBSIDIZED CAPITAL AND RISK MITIGATION TO ADDRESS INCREMENTAL INVESTMENT NEEDS AND HIGHER COSTS OF CAPITAL

Going beyond the creation of enabling environments, donors need to use the assistance they bring to directly address the financial barriers that currently inhibit the scaling-up of investments in renewable energy technologies. Such barriers include incremental costs due to the higher lifetime costs of projects, incremental investment needs due to higher upfront costs on capital investments, and higher costs of capital due to risk perceptions.

Various models have been attempted to address some of these risks, including the provision of direct subsidies or subsidized capital, the combination of different sources of finance to develop attractive financial packages, and the use of refinancing mechanisms for financial intermediaries.

For example, the Rural Energy Enterprise Development (REED)[91] program, a UN Environment Programme (UNEP) initiative, provides seed capital in the form of low-interest loans directly to

[88] Greacen and Mbawala, *Country Case Studies: Thailand & Tanzania. Feed-in-Tariffs and Small Power Producer Regulations.*

[89] Mostert, W. and Lindlein, P. *Financing Renewable Energy,* December 2005, Kreditanstalt fuer Wiederaufbau (KfW) Entwicklungsbank.

[90] Soliano Pereira, *Status of Brazilian Renewable Energy Policy.*

[91] UNEP REED Programme http://www.unep.fr/en/hilites/thematic_sites/reed.htm

the private sector on a project-by-project basis.[92] Such loans help to lower the cost of capital to the project, improve returns, and thereby improve the viability of the project. However this approach does not address projects that face incremental costs.

Some programs have combined grants with subsidized capital. For example, the Indian Renewable Development Agency (IREDA) has combined concessional credit lines from international development agencies such as the Asian Development Bank, KfW, and the World Bank, with grants from the Global Environment Facility to provide long-term credit of up to 70-80 percent of the project costs.[93]

IREDA was able to tap the domestic capital markets by issuing bonds in order to provide this financing. Accessing domestic capital by leveraging commercial financial intermediaries can be even more effective. In Vietnam, for example, the World Bank refinanced 80 percent of the loans provided by three commercial banks to eligible small-scale renewable energy projects, thereby encouraging commercial lending to projects.[94] UNEP similarly used financial intermediaries in Programme Solaire from 2004 to 2007 (PROSOL), a loan program in Tunisia to lower the financing costs of solar hot water systems.[95] PROSOL helped to develop a market for solar heating by providing financial support and capacity to national financial institutions rather than capital subsidies to producers. This helped ensure the sustainability of the PROSOL program with continued lending from the participating banks. Thus, reducing the risks for domestic financial institutions can play an important role in scaling-up investments in renewable energy technologies.

Another interesting example of blending tools to create attractive financing packages is the Philippines' approach to financing wind power. The Philippine Renewable Energy Board cites the combined financing package offered by local banks combined with international support as key to successfully kick-starting the first on-grid wind farm in the country. Under this scheme, local banks provided upfront investment support to the project's developers, which had more than 50 percent domestic shareholders. This then paved the way for the rest of the funding to come through from the Danish International Development Agency, the Philippines Export Import Credit Agency, the Korean Export Import Bank, and the Japan Bank for International Cooperation.[96] Similarly, the International Finance Corporation has started a program in the Philippines to support domestic banks in financing renewable energy projects by providing technical and financial support including credit lines and partial guarantees of up to 50 percent of the loan principal.[97]

[92] Climate Finance Options, UNEP Renewable Energy Enterprise Development (REED) http://www.climatefinanceoptions.org/cfo/node/45

[93] Mostert, W. and Lindlein, P. *Financing Renewable Energy,* December 2005, Kreditanstalt fuer Wiederaufbau (KfW) Entwicklungsbank.

[94] Wang et al., 2010.

[95] Financing a Climate for Change, UNEP 2008.

[96] Pete H. Maniego, "Country Case Study: Philippines" (presented at the Renewable Energy Policy Workshop, WRI, Washington, DC, November 22, 2010).

