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Transitioning to Renewable Energy An Analytical Framework for Creating an Enabling Environment

By the International Institute for Energy Conservation (IIEC)

Content

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Transitioning to Renewable Energy:
An Analytical Framework for Creating an Enabling Environment
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Foreword

By Marc Berthold, Heinrich Böll Foundation, Washington Office

When governments, civil society, international organizations and business leaders meet for the first International Conference for Renewable Energy (Renewables 2004) in Bonn from June 1 to 4, 2004, they will seek actions and commitments to promote a global increase in renewable energy for sustainable development and for combating climate change. The conference will be hosted by the German government, which invited the world to Bonn at the World Summit for Sustainable Development 2002 in Johannesburg, South Africa.

The goals of Renewables 2004 are the formation of enabling political framework conditions allowing the market development of renewable energies, increasing private and public financing in order to secure reliable demand for renewable energies, and human and institutional capacity building, and coordination and intensification of research and development.

The Heinrich Böll Foundation, which was deeply engaged in promoting civil society participation at the Johannesburg Summit, decided to follow-up on those activities, and to also promote and facilitate global civil society's extraordinary contributions to the International Conference for Renewable Energy.

Many of the expected outcomes of this conference will have to be implemented on the local, national and regional levels, in partnerships with all involved stakeholders of the conference and, particularly, on the ground. Many of the policies, programs and institutional development initiatives that have sought to promote the use of Renewable Energy (RE) systems have largely focused on RE systems alone rather than attempting to integrate RE into the existing energy frameworks and markets. A "Fossil Today - Renewable Tomorrow"-vision has resulted in many successful individual projects, but fewer successful, self-sustaining markets for RE in developed as well as developing countries.

In preparation for Renewables 2004, the Heinrich Böll Foundation acknowledged that there has been a need to take a closer look at existing policies, programs and institutions that promote renewable energy particularly in developing countries, and to develop a framework for analysis and comparison in order to design successful and sustainable initiatives and to enhance existing ones. The Foundation decided to commission such a research project in the run-up to Renewables 2004, so that it may contribute to the deliberations, and help finding appropriate approaches for action and commitments in Bonn, particularly with regard to the formation of enabling political framework conditions allowing the market development of renewable energies in developing countries.

The International Institute for Energy Conservation (IIEC) with its offices in Africa, Asia and South America was the perfect match for this effort. Its members and regional networks brought their excellent expertise and vision into this partnership. We are very honored and grateful for this outstanding cooperation.

The study project started in July 2003 in close collaboration between IIEC and the Heinrich Böll Foundation’s regional offices in Brazil, India, South Africa and Thailand, and led to a discussion of initial findings at a closed workshop in Washington on January 27, 2004. Through this exercise, IIEC and the Heinrich Böll Foundation invited additional expert input and comments from German and U.S. officials, representatives of international organizations, such as the World Bank and the Global Environment Facility, research institutions and non-governmental organizations. Their contributions were incorporated in this final version of the study.

The Heinrich Böll Foundation and the International Institute for Energy Conservation are hoping that this study will make a contribution beyond Renewables 2004. Its analytical framework creates an opportunity for the countries of the case studies to examine their renewable energy approaches, for other peer developing countries, which are designing their own policies and programs for renewable energy, to learn from these experiences, and for global partners, such as financial institutions and development agencies, to develop comprehensive and holistic strategies for creating an enabling environment, which increases the share of renewables in the energy mix of developing countries.

The Heinrich Böll Foundation would like to thank the International Institute for Energy Conservation for their outstanding work; in particular Wayne Abayan, Raymundo Aragao, Angelica Dealino, Bosworth Dewey, Nitin Pandit, Mahesh Patankar, Sommai Phon-Amnuaisuk, Monali Ranade, and Jason Schäffler. The Foundation’s Washington Office would also like to thank its international colleagues for their help on the ground and their comments to the study, particularly Stefan Cramer, Peter Crawford, Thomas Fatheuer, Jörg Haas, Heike Löschmann, and Mukul Sharma. Last but not least, the Heinrich Böll Foundation and the International Institute for Energy Conservation are extremely grateful for the substantive support of the following individuals: Ida Aroonwong (AEPS, Thailand), Matthew Banks (World Wildlife Fund), Uwe Büsgen (German Federal Ministry for Environment), Taryn Fransen (United Nations Foundation), Uwe Fritsche (Öko-Institute, Germany), Norbert Gorissen (German Federal Ministry for Environment), David Hales (Stakeholder Forum), Waeni Kithyoma (AFREPREN, Kenya), Crescencia Maurer (World Resources Institute), Griffin Thompson (U.S. Department of State), Judy Siegel (Global Village Energy Partnership), Thomas Triller (Embassy of the Federal Republic of Germany, Washington DC), Xiaodong Wang (World Bank), Jerome Weingart (Jerome Weingart and Associates), and Christine Woerlen (Global Environment Facility).

List of Acronyms

CDM	Clean Development Mechanism of the Kyoto Protocol
CER	Certified Emission Reduction
EIT	Economies in Transition
GDP	Gross Domestic Product
IPP	Independent Power Producer (Project)
LDC	Less Developed Countries
JI	Joint Implementation (carbon offset projects implemented in LDCs with funding derived in part from offset sales or trades)
kW / kWh	Kilowatt / Kilowatt-hour
MW / MWh	Megawatt / Megawatt-hour
GW, TW	Gigawatt (1000 MW), Terawatt (1,000,000 MW)
NGO	Non-Governmental Organization
NRERE	New and Renewable Energy
O&M	Operations and Maintenance
PPI	Policies, Programs and Institutions Initiatives
RE or RES	Renewable Energy (Systems)
SHS	Solar Home System
SME	Small and Medium Enterprise
UNFCCC	United Nations Framework Convention on Climate Change
WSSD	World Summit on Sustainable Development (Johannesburg, 2002)

DISCLAIMER

This report has been written using secondary data sources only. No attempts have been made to verify the information contained therein. Some anecdotal experiences collected, but not always with complete citation, are presented with the larger purpose of the report – to create a framework for a meaningful dialogue among the participants of the conference Renewables2004 in Bonn, Germany.

1 Introduction

“Transitions are transformation processes in which society changes in a fundamental way over time….A transition (is) a set of connected changes, which reinforce each other but take place in different areas, such as technology, economy, institutions, behavior…and belief systems….Yet even if transition is multi-dimensional, with different dynamic layers, it is still necessary for several development in different domains to come together to reinforce each other.”

From “Transition Management in Public Policy”
By Jan Rotmans, Rene Kemp and Marjolein Van Asselt , Camford Publishing 2001

“The Shift towards sustainable energy systems creates tremendous opportunities for private investments, job creation, and economic development, particularly in rural areas…(but) since the transformation of today’s energy systems towards sustainability requires a fundamental change in the sector, there will be winners, but also losers…”

From “Changing Course, A Contribution to a Global Energy Strategy
Commissioned and Published by the Heinrich Böll Foundation, 2003

At the 2002 World Summit for Sustainable Development (WSSD) in Johannesburg, a consensus emerged amongst stakeholders on the vital connection between sustainable energy development and appropriate economic development. Access to sustainable and affordable energy was not only seen as a cornerstone of national economic development, but also as a critical element to poverty alleviation and social equity. As part of the follow up to the WSSD and its renewable energy initiatives, the Heinrich Böll Foundation has supported this study under its North – South Dialogue Program.

One of the difficulties in developing an approach to renewable energy transition, and the underlying motivation for this study, is that each country has a very unique set of circumstances and conditions that promote or hinder renewable energy development. What works in South Africa, with its abundant coal reserves, heavy industry and cheap energy prices is going to be quite different than what works in the Philippines with its dispersed, island-based agricultural economy. Therefore, the real intent in our case studies is not to focus on each PPI design and results per se, but also to analyze how these PPIs addressed the barriers and challenges and promoted transition within their specific contexts. The real challenge is to develop a methodology that can enable us to compare and contrast such disparate case studies.

As a result, this study is intended to provide the basic framework for further deliberations on the potential paths of renewable energy development. It is hoped that it will be a useful starting point for substantive discourse between local governments, NGO’s, donors and Multilateral Financial Institutions, and any other stakeholders in the process on effective mechanisms to promote renewable energy.

This study and the workshops that lead up to the International Conference for Renewable Energy 2004 in Bonn are primarily focused on learning experiences between Southern nations. While there are several instances of transitional efforts in developed Northern countries, the Heinrich Böll Foundation felt that it was more useful for developing nations to learn from other nations that are facing similar development challenges.

The study attempts to follow a series of questions in order to frame the dialogue within real conditions in which each economy finds itself:

- What is the energy system in place and what are the energy and development challenges which each country is attempting to address?
- What are the primary drivers, motivations, for the nation to support the development of RE. What are the stated goals of the government and what lies behind them. Is it fuel import substitution, rural economic development and electrification, or climate change?
- What were some of the policy initiatives or program mechanisms which each country attempted to undertake and were they successful in creating an environment in the energy market for new energy technologies and implementers to take root?
- What were the lessons learned that other nations could utilize to address similar energy and development challenges?

The report presents a model of RE transition in the second chapter. Subsequent chapters provide a case study of the application of the model in the five countries to specific PPIs to promote RE.

2 Transitional policies, programs & institutions: an overview

"…the key tasks of the coming years include encouraging and supporting the transition towards sustainability, involving both public and private stakeholders, and building alliances for the next crucial steps."

From "Changing Course – A Contribution to a Global Energy Strategy"
Commissioned and Published by the Heinrich Böll Foundation, 2003

Many of the policies, programs and institutions (PPI) that have sought to promote the use of Renewable Energy (RE) have focused on it as an end in itself rather than as an integrated piece within a larger energy and economic structure. This view of renewable energy has resulted in some successful, if discrete, projects, but fewer successful, self-sustaining renewable energy markets in developing countries. There is a need to evaluate RE PPIs in a broader context, within the broader energy market and the macro-economy.

Further, while there is general consensus on the need to promote renewable energy in emerging markets, there is little consensus on how to get there. In much of the literature of the WSSD and in subsequent writing, the terms "transformation", "shift" and "transition" are becoming more common throughout. The lack of definition is characteristic of nascent markets where most advances appear to occur through the well documented economic process of "muddling through" (Lindblom, 1959). However, recent experiences demonstrate that a healthy relationship between states and industry can create the enabling environments for toward a successful transformation (Evans, 1995). In this study and the dialogues to follow, we propose to address the process of "transitioning to renewable energy" as creating the "enabling environment" for the development of renewable energy markets.

The hope for this study and the model it presents is to promote analysis of PPIs to enable stakeholders to recognize RE as a part of a larger market context and to ensure that efforts to promote its transition into mainstream usage have incorporated the realities of the larger market forces. The process, if successful, will allow RE practitioners to "step back" from a narrow focus of the RE mission and to manage the barriers and utilize the opportunities presented. It is meant to be instructive for understanding why some have failed and constructive in providing a slightly different way of approaching PPI creation toward a transition to RE. It is also hoped that by beginning to focus on where a specific PPI falls into the "rings of influence" of the larger market, RE supporters can both better adapt their PPI, but also find allies to join the effort.

2.1 The Thesis

The focus of this study is to evaluate a slightly different approach to the development and diffusion of renewable energy systems in emerging markets. Rather than review

PPIs that support renewable energy development and diffusion exclusively on the basis of their short term MW or KWh impact, this study attempts to look at PPIs within the broader energy and development market. In other words, this study looks at the transitional impact of PPIs in terms of their ability to create a platform for ongoing indigenous economic activities. The effort is intended to move beyond the false progression of "fossils today - renewables tomorrow" and to begin to see RE as a vital component within a larger, existing macro-energy system. This report is based on a thesis that RE must engage the larger market within the economy.

Sustainable energy PPIs that do not account for failures or dysfunctions in the larger energy market, such as subsidized utility rates or poor regulatory structure, or in the national economy, such as an underdeveloped legal system or an inefficient financial sector, is not likely to survive and create a sustained enabling market for RE over time. There is clearly a need to look not only at diversified energy policies and solutions, but also to ensure that those solutions work with the larger energy and socio-economic systems. Without this broader perspective, most experts believe that RE will not likely reach into the mainstream of energy use in the near future.

Policy makers and RE practitioners now recognize that transitioning to gain a significant share of the energy market is a slow, episodic and uncertain process. According to work at the Institute for Applied Systems Analysis (www.iiasa.org) undertaken over the last 30 years, estimates of RE use of 30-50% was expected to take between 70 and 120 years. As an example, while wind energy is now becoming a more accepted source of energy by utilities in the North, it has taken nearly 30 years since the technologies were really launched for this to be the case. And while promising, wind energy systems still only account for a fraction of new generation over the next decade.

Therefore, a principle of the transitional PPI is that it must continually engage the market in a meaningful way. It must take into consideration the interests and aspirations of each of the stakeholders at each of the levels of influence along the supply chain, from the policy maker to the energy suppliers to the energy consumers. Thus the old adage that a solar home program that does not account for local preference towards grid extension will not likely work, even with attractive the rebate or other incentive programs. As it states in the Heinrich Böll Study "Changing Course", "…no global management can govern the process from the top: if the transformation is to succeed, it will involve a multitude of actors, and will be built from the variety of circumstances in [each country and region]".

Clearly the process of transition is going to be measured in what lasts after the donor funding is gone – within the framework of the broader energy market and the macro-economy.

2.2 Transition – A Working Definition

A precise definition of the concept of transition is difficult, as it will have unique applications for each market. But for the purposes of this study and dialogue, we are defining "Transition" and "Transitional PPIs" as those which not only support, directly or indirectly, increased diffusion of renewable energy technologies in a country, but also create the platform or “enabling environment” within the broader energy “market[1]” that allows renewable energy to increase its share.

In an E7 report issued last year, the authors focused on the concept of technology “diffusion” rather than “transfer” or “dissemination”. These latter terms, the report said, “are often understood to connote a ‘supply-push’ model of the flow of technologies”, whereas the term diffusion describes a ‘demand-pull conceptualization of how technologies flow. In this model, public policies do not dictate the movement of technologies directly. Rather, stakeholders cooperate to encourage free market forces…” to determine the most appropriate applications and mechanisms. The E7 also captures the “software” component of technology diffusion by recognizing the critical importance of human capacity, management practices, and institutional arrangements.

Transitional PPIs focus on the institutions, companies, and even individuals who can support and expand RE usage over the long term. In fact, some transitional PPIs may not even focus on RE, but rather on some of the macro economic or energy market barriers that RE projects encounters. For example, a PPIs that promotes grid accommodation for distributed generation, regardless of technology or fuel source, may in fact do more good for RE scale up than another program that is RE technology specific.

In their study on Transition Management, Rotmans argued that transition was the interaction of short-term changes in flows and long-term changes in stocks (Rotmans, et al., 2001). (See Figure 1). The latter are the material property within the larger system that change slowly (generation capacity, for example), while flows change rather rapidly and have an impact on the make-up of the stocks (RE PPIs, for example). What this means is that PPIs impacting each of the layers of influence can create a change in flow that can in turn alter the direction of the basic stock.

