WORLD RESOURCES INSTITUTE

Prayas, Energy Group

Working Paper

Electricity Governance Initiative

10 QUESTIONS TO ASK ABOUT SCALING ON-GRID RENEWABLE ENERGY

DAVIDA WOOD, SARAH MARTIN, BHARATH JAIRAJ, SHANTANU DIXIT, AND LETHA TAWNEY

THE 10 QUESTIONS TO ASK SERIES: FRAMEWORKS FOR DESIGNING GOOD ELECTRICITY POLICY

The 10 Questions to Ask Series, or the 10Q Series, is an initiative of the World Resources Institute's (WRI) Electricity Governance Initiative (EGI) and Prayas, Energy Group. It aims to build the capacity of electricity sector stakeholders—government agencies, regulators, utilities, the private sector, civil society, and others —to design and participate in policy making and implementation processes. Each paper in the series asks a set of 10 questions relevant to a particular topic within the broader electricity sector. The series pays particular attention to public interests—interests in which society has a stake and that warrant government recognition, promotion, and protection. These interests may include decisions concerning public expenditures, affordability, service quality, and impact on local and global resources. We consider "good" electricity policy to be policies designed to improve effectiveness of public expenditures, reduce unnecessary costs, raise the quality of service, and minimize social and environmental impacts while seeking to reach specific policy objectives. "Good" also references "good governance" as laid out in EGI's flagship publication, the "Electricity Governance Initiative Assessment Toolkit" (EGI Assessment Toolkit) (see Box 1).

CONTENTS

Disclaimer: *Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Most working papers are eventually published in another form and their content may be revised.*

Suggested Citation: Wood, D., S. Martin, B. Jairaj, S. Dixit, and L. Tawney. 2014. "10 Questions to Ask About Scaling On-Grid Renewable Energy." Working Paper. Washington, D.C.: World Resources Institute. Available online at Wri.org/publication/10-questions-scaling-on-grid-renewable-energy.

The questions raised in the 10Q Series are relevant in a variety of policy making contexts. Individuals in government, utilities, and planning agencies can use the 10Qs to assess or review electricity policies. Civil society groups can draw on the 10Qs as a guide to engaging with policymakers at public hearings or other consultations. Combinations of these modes of engagement can guide multi-stakeholder forums to design policy roadmaps under a common framework.

The questions posed are designed to help readers focus on issues affecting their country or region. The questions can be used to identify crucial gaps and challenges within a country's electricity sector; query decision-makers on plans to fill those gaps; and help ensure that electricity policies represent public interests by keeping social, economic, and environmental considerations in mind. Each question is formulated to emphasize the active role that stakeholders can play in policy design and review processes, and is accompanied by an explanation of its relevance to the public interest. Users should feel free to adapt the questions to the knowledge level of different types of stakeholders. For example, pilot tests found that those wanting to build the capacity of consumers to participate in public hearings needed to adopt less technical language. Additional resources are provided for readers who are interested in pursuing each question in greater detail.

Box 1 | **TAP–C Key Principles of Good Governance**

THE ELECTRICITY GOVERNANCE INITIATIVE TOOLKIT
Benchmarking Best Practice and Promoting Accountability in the Electricity Sector

Transparency and Access to Information: Transparency is the process of revealing actions and information so that outsiders can scrutinize them. Attributes of transparency include the comprehensiveness, timeliness, availability, comprehensibility of information, and whether efforts are made to make sure information reaches affected and vulnerable groups as appropriate.

Accountability and Redress Mechanisms: Access to justice and redress are necessary to hold governments and actors in the private and public sector accountable. Accountability includes the extent to which there is clarity about the role of various institutions in sector decision making; there is systematic monitoring of sector operations and processes; the basis for basic decisions is clear or justified; and legal systems are in place to uphold public interests.

Participation: Diverse and meaningful public input helps decision-makers consider different issues, perspectives, and options when defining a problem. Elements of access to participation include formal space for participation in relevant forums, the use of appropriate or sufficient mechanisms to invite participation, the inclusiveness and openness of such processes, and the extent to which the gathered input is taken into account.

Capacity: Capacity refers to the government's social, educational, technological, legal, and institutional ability to practice good governance, and the ability of civil society to engage in decision making. This includes the capacity of government and official institutions to act autonomously and independently, the availability of resources (both human and financial) to provide access, and the capacity of civil society (particularly NGOs and the media) to analyze the issues and participate effectively.

Source: Dixit, S., N.K. Dubash, C. Maurer, & S. Nakooda. 2007. The Electricity Governance Initiative Toolkit: Benchmarking Best Practices and Promoting Accountability in the Electricity Sector. Washington DC & Pune: WRI & Prayas, Energy Group.

The 10Q Series builds on the Electricity Governance Initiative Toolkit (EGI Toolkit), which provides a set of good governance indicators customized for policy and regulatory processes in the electricity sector. The EGI Toolkit highlights the good governance principles of transparency, participation, and accountability, which correspond to the principles of access to information, decision-making, and justice in Principle 10 of the 1992 Rio Declaration on Environment and Development [1]. The EGI Toolkit adds a fourth principle of capacity (see Box 1). Indicators from the EGI Toolkit may be used to supplement the 10Qs to assess procedural aspects of governance.

To date, the 10Q Series includes:

- 10 Questions to Ask about Electricity Tariffs
- 10 Questions to Ask about Integrated Resources Planning
- 10 Questions to Ask about Scaling On-Grid Renewable Energy

INTRODUCTION TO SCALING ON-GRID RENEWABLE ENERGY

By the end of 2012, 138 countries worldwide had introduced renewable energy (RE) targets, and investments in new RE capacity totaled US$244 billion that year.[2] Globally, RE is gaining momentum, with over 480 gigawatts (GW) of installed renewable power capacity.[3] RE is now at the forefront of many national energy development plans.

The progress made in many countries has also highlighted the complexities of increasing the rate of RE deployment at the national level. Deploying renewable energy on an economy-wide scale requires solutions to a range of short- medium- and long-term challenges. These include resolving economic questions about how the costs of new RE generation will be distributed among electricity consumers, investors, taxpayers, and other stakeholders, and technological challenges such as accommodating intermittent supply, upgrading or adding transmission and distribution grids, and addressing knowledge gaps.

"10 Questions to Ask About Scaling On-Grid Renewable Energy" provides a framework to help stakeholders—including decision-makers, investors, civil society, and others—engage with each other to resolve common questions. It is primarily intended for regulated or partially regulated electricity industry structures and offers questions about renewable energy planning for stakeholders to consider.

This framework paper focuses on large-scale renewable energy projects that are not on the customer's side of the meter, but are connected directly to the grid. Because large-scale and small-scale RE systems have different market structures (see Box 2), two "10 Questions to Ask" frameworks will explore elements of scaling renewable energy. Whereas this framework addresses target setting and planning for renewable energy generally and the enabling environment necessary for larger scale systems, a second framework paper will address the enabling environment necessary for smaller systems that may be on grid, off grid, or sometimes on grid.

Box 2 | Convergence at the Grid Edge

It is common to delineate between on-grid and off-grid solutions, particularly in energy access situations. Similarly, in renewable energy, it is common to differentiate between "decentralized" small systems that serve a single home or building and larger "utility-scale" systems—though there is little agreement on where the dividing line falls.