[97] http://www.chathamhouse.org.uk/files/16504_0410pp_hamilton.pdf

7 Building the Necessary Technical Environment

LESSONS LEARNED: TECHNICAL CAPACITY AND INFRASTRUCTURE ARE NECESSARY

Developing, installing, operating, and maintaining renewable energy projects requires specific capacities. Skilled engineers are needed for the planning, installation, and operations phase as well as for managing transmission and distribution systems on the electric grid. Projects also need the equipment and trained personnel to generate and process data on resource availability and project economics. Service providers, from banks to construction companies, are also necessary to develop and install projects.

A domestic industry that is able to supply some components and adopt the equipment to local circumstances will have to emerge. To some extent, the necessary technical capacity can grow with the renewable energy sector, but a minimum level needs to be present to establish a stable foundation. Targeted training and education programs as well as support for clean-energy start-ups can help build this capacity.

The unique challenges renewables pose for grid infrastructure in terms of transmission and intermittency need to be addressed. Renewable energy has two characteristics that make it challenging for grid operators. First, renewable energy is location-bound: It is often abundant in places remote from consumer population centers. Yet current transmission infrastructures have been developed with conventional fuels like coal in mind, which can be transported to generating facilities relatively close to these population centers. Scaled-up deployment of renewable energy requires a robust transmission infrastructure, designed to interconnect demand centers to regions with good renewable energy resources. Special rules must be imposed to manage this particular kind of energy flow.

Second, renewable energy is often intermittent or variable. The amount of electricity produced by some renewable energy sources is dependent on the weather and time of day. A responsible provider of electricity must assure that electricity is available on demand. This requires the grid operators to change how they manage supply and demand on the grid. The amount of electricity produced by renewable energy sources is dependent on the weather and time of day. Managing the grid requires the grid operator to finely balance the supply of electricity against the demand for electricity constantly. Traditionally, this is accomplished by adapting supply to meet demand. When consumers arrive home from work at the end of their day and turn on their air conditioners, the grid operator brings more supply onto the grid nearly instantaneously. Fluctuating supply that cannot be controlled is a new paradigm for most grid operators. While regions with large renewable energy capacity have learned to optimize its use through sophisticated weather and electricity demand forecasts, advanced technology, and new dispatching policies, these changes present a significant learning curve for grid operators.

Bundling of renewable energy projects into clusters can help transmission planners prioritize geographic areas for building new grid capacity. To help match investments in new transmission capacity with the most promising areas for scaled-up renewable energy development, project bundling offers an efficient policy tool, which is also appealing to prospective investors. The process of prioritizing regions requires a well-designed planning process, with the engagement of the private sector and other stakeholders, to understand resource requirements and to appropriately allocate transmission costs.

In *Mexico*, an "open season" mechanism for private generation of wind in Oaxaca facilitated an efficient means of collaboration and burden-sharing among developers and with the national utility. The state of

Oaxaca has very strong wind energy resources, with an estimated potential of 10,000 MW and plans to build more than 2,000 MW in wind projects. However, the transmission infrastructure in the state is insufficient to connect new wind capacity to the demand centers elsewhere in Mexico. The public utility could not finance the necessary grid expansion with public funds alone. The open season was an elaborate bidding mechanism to determine how much wind power capacity was to be developed and transported by a new transmission line. It allowed the public utility to commit to building new transmission infrastructure and the project developers to commit to using that infrastructure and paying around 80 percent of its cost.[98]

INTERNATIONAL SUPPORT: TECHNICAL CAPACITY BUILDING AT THE OPERATIONAL LEVEL

Beyond providing support to create the enabling environments and investments to overcome the financial barriers, donors also have a role to play in supporting feasibility studies and other assessments at the project level, and enabling knowledge transfer and technical capacity building at the operational level.