The basic premise of transitional policies and programs is that they are focused on creating sustainable markets and not merely on installing a fixed amount of MW. These policies have to be more long term, they must deal with the market forces as they exist, and they must fit into the economy’s long-term energy needs and economic circumstances. It is important to recognize that these overall circumstances are constrained by the need for resources for other national priorities, such as education and health, and therefore, an economy which chooses to subsidize clean energy often does so at the expense of other needs. In such a constrained fiscal and market environment, large scale and long term progress typically follows a logistic diffusion curve. Lessons learned from RE interventions to date show that transitional PPIs assist such incremental change. For example,

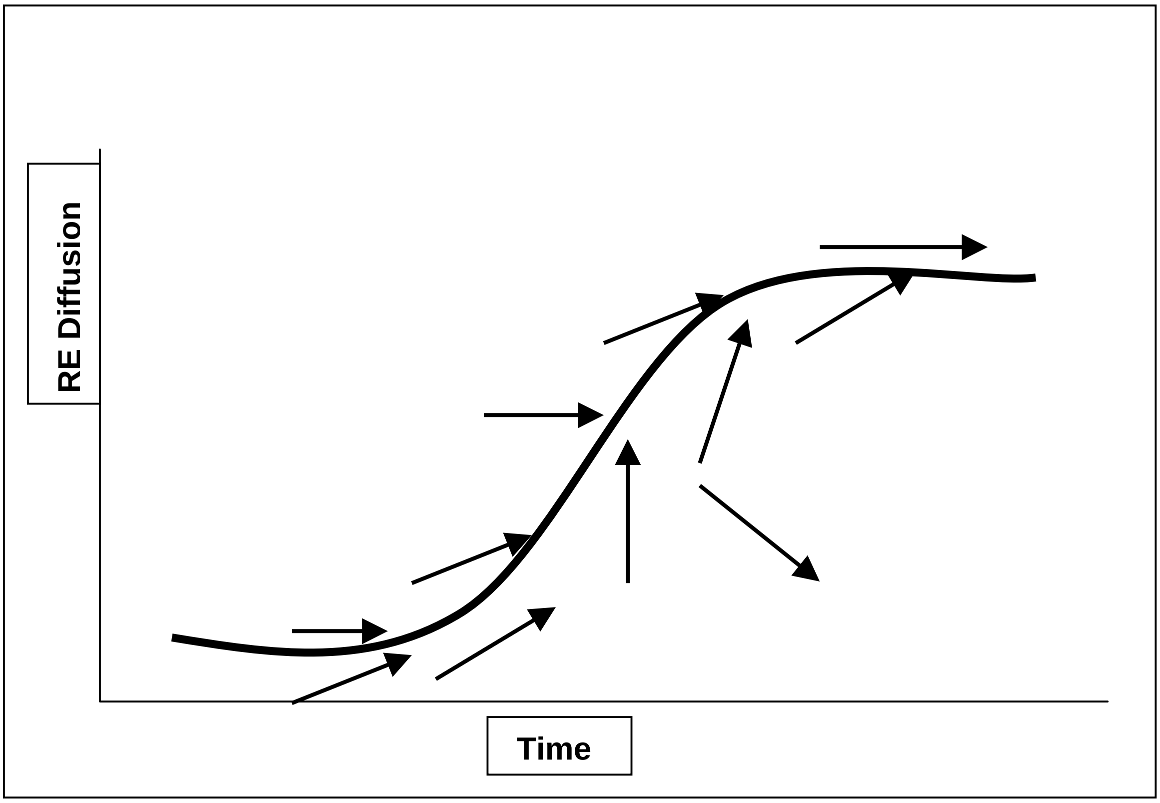
- A positive example of a program that has successfully created a market for renewables is the Indian State of Maharashtra’s wind energy program (described in detail later). Maharashtra established MEDA, the Maharashtra Energy

[1] “Market” in this context does not indicate only the private sector market, but rather one in which at least conventional “market-like” motivators exist. The norm in many countries is for publicly owned “para-statal” utilities to control the energy market from generation to distribution. In most cases now, these entities have to respond to conventional market forces and behave in a responsible manner to their stakeholders, whether it is shareholders or the national treasury.

Development Agency to act as a technical development and co-investment agency. By tapping into available state and federal monies to create demonstration programs and then following up with equity investments in private sector wind farms, MEDA has catalyzed more than $400million in new investment in 400 MW of new wind energy, including the largest wind farm in India. By successfully merging policy initiatives, demonstration and technical capabilities and co-investing in new private projects, MEDA has been able to generate new revenues that it then uses to develop and invest in new projects.

- An example of a program that was not successfully transitional as originally designed was the PRODEEM program in Brazil. PRODEEM was originally designed to provide energy to remote areas for lighting, water pumping and for small productive uses. Several million dollars were committed and several thousand PV systems were purchased and installed. However, insufficient attention was given to long-term maintenance and financial sustainability. The program has been scaled back and is now undergoing a redesign to better create a sustained market scale-up.

Figure 1 Transition to greater RE usage is the accumulation of multiple influences



From Jan Rotmans, et al., 2001.

To learn from such examples, this paper lays out a general approach to the issue of "transition" and then looks at the experiences of five countries and their efforts to promote RE: South Africa, Brazil, Thailand, India and the Philippines[2]. In many cases, these efforts have involved very substantial political investments with the creation of nation-wide institutions or programs, such as India's Ministry of Non-conventional Energy Sources (MNES) or Brazil's ambitious bio-liquids program. In others, this has involved the creation of funding windows and institutions, such as those at the Energy Conservation Fund of Thailand, the Development Bank of the Philippines and India's Renewable Energy Development Authority. In some cases interventions consisted of a specific tax incentive or a specific village electrification program.

Therefore, the objective of the case studies presented in this report is to try and develop a framework to enable us to compare and contrast such diverse lessons learned by RE stakeholders in "muddling through" various well intentioned means of promoting RE.

2.3 A Rings Model for the "Enabling Environment"

The concept of transition and the creation of an "enabling environment" for RE is being increasingly reflected in donor and multilateral funding patterns. In an IRG report to the World Bank on off-grid RE scale-up, the authors note that for the projects currently in development, as opposed to those already underway, "…have a greater emphasis on establishing the enabling conditions and less emphasis on total connections. This is consistent with the Bank's role to primary focus on establishment of conditions conducive for sustainable large-scale applications of renewables for off-grid energy services". (IRG, 2001).

Success or failure of a given PPI strategy will depend on the specifics of a country's macro –market conditions (legal, political, cultural, economic, etc) as well as its energy market conditions (regulatory structure, utility structure, energy "politics", private sector engagement, fuel costs, culture of payment, etc.). The conditions that apply to its sustainable energy markets are those which are given (fuel resource availability, human resource availability, financial resources) and those which are created (tax incentives or subsidies, regulatory requirements, carbon offset opportunities, etc).

To develop a successful PPI, it is critical that stakeholders understand the pressures on the markets in which they are operating and to address them directly. For the purposes of this discussion, we have broken the "enabling environment" into three rings of influence: the Macro-Market, the Energy Market and, finally, the sustainable energy market. Of course, one could argue that there are layers within these, but for our purposes these will suffice.

These layers of influence are referred to by some as Macro, Meso and Micro levels (Rotmans, et al, 2001) and by others as the Socio-technical, Regime and Niche levels (Rip and Kemp, 1998). The evaluation of each of these layers or "rings" of influence in each country allows stakeholders to better understand how to approach the creation of transitional PPIs by:

1) understanding where RE fits into the larger policy drivers of the Macro (economic/political) and Meso (energy sector) players;

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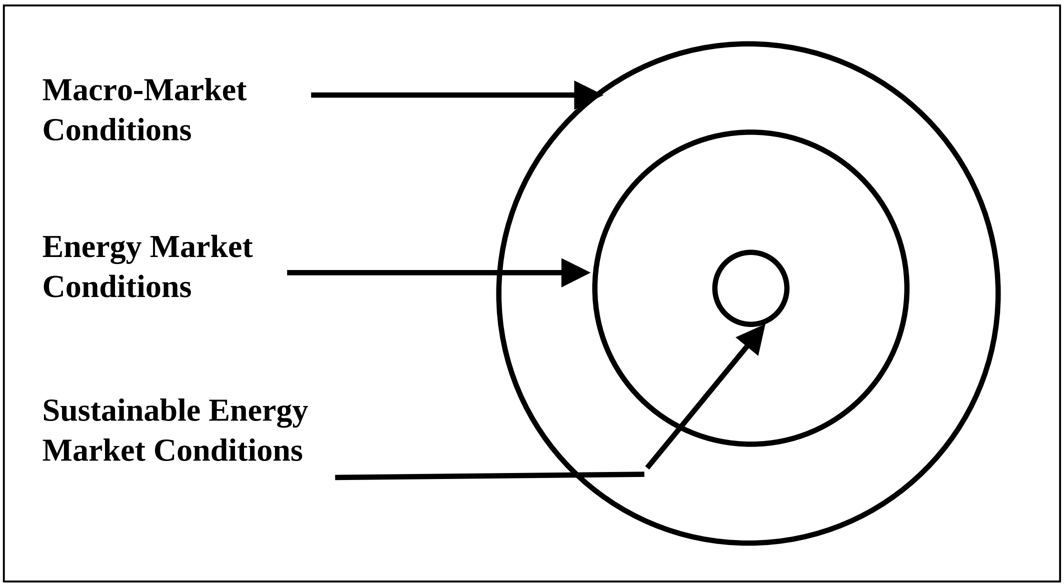
[2] It is hoped that there will be opportunities for evaluating case studies in other nations.

2) creating PPI mechanisms which provide a window of opportunity within, or a buffer against, any dysfunctional elements of the larger market (e.g., provide for arbitration in another venue if local legal standards are insufficient); and,

3) understanding where mutual interests can link stakeholders in non-traditional ways to resolve specific barriers or to take advantage of mutually beneficial opportunities[3].

The key observation is that successful scale up of a RE market will require a more holistic view of the "enabling environment" in which renewables operate. This "macro to micro" evaluation will be discussed further below. (See Figure 2 below)

Figure 2 The Sustainable Energy Market "Target"



The purpose of this simple model is to highlight the fact that the sustainable energy market exists within the larger energy market, which itself operates within a national economy with all the forces and pressures that that entails. While the development of a successful PPI does not require a complete analysis of all aspects of a nation's economy or its energy sector, understanding them sufficiently to avoid costly mistakes, or to take advantage of opportunities, is important. In this manner, sustainable energy PPIs are implemented to address the negative conditions, or dysfunctions, of the larger markets which, in turn, spur the development of RE markets.

2.3.1 The Outer Ring - The Macro-Market

The energy market is but one component of the larger economy. All of the legal, political, financial, infrastructural, bureaucratic and economic forces that impact all

[3] For example, if property laws are insufficient to support a leasing program for Solar Home Systems (SHS), it may be that there are other parties, such as agricultural interests, which could join the effort to rewrite them.

other projects will impact an RE project. This sounds simple, but it is not uncommon for RE PPIs to address an issue of RE financing, for example, with little real regard for the larger financial system. If interest rates are high and a RE is capital intensive, then this is going to influence how RE is received in the market, or at least inform how much compensation is going to have to be included in the PPIs. For example, if interest rates are over 20%, then developing projects with paybacks over 3-4 years is probably not going to be a successful formula. If the legal environment is poor, either one must work to compensate for the legal system internally or one must find ways of having disputes arbitrated in a third country.

When the sustainable energy market can be viewed in this larger context, then renewable PPIs can be also appropriately designed. This has at least two applications to the renewable market. 1) Rarely does a renewable PPI work in isolation. More often it is the judicious combination of PPIs which create a proper enabling environment. Creating an investment incentive or funding window can catalyze new investment, but when combined with a production incentive, it keeps the assets working to generate new energy. 2) By viewing renewables as part of a larger market, there are often promising alliances that can be formed to overcome barriers and address challenges. These alliances cannot only deliver more effectively; they often have the effect of mainstreaming renewable energy. This latter was certainly the case in the US when renewable energy actors joined with agricultural interests to create new PPIs to support RE on farms. The result has been a boom in wind power in the agricultural mid-west.

2.3.2 The Middle Ring – The Macro-Energy Market

As noted, every country has a unique energy market in which renewables must find its place. Unless a RE system is completely off-line and funded through a third party, the influences and pressures that apply to the broader energy sector, apply to the RE as well. If there are transmission supply problems or poor credit histories with the utility, for example, then a program focusing on small-scale cogeneration of agricultural wastes is going to be just as negatively affected as a large-scale coal plant.

While each country is different, there are many common features to markets which renewable energy is normally addressed in economies in transition (EITs). Not all apply to all countries or in equal measure, but most will have more than one of these challenges:

- Significant portions of the populace live without connection to the grid or with poor service by the grid. These populations are nearly always in peri-urban and rural areas and the customer base is often living at or near subsistence levels with limited ability to pay. If electricity is provided, it is nearly always at subsidized levels making an RE project dependent on government coffers.
- The energy system suffers from a generation or transmission capacity deficit. This can be due to inefficient generation, poor maintenance, insufficient investment, increases in demand, poor transmission and/or distribution infrastructure, and so forth.

- Fuel sources which are limited, expensive, or not environmentally preferable or reliable. For example, even Brazil's huge hydro resources are both environmentally controversial and vulnerable to drought conditions.
- State control of energy either through direct control or through para-statal corporations. Often there is a poorly developed or conflicted regulatory regime.
- Other limiting factors, such as underdeveloped financial sectors, supporting infrastructure (roads, telecommunications, industrial suppliers), uncertain or unclear political and legal conditions, and difficult economic factors, such as balance of payments problems, high interest rates, high cost of inputs and imports, low technical capacity, and so forth.

Understanding the regulatory and government forces, the utility interests, the transmission capacities, the fuel sources and costs, the customer base, and other factors in the energy market is critical to understanding how to craft the sustainable energy PPI to ensure program sustainability.

2.3.3 The Inner Ring – The Sustainable Energy Market

The sustainable energy marketplace (the inner ring), its projects and technologies, has it own challenges. Renewable energy is largely a new technology and is therefore less attractive. It is also often intermittent, or variable, and therefore less attractive to customers, whether they are utilities or end-users; the systems are usually more costly on an installed basis and sometimes on an operating basis; the technology is usually imported and more technically advanced; given their size, they tend to be more distributed and therefore more difficult to manage on a unit basis, and so forth. Due to their size, cost, placement, novelty, sustainable energy projects and programs are simply more difficult to undertake than conventional ones. (Clearly we are speaking of the smaller RE projects and not the large scale hydro and geothermal, which already attract significant investment). Most of the renewable PPIs attempt to address the barriers and challenges within this ring. This is necessary, of course, but by itself, it rarely guarantees market transformation.

Added to this situation is the added complexity that many renewable applications are in the off-grid, rural poor areas of the developing world. While a natural fit for many situations, the sustainable development mandate to combine renewable energy with a other social development goals and criteria often makes development of these projects even more difficult. Creating a sustainable PPI for any sector in rural poor areas, whether it is education or health care, is difficult and requires careful consideration of long-term funding sources or alternative methods of compensation. Often it makes sense to combine RE PPIs with other economic development or social PPIs, but then the success of one program becomes linked to the success of another, often unrelated, sector. This impacts the risk profile of the project and can drive up costs.

2.3.4 The Policy Matrix – Applying the Rings Model

To evaluate projects using the rings to model the "enabling environment", a simple matrix can be used to lay out the three levels of the analysis against the three operating factors of "Objectives, Barriers, and Mechanisms". The purpose of this exercise, as is seen in some of the Case Studies in the subsequent chapters, is to understand how different PPIs approach problems at the appropriate level.

By seeing the interaction between the objectives of one level and the barriers of another, it is easier to see where a barrier on one level can impact an objective on another. It is also possible to see that a barrier on one level can be addressed at a higher or lower level more effectively. For example, a problem of securing a power purchase agreement for a renewable energy project may be best seen within the larger context of the energy market and allies sought out at that level that can support that development process. In this way, the needs of a biomass cogenerator are not different from a coal based generator.

Table 1 Matrix of the Rings Model

Rings/Levels	**Objectives**	**Barriers**	**Mechanisms**
Macro/ National/ Economic-political	Kyoto/CO2, Energy indep., Rural Econ Dev	Poor Financial, legal systems; political resistance	Econ Dev initiatives; RE finance programs, Carbon taxes
Meso Energy Sector	Diversify fuel sources; extend energy to remote areas	Utility resistance; small customer base	Regulatory reform, incentive programs
Micro/ Renewable Energy	Promote RE for Sustainable Development	Technical limits, capital cost, consumer acceptance	Tech Assistance; Finance Windows; Community outreach

2.4 Challenges and Opportunities

RE markets are too thin and nascent to behave like the larger national and sectoral markets. But it is surprising how many RE PPIs have failed over the last 20 years because they simply failed to incorporate some realities in their designs.

- Many RE PPIs programs focus on short-term obstacles in RE usage, often at the expense of the more difficult measures necessary to support, long-term development of a real market within which RE can take a logical place. Many hard fought markets, for example, have been destroyed by a well intentioned but poorly placed subsidy or grant program. Some are driven more by political expediency or "photo-op" values. There are examples of programs to install Solar Home Systems (SHS) in rural villages which did not consider long-term maintenance and operational requirements, resulting in defunct solar panel soon after the systems failed.

- Additionally, some inappropriately designed PPIs can create a "gold-rush" market that evaporates when the price support/funding is removed. An example of this phenomenon occurred in India in the mid-1990s when the government adopted a rapid depreciation incentive scheme to promote renewable power. During the limited program period, dozens of wind turbines were installed, but few of the companies that underwrote these installations ensured that there were the proper management and even financial mechanisms (such as O&M and power purchase agreements) that would ensure their sustained operation over time. As a result, there were many failures and the real energy generation potential was not achieved. If this policy had been coupled with a production incentive, such as a guaranteed tariff or a tax credit, then perhaps the combination would have created a sustained transition to greater wind generation.