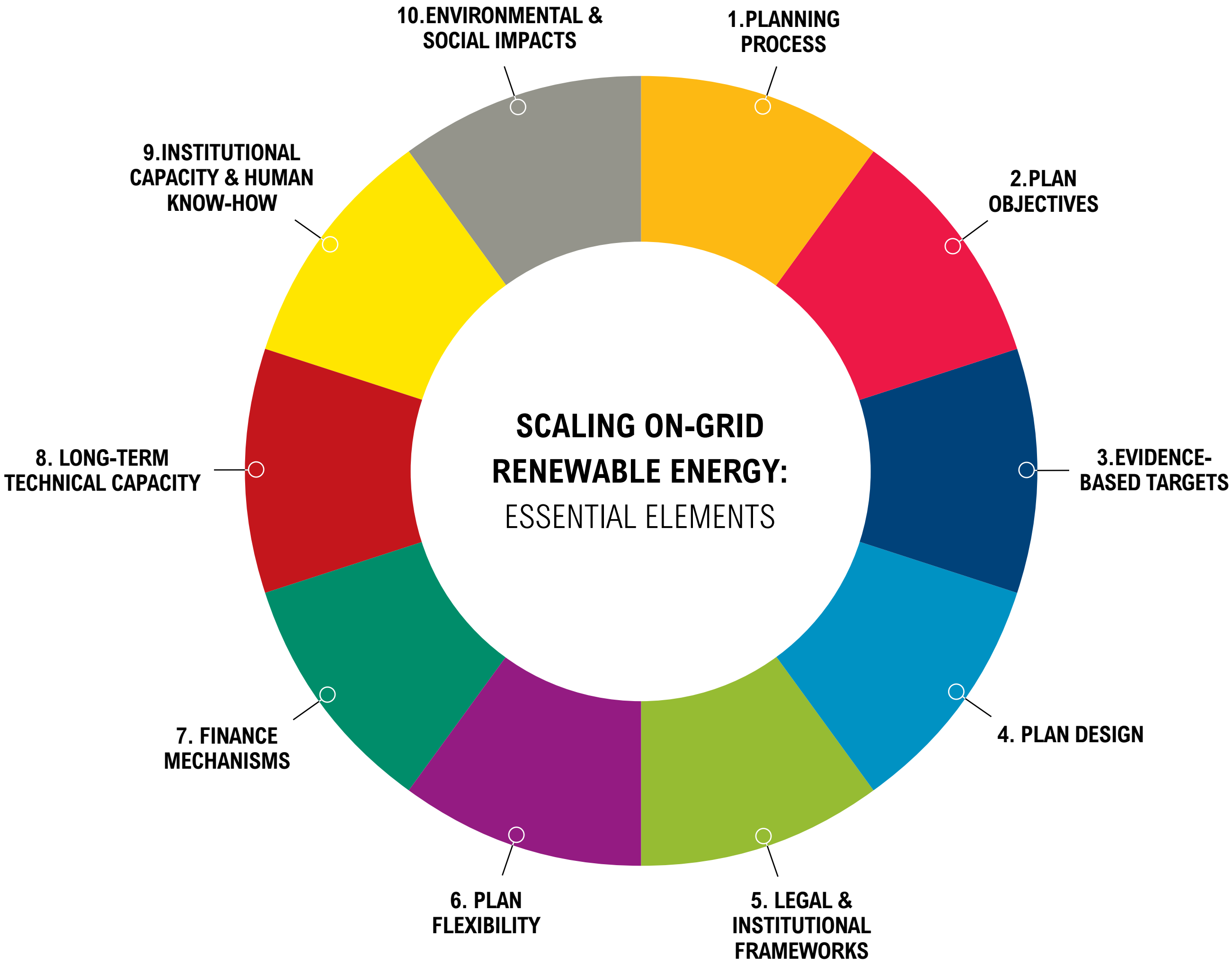
As the cost of renewable energy and storage solutions continues to fall and renewable energy plays a more central role in the electricity sector, these definitions become less useful. A university in the United States or an industrial park in India may have a 20 megawatt (MW) renewable energy system, supported by an onsite natural gas combined heat and power facility on a micro-grid that is sometimes feeding power to the grid, sometimes drawing power, and sometimes islanded. A village in a rural region may begin with small home systems that converge into a micro-grid and eventually connect to a regional grid where they are both providing and drawing power. A home system in any urban center—developed or developing—may have storage to provide both services that stabilize the grid and power when the grid is unavailable.

However, different regulation, policy, investment, and supply chains will likely be required to increase deployment of smaller systems primarily meant to serve a single facility versus larger systems meant to serve a grid.

This framework can be useful in all stages of the scale-up process, including planning, implementation, and monitoring and evaluation. It identifies 10 key elements that are fundamental to integrating RE into options for generating electricity (see Figure 1). Each element is presented as a question that can be explored by decision makers and stakeholders in their own context, and is followed by a short explanation of its significance with key points highlighted in grey. Each question is accompanied by a list of resources and country examples for readers interested in further exploration.

"10Qs about Scaling On-Grid Renewable Energy" can be used in multiple ways. Stakeholders can use it to create a common vision and research agenda. Policymakers can use it to guide interagency cooperation or to convene technical working groups. Project developers and civil society groups can use it to prepare for public hearings. The framework can also be adapted to develop a roadmap for reaching specific RE technology targets. In Thailand, for example, a multi-stakeholder forum adapted a pilot version of the framework to design a roadmap for increased deployment of solar photovoltaics. The treatment of each question is not prescriptive. The examples provided are not considered "best practice" because they are context specific and may not be appropriate for other countries at different times. They show possible solutions that could be the basis of further research and context-specific policy development. Many of the examples are drawn from WRI's research, including the reports "Grounding Green Power: Bottom-Up Perspectives on Smart Renewable Energy Policy in Developing Countries" and "Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation." These reports, which can be used as companion documents to "10 Questions to Ask about Scaling On-Grid Renewable Energy," provide additional case studies and detailed information about national RE plans and policies.

Figure 1 | **Scaling On-Grid Renewable Energy: 10 Essential Elements**



Q1. WHAT IS THE PROCESS FOR ESTABLISHING THE RENEWABLE ENERGY PLAN?

The RE planning process is central to renewable energy deployment and has implications for financial and technical change throughout the electricity sector. The decision-makers and institutions responsible for planning, the methodology used to set RE targets, and the degree of transparency and public participation throughout the process all influence the plan.

Each country has a set of institutions responsible for setting renewable energy plans. Often a nation's ministry of energy or its planning commission takes the lead. In some countries, state or regional entities are authorized to establish renewable energy plans, while other countries have specialized departments dedicated to promoting renewable energy. Two examples of the latter are the Philippines' National Renewable Energy Board, a consultative body to facilitate policy implementation; and India's Ministry of New and Renewable Energy, the nodal government ministry for all matters relating to new and renewable energy. Regardless of the arrangement, a crucial first step is ensuring that the creation and composition of all relevant decision-making bodies are transparent and that roles and responsibilities are publicly known.