In Colombia, Cuba, and Peru, for example, the U.K. Department for International Development developed a step-by-step manual for villagers operating micro-hydro, solar, biogas, and wind systems to enable them to develop basic skills to resolve on-site problems.[99] In another program funded by GTZ, DfID's German equivalent, a training program for renewable energy in rural areas was organized for 200 "master trainers," who in turn trained 1,500 service engineers and local system operators in China.[100]

Providing support to grid companies is also essential to build their capacities to address issues unique to renewable energy technologies, such as intermittency. In another technical assistance program at the operational level, the Asian Development Bank is providing support to the State Grid Corporation of China to develop a smart grid roadmap, technical standards for renewable energy connectivity to the grid, the upgrade of wind power forecasting systems, and training and study tours.[101]

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98 Francisco J. Barnes, "An Open Season Scheme to Develop Transmission Interconnection Investments for Large Wind Farms in Mexico" (Washington, DC, April 1, 2009), http://siteresources.worldbank.org/INTENERGY/Resources/335544-1232567547944/5755469-1239633250635/Francisco_J_Barnes.pdf.

99 http://www.dfid.gov.uk/r4d/PDF/Outputs/R8018Technical-report.pdf

100 German Technical Cooperation, "Wind power research and training center project," http://www.gtz.de/en/weltweit/asien-pazifik/china/8641.html

101 http://www.adb.org/Documents/TARs/PRC/43053-01-PRC-TAR.pdf

8 Recommendations

This working paper has analyzed case studies of developing countries using smart renewable energy policy to address the financial, technological and policy barriers scaling up renewable energy. Successful approaches vary by country, but there are some common themes:

- Smart renewable energy policy creates markets by setting targets and using predictable, cost-effective, generation-based incentives that reward performance and innovation.
- Smart renewable energy policy is developed, adapted, and implemented through decision-making processes that are transparent, accountable, and participatory.
- Smart renewable energy policy also ensures the necessary technical capacity, financing conditions, and infrastructure are in place to support the growing deployment.

While the policy mix should always be context- and country-specific, the conclusions drawn from the case studies in this paper are useful for several audiences. Policymakers and regulators in developing countries should take these lessons learned into account when designing their own policies and when formulating their needs and demands for international support. Civil society and the private sector in developing countries should promote the key principles and components of smart renewable energy policy. Donors and international institutions should focus their support on the design and implementation of policies that reflect the principles of smart renewable energy policy.

This paper has identified areas where governments in the United States, Europe, and other developed countries, through their bilateral support and multilateral institutions, as well as philanthropic organizations can support transformative renewable energy scale-up in developing countries. This will require the development of country-specific support packages and mixing and matching of a range of finance sources and tools. The balance of the evidence collected in this paper suggests that support should move beyond a project-by-project focus and shift to country-wide and sector-based programming addressing all of the elements of smart renewable energy policy.

This support will have to include:

1. **Technical assistance, capacity development, and institution building to help developing countries develop strategies, targets, and policies.** This should include:
    - An investment in policymakers' and regulators' capacity and technical know-how, so they can draft the plans, laws, and regulations that are needed for a transformative shift to more renewable energy;
    - An investment in regulatory institutions and transparent, accountable, and participatory decision-making processes;
    - Capacity building for civil society organizations to effectively participate in planning and regulatory processes, in order to make renewable energy policy more effective and efficient; and
    - Support beyond one-off technical assistance projects, because the ongoing stakeholder engagement and regular review that is crucial might be best supported through long-term partnerships.
2. **Grant-based international public financing for generation-based incentives to cover additional cost.** This form of support is currently underdeveloped yet will be crucial

to achieve the shift from project-by-project to programmatic support.

- Countries that already have renewable energy policies and generation-based incentives in place represent an opportunity for donors to realize additional benefits relatively easily. For example, in a country that already has a modest, capped FiT in place, the existing cap could be increased or removed or the group of eligible technologies could be broadened.
- Bilateral or multilateral donors should begin pilot initiatives to test this approach, likely with smaller countries that have already demonstrated a commitment to renewable energy first.
- In the long run, a multilateral fund might be the most appropriate source of the long-term, large-scale funding that would be needed to support generation-based incentives in a number of developing countries.

3. **Subsidized capital and risk mitigation to address incremental investment needs and higher costs of capital.** Donors have some experience with the provision of this form of assistance and should continue to provide it, in order to lower the risk of investments in smart renewable energy development.