As was noted above, the specific nature of each transitional PPI will depend on market specific conditions and on the particular motivators or drivers of the governments and of the other actors in energy and economic development. "Context informs content" and therefore, the design will also depend on the specific nature of the customer base and its willingness to support the RE usage. Each of these energy market factors - constrained resources, pollution prevention, energy access or poverty alleviation – will present a set of challenges to RE adoption and will likewise guide the opportunities that stakeholders can attack.

The challenge of creating PPIs that promote a change in energy stocks is to ensure alignment of the aspirations, objectives and capacities of each of the layers, from Macro to Micro. There will be natural, and sometimes healthy, tension between these objectives – a long-term policy goal of RE implementation may encounter resistance from entrepreneurs more focused on short-term cash flows. Failing this integration, PPIs can be structured to provide buffers or supports against those elements in each layer that work against RE diffusion.

The case studies below demonstrate the use of the rings model applied in this manner to explain the sequence of events that led specific RE programs and initiatives to where they are today. As such, given that most RE development has followed the process of "muddling through", we expect to see the matrix characterized by incremental, successive limited attempts at improvement. We also expect to see most RE programs being their intervention at one ring level – only to realize that intervention is also needed at other levels later on. The value of learning from these case studies is to enable RE program planners to appreciate that programs should take a comprehensive view and spend their resources judiciously at all three ring levels.

To design RE programs, the Macro level would include the larger economic or development objectives (poverty alleviation, affordable energy for economic productivity, etc), while the Meso-Ring would represent the energy options available to support those macro economic objectives. Again, sitting in the midst of this energy delivery ring, the Micro RE ring must address the concerns and forces of the larger rings in order to be relevant and sustainable.

For example, if a program to support rural economic development has identified the need for energy services, the program should look to any fuel source as a potential solution, whether it is diesel generators or Solar Home Systems. The RE solution must fit within the solution parameters of the development goals to be sustainable and ultimately transitional.

The subsequent chapters of this report present the application of the rings model to case studies derived from South Africa, Thailand, India, Philippines, and Brazil. The applications prove the applicability of the model and thereby present a methodology for evaluation of RE PPIs in other cases.

3 South Africa

3.1 Energy Market Context

3.1.1 Macro-Economic Market Conditions – The Outer Ring

South Africa rates among the best performers in corporate governance in emerging markets - a key contributor to the overall modernization of SA's economy and its increasing attractiveness to international investors - according to the Institute of International Finance. The International Monetary Fund has commended South Africa's economic performance and financial management, and has forecast 3% economic growth for the country this year. From initiating the New Partnership for Africa's Development (NEPAD) to regenerating its inner cities, and from boosting small businesses to fostering sustainable industrial development – South Africa is on a development drive.

South Africa's macroeconomic strategy is based on promoting the free market and financial and fiscal discipline. It is also aimed at economic growth, job creation and the development and distribution of basic services to all South Africans. South Africa has a world-class, modern infrastructure including a sophisticated transport system, low-cost and widely available energy, and sophisticated telecommunications facilities.

3.1.2 Energy Market Context – The Middle Ring

South Africa's energy sector is critical to the economy, and has an above average energy intensity owing to large-scale industry use. Because of the country's large coal deposits and massive investment into generation capacity in the 1970s and 1980s, South Africa is one of the four cheapest electricity suppliers in the world. SA has a highly developed synthetic fuels industry, as well as small deposits of oil and natural gas. South Africa's prospects for natural gas production increased dramatically in 2000, with the discovery of offshore reserves close to the Namibian border. The reserve, named the Ibhubezi Prospect, contains three trillion cubic feet of oil. Production will commence in 2004, and will be channeled to regulate electricity production.

Coal

Coal accounts for 75% of primary energy consumption. The majority of this is used to generate electricity. A significant amount is also channeled to synthetic fuel and petrochemicals operations.

Sasol and PetroSA are the two major players in the synthetic fuel market. Sasol is the world's largest manufacturer of oil from coal, gasifying the coal and then converting it into a range of liquid fuels and petrochemical feed stocks.

Since 2000, the company has been investigating the feasibility of replacing coal with natural gas, based on the high impending capital investment expenditures in coal mining operations and the high cost of compliance with environmental regulations associated with coal. Construction has commenced on the gas pipeline from Mozambique. The two governments have an option to jointly invest in up to 50% of the gas pipeline.

Oil and gas

In 2001, PetroSA, the SA para-statal responsible for oil and gas activities, was created in a merger. PetroSA converts natural gas into a variety of liquid fuels like petrol, distillates, kerosene and petroleum gas.

South Africa has a well-developed refining and downstream oil sector and is one of the major refining nations in Africa.

Nuclear energy

Nuclear energy does not play a major role (accounting for 3% of all energy), but is being investigated as a future potential energy source and alternative to coal. ESKOM is currently developing a cost effective nuclear technology called the Pebble Bed Modular Reactor (PBMR). Depending on further feasibility and environmental work, the PBM may become a foundation of ESKOM's future energy development.

Access

Residential use is characterized by poor access to facilities and inefficient or hazardous energy sources, such as fuel wood and paraffin being used. Although population growth has remained at the expected 2%, the number of houses in South Africa has grown by 12%. As a result, the total number of houses electrified has fallen below 70% since 2001.

The Energy White Paper, passed in 1998, hopes to prioritize this sector. The paper's objectives are to encourage affordable and accessible resources, stimulation of economic development, management of environment-related impacts and the securing of supply through diversity. The state is redefining its role in energy production and management.

3.1.2.1 The 1998 Energy White Paper

The 1998 energy white paper is the authoritative document on energy policy in South Africa. The paper sets out 5 overall energy sector policy objectives with each having earmarked policy priorities in the short medium and long term. Broadly renewable energy is address in two statements namely:

> "The research and development of alternative and renewable energy sources is [also] being promoted. As a signatory to the Framework Convention on Climate Change, South Africa intends to play a constructive role in the alleviation of environmental emissions. It is also possible that direct pressure will be placed on South African exports through environmental conditionalities."

and

> "Not only must government increase its capacity to deal with the pressing needs of the day, but it must also improve its ability to address

long-term issues, such as the development of renewable energy resources to achieve a more sustainable energy mix."

Furthermore one of the medium term activities requirements to improve energy governance is suitable renewable energy information, statistical and database systems. In attempting to manage environmental impacts of energy provision the government will

- Facilitate the monitoring, evaluation and demonstration of clean energy technologies
- Monitor international developments and participate in negotiations on response strategies to global climate change and
- Investigate an environmental levy on energy sales to fund the development of renewable energy, energy efficiency and sustainable energy activities.

In securing supply from diverse energy sources, integrated resource planning methodologies will be used to evaluate future energy supply options. A start towards all of these has been made both for the renewable energy and energy sector in general since the release of the white paper. The development and publication of the paper itself has therefore had positive impacts.

Finally, the entry of new players into the generation market will be encouraged.

This policy will initially be implemented by obliging the national transmission system to publish National Electricity Regulator (NER) approved tariffs for the purchase of co-generated and independently generated electricity on the basis of full avoided costs. Tariff based mechanisms will, however, take longer, well beyond the current subsidy approach initiated in the renewable energy white paper below. Timing on the creation of regional electricity distributors as a first step in the restructuring of the electricity supply industry will probably be five years at least anyway, prerequisites for which are the introduction of wholesale electricity pricing system, consensus on multi-market model rules and ultimately, within the inner circle, enabling renewable energy market rules.

Figure 3 SA Primary Energy

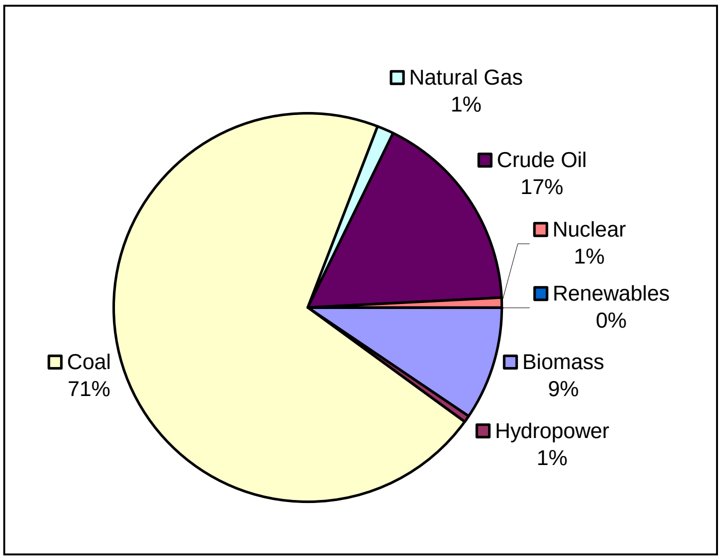
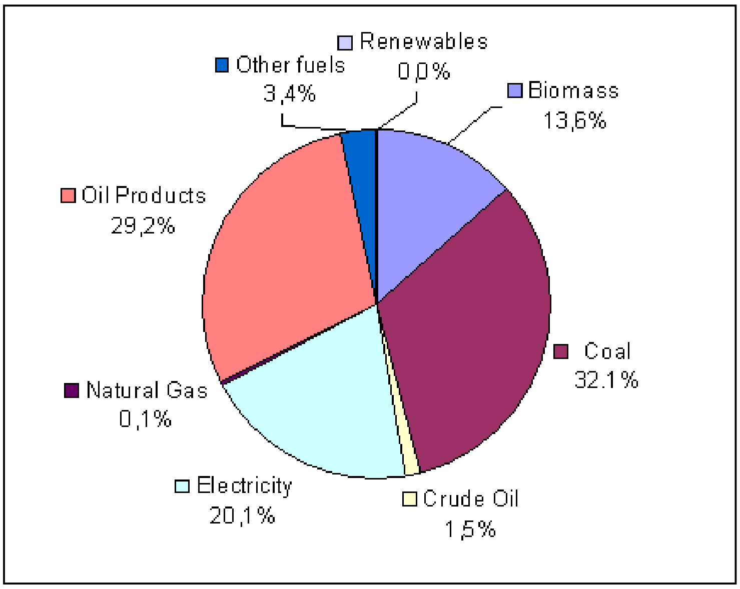


Figure 3 shows South Africa's energy consumption by primary energy carrier, while Figure 4 shows the final energy demand by fuel source. These figures highlight the dominance of coal as the primary fuel source and the contribution of electricity to meeting final demand, second only to coal.

Figure 4 Final Demand by Fuel



3.1.2.2 Electricity

ESKOM, a para-statal, generates 95% of the country's electricity, as well as two-thirds of the electricity for the African continent, and owns and operates the national transmission system.

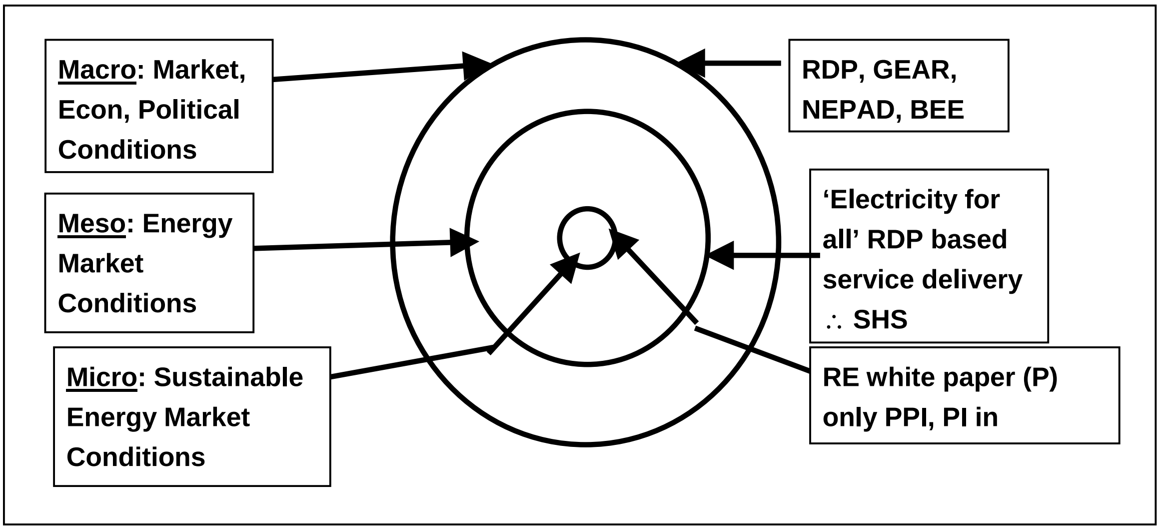
Electricity is primarily coal-fired (92% of SA's electricity is produced from coal); there is one nuclear power station (Koeberg), two gas turbine generators, two conventional hydroelectric plants and two pumped storage stations. The total South African electrical production capacity is 42 237 MW

New generation sources will not be required before 2007, and possibly only in 2010. A limited number of large industries generate their own electricity. The first private player in the industry is the US' AES Corporation, which bought 50% of Johannesburg's Kelvin power station in 2001.

The major consumer of energy in SA is industry. 70.4% of households in South Africa, responsible for 19% of national consumption, were connected to the grid in 1999 (84% of urban households and 50.3% of rural households). This figure has increased from only 40% in 1994 due to an ongoing ambitious national electrification program (Kotze, 2001).

In South Africa the total capacity of grid-connected electrical generation facilities based on non-hydro renewable energy sources connected to the network is less than 100MW. This includes bagasse-based generation facilities and six sub 10 MW hydro facilities with a total licensed capacity of 15 MW. Only four of these small hydro plants are operational primarily due to problems with power purchase arrangements. Large hydro contributes a further 653 MW.

Figure 5 Sustainable Energy Market in South Africa



3.1.3 The Renewable Energy Market – The Inner Ring

The contribution by clean electrical generation technologies to the national grid-connected generation mix is and likely will be negligible. Renewable energy activities in South Africa have, to date, been focused on the supply of off-grid energy, most notably through solar home systems. Grid connected, renewably generated electricity is seldom considered, primarily because the financial costs, particularly the capital costs involved. The off-grid electrification program was driven more by its potential competitiveness as a low cost option as it was by environmental benefits of renewable energy development.

The cost of supplying renewable energy in the off-grid context is also significantly higher in most cases than the unit cost of extending the grid. The capital cost, though, of grid extension into remote areas outstrips that of off-grid electrification. For example, Solar Home Systems for lighting and telecommunications and has been part of the off-grid concession approach to providing 300,000 connections. In addition consumption rates in newly grid electrified rural areas, often without a major anchor electrical customer, are so low that operational costs are seldom recouped.

Therefore, in the South African context, the primary driver for off-grid electrification is the comparative cost of extension of the grid into unelectrified, remote rural areas.

3.2 Policy, Program and Institutions (PPI)

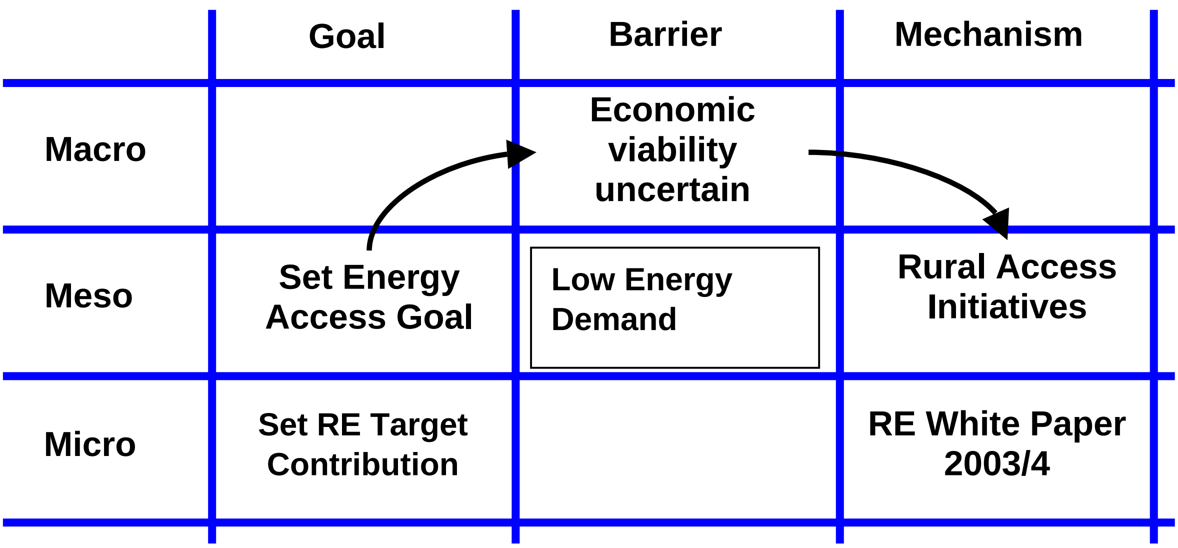
3.2.1 II.2.1. Renewable Energy White Paper 2003

The South African renewable energy white paper was approved by the cabinet in November 2003. The essence of the paper is a target of "an additional 10 000GWh of renewable energy contribution to final energy consumption annually by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro". The setting of a target and implementation of mechanisms to achieve this target are the first attempts by the South African government to bring about integration of renewable energy into the mainstream energy economy.

