**Regulatory Functions Affecting Renewable Energy in Developing Countries**

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## I. Introduction

The role of energy sector regulators in facilitating renewable energy (RE) projects depends on the laws and policies established in the executive and legislative branches of government. This article shows how ten functions of energy sector regulators in developing (and developed) countries affect the pace and pattern of investments in renewable energy. *The Electricity Journal* has published numerous articles on the strengths and limitations of different policy instruments and the RE technologies that are being targeted. However, policies are not self-implementing: "the devil is in the details". For developing countries, the challenge of implementing cost-effective RE policies is perhaps more difficult than for wealthier nations. For nations with many citizens living in poverty, the margin for error is greatly reduced, given the many claims on resources—from schools, hospitals and transportation networks to water and sanitation systems.

Some might argue that an extremely "green" approach to development is less costly in the long run, but those living today (in the short run) are concerned with access to a wide range of infrastructure services, including electricity systems that are ubiquitous and reliable. Wealthy nations have the resources (including scientific infrastructures) and emissions levels such that Greenhouse Gas reductions can have significant impacts on global targets. The BRICS group (Brazil, Russia, India, China, and South Africa) will have major impacts on future GHG concentrations, so they fall in a special category. Smaller developing countries can have more than a symbolic impact on reducing emissions. However, their policy-makers still need to balance urgent current local goals against longer term global objectives. Within this context, energy sector regulators become a key facilitator (or blocker) of renewables in developing nations.

The author's views on regulatory issues presented by renewable energy technologies have been shaped by immersion into over fifty documents and studies directed at energy sector regulators in developing countries—ranging from Handbooks and Tool Kits (NARUC, the World Bank, OECD, and others) to technology specific studies.[ii] The comprehensive review of materials was required for the preparation answers to Frequently Asked Questions added to the Body of Knowledge of Infrastructure Regulation at www.regulationbodyofknowledge.org.[iii] The questions originated from discussions with and surveys of energy sector regulators around the world. Funded by the Norwegian Trust (through the World Bank), the Public Utility Research Center has developed a web-based resource for infrastructure managers and regulators. The new material on renewable energy and energy efficiency addresses eight questions:

- *What should be the involvement and mandate of the energy regulator in connection with promotion of Renewable Energy and what are the main challenges associated from a regulatory perspective?*
- *What should be the involvement and mandate of the energy regulator in connection with promotion of Energy Efficiency and what are the main challenges associated from a regulatory perspective?*
- *What is the best choice of regulatory instruments/tools for Renewable Energy promotion based on efficiency and effectiveness of reaching policy targets (FiT versus Green Certificates versus Central Procurement and others)?*
- *What is the best choice of regulatory instruments/tools for Energy Efficiency promotion based on efficiency and effectiveness of reaching policy targets? (Energy Efficiency Certificates versus Central Procurement and others)*

- *What are the regulatory issues presented by renewable technologies (solar, wind, biomass, geothermal, and hydropower) and what are the basic characteristics of these options?*
- *If a government decides to consider feed-in tariffs (FITs) as a tool to promote distributed generation via renewable energy, what are the regulatory steps that should be taken by those implementing rules?*
- *If the government decides to use purchase power agreements as a tool to obtain renewable energy, what are the regulatory steps that should be taken to implement rules?*
- *How have countries linked policy-making related to energy efficiency to regulatory functions?*

The "answers" are not meant to be definitive, but to provide a foundation that would enable the user to ask better questions of consultants and to begin his (or her) own analysis of these issues. Rather than summarizing answers to all the FAQs, this article focuses on the first issue: how ten functions of regulators in developing countries affect the implementation of renewable energy policies.[iv]

## II. Political Context

Many governments are committed to contributing to global mitigation of greenhouse gases, although the track record on delivering on promises is not outstanding. Nevertheless, policy-makers in some nations view renewables as one way to meet international obligations under the United Nations Framework Convention on Climate Change (UNFCCC). In addition, some political leaders perceive their nations as particularly vulnerable to supply cut-offs. Of course, there are great costs to "energy independence" achieved by an expansion of renewables, so these costs need to be factored into political discussions. For example, a goal of reducing imported energy conflicts with the objective of increasing interconnections among nations in a region: trade in electricity can provide lower-cost electricity for importers, increase system reliability, and serve as a source of revenue for suppliers.