Several government agencies may be involved in the RE decision-making process. Roles in granting approvals or exercising regulatory oversight can be delegated either horizontally, across departments and agencies, or vertically, among national, state, and local governments (see also Q9). Mechanisms to coordinate the work of these multiple institutions are important to the effective roll out of renewable energy plans. Lack of coordination can lead to serious instability in the medium and long term, depressing investment and increasing costs. In South Africa, weak governmental coordination, coupled with the lack of a clearly mandated decision-maker, delayed the implementation of the country's renewable energy procurement program and significantly slowed the momentum of the South Africa Renewables Initiative.[4]

To prevent institutional disconnect, clear mandates and authorities should be set for each involved government body.

Countries present their RE plans and set their targets in a variety of ways. In some cases RE plans are part of larger national or resource campaigns. For example, in India, RE targets are set under five-year national plans, whereas South Africa incorporates RE plans into its National Integrated Resource Plan. In other cases, such as the Philippines' National Renewable Energy Plan, RE plans may stand alone. Policies related to RE targets can be presented in plans or legislation that cross sectors, such as financial, industrial, or climate mitigation acts (see also Q4). In all cases, commitments, targets, and goals should be specific, clear, and consistent across plans.

Finally, given the long-lived nature of facilities in the electricity sector, it is important that RE planning processes maintain a long-term perspective. For example, planners should consider long-term goals—ideally, 20 years into the future—even when developing short- to medium-term plans. Opportunities for future feedback and review can be built in to evaluate progress toward long-term objectives. A long-term perspective can also be secured by prescribing clear triggers and criteria for modification to meet technological and other changes (see Q6). This requirement allows planners to regularly evaluate plans against the original environmental, social, and/or economic objectives (see Q2).

In some cases, long-term goals related to RE can be articulated with different types of plans, such as economic development plans, climate plans, and/or resource plans. In these cases, linkages among different plans should be made clear.

Q1. Analysis Highlights—RE Planning Process

LOOK FOR:

- Transparency in roles and responsibility of decision-making bodies
- Coordination among agencies and related plans
- Long-term vision

Additional Resources | Page

Q2. WHAT ARE THE OBJECTIVES OF THE RE PLAN?

A clear statement of objectives can help hold key decision-makers and implementers accountable for their decisions and actions and make progress easier to evaluate. Common objectives include diversifying the energy portfolio, promoting energy security, lowering energy import costs, improving energy access, providing affordable energy, improving air quality, reducing negative health impacts, boosting domestic manufacturing, creating jobs, cutting cleaner fuel costs, and reducing the impact of fossil fuels on the environment. Information on different national objectives for promoting RE development is listed in Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation, table 2.

Renewable energy may be promoted to concurrently satisfy environmental, economic, and social objectives in a country. Because many of these objectives can conflict with one another, priorities and trade-offs should be clearly articulated. For example, building domestic industries can keep costs of RE high compared with importing equipment that is cheaper and of better quality.

In that case, there is a trade-off between promoting new and growing industries and providing affordable energy. Economic, social, environmental, and other factors must be weighed carefully and transparently when deciding between such trade-offs.

RE objectives are often linked to national commitments, which are frequently expressed as targets. These commitments should be clearly outlined and defined in plans and strategies that include precise timeframes. For example, if the national objective is to achieve 50 percent electricity production through RE sources, the target should explicitly outline the types of sources, methods for target achievement, and specific timelines.

Q2. Analysis Highlights RE Plan Objectives

LOOK FOR:

- Clearly defined policy objectives
- Consideration of trade-offs between conflicting objectives
- Alignment with national commitments

Additional Resources

Additional Resources	Page
Delivering on Clean Energy Economy: The Role of Policy in Developing Successful Domestic Solar and Wind Industries	1-15
India Jawaharlal Nehru National Solar Mission	2,3,7
Thailand Renewable and Alternative Energy Development Plan	Section 2
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	8-11

Q3. WHAT IS THE EVIDENCE BASE FOR SETTING RE TARGETS?

RE targets should be based on evidence from credible assessments of potential for renewable energy in a region. Renewable energy potential is determined by a combination of variables, including geographical factors, prevailing technology, and economic viability.

Geographic potential measures the RE capacity that can be achieved keeping in mind local constraints such as weather variations, land use cover, and access. Technical potential is based on commercially available technology. Economic potential is the maximum capacity of renewable energy that can be achieved cost-effectively. Calculating these variables for a country provides a solid evidence base to determine nationally appropriate plans. Renewable energy is a rapidly evolving field with both the technical and the economic potential constantly improving. These future improvements should be anticipated when setting a target (See Q6).

Electricity sector RE targets should specify not only installed capacity (maximum capacity at which a unit can be operated), but also dependable capacity. Dependable capacity is based on resources such as the number of sunny days and wind speeds, which vary according to geography and seasons. Geospatial maps and data on resource availability such as solar insolation and cloud cover can be created. Optimization studies can calibrate the feasibility of RE projects and seamlessly integrate them into the existing electric system. These studies should also include assessing transmission and distribution system requirements (See Q8).

Reliable assessments can provide an evidence base to help those responsible for allocating resources do so more efficiently, as well as set ambitious targets based on realistic achievability. Reliable RE target assessment procedures, which require a high level of technical capacity and human expertise (See Q9), are critical to making informed decisions about important technical issues such as:

- RE technologies to consider,
- assumptions about certain technologies,
- suitable methodology for estimating resource potential,
- spatial and temporal variations of RE sources, and
- grid connectivity.

Decision-makers should be able to justify their choices to stakeholders using data from credible assessments. Making this information available to the public is a key aspect of transparency in the RE target-setting process and can help ensure the political stability of the goals.

Q3. Analysis Highlights—Evidence-Based Targets

LOOK FOR:

- Evidence based on geographic-, technical- and economic-potential assessments
- Targets presented as installed and dependable capacity
- High level of technical and human capacity
- Transparent assessment processes
  - Methodology
  - Data

Additional Resources

Additional Resources	Page
The Philippines' National Renewable Energy Plan	
Clean Technology Fund Investment Plan for South Africa	25-26
Unleashing the Potential of Renewable Energy in India	13-22, 23-33
Encouraging Renewable Energy Development: A Handbook for International Energy Regulators	25-30
South Africa's Renewable Energy Policy Roadmaps	12

Q4. HOW IS THE RE PLAN DESIGNED TO ACHIEVE THE STATED OBJECTIVES?

Objectives are supported by policies and targets that incorporate “SMART” and flexible design, and link with other sector policies. Suitable policies vary according to the objectives. For example, to increase installed RE capacities, policymakers can design “demand-pull” policies (policies that increase demand for RE by reducing market barriers), such as feed-in tariffs or other incentives. If the objective is to increase job creation, policymakers can design “supply-push” policies (policies that increase incentives for firms to generate new knowledge and, therefore, new RE technologies or improve existing ones), such as investing in research and development (R&D).[5] Of course, these objectives and policies can be interrelated. Supply-push and demand-pull policies are often used in conjunction with each other and other policies that encourage innovation and training to achieve a country’s objectives. Some policies can present unwanted trade-offs. Policies are most effective when clearly designed to achieve stated objectives and manage potential trade-offs.