The Government White Paper on energy suggests that for non-utility generation, electricity tariffs shall be approved 'on the basis of full avoided costs'. It notes that 'by including environmental costs into the pricing structure, the further development of renewable and environmentally benign generation technologies such as hydro, wind, solar thermal, and waste incineration will also be encouraged' (DME, 1998). Initiatives to decide on suitable mechanisms, such as voluntary or mandatory obligations on purchase, have included workshops such as 'Towards an implementation strategy 2000', and a donor funded study on Bulk Renewable IPPs which recommended creation of a rate set aside. There has also been a debate between tradable RE Certificates and guaranteed purchase price initiated through the SEPCo project in 2002. This continues as part of the decision concerning the precise mechanisms that will be used within enabling Renewable Energy specific legislation currently in the early stages of development. On the implementation side, there is more discussion on a direct subsidy to the off-grid concession process.

Besides providing electricity as an "almost unmitigated good" (ERC/DME integrated energy planning process) to people who may otherwise not have has access to it in 15 years or more, the off grid electrification drive created significant institutional capacity both public and private (through their partnership) for dealing with its rollout while grid-connected issues received little attention or share of resources. The opportunity now lies in truly integrating the significant efforts that have gone into the off-grid process with the drive to achieve the grid-connected target. Projects within the geographical areas on the boundary between financially viable grid electrification and financially viable off-grid electrification identified through the past and ongoing hybrid mini-grid work could provide the impetus for this integration.

Figure 6 Goals, Barriers and Mechanisms



3.2.2 *Specific Transitional Programs*

Past programs which could be considered as having at least a minor contribution to increasing the use of renewable energy include the reconstruction and development schools and clinics electrification, a solar water heating (SWH) standards and testing drive as part of market establishment, a off-grid Hybrid pilot program and an ambitious off-grid solar home system electrification program ("Solar Utilities").

3.2.2.1 Rural Schools and Clinics Electrification Program

The Rural Schools Electrification Program was a Reconstruction and Development Program (RDP) initiated program that is managed by the Department of Minerals and Energy (DME). The program relied on donor funding such as from Holland, and the EU. It was considered one of the successful RDP programs, already providing electricity to schools in very rural communities where there are often no other public services. More than 2000 communities were served in just over 18 months of implementation. In many of these communities school electrification was the first tangible indication of changes under the new government. The program aimed at electrifying 16,400 schools with grid and non-grid electricity over five years.

3.2.2.2 Solar Water Heating

Apart from space heating, water heating is one of the most energy intensive household activities. Appropriately designed, sized, installed and maintained solar water heating (SWH) systems can significantly save on energy (e.g. grid electricity and fuel heated). The solar water heating industry in South Africa is not well established and SWH prices are still beyond the reach of many. Although the standards and testing for solar water heating systems are available through the South African Bureau of Standards (SABS), the demand, capacity and "pressure" to apply and enforce these standards and testing are lacking. These SABS SWH standards are also outdated and do not adequately make provision for low cost SWH systems that would be most appropriate in poorer areas. Consultations by the DME with the SABS and the SWH industry have started to "revive" the potential benefits of solar water heating.

The different aspects of solar water heating which need to be investigated are:

- Technical specifications of the system
- Infrastructure for testing
- Infrastructure for research and development
- Demonstration, promotion, monitoring and evaluation

3.2.2.3 Off-grid electrification

This program is an example of renewable energy, namely solar home systems, fitting into part of a larger program – the national electrification drive. This larger energy program in turn formed part of the original reconstruction and development plan of the national government initiated in 1994. The actual achievements of the RDP electrification program under the first democratic election promise of the ANC "electricity for all" was that 3.2 million new household were connected (both grid and off-grid) between 1994 and 2000. The program was financed partly through a surcharge on ESKOM sales of electricity and partly through debt financing by the respective distribution utilities. Through an agreement between the National Electricity Regulator and ESKOM, a transfer of R300 million (US$1=R6.4) per annum was made to municipal and regional utilities. On average the total annual investment in electrification over this period was R1.2 billion.

For the off-grid concessions (Solar Utilities), private or non-governmental organizations have been provided a concession for a defined area and were contracted to supply this service through the installation of SHS. The concessionaires receive a subsidy of R3 500 per installation (app 80% of system cost) with the remainder coming from the homeowner either through cash payment or through targeted finance schemes. The homeowner is also responsible for regular payments to cover operation and maintenance costs.

The off-grid electrification program can be considered to be an energy market or (middle ring) PPI rather than a renewable energy (inner ring) one. It also fits within the macro economic sphere (outer ring) as a service delivery initiative. The viability from the private investors' perspectives is yet to be proven but is undoubtedly a function of volume of systems installed. Similarly, low levels of usage typical for low income grid-electrified homes are often well below that required for investment recovery. The situation in the off-grid program is currently uncertain as there has been insufficient uptake by homeowners. But it will depend on penetration levels and may also be sensitive to operational costs being in excess of those initially expected in the deep rural environment.

Te electrification program is fundamentally a long-term social investment program with an indirect future return on capital. The problems identified so far are that financing such a program from within the electricity distribution industry places an undue burden on the utility and jeopardises its sustainability. The financing mechanism also is not transparent and is difficult to coordinate with other infrastructure investment programs. Finally, it is not clear that there is adequate local acceptance of the SHS technology as it can be regarded as "inferior" energy to grid based electricity. Some have argued that homeowners would rather wait for the grid than be considered "electrified" with SHS.

3.2.3 Sustainability of the Current Initiatives

It is intended that the current target will be achieved through a direct fiscal subsidy for the next 4 years with a review of the policy thereafter. It is therefore unlikely that any other incentive mechanisms such as feed-in tariffs, tradable renewable energy certificates rebates will be implemented in the next 5 years. Imposition of renewable energy purchases by the proposed regional electricity distributors is also unlikely given that this could make renewable energy into a "business-as-usual" condition and make any certified emission reductions (CER) ineligible for consideration under the CDM and the Kyoto Protocol. The potential revenues from CERs are approximately R440 million annually compared to the required fiscal subsidy of R240 million.

The analysis used in the study (DME, CaBEERE 2004) for optimising RE technologies in achieving the 10,000 GWh target has been based on a "least-cost-per-kWh-first" approach. This approach has been compared to the approach of optimising RE technologies based on pursuing a "lowest-cost employment creation" strategy, in terms of which employment creation would be maximised. The marginal effect of pursuing this approach is that jobs created will increase by a further 12,543 new jobs. However, this will require an additional R217 million in subsidies per annum. While the final conclusion of this paper highlights the need to combine renewable energy PPIs with the PPIs from the Macro and Meso spheres of influence, it is important that macro-economic level objectives be seen as a by-product of energy delivery and not an additional function and responsibility of the RE PPI itself.

3.3 Summary

Most of the RE PPIs to date, other than the Government's White Paper and some ESKOM related R&D and small demonstration programs, have been individual donor provided information, outreach and demonstration projects. While many have had positive impacts on local welfare and access in the poorer areas where they have been focused, there has yet to be any sustained transition to RE in the larger context. It is also clear that while the Government, in its recent White Paper, believes that RE can play a significant role in rural and poor economic development, there has been little movement on the ground. Reluctant support from the national utility, which is also wrestling with more fundamental issues of sectoral reform, including the separation of generation, transmission and distribution, is also a major barrier to scale up. Without active and engaged support from ESKOM, the success of RE programs will be slowed.

The ambitious Solar Utility, which might have demonstrated a transformation of the RE market in rural areas, is currently limited by slow rollout rates and curtailed funding, presumably due to plans for long-term grid electrification and low customer acceptance. By looking at this Solar Utility initiative through the spheres of influence model it becomes clearer that it was actually an energy and macro economic initiative rather than one focussed on renewable energy. The recently approved renewable energy white paper and the target on the other hand does demonstrate that South Africa has attempted to develop a market-based solution by focusing on least cost options and long-term program sustainability. While the concept is in keeping with a market transition, the enabling environment, including utility buy-in, marketing and outreach to support customer buy-in, appropriate financing, and so forth are yet to be established. PPIs developed in the implementation of projects to reach the target should be focused on addressing these barriers in concert with the off-grid electrification and mini-grid hybrid initiatives.

4 India

4.1 Energy Market Context

Since independence, India's energy sector has been largely in the hands of the government, both federal and state. The electricity generation function in India is shared by some of the central agencies such as the National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), among others, and the 25 state electricity boards from the individual states (more than 25 states). Electricity distribution function rests primarily with the State Electricity Boards (SEBs), who depend on the central electricity generating agencies to augment their own generation. There are several privately owned utilities in India, such as Tata Power Limited and Reliance Energy, but these are the exceptions. With the exception of these private utilities and a few IPPs, the electricity sector has been seen more as a public works than as businesses and several SEBs are technically insolvent, surviving only with state budget set-asides. Complicating this process is that the SEB's also acted as the regulatory and tariff setting body, although this is changing.

Over the last several years, however, there has been a shift in the generation and distribution of the electricity as a result of sectoral reforms and new provisions for independent power production. During the last decade, at least five states have gone through the reform process that has attracted private sector entities in this market. Government of India recently enacted the Electricity Act 2003, which changes the ownership functions of the supply chain from generation to distribution. Transmission still rests with the Power Grid Corporation of India Limited (PGCIL), an entity under the Ministry of Power (MoP). With the new act of 2003 and the private sector interests in the market, some of the "cost of provision" issues will be balanced with the issues of reliability and cost of generation. The Electricity Act 2003 and its provisions for the open access for distribution act as the "middle ring" macro energy market feature. Renewable energy sources in this context will play a key role in the energy sector to meet the increasing consumption patterns (per capita consumption increased from 15.6 kWh during 1950 to 366.12 kWh in 2001)[4].

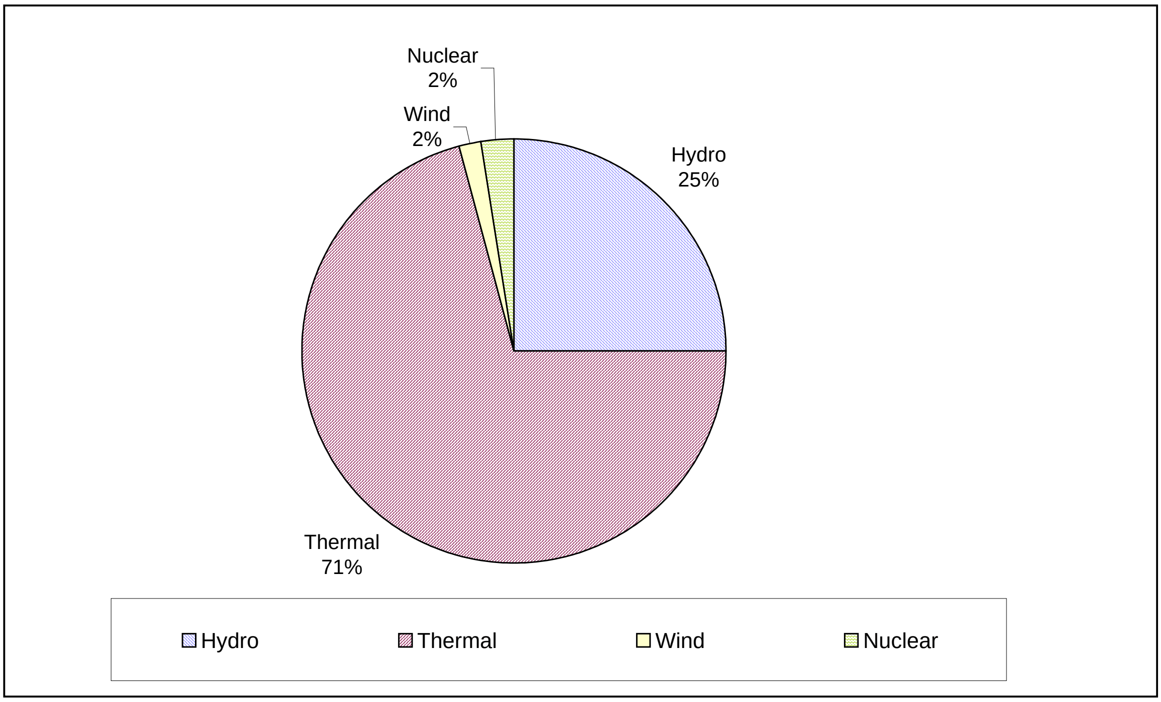
The Indian government has a strong mandate, as well as political pressures, to provide electricity to the rural areas. The agricultural sector is not only a critical part of the total economy, it is often the only source of income in the country's 580,000 villages. As a result, rural agricultural tariffs are heavily subsidized by the residential, commercial and industrial sectors. As the Indian economy moves rapidly towards service industries in urban areas, there is likely to be increased pressure to rationalize electricity tariffs with the mandate under the Electricity Act 2003. This change is a clear example of the "outer ring" macro market condition.

[4] Annual Report 2002-03, Ministry of Power

4.1.1 *Existing Energy Mix and Targets*

Electricity generation in India is largely based on the thermal resources. Figure 7 below illustrates current share of generation mix out of the total installed capacity of 109,868 MW installed as of October 31, 2003.

Figure 7 Share of Generation Source (Total: 109,868 MW)



Source: Reports of Central Electricity Authority

The Tenth National Plan of 2001 set the target of 100,000 MW of additional generation capacity over the next decade, which puts tremendous pressure on the public and private sector power generators. Concerns of higher dependency on fossil fuels coupled with increasing technological capability within the country means that renewable energy may play an important role in the Indian electricity mix. Political and social stand of GOI in the world treaties will also play an important role in the evolving renewable energy markets.

4.1.2 *Political and Social Drivers for RE Usage*

Indian society has traditionally depended on various forms of renewable energy sources in both their households as well as the small industries. With the spread of the electric grid over time, centrally produced and distributed electricity sources made in-roads in local energy markets. New renewable energy technologies have been positioned in recent programs as not only a source of electricity in unelectrified villages but also as a foundation of new economic development. . One of the well-illustrated examples of such an initiative is the National Project on Biogas Development that was started in

1981-82 and has benefited approximately 3.368 Million families. Another example is the Research and Development Program on Biomass Gasifiers. So far, 1796 gasifier systems with an aggregate capacity if 51.3 MW, have been installed (Gokak Committee Report 2002).

Several programs are now trying to link power generation and delivery with productive uses in rural areas by using biomass as the fuel source and pumped water as the measured output. Renewable energy in India has been linked with the climate change debate as well. India signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and ratified it in November 1993. India acceded to the Kyoto Protocol in August 2002. Under the UNFCCC, India does not have binding GHG mitigation commitments in recognition of its relatively low contribution to the greenhouse problem as well as its modest financial and technical capacity. Among the various provisions under the Kyoto Protocol, India has shown a potential interest in the Clean Development Mechanism. There has been significant interest in renewable energy and carbon offset opportunities, with at least 6 Joint Implementation stage projects coming up in India at the demonstration stage. Increased emphasis on the RE is setting the stage for the “inner ring” sustainable energy market.

4.1.3 Renewable Policy in the Rural, Off-Grid Sector

The total number of villages electrified since 1951 has increased from 3061 to 508035 by 2001, representing 86.76% of all villages. The 10th five-year plan proposes to cover all villages that can be electrified through grid extension. Remaining remote villages are to be electrified by 2011-12 through the use of non-conventional technologies.