While *market failures* might justify government playing a role in promoting RE, there is also the possibility of *government failures*, as when particular technologies are favored as a result of special interest lobbying that benefits one set of stakeholders but results in cost burdens being met other stakeholders (utility customers); this raises questions of *fairness*. In addition, the benefits might not exceed the costs of particular renewable energy initiatives; this possibility raises the question of *efficiency*. As has already been noted, the ability to devote resources to renewable energy (and to energy efficiency initiatives) depends on the nation's income level, so the availability of external funds is often another driver of renewable energy policies. NGOs and those groups providing funding to developing countries should also take care that excessively rapid shifts to non-traditional energy sources do not create more problems than are solved.

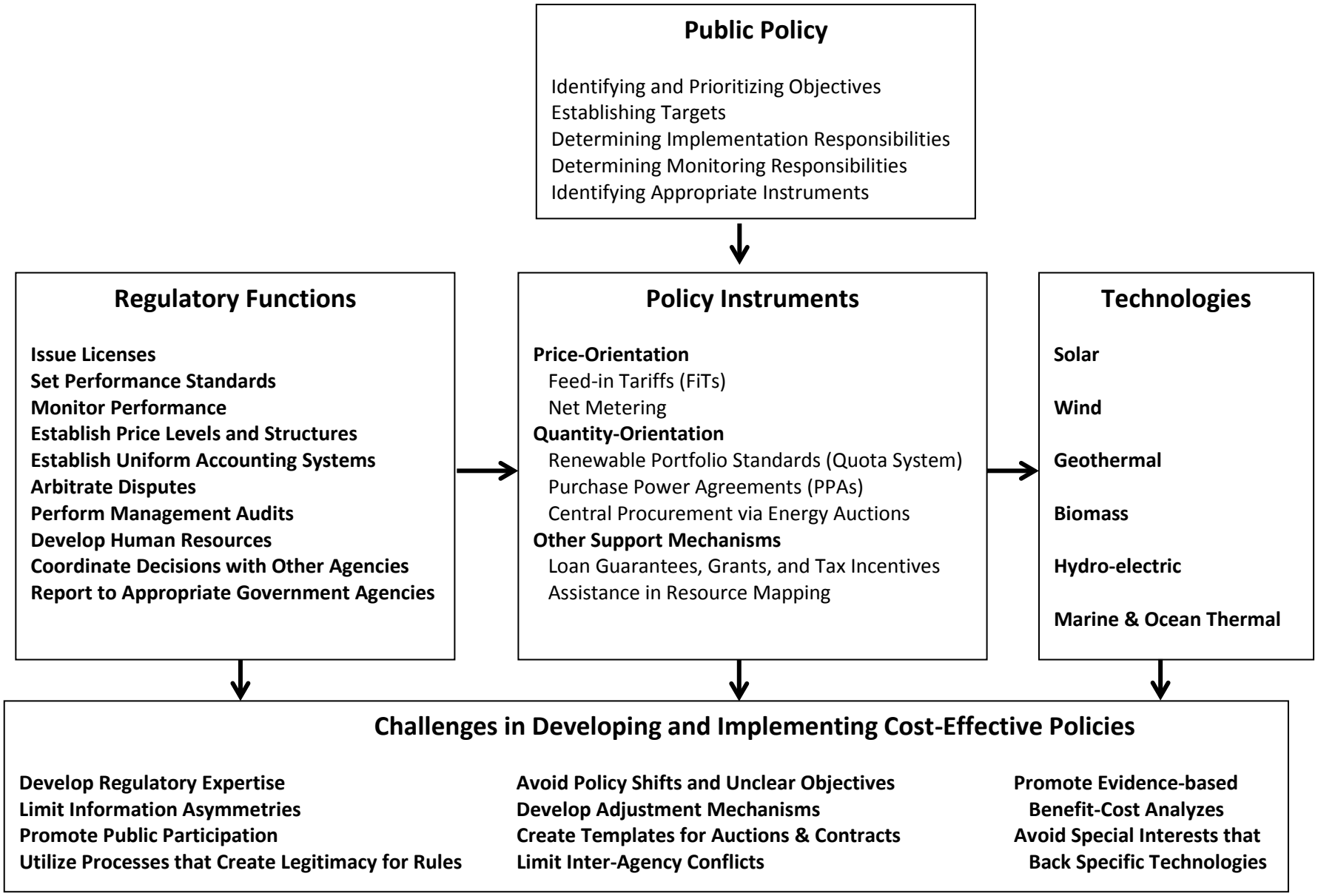
Decisions regarding energy mix depend on key policy issues such as energy security, environmental policy and rules, how consumers will pay for a cleaner energy mix, and funding sources (if the technology requires subsidization from an external agency or cross-subsidization from customers). Such policies usually depend on the Ministry of Energy (or whatever agency is responsible for RE expansion plans or targets) and the Ministry of Finance (regarding sources and extent of subsidization). If the RE policy does not prioritize the objectives, the regulator will have to balance the objectives identified in the enabling legislation (or executive order). This process can be particularly contentious since the objectives are seldom prioritized: the balancing and timing of initiatives is often left to the agency overseeing RE initiatives.[v]