Plans should incorporate SMART targets: targets that that are specific, measurable, achievable, realistic, and time-bound. For example, to increase deployment of renewable energy, a plan should include quantitative electricity generation goals (i.e., megawatts by a specific date) and the target should be rooted in technical and economic assessments of a particular technology within a specific geographic region (see Q3). SMART targets rooted in reliable data are credible; unrealistic targets can reduce credibility. In Indonesia, for example, regularly changing RE targets based on unreliable data has caused uncertainty in the RE policy framework. RE targets were initially set in 2006 at 25 percent by 2025, then revised in 2008 to 10 percent by 2010, and revised again in 2012 to 25 percent by 2025.[6]

Plans should also include clear provisions for techno-economic and governance issues such as curtailment (e.g., should wind generators be required to reduce their generation output when there is excess electricity production?); RE grid connectivity (who is responsible for connecting RE projects to the grid?); and grid access (should RE have mandatory and priority access to the grid?). Providing clarity on such issues helps minimize project risk and instills investor confidence. German, Spanish, and Chinese legal frameworks for RE include provisions necessary for RE development and deployment, including clear expectations for who is responsible for grid connectivity.[7]

Well-thought-out plans often go beyond RE plans and cross sectors (e.g., manufacturing, infrastructure, finance, employment, and R&D). Policies and regulations can be most effective when designed in coordination with affected and relevant sectors, and in a way that integrates and considers pre-existing policies and regulations. For example, growth in RE requires both upstream (manufacturing) and downstream (deployment) industries and ancillary services to provide equipment and expertise. Existing industrial capacity can establish a stable foundation, although specialized industries often develop as the RE sector grows. China’s sizable manufacturing sector contributed greatly to the success of the country’s wind industry.[8] Construction companies and technical service providers can contribute valuable infrastructure, products, and services that make the RE industry more competitive. Engaging other sectors in RE planning can be advantageous for all industries involved.

Q4. Analysis Highlights - RE Plan Design

LOOK FOR:

- Appropriate policies for achieving objectives
  - Identified pull policies
  - Identified push policies
- SMART and flexible targets
- Coordination with relevant industries and sectors

Additional Resources

Additional Resources	Page
Delivering on the Clean Energy Economy: The Role of Policy in Developing Successful Domestic Solar and Wind Industries	1-15
Encouraging Renewable Energy Development: A Handbook for International Energy Regulators	35-46, 60-70
Grounding Green Power: Bottom-Up Perspectives on Smart Renewable Energy Policy in Developing Countries	11-13
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	12-17
The Electricity Governance Initiative Toolkit, Benchmarking Best Practice and Promoting Accountability in the Electricity Sector	70, 78-80

Q5. WHAT LEGAL AND INSTITUTIONAL FRAMEWORKS ARE IN PLACE TO HELP ACHIEVE RE OBJECTIVES?

RE policies often require new legal and regulatory frameworks in order to be effectively implemented. An important step, therefore, is to establish whether such frameworks exist and to evaluate the extent to which they foster the deployment of RE as envisioned by the targets.

For example if a policy calls for increasing the share of cost-effective RE over a specified time, laws and regulations designed with conventional generation in mind, may need to be altered. Examples of regulatory provisions for grid-integrated RE include:

- renewable portfolio standards,
- mandatory grid integration of RE,
- feed-in-tariffs,
- balancing supply and demand (curtailment measures),
- clear distribution of roles and responsibilities regarding grid connectivity,
- cost allocation, and
- rules for allocating resources such as land and water.

Policies can aim to enhance the competitiveness of new technologies. For example, provisions for sustained R&D and demonstration programs can lead to more installed capacity, cost reductions, and more efficient technologies. Given the potential benefits, it is worth evaluating existing national R&D schemes as to whether they support short-, medium- and long-term RE improvement goals. For example, Morocco's National Energy Strategy integrated several university programs to create a Bachelor's degree in energy. The energy BA incorporated technical and economic components related to energy, the appropriation of new technologies through R&D, technology transfer, and domestically produced equipment. Emphasizing RE in higher education is one way a policy can make strides toward RE innovation.

Regulations should encourage technology performance improvements and long-term price decreases. For example, feed-in tariffs, which use a long-term contract to pay power producers cost-based rates for renewable energy, can be structured to reduce payments as technology becomes more efficient and pass the savings on to consumers. Germany's pioneering feed-in tariff mechanism is designed to reflect market changes, making cost-efficiency an important aspect and incorporating "degression rates," which are used to account for technological learning curves and avoid overcompensation of RE power producers.[9]

A maturing market might warrant a shift from feed-in tariffs to competitive bidding mechanisms, or a hybrid of feed-in-tariffs and competitive bidding. In India, for example, most states are following a reverse bidding program with a feed-in tariff acting as a ceiling cap for the tariff rate for solar photovoltaic.[10]

Regulations should facilitate transparent monitoring mechanisms for RE project bidding, power purchase agreements, and alignment of the projects with national RE goals (including R&D and large-scale RE deployment). In addition, legal and institutional support for stakeholder participation and community engagement in the decision-making process can promote smooth procurement processes and political sustainability.

While many of these principles hold true for the healthy development of a distributed renewable energy market, additional issues emerge that are specific to small-scale solutions such as micro-grids, which may or may not be connected to the grid. A forthcoming topic in the 10 Questions to Ask series will elaborate on these issues.

Q5. Analysis Highlights—Legal and Institutional Frameworks

LOOK FOR:

- Clearly defined legal and regulatory provisions
  - Support for large-scale deployment of RE
  - Support for technology performance improvements and price decreases
- Transparent monitoring mechanisms

Additional Resources

Additional Resources	Page
India's Jawaharlal Nehru National Solar Mission	9, 11-12
The Philippines' National Renewable Energy Plan	
Thailand Renewable and Alternative Energy Development	Section 4
Grounding Green Power: Bottom-Up Perspectives on Smart Renewable Energy Policy in Developing Countries	34-36
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	18-27

Q6. HOW FLEXIBLE IS THE RE PLAN TO CHANGING CONDITIONS?

Renewable energy markets and technologies are dynamic and evolving. RE plans and targets can best respond to technology changes, price and performance improvements, and evolving market conditions when they are flexible (see Box. 3 Policy Flexibility: Advantages and Disadvantages). When targets are achieved sooner than expected, an effective RE plan can call for targets to be reviewed and updated. When India exceeded by 13 percent the target in its Five Year Plan 2007–12 to add 12.4GW of grid-connected renewable energy, planners set a new target of adding 30GW of renewable energy in 2012–17.

Flexibility is also key to resiliency in the face of risks, including investment and cost risks (see Q7), technological risks, and political risk. RE policy can be made more flexible by embedding provisions for conducting regular policy reviews, empowering energy regulators to approve power prices, monitoring national and international RE sectors, and benchmarking best practices in technology and deployment strategies.

While flexibility can make an RE policy more effective over the long term, predictability is equally important, especially for stakeholder confidence and cost efficiency. Review processes that are guided by clear triggers and criteria for modifications can help balance the flexibility and predictability dimensions of the RE plan.

Box 3 | **Policy Flexibility: Advantages and Disadvantages**

	ADVANTAGE	DISADVANTAGE	EXAMPLE
Policy Flexibility	■ Quick to adapt to market signals, learning curves, and technology changes.	■ Can create policy instability, if reviews, policy changes and long-term rates are not clearly stated and planned. ■ Difficult to anticipate rapid changes and learning curves	Germany's degression rate system, which accounts for technological learning curves and helps avoid over compensation.