   - Grant-based mechanisms, including the provision of subsidized capital, or concessional finance should be blended with commercial loans as well as capital on the debt and equity front to facilitate large-scale programmatic renewable energy programs.

4. **Technical capacity building.** Donors should help ensure the necessary technical capacity exists to produce equipment and adopt it to local circumstances, to develop, install, maintain, and operate renewable energy projects and to manage the transmission infrastructure that is needed for grid-connected projects.

Various institutions can play a role in providing this support:

- **Bilateral development agencies**, as part of their broader development assistance strategies — in their existing electricity sector work, specific bilateral climate change-related initiatives, or through new clean technology initiatives — can provide support in all four areas identified above. Technical assistance, capacity building programs, and facilitation of South-South exchange can help address the first and fourth area. Larger financial support will be needed for the second and third area. Bilateral donors can develop pilots for innovative support packages. These pilots can serve as proof of concept and inform larger multilateral initiatives.
- **Multilateral development banks** such as the World Bank and other regional development banks, **bilateral financial institutions**, and **export-credit agencies** have a role to play in reducing investment risk. Multilateral development banks have a long history of engagement in the electricity sector of developing countries and therefore can play an important role in reducing these risks via public capital and ensuring strong support for policy, regulation and institutional capacity integrated into country assistance strategies and program and policy loans.
- Existing **multilateral climate funds** as well as new ones such as the Green Climate Fund, once operational, could provide the needed support for smart renewable energy policy

as part of country-wide low-carbon plans (known as NAMAs) or sectoral initiatives. For maximum impact, they should address all of the four areas identified above.

- **International technology cooperation** through institutions such as the International Renewable Energy Agency or the emerging UNFCCC technology mechanism can play an important role by facilitating knowledge sharing, South-South exchanges, and capacity building.

9 Annex: Overview of Case Study Countries

Country	Expert	Focus	Material Online
	Workshop materials are available online at http://www.wri.org/developing-country-renewables		
Brazil	Osvaldo Soliano Pereira (University of Salvador, Brazilian Center for Energy and Climate Change)	Policy mix/different generation-based incentives	Presentation, Country Case Study
India	Ranjit Deshmukh (Prayas Energy Group), Suman Kumar (Confederation of Indian Industry), Neerja Upadhyaya (Madhya Pradesh Rural Livelihoods Project)	Policy mix/different mechanisms; governance; energy access	Country Presentation, Governance Presentation, Governance Case Study
Indonesia	Fabby Tumiwa (Institute for Essential Services Reform)	Governance, role of multilateral development banks	Presentation, Best Practice Case Studies
Kenya	Mark Hankins (consultant)	Energy access; FiT readiness	Presentation; Regional Case Study (Solar in Africa)
Mexico	Odon de Buen (consultant)	FiT readiness	Presentation
Morocco	Mustapha Taoumi (IRENA)	Regional case study; South-South cooperation; International support	Presentation, Regional Case Study (Middle East and North Africa)
Mozambique	Osvaldo Soliano Pereira (advisor to the National Electiricity Council)	Challenges in an LDC with low electrification rate; South-South cooperation with Brazil	Presentation
South Africa	Hilton Trollip (Idasa)	Governance; role of multilateral development banks	Presentation; Country Case Study; Background on REFIT
Sri Lanka	Asoka Abeygunawardana (Energy Forum, Advisor to the Energy Minister)	Policy mix/different mechanisms	Presentation; Country Case Study
Philippines	Pete Maniego (Renewable Energy Board); Jasper Inventor (Greenpeace)	Policy mix/different mechanisms	Presentation
Tanzania	Anastas Mbawala	Policy mix/different mechanisms; South-South cooperation with Thailand	Country Presentation; South-South Cooperation Presentation; Country Case Study
Thailand	Chris Greacen	Policy mix/different mechanisms; South-South cooperation with Tanzania	Country Presentation; South-South Cooperation Presentation; Country Case Study; South-South Cooperation Case Study

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