4.1.4 Renewable Energy Achievement of Targets in India

Table 2 Renewable Energy Potential in India

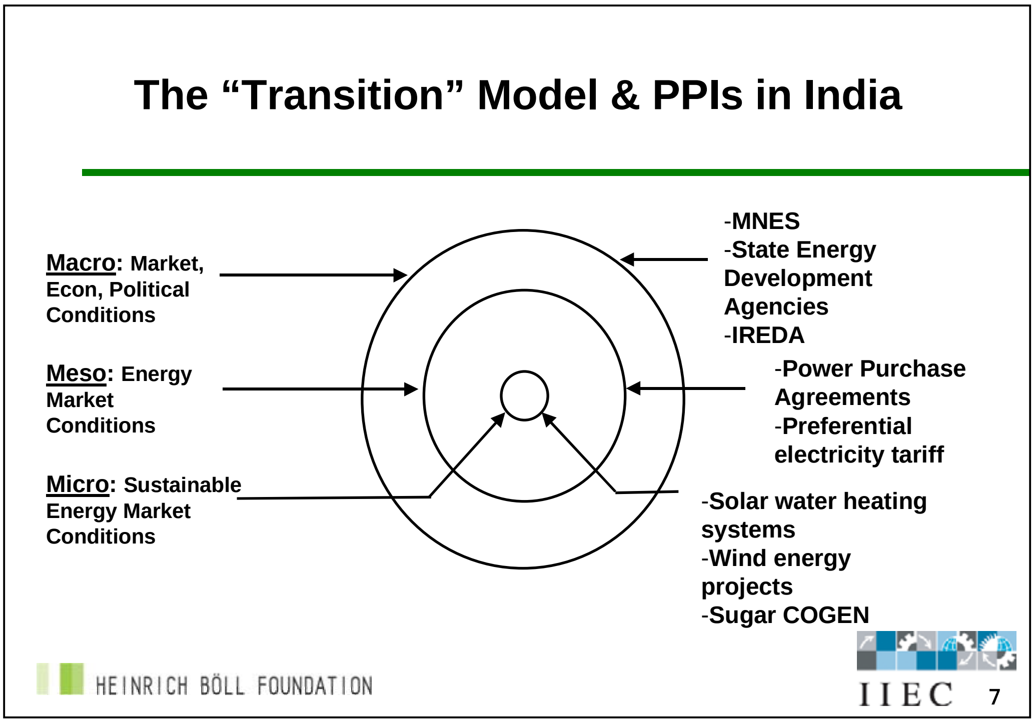
Technology	**Potential**	**Achievement**		
		1999-2000	**2000-01**	**2001-02**
Wind (MW)	45000	1081	1267	1640
Small hydro (MW)	15000	210*	1341	1423
Biomass Power (MW)	19500	222	273	420
Biomass gasifiers		34	35	42.80
Solar PV (MW/sq km)	20	1.04	1.615	82**
Waste-to-energy (MWe)	1700	15.15	15.15	17.10
* Includes capacity under 3 MW only				
** Installed capacity in MW. Of this, 29 MWp SPV products have been exported				

4.2 Policy, Program and Institutional Initiatives

The increased use of renewable energy technologies has been facilitated by a variety of policy and support measures from the Government of India[5]. In early 1990s, the GOI created the Ministry of Non-conventional Energy Sources (MNES) and entrusted it with the responsibility of policymaking, planning, promotion and co-ordination of various aspects of renewable energy. MNES, which created the enabling institutional framework for RE promotion, is responsible for integrating renewable energy sources in the mainstream electricity markets by promoting research and development, addressing import barriers for new technology, and implementing a media plan to popularize the non-conventional energy.

Please see Figure 8 for a graphic representation of the PPI's instituted by the GOI to address the specific challenges to renewable energy development at the macro, meso and micro levels.

Figure 8 Sustainable Energy Market in India



4.2.1 Government Initiatives in Promoting Renewable Energy

Over the last decade, the GOI has promoted several RE favorable fiscal and policy initiatives. Some of the initiatives include income tax holidays, accelerated depreciation, concessions in import duties, and capital and interest subsidies. Even the individual states have promoted a few schemes including energy buy-back, power wheeling and banking facilities, sales tax concessions, electricity tax exemption, and capital subsidies.

[5] http://mnes.nic.in/frame.htm?majorprog.htm

As a long-term policy thrust, MNES has proposed draft renewable energy policy and program interventions required to achieve the goals of meeting the minimum rural energy needs, providing decentralized off-grid energy supply and generating grid quality power based on renewables. This draft also sets medium term goals to be achieved till the year 2012, which are to achieve a 10 % share in the new power capacity projected up to 2012 (approximately 10,000 MW), deployment of solar water heating system in one million homes, electrification by renewables of at least 6000 un-electrified villages, deployment of 5 million solar lanterns and 2 million solar home lighting systems, coverage of 30 million households with improved wood-stoves, and setting up of additional 3 million family size biogas plants. The Renewable Energy Plan 2012 aims at increasing women participation in renewable energy programs for their employment and empowerment; availability of minimum cooking energy to all households; to provide cost effective energy for water pumping, irrigation, drinking and for rural electrification and general rural development through Integrated Rural Energy Program. Renewable Energy Plan 2012 essentially creates an enabling environment for financing of RE projects in the mainstream energy market.

4.2.2 Financing of Renewable Energy in India

Several financing institutions and banks have promoted non-conventional energy sources in rural, residential, industrial, and commercial applications. To bring greater focus onto the special financing needs of renewable energy, MNES instituted the Indian Renewable Energy Development Agency (IREDA), established in 1987 as a public sector enterprise. Over the past 15 years, IREDA has evolved into a unique developmental financial institution in the renewable energy sector, reaching out to the individual user and providing micro-credit through financial intermediaries. So far, IREDA has leveraged nearly $1.25 Billion worth of projects, out of which the actual disbursement has been to the tune of $670 million. In the year 2002 alone, loans supported 108.5 MW of installed capacity of power generation from renewable sources. IREDA has acted as the financial intermediary to the multilateral and bilateral banking institutions like The World Bank, Asian Development Bank, as well as several national donor agencies, such as Germany’s KfW, and Japan’s ICA. Total commitments from the various financial institutions have reached approximately $80 million over the last decade. Recognizing commercial lending opportunities, Canara Bank and Syndicate Bank have initiated a United Nations Environmental Program (UNEP) sponsored “interest buy-down” financing scheme to popularize solar-thermal applications in the residential sector.

4.2.3 Specific Policies, Programs and Institutions

There are several examples of renewable policy promotion in India that have succeeded and failed. As the promotion of the renewable sources benefited from GOI’s thrust by way of formation of a separate line ministry (MNES) and creating conducive financing environment by developing IREDA, a number of programs can be cited as good examples. This section presents two case studies, one of which promotes a particular technology and the other that brings forward the benefits of institutional aspects of promotion of renewables.

4.2.3.1 Case Study 1: Solar Thermal Program[6]

Background:

MNES promoted the Solar Thermal Energy Program to develop markets and commercialize solar thermal systems, such as solar water heaters, solar cookers, solar air heaters and dryers etc. One of the components of interest in this program is the Solar Water Heater Program. India receives solar energy equivalent to more than 5,000 trillion kWh per year, which is far more than its total annual energy consumption. The daily average global radiation is around 5 kWh per sq.m per day with the sunshine hours ranging between 2300 and 3200 per year.

Implementation:

MNES supported an interest subsidy scheme through IREDA and a few designated banks to promote solar water heating systems. This helped offset the high initial cost of the systems, provided an acceptable pay back period to the end users, stimulated the market and helped to establish a strong manufacturing base. The interest subsidy scheme has been extended for the entire Tenth Five Year Plan. Under the extension scheme, the banks have been authorized to finance solar water heaters up to a capacity of 5000 liters instead of 2000 liters. The subsidized rate of interest is 5% to the end users. Considering the prevailing interest rates in the market and structure of income tax, the rate of interest for loans to end users in the commercial category through IREDA has been reduced to 7% from 8.3%. Housing co-operative societies and developers of real estates have also been made eligible for soft loans for installing solar water heaters in bulk at an interest rate of 5%. However, all borrowers taking loans at 5% interest rate (except individuals) are not allowed to take accelerated depreciation on their investment. MNES and IREDA schemes are now looking at new technologies such as evacuated tubular collectors under the soft loan schemes.

To encourage local governments to accept the mandatory provision for solar water heating systems, a provision for central financial assistance to municipalities and municipal corporations has been made in the new scheme. MNES has extended financial support in popularizing this scheme. The level of assistance is $ 11,000 for municipalities and $ 22,222 for municipal corporations and is meant for training, study tours, awareness creation, demonstration, and preparation of brochures/manuals, creating the infrastructure for implementing the mandatory provision.

Results:

A large number of solar water heaters comprising collector area of about 30,000 sq. m have been financed up to December 2002. A total collector area of 680,000 sq. m. has been installed in the country so far. There has been substantial increase in the number of manufacturers supplying the solar water heating system in the country.

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[6] http://mnes.nic.in/snov02.htm

Features:

There has been a substantial success in creating an enabling environment for solar water heating systems in domestic energy use. Two important aspects of this transition have been market development and the enabling environment, largely created by the financial subsidies. However, this program has not contributed to a sustainable energy market as this clearly falls outside the macro energy market.

4.2.3.2 Case Study 2: Wind energy program

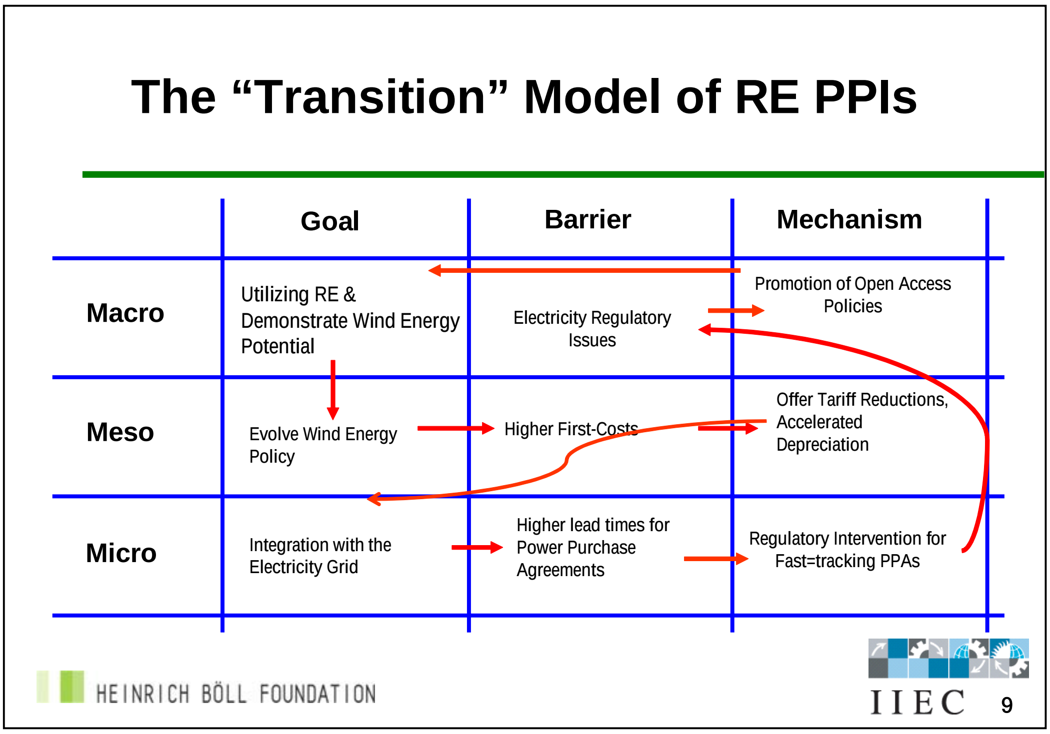
Background:

This case study represents the institutional building in the renewable energy sector. Over the last several years, MNES has created quasi-governmental institutions all across the country. Maharashtra Energy Development Agency (MEDA) was registered as an independent society and started functioning in July 1986. MEDA's objectives are primarily to develop renewable energy and facilitate energy conservation in the State of Maharashtra. Since inception, MEDA has promoted renewable energy use and energy conservation in several sectors including rural and urban households, industries, and distributed generation.

Implementation:

MEDA created a positive environment for renewable energy use in the state of Maharashtra. As a part of the government’s changing funding options, MEDA created its own business model by generating capital buy-down grants from the state and central governments and using its own internal capabilities to develop the market. Of great interest in this technology development, MEDA’s steps towards creating its own capacity to generate wind power and to demonstrate the electricity wheeling protocols have helped in creating a conducive environment to the power producers.

Figure 9 The “Transition” Model of RE PPIs



Results:

Investor-friendly policy shifts by the Government of India and Government of Maharashtra since 1983-84, have resulted in effective commercialization of wind power. Out of the total installed capacity of 3700 MW renewable power in the country, wind power projects comprise 1702 MW. Wind power accounts for 1.69 % of the national installed capacity in India. Assessed wind power potential in the country is about 45,000 MW, while in Maharashtra it is 3650 MW. Investor-friendly policies of the Government of Maharashtra and technical viability proven by demonstration projects have attracted private investment of more than $ 444 Million in the wind sector so far. Nearly 400 MW of private wind power projects have been installed in the State. Asia's largest Wind Park has been developed at Vankusavade plateau of Satara district.

Features:

MNES and MEDA created strong investment-friendly enabling environment to push wind energy in Maharashtra. MEDA also ensured the sustainability of the projects by co-investing in the wind power capacity. MEDA as a not-profit society used the revenues for developing further potential in other renewable energy sources. This is a unique Indian example of institutionalizing renewable energy policies and programs and effectively integrating them in the state budgets in order to promote renewable energy sources in India. With demonstrated integration of wind power in the western electricity distribution grid in India and ongoing efforts towards tariff rationalization for RE in Maharashtra, this program can be termed as a perfect preamble of RE transitioning.

4.3 Summary

The current low level of electrification and the additional requirements for Indian electricity generation, transmission, and distribution remain a challenge. GOI, having recognized both political and societal pressures, has taken several steps to fill the gaps by promoting non-conventional energy sources. A structured approach by way of establishing the line ministry (MNES) and a financial intermediary (IREDA) are examples of enabling environment created to impact the meso energy market. Both case studies exhibit the potential renewable energy has in India to a great extent, with contrasting features. The case of solar water heating system exhibits the efforts that a government mechanism can take to commercialize and diffuse the technology by creating an enabling environment of financing, technology stewardship, and a market based savings approach. Several other technologies in India can be promoted in the similar way.

The second case study exhibits a different role of an agency promoting renewable energy that can build a business model to sustain by itself. One could draw a parallel with a typical private entity that can reap the benefits of an enabling environment created by the directed wheeling approach and buy-back guarantees. Several other distributed generation technologies, supported by the enabling environment and the capability in manufacturing can potentially be disseminated in the electricity sector in India, riding on this transitions example.

Important lessons learned from the Indian analysis include how an enabling environment helps technology promotion, role of financial capability clubbed with a specific fiscal measure, and adaptability of technologies in a large-scale promotion. Though the success of renewable policy is illustrated in the Indian case studies, a large-scale promotion effort in the mainstream electricity market has yet to be demonstrated entirely.

5 Brazil

5.1 Energy Market Context

5.1.1 Energy System Description

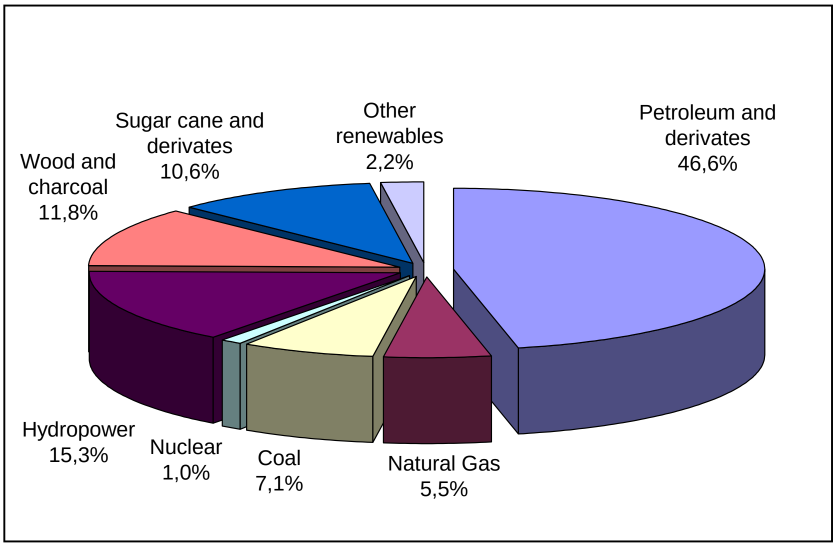
Brazil uses energy from different sources, and is recognized by its large and integrated electric grid. The table below presents the availability of main sources and their evolution from 1995 to 2000 (expressed in Tons of Oil Equivalent (TOE)). The numbers are presented graphically in Figure 10.