Source: Ballesteros, A., S. Martin & D. Wood. 2013. Meeting Renewable Energy Targets: Global lessons from the road to implementation. Gland: WWF International Online at: http://awsassets.panda.org/downloads/meeting_renewable_energy_targets__low_res_.pdf

Q6. Analysis Highlights—Plan Flexibility

LOOK FOR:

- Provisions to adapt plans and targets to technology and market evolution
- Technology performance assessments
- Regular policy reviews and monitoring mechanisms

Additional Resources

Page

Q7. HOW ARE INVESTMENTS FOR RE FINANCED?

Access to adequate financing can determine whether RE targets are met on time. Policymakers should identify the costs of RE plans and consider the implications of various types of financing for government, utilities, the private sector, and individuals.

At the policy level, financing for RE can come from fiscal policy, such as taxes and subsidies. At the project level, funding can come from various sources, such as premiums for energy generated by RE, bonds, and concessional finance. It is therefore important to consider the structure of different financing options. Which institutions, public or private, are in charge of financing RE projects? Are there mechanisms to generate funds through subsidies, fees, or taxes? Is the needed institutional capacity to plan, run, and evaluate projects financially supported?

A robust literature describes various financing models and mechanisms that can be used to incentivize potential investors in the large-scale RE sector.[11] Although costs for many technologies have fallen in recent years, governments can provide fiscal incentives to investors, equipment manufacturers, and clean energy developers and suppliers to stimulate their participation and increase the ability of clean energy to compete with fossil fuel energy sources. Fiscal instruments include tax rebates and credits, and duty-free import of clean technology, as seen in the Philippines, among other countries. They also include guaranteed prices and incentives for RE-produced electricity.

In some markets, governments are paying increasing attention to the impact of financial models on public budgets and on consumers, particularly as renewable energy penetration has increased. Managing these impacts ideally shapes the choice of financing mechanisms at the outset, just as with standard cost-recovery tariff design for traditional electricity generation (see the 10Qs about Tariffs). Some countries choose to finance RE policy through public investment and subsidies to avoid passing costs directly to consumers. Other countries adopt a customer-based rate model.

While both approaches can be successful, each has risks. The subsidy approach is more vulnerable to public fiscal constraints and financial crises, whereas customer-financed mechanisms raise concerns about equity. Passing through incremental costs to consumers places a burden on the poor. Such was the case in the Philippines where the feed-in tariff faced substantial opposition based on the argument that it would raise the already elevated electricity rates.[12] To avoid public controversy and provide stability for investors, RE policies should be designed and introduced in combination with strategies that clearly identify sources of finance and establish cost-related support mechanisms which strengthen utilities' performance and protect the poor.

Even if a financing mechanism aims to keep the public's contribution to a minimum, some budgetary support is still necessary to build the government's institutional capacity. Government agencies responsible for evaluating, selecting, and monitoring RE projects require ample funding to ensure those duties are executed adequately by skilled individuals (see Q9). Public investment might also be needed to enhance transmission capacity (see Q8) and to provide loan guarantees to utilities that must purchase power from RE developers. It is important to evaluate whether institutions that implement RE policies receive the necessary funding and whether they have systems in place to manage the funds effectively.

When an RE project is financed by multilateral donors, transparency requirements for policy-linked loans can ensure that the project considers public interests and local contexts. Multilateral donor-specific indicators from the EGI toolkit can be used to analyze these factors, some of which can also be applied to other types of funding.

Q7. Analysis Highlights—Finance Mechanisms

LOOK FOR:

- Clearly identified and transparent sources of finance and costs
- Consideration of impact of tariffs on utilities, public, poor, and investors
- Budgetary support for institutional capacity building

Additional Resources

Additional Resources	Page
Clean Technology Fund Investment Plan for South Africa	27-28, 42-43
Mobilizing Climate Investment: The Role of International Climate Finance in Creating Readiness for Scaled-Up, Low-Carbon Energy	16-19
Encouraging Renewable Energy Development: A Handbook for International Energy Regulators	31-34, 71-77
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	12-13, 22-25
The Electricity Governance Initiative Toolkit, Benchmarking Best Practice and Promoting Accountability in the Electricity Sector	74-76, 84

Q8. HOW DOES THE RE PLAN ACCOUNT FOR LONG-TERM TECHNICAL NEEDS?

Technical needs for RE integration into the existing electricity system, which often differ from those required for conventional energy integration, can present new challenges. Transmission, distribution, and grid connection of RE, for example, pose significant deployment challenges. Often, sources of RE are located far from load centers, which necessitates costly investments in large-scale transmission lines and infrastructure. Because RE projects have shorter gestation periods than other power generation projects (e.g., nuclear plants), they are susceptible to bottlenecks if transmission lines are not expanded at the requisite pace. Existing procedures for dispatching power, which are often designed primarily for conventional fuel and do not account for the variable nature of RE, may also be problematic. Without adequate planning, integrating RE into the existing electricity infrastructure can adversely affect grid stability and power quality; but if properly anticipated, RE can be reliably deployed and accessible. China has had challenges connecting its rapidly growing fleet of wind turbines to the grid in a timely manner, meaning it cannot yet sell wind-generated electricity that would contribute to reducing its serious urban air pollution. Regions with the most wind resources are distant from demand centers and the grid infrastructure is not yet sufficient to support large loads over such distances. Plans to finance and subsidize an upgrade in the country's grid infrastructure over the next five years have since been put in place with the aim to resolve the sector's inefficiencies.[13]

When the impacts of RE expansion on transmission, distribution, and grid connection are recognized early in the planning process, guidance can be tailored to address foreseeable challenges. RE plans that clearly lay out the long-term requirements for RE transmission, distribution, and deployment are helpful. Examples of these requirements are:

- Codes for RE grid connection (which depend on the level of power voltage lines) and certification processes through grid operators
- Long-term plans for transmission and distribution linkages that can manage intermittent supply load control options, and provide options for storage and net metering[14]
- Provisions to ensure that the pre-existing generation fleet has enough flexibility and ramping capacity to balance larger portions of RE at the least cost

Scaling-up for RE will require specific funding schemes to pay for new construction and transmission and distribution (T&D) grid upgrades. However, the impetus to improve certain infrastructure does not always come from renewable-energy-specific capacity building alone. In many cases—as in T&D upgrades—such improvements are likely required regardless of the type of generation that is being added; which means financing for such improvements might already be built into existing plans.

Additionally, plans should be designed in coordination with others involved in the sector, including T&D operators and independent operators (see Q1). Coordination may involve specialized research and information sharing regarding T&D plans and technical requirements.

Q8. Analysis Highlights—Long-Term Technical Capacity Planning

LOOK FOR:

- Clearly identified RE expansion effects and challenges
- Long-term plans for enabling the transmission and distribution infrastructure
- Clearly identified funding requirements
- Coordinated planning with other sectors

Additional Resources

Additional Resources	Page
The Philippines' National Renewable Energy Plan	
Thailand Renewable and Alternative Energy Development	Section 4
Mobilizing Climate Investment: The Role of International Climate Finance in Creating Readiness for Scaled-Up, Low-Carbon Energy	19, 21-43
Grounding Green Power: Bottom-Up Perspectives on Smart Renewable Energy Policy in Developing Countries	40-41
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	30-35

Q9. WHAT INSTITUTIONAL CAPACITY AND HUMAN KNOW-HOW IS NEEDED FOR A SUCCESSFUL RE PLAN?