Policy-makers will set the targets and (often) procedures for RE initiatives. Their tools can include taxes, subsidies, and targets for utilities. Ultimately, the regulator ends up implementing government policies. Although the boundaries between "policy-making" and "regulating" are inherently fluid and uncertain, the role of the sector regulator in promoting RE is limited by legislative and executive decisions. RE policies and frameworks are policy decisions that are customarily and perhaps, preferably, taken by policy makers and not regulators. In addition, the sector regulator is in a

position to give advice to the government regarding the full implications of focusing on climate change or energy security. Policymakers, however, may choose to delegate these decisions or a subset of them, to regulators; or they may choose to remain silent on such issues. In the former case, of course, regulators have the power to exercise their discretion, while, in the latter, the scope of regulatory discretion depends on what the legal system provides. In either case, the internal practices followed by the regulator need to provide legitimacy for regulatory rulings related to RE. Such practices include transparency and evidence-based decision-making. Regulators must avoid the perception that they have been captured by special interests promoting specific technologies.

Figure 1 depicts the primary role of policy-makers in identifying and prioritizing objectives and establishing RE targets. The sector regulator has a number of roles and responsibilities for operationalizing and implementing RE. The policy instruments include those oriented towards prices and quantities. The former (such as Feed-in Tariffs) provide the supplier with certainty regarding price, but the volume depends on whether that price is high or relatively low.[vi] The latter include renewable portfolio standards that require distribution companies to purchase specific quantities of electricity generated by renewable technologies. As an example of different national objectives achieved using the same instrument, consider the Feed-in Tariffs (FiTs) adopted by regulators in Kenya and in South Africa. Kenyan regulators were particularly concerned with the potential rate impacts of higher cost renewables, so the FiTs were not very high—leading to low volumes. Output from RE is expected to increase over time, as contractors, suppliers, and others become more experienced with renewable technologies. South Africa, on the other hand, placed a higher priority on expanding renewables, so the associated FiTs were relatively high. In both cases, the exact levels of renewables were not easily predicted, but the relative prices certainly affected the patterns of investment.

**Figure 1 Regulatory Functions Influencing Renewable Energy**



While public policy will determine the extent to which renewables are to be incorporated into the generation mix, regulators implement that policy—thus affecting the pace and pattern of RE investments and connections to the grid. Energy regulators often have authority to carry out a number of functions that have implications for the financial feasibility of renewable energy projects. These are discussed in the next section.

## III. Regulatory Functions Affecting Renewables

The ten functions outlined here are often assigned to regulatory commissions in legislation, giving them specific roles and responsibilities in the implementation of RE programs. In other cases, the role could be taken by the commission as part of its regulatory responsibility, broadly defined: to protect consumers and ensure prudency on the part of utilities. The "reach" of regulation depends very much on who is pushing RE initiatives and the objectives that are supposed to be achieved. Policy that shifts with each election increases uncertainty—raising the cost of capital. Similarly, inter-agency conflicts that raise costs result in inefficient investments. The prospect of such government failures calls for involvement by some institution that has *credibility* with investors (and others funding investments) and *legitimacy* in the eyes of utility customers. The sector energy regulator is such an institution, depending on the tools it has available and its track record regarding transparency, expertise, public participation, and other aspects of rule-making.

### A. Issuing licenses related to regulatory functions

In many jurisdictions, the electricity regulator has the responsibility for issuing a "certificate of use" after completion of capital investment in a facility. Generally, existing capacity is issued a "certificate of use" stating the standards under which the facility is to be operated. Such licensing generally specifies operating standards that have impacts on cost and tariffs. For example, power quality problems with particular generating units will have cost implications for the entire system. Intermittent supply introduces back-up issues for the utility, so regulators must monitor contractual arrangements with solar and wind generators who do not provide firm capacity. Thus, operating standards are specified in advance of operation. This process requires ongoing monitoring by the regulatory commission.