Table 3 Energy sources and availability

Source	1990	1995	2000
Petroleum and derivates	56614	69031	84778
Natural Gas	4230	5289	10044
Coal	9447	11811	12904
Nuclear	587	894	1772
Hydropower	18660	23141	27772
Wood and charcoal	28180	22975	21482
Sugar cane and derivates	18460	22225	19252
Other renewables	2104	2887	4023

Source: Ministry of Mines and Energy. National Energy Balance, Ed. 2002

Figure 10 Energy matrix (2000)



Some points are relevant:

- Petroleum is still the most important fuel source for Brazil, providing nearly 50% of total consumed energy. In the last 20 years, Brazil has increased its own production of petroleum and other fuels and now provides 90 % of the country's needs.
- Natural gas use increased from 3.1 % in 1990 to 5.5 % in 2000. The availability of Bolivian gas supplied by a new pipeline allowed for the construction of several thermal plants and the conversion of industrial equipments (boilers, furnaces) and vehicles.
- The role of wood and charcoal as a primary source of fuel in rural areas is being reduced, due to elimination of native forests and the availability of other sources (Liquid Petroleum Gas (LPG), electricity).

Brazil is recognized for its large and integrated electric system. Brazil's hydroelectric generating capacity is one of the largest in the world, supplying 62,000 MW, or 86%, of the nation's installed base of 72,000 MW. There is still good potential to be exploited, with more than 200,000 MW that can be added that take advantage of the hydro-geologic condition: when the systems in the North are in the dry season, systems in South and South-East are in the rainy season.

A combination of different factors, especially droughts, rising electricity demand and a long-term lack of investments led to a severe supply crisis in 2001. An emergency power program was created, based primarily in the installation of thermal (fossil fuel) plants with capacities from 10 to 350 MW. These plants are kept in a stand-by status in case reservoir levels get close to a critical level (in November 2003, levels in North-East system dropped to 2% over security levels).

Voluntary energy efficiency programs, launched during the crisis, supported the radical measures imposed by the Government of Brazil. There are no official numbers about the contribution of these programs, but they were extended as a permanent initiative.

In 2002, an expansion plan was announced, and the participation of so-called "alternative" sources was expected to increase from 3% (2001) to 5% (2004). The table presents the expected numbers for electricity generation expansion in Brazil.

Table 4 Expansion in generation (MW)

Source	**2002**	**2003**	**2004**
Hydro	3050	2421	3122
Thermal	2530	3928	3622
Small hydro	134	119	n/a
Cogeneration	83	500	n/a
Wind	261	394	393
TOTAL	**6058**	**7362**	**7137**

Source: "Energia Brasil" Program

5.1.2 Legal Framework

The Federal Constitution, published in 1988, determined that energy is a public service. As a result, utility concessions and authorizations are awarded through a bidding process. Subsequent laws that restructured the energy sector introduced new agents such as independent consumers (large consumers that can purchase electricity directly from generators), producers and traders. It also granted them open access to transmission and distribution grids. New opportunities were also created for renewable sources. For example, a wind farm or a small hydro plant now can be built specifically to supply a large consumer. Some of the elements of the new laws have acted as market drivers for renewable and sustainable energy development in Brazil. Some of the fundamental concepts of the new laws were as follows:

- Concessions and authorizations are non-exclusive and, for smaller power projects, only a formal communication to the regulator is required (for hydropower up to 1MW and thermal up to 5 MW).
- It redefined what is an independent producer, that can sell to utilities and independent consumers, with specific economic incentives for renewable power.
- Utilities are required to buy (and sell) energy regardless of access to transmission and distribution systems.
- In December of 1998, the regulatory agency (ANEEL) and the Ministry of Sciences and Technology agreed to start implementing actions related to climate change, considering the vulnerability of energy sector to climate factors. In 2002, the Brazilian National Congress ratified the Kyoto Protocol.
- In 1999, ANEEL established reference values ("normative values") to be considered by utilities in respective tariff mixes, according to generation source. It allowed long-term power purchase agreements with generators, including renewable providers. These values were revised in 2003.
- In 1999, a resolution required investment from utilities in energy efficiency and research and development, and includes the possibility of investing in renewable technologies.

Other initiatives are under consideration by the Federal Government and Chamber of Deputies[7]:

- Reduction in connection and transmission costs for small hydro and renewables plants.
- Creation of a development fund aimed to promote regional development and competitiveness based on renewables.
- Creation of a minimum quota of renewable energy for systems based on fossil fuel generation.
- Creation of a minimum quota of renewable energy in the expansion of generation capacity, to be followed by utilities.

[7] Winrock International. Perspectives of New Renewable Sources in Brazil.

5.1.3 Electricity Prices

According to ANEEL, the Brazilian Regulatory Agency for the electric sector, average prices for electricity (according to each region and class of consumers) are presented in the table below.

Table 5 Energy Prices in Brazil

Class	North	North-East	South-East	South	Central-West	Brazil
Residential	201,59	187,44	253,42	227,80	216,61	233,40
Industrial	67,23	84,58	117,08	120,23	120,16	108,02
Commercial	185,18	187,00	213,49	196,97	202,47	204,78
Rural	144,43	117,33	143,00	117,79	130,46	128,18
Public lighting	118,49	115,24	135,57	121,68	118,40	126,56
AVERAGE	**131,94**	**174,53**	**161,36**	**124,42**	**173,88**	**161,93**

ANEEL – Agencia Nacional de Energia Eletrica (www.aneel.gov.br). Reference: August 2003. Prices expressed in R$ (Reais). Reference: US$1 = R$ 2.90

There are substantial differences between regions and consumer classes within the same region. Residential consumers pay more for electricity than industries, although this difference might be reduced in the future.

5.2 Policy, Program and Institutional Initiatives

The utilization of renewable energy in Brazil addresses many relevant points:

- The increasing demand of energy and limitation of hydro generation in South and South-East regions, where the main consumers are located.
- The environmental costs of traditional energy sources.
- The necessity of reaching isolated communities.
- The commitment of Brazil in expanding the renewable share in the energy matrix.
- The development of Brazilian technology and independence from external sources.

The Government of Brazil considers the expansion of renewables fundamental in the expansion of generation capacity, as a proper form to explore the large identified potential of these sources in Brazil (sponsoring, for example, the development of Wind and Solar National Atlases) but also reinforcing its commitment with climate change agreements.

The regulatory agency (ANEEL), the Ministry of Sciences and Technology and other federal organisms stimulate the expansion of renewables in Brazil. The mandatory investments in research and development and end-use efficiency (representing 1% of annual revenues of electric companies – generation, transmission and distribution) create a significant source of financial resources for universities, NGOs and private companies to design and install systems utilizing solar, biomass, wind and other renewable sources. Supporting activities, such as training of professionals and communities, are integrated to these projects.

5.2.1 Review of Overall PPI Initiatives

The Government of Brazil has a commitment to supply energy to all communities, as a social and economic development mechanism. The expansion in supply, however, does have an environmental impact, both locally and internationally including the Kyoto Protocol. The challenge is to create policies which promote the development of a competitive and sustainable RE market. The main barrier is the relatively low price of hydropower that limits new investments in more expensive renewable energy.

5.2.2 Specific Policies, Programs and Institutions

5.2.2.1 PRODEEM

PRODEEM (Program for the Energy Development of States and Municipalities) directed by the Ministry of Mines and Energy, is the largest program in terms of installed and expected capacity. Its principal objective is to make electricity available to the rural population in order to promote social and economic development. Although the program allows the utilization of any energy source, for the most part photovoltaic systems were bought and installed for power generation, public lighting and water pumping. The program installed more than 8700 systems and a total power of 5200 kW up to 2002.

The program faced several difficulties, including long-term maintenance and operation, and is under re-evaluation. One alternative is to develop projects tied to productive use of energy. The GOB expects to test business models, financial mechanisms and implement training activities, as well as a network to disseminate information, using intermediate agents such as industrial and commercial associations, cooperative, small entrepreneurs, NGOs, universities and suppliers.

5.2.2.2 LUZ NO CAMPO (LUZ PARA TODOS)

LUZ NO CAMPO ("Light in the Countryside") program was specifically designed to supply energy to remote, rural communities. Although focused in grid extensions, some specific projects include the utilization of PV panels to generate energy. An example is the program led by the utility in the State of Bahia, under which 9,000 home systems are being installed.

In 2003, the program was converted into LUZ PARA TODOS (“Light for All”), including urban communities as target. Brazil has more than 10 million people that do not have access to electricity. The total investment is about R$ 7 billion (approximately US$ 2.4 billion) and will be implemented in partnership with State Governments and ELETROBRAS (federal electricity company).

LUZ PARA TODOS considers three different alternatives for supplying electricity to this population:

- Grid extension
- Distributed generation (for small communities)
- Individual (household) generation

The concept is to create a new model of supply, and considers the utilization of renewable sources especially to isolated communities. The transition from conventional – hydro and fossil fuels – sources to renewables is very attractive, specially because the majority of the poor, rural population lives in the North and North-East, where solar and biomass are plentiful and therefore viable options.

5.2.2.3 PROALCOOL

This is Brazil’s most significant, in terms of numbers, program ever conducted. After the second petroleum crisis , Brazil, under a military government, began a program to promote the utilization of combustible alcohol (specially ethanol) as fuel for vehicles.

Using sugar cane as its base, the program encouraged large investments in biofuel technologies (new sugar cane specimens, soil preparation and motors development), reaching a peak in the middle of the 1980’s when more than 90% of all vehicles produced in Brazil used alcohol as fuel. The program declined as the international price of petroleum dropped and sugar prices increased.

The main contribution, not considering all technological development, was the addition of alcohol to gasoline, which remains at 20% today. This has not only limited oil imports, but has also reduced automobile emissions.

5.2.2.4 PCH-COM

PCH-COM (Small Hydro Power Development and Commercialization Program) was created by Eletrobras in 2001. Its objective was to stimulate the installation and modernization of grid connected SHP by private companies, and aimed to reach a total of 1,200 MW of generation until 2003. The main incentives are:

- Possibility of immediate commercialization of energy.
- Technical support from Eletrobras
- Power purchase agreement from Eletrobras

The main problem was the relatively low price offered from Eletrobras to energy producers, which did not create any interest from entrepreneurs to develop projects.

5.2.2.5 PROINFA

PROINFA (Alternative Sources for Electric Energy) is a program launched by Federal Government in 2002 to increase the availability of electricity from renewable sources. Under the program, a financial mechanism was created to assure that all energy generated is purchased by Eletrobras, and to ensure that the share from renewables in additional generation reaches 10% (minimum) by 2020. Resources from a special fund (named CDE – Energetic Development Account) guarantee this purchase. The energy bought by Eletrobras will be diluted in existing sources, compounding a mix with competitive prices.

The program is under development, and results will depend on the determination of reference values for each source. Projects are in the pipeline, and definition of these values are expected to occur by the end of 2003.

The program considers the integration of all market agents – investors, designers and suppliers – to become a success. To encourage the investment in renewables, PROINFA announced reference values to energy generated according to each source, as indicated in the table below.

Table 6 Normative Values – PROINFA

Type	**Source**	**Normative value (R$/MWh)**
Biomass	Biogas	166,31
	Rice	108,17
	Wood	116,05
	Sugarcane	119,61
Wind		181,46
Hydro	Small-hydro	114,74

Source: Ministry of Mines and Energy, PRODEEM

These values refer only to generation costs, and would be considered for a long term (15 years) PPA with ELETROBRAS. Reduced costs for connection and transmission tariffs are also considered, so the final price for energy generated from PROINFA can be very competitive.

5.2.3 The New Electric Model

In December 2003, GOB published a Temporary Decree (that needs to be evaluated by the Congress) with significant changes in the energy sector. A centralized planning for expansion and the control by GOB and its agents of energy transactions are the main innovations.

It means that GOB can act as a key stakeholder, supporting investments in renewable energy. With the support of PROINFA and other existing programs, the decisions to invest or not in new renewable generation might only come with governmental directives.

This Decree is still under discussion, and different opinions have been announced. If approved without significant changes, industries and large consumers (with demand greater than 500 kW) can purchase electricity directly from independent producers. The question is if these consumers will consider renewable energy to be an additional benefit. While many will not, some analysts foresee a great new opportunity for CDM mechanisms to support new generation.

5.3 The Transition Model and a PPI Case Study

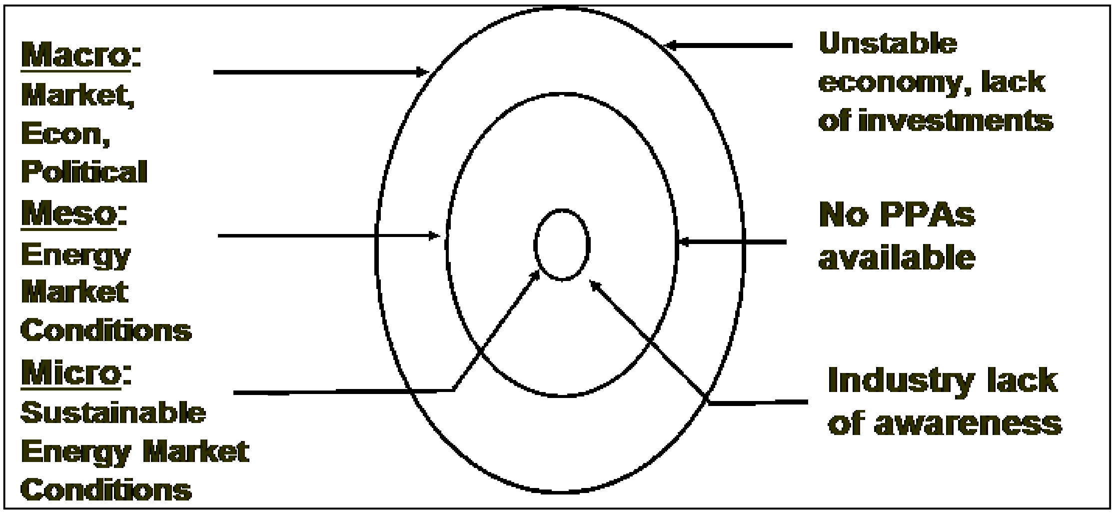
5.3.1 Transition Model and PPIs in Brazil

As discussed in the previous sections, Brazil has developed successful programs for increasing the utilization of renewable sources in spite of the cheap hydro-electricity.

Due to difficulties in expanding its hydro capacity, fossil fuel will remain a critical part of the generation mix. For example, natural gas more than doubled its share in the energy matrix from 1990 to 2000. However working against that, the Government of Brazil has assumed several international commitments to reduce GHG emissions and is maintaining its policy to promote renewable sources.

A lack of investments, limited by relatively higher costs for renewables and the absence of long term power purchase agreements (PPAs), created barriers to new investments in cleaner sources. The following depiction as a rings model illustrates current situation in Brazil.

Figure 11 Sustainable Energy Market in Brazil



5.3.2 PPI Case Study: PROINFA

A specific program to promote the utilization of renewable sources – PROINFA - was announced in 2002 by the Federal Government. A target of 10 % of all electricity produced by renewables (not considering large hydro plants) in 2020 can be considered the starting point to this program, as part of Brazilian responsibilities in international agreements.

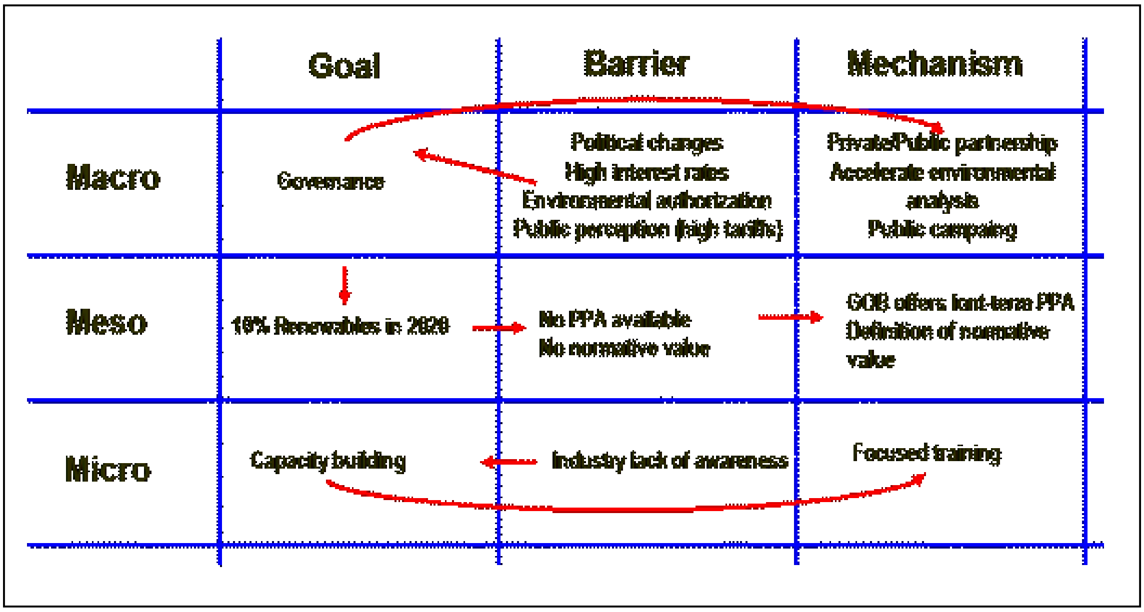
But some of the identified barriers remained, especially conditions for investors: long term purchase contracts and with attractive prices – otherwise, the expansion of generation capacity would occur in conventional and non-renewable ways. GOB is intended to offer, as soon as possible, defined values for PPAs based in normative and economical values for purchased energy.