Designing and implementing policies for RE may need specialized capacity in government institutions. Government officials and workers involved in oversight and regulation of conventional energy sources may need to learn about technical and economic complexities unique to RE. Relevant agencies should be prepared to competently handle these complexities by understanding the knowledge requirements for long-term RE planning, procurement, negotiations, and monitoring. For example, agencies that analyze resource potential should have the capacity to analyze and validate RE potential assessments (see Q4), agencies charged with integrating RE into the system should have the technical capacities to understand the grid requirements, and agencies that oversee procurement processes should have the knowledge required to negotiate power purchase agreements with independent RE producers. There are several possible organizational models for delegating these tasks, including RE agencies, separate ministries or sub departments within departments of energy. Whichever model is chosen, responsible agencies will need managers with the appropriate skill sets to plan for, regulate, and oversee the effective scale up of renewable energy.

Inter-agency coordination is another aspect of institutional capacity building. Where multiple agencies are involved, coordination systems can foster knowledge sharing and strengthen collaboration (see also Q1). In Morocco, the Ministry of Energy established the initiative "Team Energy Maroc" to ensure homogeneity and coordination across all agencies involved in the sector, including the National Office for Electricity and Drinking Water (ONE, in its French acronym), the National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE, in its French acronym), and other RE research institutes and agencies.[15]

Large-scale RE expansion also requires a skilled labor force. If job creation is an explicit policy objective, an employment potential assessment should be conducted (i.e., assessing the amount and type of jobs required to implement the RE plan, as well as assessing whether the requisite know-how exists). Employment opportunities might be found along the life cycle of RE deployment, such as upstream jobs in manufacturing and downstream jobs in installation, system design, and project management. Downstream jobs largely depend on the scale of RE deployment.

Advancing long-term capacity and human know-how requires a commitment to education and training programs, including sufficient funding. R&D is particularly important in creating skilled personnel and supporting RE growth at the national level. Investing in R&D strengthens local knowledge and industrial capacity, and can reduce reliance on costly imported expertise and hardware.

Q9. Analysis Highlights—Institutional Capacity and Human Know-How

LOOK FOR:

- Required capacity and know-how to carry through plan's activities
  - Plans for developing appropriate technical and managerial skill sets
- Commitment to education and training programs for workforce development
- Sufficient funding to develop and support human capacity

Additional Resources

Additional Resources	Page
Delivering on the Clean Energy Economy: The role of policy in developing successful domestic solar and wind industries	1-15
India's Jawaharlal Nehru National Solar Mission	6-7, 13
Thailand Renewable and Alternative Energy Development	Section 4
Grounding Green Power: Bottom-Up Perspectives on Smart Renewable Energy Policy in Developing Countries	29-33, 36-37
Meeting Renewable Energy Targets: Global Lessons From the Road to Implementation	34-35
The Electricity Governance Initiative Toolkit, Benchmarking Best Practice and Promoting Accountability in the Electricity Sector	30-46, 52

Q10. HOW ARE ENVIRONMENTAL AND SOCIAL IMPACTS CONSIDERED IN RE PLANNING?

If designed properly, an RE plan can promise substantial environmental and social benefits. Conversely, a poorly developed plan can create or exacerbate social and environmental problems, such as accelerating severe impacts on people, water, flora and fauna, and other natural resources.

Different RE technologies can have different impacts at different stages of their lifecycles. These impacts may call the sustainability of the use of this technology into question. For example, solar thermal can be water intensive, geothermal is land intensive and often located in forested areas, and biomass has been linked to adverse health effects, such as respiratory issues from airborne particulate matter. Negative social impacts include additional costs for consumers, or dislocation from homes and property. Understanding the environmental and social impacts specific to different RE technologies can help minimize adverse effects and lead to greater acceptance of RE.

Impact assessments, such as environmental impact assessments, can identify and mitigate inadvertent impacts. RE plans should include provisions for mandatory impact evaluations and mitigating measures prior to approval of project permits or licenses. In Thailand, where biomass energy has a large potential for energy generation, many poorly planned projects have resulted in adverse environmental and health effects, including air pollution, water contamination, and respiratory illness from airborne particulate matter and carbon monoxide. Until recently, only projects 10MW and larger were subject to impact assessments. The government now enforces a new code of practice for biomass power plants smaller than 10MW, which are analyzed to determine their environmental and social impacts throughout their lifecycles.[16]

Careful consideration of stakeholders' priorities and concerns can help secure RE acceptance. Making assessments publicly available for scrutiny before decisions are final and holding public consultations may address stakeholder concerns and enhance stakeholder support for RE projects. Clear safety and zoning criteria, for example, can help mainstream projects and address concerns.

Stakeholder acceptance of RE projects can be gauged at different levels. Sociopolitical acceptance involves the acceptance by key stakeholders of RE policies. Community acceptance involves local stakeholders, consideration for cost and benefit sharing of RE projects, and fair decisionmaking processes. Market acceptance determines the level of acceptance by investors.[17]

Acceptance also depends on understanding the positive impacts of RE. Stakeholders may be more open to RE projects when policymakers clearly communicate the benefits, including reduced air pollution, climate resilience, climate change mitigation, and reduced fuel-cost risk to the economy and electricity consumers. If RE projects have replaced higher-polluting options, communities will benefit from environmental and health benefits. In Ontario, Canada, for example, a cost-benefit analysis for replacing the province's coal-fired plants with cleaner options demonstrated annual savings of $2.6 billion in avoided health damages.[18]

Q10. Analysis Highlights—Environmental and Social Impacts

LOOK FOR:

- Consideration for environmental and social impacts
- Mandatory impact assessments and mitigation measures
- Publicly available assessments and opportunities for public consultations
- Consideration of stakeholder priorities and concerns
- Communication of positive environmental and social impacts

Additional Resources	Page
Thailand Renewable and Alternative Energy Development	Section 6
Cost Benefit Analysis: Replacing Ontario's Coal Fired Electricity Generation	6-40
Social Acceptance of Renewable Energy Innovation	2683-2691
Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation	22-25
The Electricity Governance Initiative Toolkit, Benchmarking Best Practice and Promoting Accountability in the Electricity Sector	86-100

SUMMARY TABLE

	QUESTIONS	ANALYSIS HIGHLIGHTS: WHAT TO LOOK FOR
Q1	What is the process for establishing the RE plan?	■ Transparency in roles and responsibility of decision-making bodies ■ Coordination among agencies and related plans ■ Long-term vision
Q2	What are the objectives of the RE plan?	■ Clearly defined policy objectives ■ Consideration of trade-offs between conflicting objectives ■ Alignment with national commitments
Q3	What is the evidence base for setting RE targets?	■ Evidence based on geographic-, technical- and economic-potential assessments ■ Targets presented as installed and dependable capacity ■ High level of technical and human capacity ■ Transparent assessment processes ¤ Methodology ¤ Data
Q4	How is the RE plan designed to achieve the stated objectives?	■ Appropriate policies for achieving objectives ¤ Identified pull policies ¤ Identified push policies ■ SMART and flexible targets ■ Coordination with relevant industries and sectors
Q5	What legal and institutional frameworks are in place to help achieve RE objectives?	■ Clearly defined legal and regulatory provisions ¤ Support for large-scale deployment of RE ¤ Support for technology performance improvements and price decreases ■ Transparent monitoring mechanisms