New plants (whether representing Independent Power Producers or system expansion by incumbent generators) that have been approved by appropriate authorities still require a license indicating compliance with regulations. Licensing of new generation, transmission, and distribution facilities or approval of sites can be contentious given citizen concerns over *Not In My Back Yard* (NIMBY) facilities. For example, wind farms have been a source of complaints for those affected by new sites (in terms of both noise and impairment of scenic vistas. On-shore siting issues include tall structures which are usually highly visible on mountain peaks/ridges. Offshore issues include waters with sometimes overlapping regulatory jurisdiction within federal or state governments. Offshore challenges also include balancing competing interests such as fishing and boating. Similarly, large scale solar facilities at a distance from load centers will require access to transmission lines. The licensing process can be used to promote cost-effective systems.

### B. Setting performance standards

Performance standards on quality/reliability have cost/tariff implications since these involve resources. Consumers are willing to pay for a defined standard of service quality; however, performance standards have implications for the cost of service. To protect consumers from excessive prices while implementing public policy, the regulatory agency will need to prescribe procedures and standards for companies' investment programs. This includes criteria for least-cost expansion and competitive bidding for resources. As renewable penetration within the system increases, the commission will need to adapt existing codes of conduct and eventually develop new ones for generation, transmission and distribution companies, ensuring that market participants have access to information in a timely manner. Performance standards will be set for system reliability; regulators need to identify the implications of new types of

electricity generators that are added to the grid—especially those supplying intermittent power. Since small scale RE investments involve distributed generation, access to the grid, power quality, and related issues need to be addressed by regulators in the design of the instruments. In addition, regulators often oversee network expansion targets (including renewable portfolio standards and the issuance of green certificates).

### C. Monitoring the performance of regulated firms

Collecting and analyzing data on costs, revenues and performance is essential for tariff determination. Although regulatory commissions need to avoid micro-management of firm activities, it is essential that they be authorized to request information and receive appropriate responses. It is standard practice for regulated firms to prepare audited financial reports on an annual basis to facilitate regulatory review. The commission also needs the authority to penalize firms that do not comply with data requests. Similarly, regulators need the capability to benchmark operations and provide incentives for cost-containment. Ensuring that Purchase Power Agreements (PPAs) are consistent with model PPAs would be another regulatory task. Thus, monitoring RE/EE activities falls under the purview of the regulator. Templates, such as those proposed by Bessant-Jones et. al.[vii] promote greater confidence in procurement practices and the contracts resulting from auctions.

### D. Establishing the price level and the structure of tariffs

The *rate level* is based on revenues required for financial sustainability, including fair returns to invested shareholder capital. It is reasonable for consumers to pay the costs associated with utility generation diversification. Customers would be vulnerable to input price changes due to the excessive dependence upon one fuel source, so the addition of renewables to the generation portfolio has some benefits. In addition, if public policy mandates a shift away from fossil fuels, customers become responsible for covering the associated costs. However, the higher cost of some renewables affects electricity affordability, so regulators must address trade-offs among policy objectives.

*Rate structure* refers to rate designs that allow the opportunity to recover prudently-incurred costs, incentivize the efficient use of scarce resources, and promote fairness. In the context of RE, this means that regulators analyze, evaluate, and approve rate designs, including time of use rates, Feed-in Tariffs, and terms for net metering.[viii] As these technologies are being scaled up worldwide, capital costs have been dropping significantly. Thus it is important that the regulator follows closely the trend in capital costs of renewable technologies to avoid windfall profits, especially when these technologies are benefitting from regulated tariffs. Furthermore, cost-recovery decisions will have to be made for connecting local and remote renewables to the grid. Are costs to be socialized (and allocated to all customers) or are they borne by those supplying energy at a specific point (raising the cost of RE)? How is back-up power to be priced where the need arises from weather pattern variability?

### E. Establishing a Uniform Accounting System

Information asymmetries are prevalent when comparing utility operators and energy sector regulators. Operators should be required to file reports in formats determined by the regulator. Income statements, balance sheets, statements of cash flows, and operating statistics are all essential inputs in managerial decision-making and regulatory review. These reports include financial and operating data needed to evaluate corporate performance. Furthermore, accounting separations according to functions facilitate benchmarking—so performance comparisons can be made across firms facing comparable production conditions.