On the macro level, economic barriers are a significant factor in limiting renewable energy generation. High interest rates, changes in political orientation, and difficulties to obtain environmental permission for construction makes it difficult to implement new projects. To accelerate the process, GOB is proposing an alternative of public-private partnership and to facilitate the concession of environmental permits.

On the micro level, renewable energy generation – from design to construction and operation – still remains unknown for most professional and investors. To overcome this barrier requires continued investment in capacity-building and focused training within the financial community and other stakeholders.

The table below demonstrates the goals, identified barriers and mechanisms to promote scale-up.

Figure 12 Goals, Barriers and Mechanisms for RE scale-up promotion



5.4 Summary

Brazil had developed many initiatives to increase the utilization of renewables in its energy matrix. Some were successful and others are still under development and evaluation. While the experience in hydropower generation has increased awareness of the benefits of RE sources, it has also limited investments because most dams are amortized and produce low-cost energy. On the macro-economic level, Brazil still has some fundamental issues, especially the stability of its currency and the difficulties of its financial system to support small scale investment in remote areas.

There are competing and conflicting interests in the energy sector which make RE diffusion complicated. On one hand, increasing oil and natural gas exploitation and the utilization will limit uptake of RE. But on the other hand, the necessity (and obligation) of the Government to supply energy to small communities in remote areas can increase the utilization of RE to the extent that it is competitive with conventional sources. More progress is needed to move information and financial support to these remote areas in order to overcome barriers of high capital costs and limited experience with the new technologies. More effort will likely be needed to ensure that the national and regional bodies incorporate RE evaluations into their rural electrification plans.

One promising "transitional" trend has been the development over the past several decades of the human capacity to promote renewable energy. Universities and research centers have a large experience in designing and monitoring equipments and systems; engineering companies and NGOs have professionals with specific background in renewable projects; and investors, suppliers and large industrial entities, including electric and oil companies, are interested in market development for sustainable sources.

The GOB is sensitive to this opportunity, and the combined efforts of its institutions – Ministries of Mines and Energy, Science and Technology, Environment, regulatory agencies and state-owned companies – can facilitate the transition to RE.

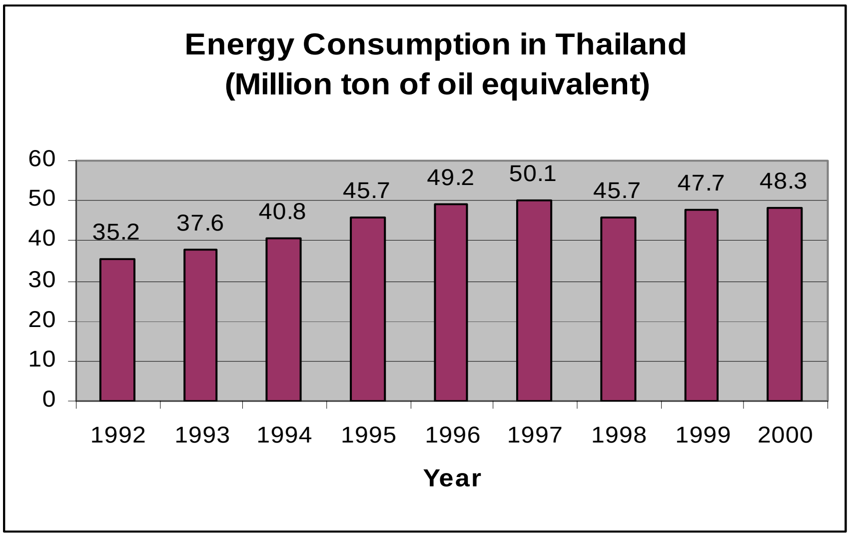
6 Thailand

6.1 Energy Market Context

6.1.1 Background

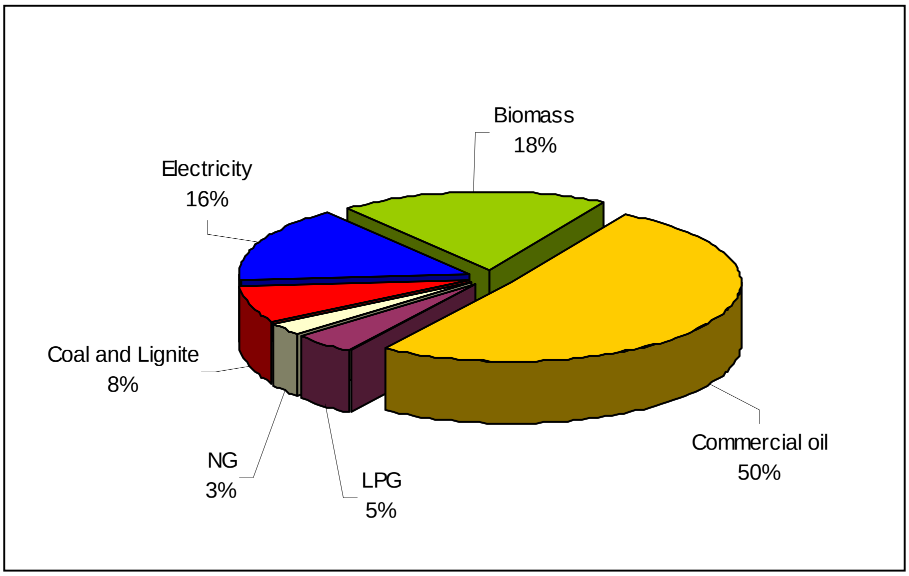
Thailand has very limited reserves of oil, gas and coal, and, hence, is heavily dependent on imported fuels to fulfill the country's energy requirements. Fossil fuels account for approximately 80% of the total primary energy consumption and about 90% of total electricity production. Average energy consumption growth in Thailand was 7.5% per annum during 1992-1997. After the financial crisis hit Thailand in mid-1997, energy consumption was shown almost 10% lower than in 1997 with less than 5% growth per annum until 2000, as shown in figure 13.

Figure 13 Energy Consumption in Thailand



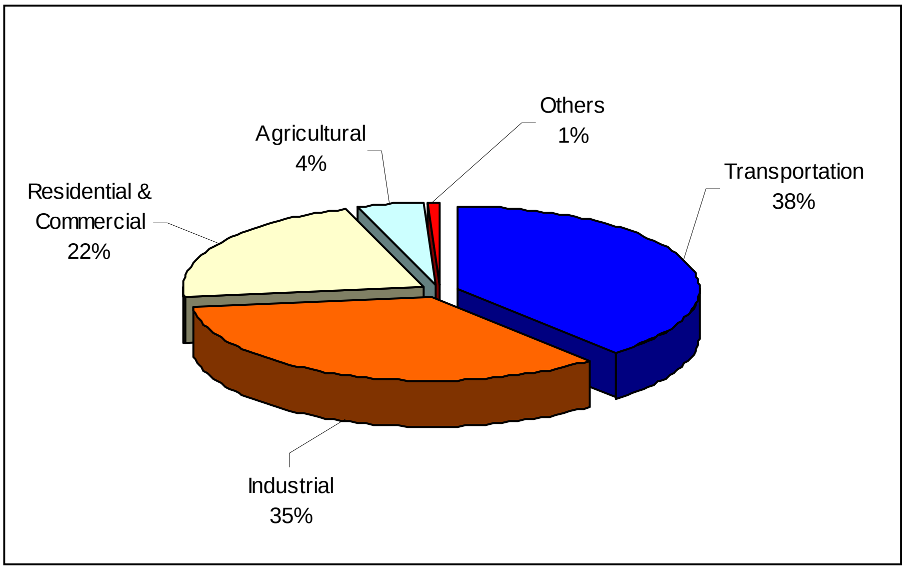
In 2000, commercial oil was 50.8% of national energy consumption while the second largest is electricity, accounting for 15.5%. Commercial oil, mainly used in the transportation sector, is derived from imported crude oil which accounts for 80% of total imported energy. For electricity generation, natural gas, lignite, and coal are primarily used. Approximately 80% of natural gas is produced from Thai Gulf and the rest 20% is imported from Myanmar. Lignite is indigenous to the northern part of Thailand, while coal is mostly imported. Biomass is the main renewable energy (RE) source in Thailand and is normally used in the residential sector, mainly in rural areas, and small and medium enterprises (SMEs) in the industrial sector. Types of biomass commonly used in the residential sector are fuel wood and charcoal while agricultural base biomass such as rice husk and bagasse are the main supply to the industrial sector. Figure 14 shows proportion of energy mix in 2000.

Figure 14 Energy Mix in Thailand, 2000



In terms of end-user sectors, the transportation sector is the largest end-use sector, accounting for 38.6 % in 2000, while industrial and, residential & commercial sector show 34.6 % and 21.8 % respectively. Figure 15 illustrates energy consumption by sector in 2000.

Figure 15 Energy Consumption by Sector, 2000



6.1.2 Renewable Energy Plan and Target

Thailand's energy policies have focused on providing sufficient energy resources to fulfill the country's development needs and at the same time maintaining a strong commitment to the protection of the environment. While Thai energy development plans have emphasized the provision of an adequate energy supply at reasonable prices, several targets have been set to reduce the level of energy import and pollution emission. Thailand is endowed with various renewable energy resources, especially biomass, solar and hydro. Wind energy has very limited potential in Thailand, mainly due to low wind speed, and high investment costs. Given the enormous RE potential that can be utilized through various commercially viable technologies, the government of Thailand has set a target for accelerating the increasing use of RE in their energy development plan from 19.8% in 2001 to 20.81% and 21.21% in 2006 and 2011, respectively. Table 7 shows government target on renewable energy development during 2006-2011.

Table 7 Government's Target on Renewable Energy Development

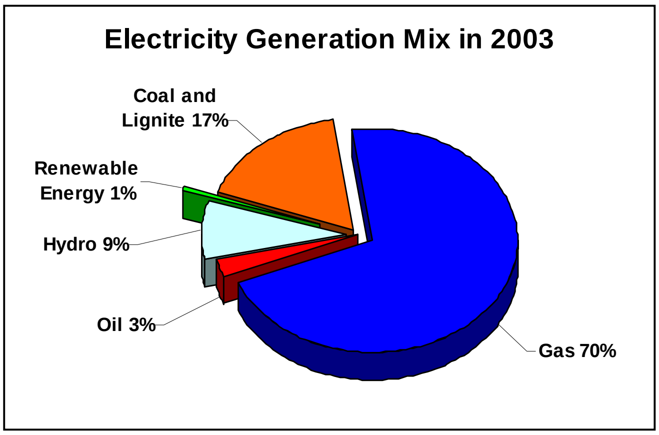
Technologies	**End of 2006**	**End of 2011**
1. Solar Energy		
1.1 Electricity Generation	35.9 MW	229.7 MW
1.2 Heat	8.77 ktoe/year	17.73 ktoe/year
Total	11.64 ktoe/year	43.17 ktoe/year
2. Biogas		
2.1 Electricity Generation	11.8 MW	23.2 MW
2.2 Substitute LPG	300.18 ktoe/year	632.52 ktoe/year
Total	305.89 ktoe/year	643.8 ktoe/year
3. Biomass		
3.1 Electricity Generation	1,724.4 MW	2,724.1 MW
3.2 Heat	11,033 ktoe/year	14,472 ktoe/year
Total	11,870 ktoe/year	15,794 ktoe/year
4. Wind		
4.1 Electricity Generation	64 MW	120.6 MW
Total	7.09 ktoe/year	13.36 ktoe/year
5. Biofuel		
5.1 Substitute diesel oil	325.60 Million liter	3,057.81 Million liter
5.2 Substitute gasoline	3,057 Million liter	4,649.77 Million liter
Total	2,558.95 ktoe/year	6,286.3 ktoe/year
6. Hydro		
6.1 Electricity Generation	2,926 MW	3,271 MW
Total	430.26 ktoe/year	481.01 ktoe/year
7. Geothermal		
7.1 Electricity Generation	0.8 MW	7.8 MW
Total	0.39 ktoe/year	3.78 ktoe/year
8. Fuel cell		
8.1 Electricity Generation	0.57 MW	2.33 MW
Total	0.28 ktoe/year	1.13 ktoe/year
9. Total	4,929.85 MW 15,210.13 ktoe/year	6,378.9 MW 23,266.31 ktoe/year

Source: Energy Policy and Planning Office

6.1.3 Power Development Plan

Electricity production in Thailand predominantly relies on thermal and combined cycle generation. Based on 2003 data, natural gas is the dominant fuel for electricity generation, accounting for about 70% of the total electricity generation. The remaining is made up of 17% lignite/coal-fired power plants, 9% large-scale hydropower, 3% fuel oil, and about 1% from renewables (See Figure 16).

Figure 16 Generation Mix (2003)



The Government of Thailand aims to establish a 3%-5% Renewable Portfolio Standard (RPS) for all new generating capacity installed and the share target of renewable power generation has been proposed at 6% of the total generating capacity in 2011. In order to achieve these targets, the government has put forward a number of programs, policies, and incentives that support and promote renewable energy including technology development and price mechanism. Some of key existing renewable energy promotional programs are discussed in the following sections.

6.2 Policy, Program and Institutions

6.2.1 The Institutional Framework in Thailand

As a result of the new Ministry of Energy established in October 2002, the various government agencies and state enterprises responsible for energy, that were previously under different ministries, have been transferred to the new Ministry. Role and responsibilities of some key government agencies with respect to renewable energy are summarized below.

6.2.1.1 Energy Policy and Planning Office (EPPO)

EPPO, formerly known as the National Energy Policy Office (NEPO), was established in 1992 under the Office of the Prime Ministry as an administrative unit supporting the National Energy Policy Committee (NEPC). NEPO changed its name to EPPO in

October 2002 and also moved to operate under the newly established Ministry of Energy. EPPO's major responsibilities are to perform planning, analysis and strategy development, including broad socio-economic analysis and evaluation of the implementation of the national energy policy.

6.2.1.2 Department of Alternative Energy Development and Efficiency (DEDE)

DEDE, formerly known as the Department of Energy Development and Promotion (DEDP), is responsible for the implementation of national policy on energy efficiency, renewable energy, and water resources. It is also in charge of developing education and training schemes for consultants and energy managers. DEDE's activities primarily receive financial supports from the ENCON[8] fund, approximately about 60-70% of the total budget.

6.2.1.3 Electric Utilities

The electricity industry in Thailand is dominated by three state-owned utilities, i.e. Electricity Generating Authority of Thailand (EGAT), Metropolitan Electricity Authority (MEA) and Provincial Electricity Authority (PEA). EGAT is responsible for electricity generation and transmission system for the whole kingdom. EGAT sells electricity to two major state-run distribution utilities, MEA and PEA. At the end of 2003, EGAT has a total installed capacity of 25,377.8 MW. Of this amount, 14,775.4 MW (58.2%) is produced from EGAT's power plants and 10,602.4 MW (41.8%) is generated by private-own power plants, i.e. Independent Power Producers (IPPs) and Small Power Producers (SPPs[9]), and imported from neighboring countries. MEA is responsible for providing power services in Bangkok and its surrounding areas, covering an area of 3,192 square kilometers. PEA is responsible for providing power services to all other provinces outside the greater Bangkok area and implementing rural electrification. At the end of 2003, PEA has achieved more than 98% electrification in Thailand.

6.2.2 Major PPIs for the Promotion of Renewable Energy

6.2.2.1 National Energy Conservation and Promotion Program

The Energy Conservation and Promotion Program (ENCON program) launched in August 1994 was established to set guidelines, criteria, conditions and priorities for the ENCON fund allocation. The ENCON program comprises of three components based on the nature of works or projects, i.e. Compulsory, Voluntary and Complementary Program. Table 8 shows project activities in each component of the ENCON program.

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[8] The Energy Conservation and Promotion Fund or the ENCON fund was established under the energy conservation act, 1992. The capital and assets of the ENCON fund are basically derived from levies imposed on petroleum products and other additional sources such as surcharges on power consumption and accruing interests.

[9] EGAT would purchase no more than 90 MW from SPPs which produce power using cogeneration systems or using renewable energy.