	QUESTIONS	ANALYSIS HIGHLIGHTS: WHAT TO LOOK FOR
Q6	How flexible is the RE plan to changing conditions?	■ Provisions to adapt plans and targets to technology and market evolution ■ Technology performance assessments ■ Regular policy reviews and monitoring mechanisms
Q7	How are investments for RE financed?	■ Clearly identified and transparent sources of finance and costs ■ Consideration of impact of tariffs on utilities, public, poor, and investors ■ Budgetary support for institutional capacity building
Q8	How does the RE plan account for long-term technical needs?	■ Clearly identified RE expansion effects and challenges ■ Long-term plans for enabling the transmission and distribution infrastructure ■ Clearly identified funding requirements ■ Coordinated planning with other sectors
Q9	What institutional capacity and human know-how is needed for a successful RE plan?	■ Required capacity and know-how to carry through plan's activities ¤ Plans for developing appropriate technical and managerial skill sets ■ Commitment to education and training programs for workforce development ■ Sufficient funding to develop and support human capacity
Q10	How are environmental and social impacts considered in RE planning?	■ Consideration for environmental and social impacts ■ Mandatory impact assessments and mitigation measures ■ Publicly available assessments and opportunities for public consultations ■ Consideration of stakeholder priorities and concerns ■ Communication of positive environmental and social impacts

OVERARCHING REFERENCES

Ballesteros, A., S. Martin & D. Wood. 2013. *Meeting Renewable Energy Targets: Global lessons from the road to implementation.* Gland: WWF International. Online at: http://awsassets.panda.org/downloads/meeting_renewable_energy_targets__low_res_.pdf

Weischer, L., Wood, D., Ballesteros, A. & Fu-Bertaux, X. 2011. *Grounding Green Power: Bottom-up perspectives on smart renewable energy policy in developing countries.* Washington, D.C.: WRI. Online at: http://www.wri.org/publication/grounding-green-power

REFERENCES

Barua, P., L. Tawney, and L. Weischer.2012. *Delivering on Clean Energy Economy: The Role of Policy in Developing Successful Domestic Solar and Wind Industries.* Washington, D.C.: WRI. Online at: http://www.wri.org/publication/delivering-on-the-clean-energy-economy

Bjork, S., C. Connors, T. Welch, D. Shaw, and W. Hewitt. 2011. *Encouraging Renewable Energy Development: A Handbook for International Energy Regulators.* U.S. Agency for International Development and National Association of Regulatory Utility Commissioners. http://www.naruc.org/International/Documents/NARUC - RES Handbook - FINAL FULL VERSION 03 04 11rev again.pdf

Clean Technology Fund (CTF). 2009. "Clean Technology Fund Investment Plan for South Africa". Washington, D.C.: CTF. Online at: http://www.climate-investmentfunds.org/cif/sites/climateinvestmentfunds.org/files/ctf_south_africa_investment_plan_revised_final_111009_0.pdf

Dixit, S., N.K. Dubash, C. Maurer, & S. Nakooda. 2007. The Electricity Governance Toolkit: Benchmarking Best Practice and Promoting Accountability in the Electricity Sector. Washington, DC.: Electricity Governance Initiative. Online at: http://electricitygovernance.wri.org/files/egi/EGI-Toolkit-2007-final_0.pdf

DSS Management Consultants Inc. and RWDI Air Inc. 2005. "Cost Benefit Analysis: Replacing Ontario's Coal Fired Electricity Generation." Prepared for the Ontario Ministry of Energy. Online at: http://www.energy.gov.on.ca/docs/en/coal_cost_benefit_analysis_april2005.pdf

Edkins, M., A. Marquard & H. Winkler. 2010. *South Africa's Renewable Energy Policy Roadmaps.* Online at: http://www.unep.org/energy/Portals/24176/Publications/10Edkinesetal-Renewables_roadmaps.pdf

Government of India Ministry of New and Renewable Energy. 2008. *Jawaharlal Nehru National Solar Mission: Towards Building Solar India.* Online at: http://www.mnre.gov.in/file-manager/UserFiles/mission_document_JNNSM.pdf

Groba, F. and B. Breitschopf. 2013. *Impact of Renewable Energy Policy and Use on Innovation- A Literature Review. Berlin: Deutsches Institut für Wirtschaftsforschung.* Online at: http://www.diw.de/documents/publikationen/73/diw_01.c.426553.de/dp1318.pdf

Nuntavorakam, S. 2013. "Working Together for Preventing the Impact of Renewable energy Projects: Thailand Experiences." Paper presented at Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation Workshop, WWF and WRI, Manila, Philippines, June 24.
Pegels, A. 2011. "Pitfalls of Policy Implementation: The Case of the South African Feed-in Tariff." *Diffusion of Renewable Energy Technologies: Case Studies of Enabling Frameworks in Developing Countries*, edited by James Haselip, pp. 101–10. United Nations Environment Programme, Risoe Centre. Online at: http://www.lowcarbondev-support.org/upload/firm%20project/publications/diffusionrenewableenergytechnologies.pdf

The Philippines Department of Energy. "National Renewable Energy Plan: Renewable Energy Plans and Programs (2011-2030)." Online at: http://www.doe.gov.ph/microsites/nrep/index.php

Polycarp, C., L. Brown, and X. Fu-Bertaux. 2012. *Mobilizing Climate Investment: The Role of International Climate Finance in Creating Readiness for Scaled-Up, Low-Carbon Energy.* Washington, DC: World Resources Institute. Online at: http://www.wri.org/sites/default/files/pdf/mobilizing_climate_investment.pdf

Remo, A.R. 2012." Aquino Commits to Act on High Power Rates in PH." *Philippines Daily Inquirer.* (January 27). Online http://business.inquirer.net/41549/aquino-commits-to-act-on-high-power-rates-in-ph

Soerjono, A. R. 2013. "Renewable Energy Target Setting: Indonesia Case." Paper presented at Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation Workshop, WWF International and WRI, Manila, Philippines, June 24.