Evaluating the cost-effectiveness of renewables policies and energy efficiency programs requires that operators provide data and reports and that regulators have the capacity to review those studies. Access to information is necessary if RE programs are to be evaluated in timely manner and refined based upon careful studies. For example, subsidies often

accompany RE programs, so monitoring the effectiveness of programs is often a regulatory responsibility. Similarly, utility executives manage what they measure, so direct costs (as reported in traditional income statements) and opportunity costs (which are harder to determine) must be considered when expanding RE.

**F. Arbitrating disputes among stakeholders**

Regulators ensure that facts are well documented and that different interests are well represented. Disputes may arise in a number of areas, including tariffs and competitive access. This particular role underscores the need for the commission to have the authority to rule on matters within its jurisdiction. Siting of new facilities (including distributed generation such as photovoltaics), cost allocation among different customer classes, and interconnection rules have differential effects on stakeholders. Delays in decisions are not neutral in their impacts on the various parties to disputes.

The regulatory commission is in a position to organize workshops and promote dispute resolution. For example in the case of geothermal electric power systems, the sector regulator can ensure that ownership is well defined. Legislation needs to specify how ownership is to be treated. For instance, do geothermal facilities fall under rules similar to minerals or petroleum? Or, does geothermal jurisdiction stay under state ownership, with rights granted through concessions to use the resource, explore a given area, and produce the energy?

**G. Performing (usually via independent consultancy) management audits on regulated firms**

Typically, the regulator reviews the organizational elements of generation, transmission and distribution companies on a regular basis to ensure cost effectiveness and a continuous and efficient supply of services. On an agreed schedule, the commission also reviews companies' performance effectiveness (achieved through incentive plans and management contracts) to reach acceptable efficiency benchmarks. Thus, the commission needs to review the performance of RE and EE initiatives: are the goals being met in a cost-effective manner? If the policy goal also includes project diversity and local development and ownership, a project size limit by resource type may be set to ensure the program is not flooded by a few large projects or a limited set of technologies. Caps reduce the cost impacts for ratepayers.[ix]

**H. Developing human resources for the regulatory commission**

Recruitment, retention, and staff training warrant particular attention as part of regular managerial responsibilities. The implementation of RE policies depends on the quality of the professionals who are conducting regulatory analyses. Agency budgets and staff recruitment procedures must be appropriate for the tasks associated with implementing RE policies. If requested, the regulator could provide technical support and inputs to the agency responsible for planning on matters; such studies could provide information on expected costs of RE, impact of renewables on security of supply, and quality of service impacts of RE. This is just one of the many roles the regulator could play in promoting cost-effective RE: however, strong technical capabilities are essential if the agency is to serve effectively in an advisory role.

**I. Reporting sector and commission activities to appropriate government authorities**

A regulatory agency should submit reports regarding sector activities to a higher authority. Given the expertise assembled at a commission, the staff are in a position to provide information and advice to appropriate government departments that are concerned with RE. To some extent, this function blends into the next function, except, these reports are primarily for those groups providing oversight for the regulatory commission. Documenting past activities and laying out plans for the forthcoming budget cycle will be important if adequate funding is to be provided—to maintain the expertise required for analyzing options and implementing policies.

**J. Coordinating decisions with other government agencies**

Clean and renewable energy is likely to be of concern to a number of organizations. Interaction between multiple authorities requires coordination. For example, regulatory differences need to be resolved for shallow or deep geothermal resources. Such coordination is necessary for environmental oversight. Groundwater and other environmental impacts must be considered with streamlined processes in place for less invasive shallow resources. Note that although shallow resources present less environmental harm, they can present some; thus, individual conditions should be monitored to guard against specific environmental harms or pollutants. "The regulator should enter into memorandums of understanding (MOUs) with other entities that are promoting electrification, such as ministries and electrification funds. Such MOUs should clarify respective roles and responsibilities and the sequence of needed approvals. The overall goal should be to streamline the regulatory process by minimizing unnecessary duplication and delays."[x]

Coordination is required for alignment with other policies, incentives, and administrative processes (including licensing and permitting). For example, in the case of biomass gasified power systems, the energy sector regulator needs to coordinate rules with the air emissions regulator to ensure air quality standards are met. Similar considerations are raised by hydro-electric dams: addressing fish migration impacts, land inundation, and population re-location characterizing some larger projects. It is important to investigate, predict and evaluate potential environmental and other impacts, and to take measures to mitigate them or incorporate the costs into the economic assessment process. Potential environmental and social impacts include sediment transport and erosion, relocation of populations, and loss of habitat of rare and endangered species.

Thus, regulators will face a wide range of decisions that affect the financial outcomes associated with RE investments. According to Stiftung[xi], the most important issues faced by policy-makers and those implementing policy requires careful definition and implementation for the following:

- Eligible technologies;
- Eligible plants;
- Financing mechanisms;
- Tariff calculation methodology;
- Purchase obligations;
- Priority grid access;
- Cost-sharing methodology for grid connection;
- Effective administrative procedures;
- Setting targets; and
- Progress reports

The basic lesson emerging from international experience is "keep it simple at the start". When designing RE programs, setting the initial payment level correctly is vital to provide economic certainty for developers and industry; if the payment level is set too high and program cap too large, the program will likely be unsustainable and costly to ratepayers. Similarly, when establishing targets (a quantity approach), those designing the program need to investigate the costs and the implications for rate-payers. In developing (and developed) countries, the energy sector regulator is the natural advocate for efficiency and cost-containment throughout the process of designing and implementing RE policies.

## IV. Concluding Observations

The issues associated with each renewable technology will differ across countries, depending on access to resources, topology, geography, population density, technical capacity to operate systems, legal obligations, inter-agency relationships, and other factors. New regulatory RE objectives specified in legislation are likely to require the agency to

balance fundamental goals of affordability, cost recovery (for sustainable utility operations), and fairness (since implicit cross-subsidies may be required to meet new policy mandates). Decision-makers can expect technological advances and increased economies of scale in production in the coming years, as input suppliers discover new features of materials and adopt improvements in their production processes. In addition, local installers and maintenance workers will gain experience with the technologies. However, the actual pace of innovation across different renewable technologies is not easy to predict. "Picking" technologies is an activity better left to those willing and able to take the risks associated with guessing incorrectly.

Regulators need not become experts in these different technologies. However, it is necessary that they be aware of the strengths and limitations of each technology as policies to promote renewable energy are developed and implemented. The key technical and operational risks associated with renewable energy projects are outlined in great detail in the literature. The risk management considerations associated with solar thermal (and large photo-voltaic), wind power, geothermal, biomass, and hydropower must be incorporated into RE planning procedures[xii]; if they are not recognized early on, investors will discover that the projects are riskier than anticipated. For private investors, realistic estimates of the cost of capital are essential if later developments are not to be saddled with negative perceptions (resulting from disappointments associated with initial RE projects). In particular, formal procurement processes warrant attention from the regulator.[xiii]

Such processes should create greater transparency, provide a level playing field for bidders, promote legitimacy (by removing any basis for charges of cronyism when contracts are awarded), and establish clear qualities expected in bidders (including experience with the technology and financial strength). As innovations impact technologies differentially, those asked to bear risk should be in the best position to evaluate likely future developments.

FiTs have been shown to be effective mechanisms to attract investments in renewables and to achieve Renewable Portfolio targets. However, the rate impacts need to be considered if the mechanism is to be used in large scale. As always, decision-makers should consider whether alternative programs could achieve the same policy objectives at lower cost. For example, instead of a technology-specific "fixed price," additional renewable generation could be acquired via an auction process (Taylor, 2010). The pace and timing of new capacity installation should also be consistent with the limited resources available for new initiatives. In addition, redirecting fossil fuel subsidies into renewables would have the dual advantage of increasing the price of a substitute and reducing the cost of renewables to consumers—moving market participants up the learning curve more rapidly.

As Grace, Donovan, and Melnick[xiv] point out: "The differing perspectives of players in the policymaking arena—legislators, administrative agencies, and regulators; renewable energy industry participants; policy advocates; and ratepayers—influence the state renewable energy policy landscape and contribute to the tension among policy objectives. The perspectives of legislators—who commonly prioritize securing local benefits—are sometimes not well-aligned with the just-and-reasonable rate mandate of utility rate regulators." This point underscores the important role of the sector regulator in promoting (and incentivizing) cost-effective RE initiatives.