Thailand Ministry of Energy- Department of Alternative Energy Development and Efficiency. 2012. "The Renewable and Alternative Energy Development Plan for 25 Percent in 10 Years (AEDP 2012-2021)." Online at: http://www.dede.go.th/dede/images/stories/dede_aedp_2012_2021.pdf

United Nations Environment Program (UNEP). "Rio Declaration on Environment and Development". Online at: http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163

World Bank ESMAP. 2010. "Unleashing the Potential of Renewable Energy in India." Washington, D.C. Online at: http://siteresources.worldbank.org/EXTENERGY2/Resources/Unleashing_potential_of_renewables_in_India.pdf

Wüstenhagen, R., M. Wolsink, and M.J. Bürer. 2007. "Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept." *Energy Policy 35.* Online at: http://www.sciencedirect.com/science/article/pii/S0301421506004824

Xu, L. and J. Alleyne. 2012, "2012 China Smart Grid Outlook: Special Planning Of 12th Five-Year Plan On Smart Grid Major Science & Technology Industrialization Projects." *SGT Research.* (May 14). Online at: www.sgtresearch.com

Yang, A. 2011. "How China Built the World's Largest Wind Power Market." *Inside Stories on Climate Compatible Development.* Climate and Development Knowledge Network (CDKN). Online at: http://cdkn.org/wp-content/uploads/2011/12/China-InsideStory_proof6F_web.pdf

ENDNOTES

1. United Nations Environment Program (UNEP). "Rio Declaration on Environment and Development". Online at: http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163
2. REN21(Renewable Energy for the 21st Century). 2013. Renewables 2013 Global Status Report (Paris: REN21 Secretariat).
3. This number does not include energy generated from hydropower sources. REN21. 2013.
4. Pegels, A. 2011. "Pitfalls of Policy Implementation: The Case of the South African Feed-in Tariff." In Diffusion of Renewable Energy Technologies: Case Studies of Enabling Frameworks in Developing Countries, edited by James Haselip, pp. 101–10. United Nations Environment Programme, Risoe Centre.
5. Groba, F. and B. Breitschopf. 2013. Impact of Renewable Energy Policy and Use on Innovation- A Literature Review. Berlin: Deutsches Institut für Wirtschaftsforschung.
6. Soerjono, A. R. 2013. "Renewable Energy Target Setting: Indonesia Case." Presented at Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation Workshop, WWF International (World Wide Fund for Nature) and World Resources Institute, Manila, Philippines, June 24.
7. Martin, S., D. Wood, and A. Ballesteros. 2013. Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation. Gland: WWF International (World Wide Fund for Nature).
8. Yang, A. 2011. "How China Built the World's Largest Wind Power Market." Inside Stories on Climate Compatible Development. Climate and Development Knowledge Network (CDKN).
9. Martin, S., D. Wood, and A. Ballesteros. 2013. Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation. Gland: WWF International.
10. Martin, S., D. Wood, and A. Ballesteros. 2013. Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation. Gland: WWF International.
11. A bibliography can be found at: Venugopal, S. and A. Srivastava. 2013. "Reading Resources on Using Public Climate Finance to Leverage Private Capital." Washington, D.C.: WRI. Online at: http://pdf.wri.org/reading_resources_using_public_climate_finance_to_leverage_private_capital_jan2013.pdf
12. Remo, A.R. 2012. "Aquino Commits to Act on High Power Rates in PH." Philippines Daily Inquirer. (January 27). Online at: http://business.inquirer.net/41549/aquino-commits-to-act-on-high-power-rates-in-ph
13. Xu, L. and J. Alleyne. 2012."2012 China Smart Grid Outlook: Special Planning of 12th Five-Year Plan on Smart Grid Major Science & Technology Industrialization Projects." SGT Research. (May 14). Online at: www.sgtresearch.com
14. Net metering is a power supply arrangement that allows for a two-way flow of electricity between the distribution grid and customers that have installed their own generation system. The customer pays for only the net electricity delivered from the utility.
15. Martin, S., D. Wood, and A. Ballesteros. 2013. Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation. Gland: WWF International.
16. Nuntavorakam, S. 2013. "Working Together for Preventing the Impact of Renewable Energy Projects: Thailand Experiences." Paper presented at Meeting Renewable Energy Targets: Global Lessons from the Road to Implementation Workshop, WWF and WRI, Manila, Philippines, June 24.
17. Wüstenhagen, R., M. Wolsink and M.J. Bürer. 2007. "Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept." Energy Policy 35: 2683–2691.
18. DSS Management Consultants Inc. and RWDI Air Inc. 2005. "Cost Benefit Analysis: Replacing Ontario's Coal Fired Electricity Generation." Prepared for the Ontario Ministry of Energy.

ABOUT THE AUTHORS

Davida Wood is a Senior Associate at the World Resources Institute.
Contact: davida.wood@wri.org

Sarah Martin is a Research Analyst at the World Resources Institute.
Contact: smartin@wri.org

Bharath Jairaj is a Senior Associate at the World Resources Institute.
Contact: bjairaj@wri.org

Shantanu Dixit is the Coordinator of Prayas, Energy Group.
Contact: shantanu@prayaspune.org

Letha Tawney is a Senior Associate at the World Resources Institute.
Contact: ltawney@wri.org

ABOUT EGI

The Electricity Governance Initiative (EGI) is a unique network of civil society organizations dedicated to promoting transparent, inclusive, and accountable decision making in the electricity sector. We facilitate collaboration of civil society, policymakers, regulators, and other electricity sector actors using a common framework to define "good governance."

Since 2003, we have worked with civil society organizations around the world to complete assessments of electricity governance in their respective countries, and to advocate for improvements in governance. More than 30 organizations around the world are now partners in the Initiative. The World Resources Institute serves as the global secretariat for EGI, with the Prayas, Energy Group (India) serving as our special knowledge partner.

ABOUT WRI

WRI is a global research organization that works closely with leaders to turn big ideas into action to sustain a healthy environment—the foundation of economic opportunity and human well-being.

ABOUT PRAYAS, ENERGY GROUP

Prayas is a nongovernmental, nonprofit organization based in Pune, India. Members of Prayas are professionals working to protect and promote the public interest in general, and interests of the disadvantaged sections of the society, in particular. Prayas, Energy Group (PEG) has been active since 1990 in the electricity sector. We believe that effective control and influence on governance by people and civil society organizations is the key to efficient governance that would protect and promote the public interest. Public interest issues include consumer issues as well as broad social issues. In consumer issues, PEG gives more attention to the issues affecting the poor and the disadvantaged. Social issues include environmental sustainability and equity.
http://www.prayaspune.org/peg/

ACKNOWLEDGMENTS

We would like to thank the many people who peer reviewed or otherwise contributed thoughtful discussions and ideas that helped shape this report. These include:

Our colleagues at WRI: Athena Ballesteros, Hyacinth Billings, Darryl Ditz, Gayatri Gadag, Taryn Fransen, Alex Perera, Nick Price, Emily Schabacker, and Peter Veit.

Global experts: John Gerhard, Regulatory Assistance Program, USA; Dave Lamont, Regulatory Assistance Program, USA; Asif Masood, Consumer Rights Commission of Pakistan, Pakistan; Sopitsuda Tongsopit, Chulalongkorn University Energy Research Institute, Thailand.

We would also like to thank our EGI partners that provided many ideas, thought-provoking inputs, and feedback on iterative drafts during our annual EGI retreats. In particular, we thank our Thai partners who adapted and tested the value of this framework in the context of the Thai Solar PV Roadmap Project:

Sopitsuda Tongsopit- Chulalongkorn University's Energy Research Institute (ERI). ERI conducts policy research on energy and environment and has worked extensively with the Thai government on renewable energy policy design and management.

Suphakij Nuntavorakam- Healthy Public Policy Foundation (HPPF). HPPF is an autonomous branch of the Thai Ministry of Public Health, with a longstanding research program exploring the environmental health implications of the energy sector.

Chuenchom Greacen- Palang Thai. Palang Thai works to ensure that transformations that occur in Thailand's and Mekong region's energy sector are economically rational, and that they augment, rather than undermine, social and environmental justice and sustainability.

Copyright 2014 World Resources Institute. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivative Works 3.0 License. To view a copy of the license, visit http://creativecommons.org/licenses/by-nc-nd/3.0/