Clearly, rules (micro policies) made by regulators are subsidiary to overall government RE policy and depend on some delegation of authority from the state. Nevertheless, there will be instances when the sector regulator can pro-active on behalf of customer and utility concerns—providing facts, reports, and public statements that build a case for care in the design of public policy towards RE. Of course, the making of policy by regulators is incidental to and inherent in their duty to decide specific cases or disputes. This micro policy making role is derived from the fact that macro RE policy cannot reasonably be expected to anticipate all aspects of policy that will have to evolve for the regulatory process to be fully functional. This point is particularly important in the area of renewable energy, with its rapidly changing

technologies and ever-changing public (and political) attitudes. Gaps will have to be filled and it is the regulators, with their functional responsibilities, technical expertise, and hands-on experience that are best positioned to accomplish that task—in both developing and developed countries.

Endnotes

[i] Achala Acharya provided helpful research assistance for this project. Ashley Brown provided useful suggestions for improving this article. Remaining errors are the author's alone. Funding from the Norwegian Trust (through the World Bank) is gratefully acknowledged.

[ii] The References include some of the main sources, including World Bank Renewable Energy Technology Toolkits; International Confederation of Energy Regulators (2012), ICER *Report on Renewable Energy and Distributed Generation: International Case Studies on Technical and Economic Considerations*, Ref: I12-CC-17-03, February 21, 2012, pp. 1-154; and *Encouraging Renewable Energy Development: Handbook for International Energy Regulators,* (2011) Prepared by Pierce Atwood for NARUC/USAID, January, viii-138;

[iii] Sister sites are the Public-Private Partnership in Infrastructure Resource Center for Contracts, Laws, and Regulation, http://ppp.worldbank.org/public-private-partnership/ and the Private Participation in Infrastructure Database, http://ppi.worldbank.org/index.aspx . The former contains sample contracts, laws, and other material. The latter contains data on over 5,000 infrastructure projects in 139 low- and middle-income countries.

[iv] Although the focus here is on renewables, regulators also can have roles to play in promoting energy efficiency since EE can be expanded via utility actions (incentivized and monitored by the regulator) and actions by other agencies. The former include reduced line losses, improvements in load patterns and system reliability, decision-relevant customer billing information, energy audits, and smart grids. Other agencies set appliance standards, provide government financial support, create tradable certificates, award tenders, and establish government programs, like improving EE in schools and hospitals.

[v] Grace, Robert C., Deborah A. Donovan, and Leah L. Melnick (2011), "When Renewable Energy Policy Objectives Conflict: A Guide for Policymakers," National Regulatory Research Institute, 11-17, October, ix-69.

[vi] Taylor, Julie **(**2010). *Feed-in Tariffs (FIT): Frequently Asked Questions for State Utility Commissions*, NARUC, funded by the U.S. DOE Solar Energy Technologies Program, 1-14.

[vii] Bessant-Jones, John, Bernard Tenenbaum and Prasad Tallapragada (2008) *Regulatory Review of Power Purchase Agreements: A Proposed Benchmarking Methodology*, ESMAP Report 337/08 October. viii-81.

[viii] Since larger plants tend to have lower average costs than smaller plants, payments can distinguish between investments that might be made by private households (such as a rooftop installation) and larger investments made by industrial or commercial buildings. Of course, setting up pass-fail scale-based qualifying standards also can result in artificially separated ownership arrangements just to qualify for support programs (as has occurred with wind farms in Brazil).

[ix] Although the focus here is on RE, when the energy efficiency outlays are by the utility, the energy sector regulator needs to monitor outcomes to ensure that the resources are being utilized in ways that are consistent with overarching public policies. Furthermore, interactions of utility initiatives with other EE policies need to be taken into account when evaluating the scale and scope of existing utility-based demand-side management programs.

[x] Reiche, Kilian, Bernard Tenenbaum, and Clemencia Torres de Mästle, *Electrification and Regulation: Principles and a Model Law*, World Bank. Energy and Mining Sector Board Discussion Paper No. 18, July 2006, 1-44.

[xi] Stiftung, Heinrich Boll (2012). "Powering Africa Through Feed-In Tariffs: Advancing Renewable Energy to meet the continent's electricity needs," World Future Council, December. pp. 1-137.

[xii] Marine and hydrokinetic technology resources (including waves, tides, and ocean thermal energy conversion) are not discussed in this article due to the limited number of sites utilizing these technologies. Information is available at http://www1.eere.energy.gov/water/marine_hydro_glossary.html .

[xiii] Maurer, Luiz T. A., and Luiz Barroso. (2011). *Electricity Auctions: An Overview of Efficient Practices,* World Bank, xix-155.

[xiv] Grace, Donovan, and Melnick (2011, p. ii)