Table 8 National Energy Conservation and Promotion Program

Compulsory Program	**Voluntary Program**	**Complementary Program**
1. Existing designated buildings and factories	1. Renewable energy and production activities in rural area	1. Human resource development
2. Buildings and factories under construction	2. Promotion of energy service company	2. Public relation
3. Other buildings and factories	3. Research and development	3. Rules and regulations
4. Government buildings		
Supervised by DEDE	Supervised EPPO	

Source: Energy Policy and Planning Office

Promotional activities that include renewable energy are integrated into each component of the ENCON program. Generally, program activities include technology promotions, technology demonstrations, research and development, feasibility studies and large-scale RE applications. Since the ENCON program has been in effect, it has significantly developed and enhanced energy conservation activities in Thailand. However, the program has not yet contributed much to the enhancement of RE utilization in Thailand.

6.2.3 Financial Support from ENCON Program for RE Investment

The ENCON program provides financial support of up to 60% of investment cost with the maximum support up to 10 million baht[10] depending on size of investment cost. The project expenses that are eligible for financial support from the program include those incurred from preparation of detailed implementation plans, consulting services and feasibility studies, construction and installation management and project evaluation. The RE projects that are qualified for the ENCON fund must have Economic Internal Rate of Return (EIRR) greater than 9% and Financial Internal Rate of Return (FIRR) less than minimum retail rate (MRR)+5%. Given a very narrow band of financial criteria, there are very few RE projects that have qualified for financial support from the ENCON fund under this scheme.

[10] Average exchange rate from Baht to US$ is approximately 40 Baht to 1 US$ in 2003.

Table 9 Financial Support for RE Projects

Investment (Million Baht)	**Maximum Contribution (Million Baht)**	**Maximum Contribution (%)**
0-2	1.2	60
2-5	2.55	45
5-10	4.15	32
10-20	6.35	22
20-50	9.95	20
>50	10	< 20

Source: Energy Policy and Planning Office

6.2.4 Renewable Energy in Power Generation

The private sector has been encouraged to enter into the electricity generation market since 1992. IPPs gradually increase their role in the Thai power market as shown in table 10 with natural gas and coal being the two primary fuel resources.

Table 10 Power Generation in Thailand

Power Plants (MW)	**Year**					
	1991	**1996**	**2001**	**2006**	**2011**	**2016**
EGAT	9,339	13,511	15,850	14,873	13,963	10,189
IPP		1,232	4,191	9,563	10,910	10,910
SPP		60	1,613	1,967	2,057	2,057
Imported			340	640	3,923	3,923
Repowering					2,893	2,893
New Power Plants					3,000	18,300
Total	**9,339**	**14,803**	**21,994**	**27,043**	**36,746**	**48,272**

Source: Electricity Generating Authority of Thailand

In addition to power generation by conventional fuels, the use of renewable energy resources in the electricity generation has been promoted for a number of years through the Small Power Producer (SPP) and Very Small Power Producers (VSPP[11]) regulations

[11] Very Small Power Producers (VSPP) are defined as renewable energy-based power producers whose installed capacity is less than 1 MW.

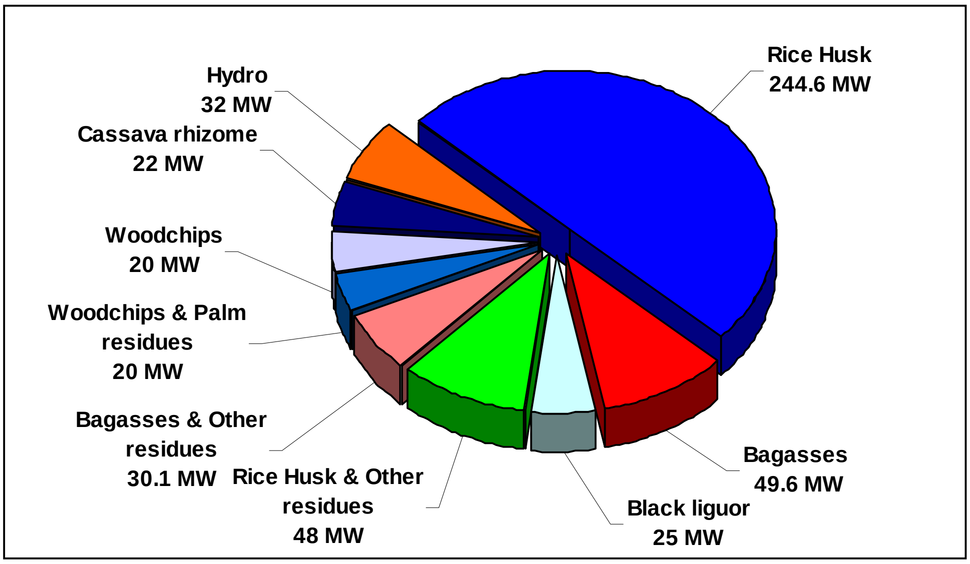
on power purchase. Brief details of renewable power generation under SPP and VSPP regulation are discussed below.

6.2.4.1 Renewable SPPs

The SPP regulation allows renewable SPPs less than 90 MW to sell power back to the grid. However due to very low buy-back tariff set out in the SPP regulation by EGAT, financial viability of renewable SPP projects is unlikely to attract many projects. To remove this financial barrier, EPPO has introduced a subsidy program using a budget from the ENCON fund to provide an incentive of no more than 0.36 baht/kWh for a period of 5 years for the qualified renewable SPPs. Since launching the subsidy program in 2001, it has received 43 proposals, of which 31 biomass-based SPPs have been approved, accounting for 491.3 MW. Rice husk is the most popular type of biomass resources for SPP, representing 12 SPPs, 244.6 MW, followed by 7 bagasse SPPs at 49.6 MW. Other biomass fuels are cassava wastes, palm residues, and wood chips (see Figure 17). So far 2,991 million baht has been requested from the ENCON fund to support these approved renewable SPP projects.

Although the participation in this renewable SPP incentive program is higher than expected, implementation of some approved projects may not be viable for several unusual reasons. One is price speculation of biomass residue which has affected its short-term availability. Second, there have been concerns from local communities over environmental and livelihood impacts from these renewable power plants. However it is expected that at least 300MW from these renewable SPPs will be exported to the grid within 2005.

Figure 17 Fuel Mix for Approved Renewable SPPs



6.2.4.2 Renewable VSPPs

The VSPP program launched in June 2002 aims at promoting and developing grid-connected electricity generation by renewable energy power producers that are smaller than 1 MW. The main target of the program is small biomass and biogas power producers, such as pig farms and small to medium food processing industries. Other renewable technologies such as photovoltaic and wind are included in the program, but they may be difficult to achieve commercial viability without additional incentives besides the buy-back tariffs. Since the VSPP program has only been in effect a short time, it is difficult to determine its potential for success. However, some obstacles that hurdle the implementation phase of the program have already been identified, e.g. net metering tariffs and possible loan schemes. All these obstacles need to be resolved in order to successfully implement this program.

6.2.5 Biomass Information Clearinghouse

One perceived key barrier that hurdles utilization of biomass resources in Thailand is lack of information and services provided to the potential biomass power and co-generation project developers. To overcome this barrier, EPPO in association with United Nations Development Program (UNDP) have successfully secured funding from GEF and the Thai government in establishment of a "Biomass One-Stop Clearing House" (BOSCH) for biomass co-generation and power generation in Thailand. Danish International Development Assistance (DANIDA) has also provided technical support to this Clearing House. To effectively manage this Clearing House, EPPO has established a separate operating unit, the Energy for Environment Foundation (E for E), to supervise all related activities concerning setting up and operating the BOSCH. The BOSCH website is available for online access at http://www.efe.or.th/indexs.htm

6.2.6 Grant for Solar Home System

The government of Thailand has recently launched a new renewable energy initiative called "Solar Home System" which aims to electrify villages in remote rural villages, covering 290,716 families. Each family will be eligible for a 25,000 baht grant to install a 120 W solar PV system which can support two of 10 watt fluorescent lamps and one 14 inches color television. The project duration is two years from April 2003 with the budget of 7,632 million baht. As it is part of a rural development agenda, it is supported by a rural development fund. Similar to the VSPP program, the success of this solar home program remains to be seen, however two key success factors for this program may include 1) awareness of this program by local communities in remote areas, and 2) availability and participation of solar PV suppliers in the program.

6.2.7 Barriers to the Promotion of Renewable Energy

6.2.7.1 Institutional Barriers

Poor coordination among government agencies and the private sector has been one of the key barriers in renewable energy development and promotion in Thailand. However, with the establishment of the Ministry of Energy, the outlook is better, but many of the institutional barriers, attitudes, cultures still remain.

6.2.7.2 Policy Barriers

Most of the government policies and measures promoting renewable power generation are highly dependent on buy-back tariffs set out by EGAT in the SPP and VSPP regulation. Adjustment of those tariffs to encourage more participation of new RE power generation is dependent on how EGAT's internal policy could fit the overall government energy policy. In addition, using the ENCON fund to offset the higher electricity prices above the buy-back tariff was designed for renewable SPPs, a bias exists in favor of large-scale and low-production cost SPPs. This will result in a limited number of smaller-scale or higher-cost biomass SPPs being promoted.

6.2.7.3 Technical Barriers

The standards for renewable energy equipments and systems have not been set. It is therefore difficult for interested consumers to be sure of the performance or quality. In addition, renewable energy technology is relatively new to the market, thus it is necessary to have properly planned human resource development to support the promotion of renewable energy applications.

6.2.7.4 Financial Barriers

It is still difficult for most renewable energy projects to compete with conventional technology projects. Although there are several financial support schemes from the ENCON fund, many renewable energy projects are still far from financial viability due to their high capital investment costs and high cost of operation relative to conventional fuels.

6.2.7.5 Social Barriers

Although renewable energy is widely recognized as clean energy, building renewable energy power plants in Thailand may encounter the same difficulty in gaining acceptance from local communities as building conventional power plants. This is mainly due to negative perception of people toward the "power plant" terminology and concerns over the impacts on environment and livelihood.

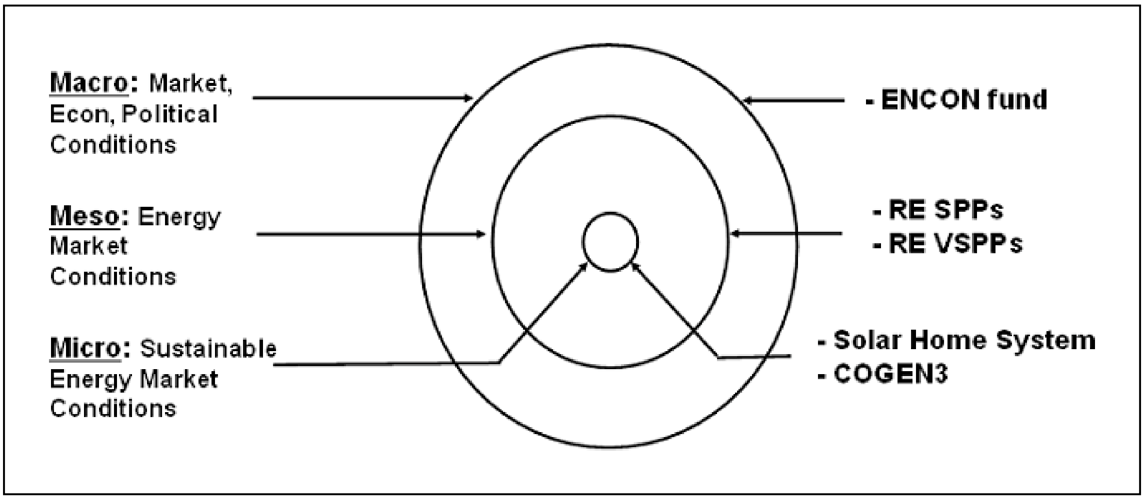
6.3 The Transition Model and a PPI Case Study

6.3.1 Transition Model and PPIs in Thailand

As discussed in the previous section, Thailand has introduced several PPIs with an intention to achieve higher utilization of renewable energy as outlined in the country's energy policy. Those PPIs could be considered as the efforts to address different barriers inside each "Layer" or "Ring" of influence on RE promotion in Thailand as illustrated in Figure 18. The ENCON program basically addresses the barrier of financial availability for RE in the country. RE SPPs and RE VSPPs unlocks business transactions between private entities and the utilities. The grants for Solar Home

System could encourage and scale up implementation of solar panel installation in the residential sector by addressing issues of information distribution.

Figure 18 PPI Efforts for Transitioning to Renewable Energy in Thailand



It is still difficult at this stage to evaluate how well these PPIs are working together because some PPIs, such as Grant for Solar Home System and RE VSPPs, have just been implemented. However, there are market responses and evidence suggesting that, while a PPI is trying to address a specific barrier perceived in a specific market condition, its implementation results in additional barriers in other levels of the market. In this report, the Renewable SPP program will be mapped to the "Transition" model to discuss how a specific PPI influence the entire transitional process and other complimentary PPIs.

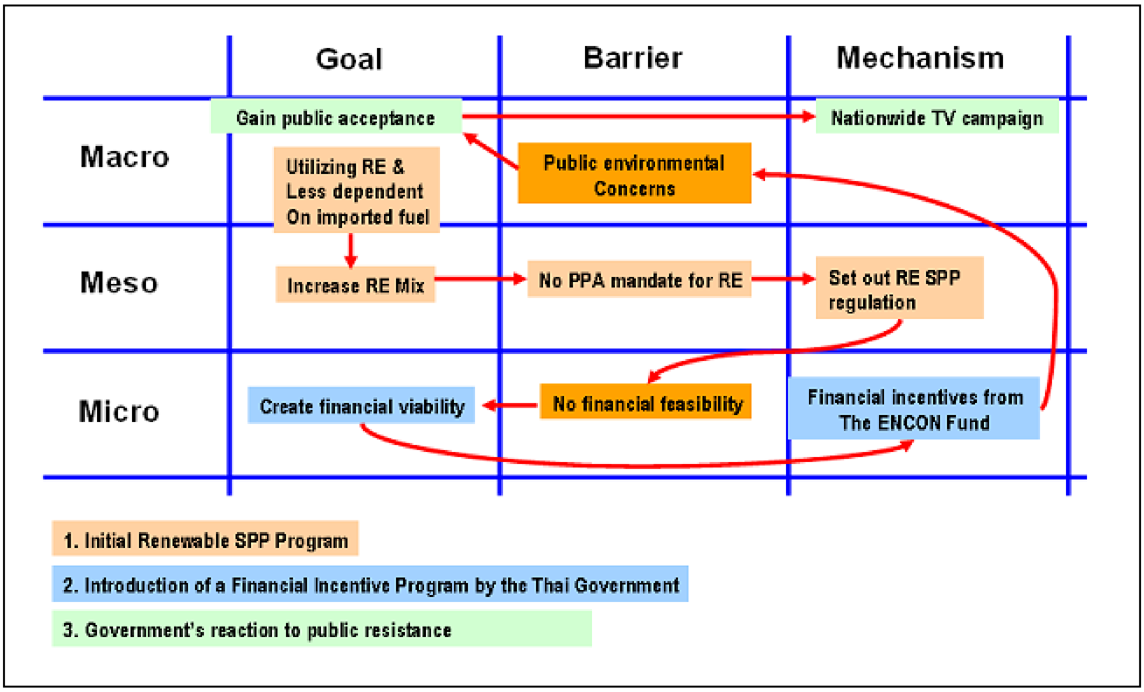
6.3.2 PPI Case Study – Renewable SPPs

The following case study looks at the development of a series of PPIs to address specific problems as the program developed. As one PPI was introduced, it often revealed the presence of other, unforeseen barriers. Thailand's response was to address these new issues as they arose and to continue with the overall theme of promoting RE SPPs.

The introduction of the SPP regulation in 1992 opened up the Thai power industry and allowed the private sector to invest in co-gen and renewable SPPs smaller than 90 MW. This initiative is supposed to enhance the share of renewable energy in total power production. However, an additional financial barrier emerged when a very low buy-back tariff set out in the SPP regulation by EGAT reduced financial viability of many renewable SPP projects. As a result, only about 180MW of electricity from SPPs, or about 10% of the total, are generated by renewables.

The government of Thailand reacted to this financial barrier by introducing a subsidy program as discussed in section 6.2.4.1. The financial incentive did increase the participation to the renewable SPP program but some approved projects are still not viable due to such problems as price speculation on biomass residue which affected its short-term availability and price, and resistance from local communities due to concerns in environmental and livelihood impacts from these renewable power plants. The government reacted to the latter by instituting a TV campaign aimed at educating local villagers about the benefits of renewable fuel sources.

Figure 19 Impacts of Renewable SPP at Different Layers of the Transition Model



6.4 Summary

The Thai government has realized the importance of RE as one of the key strategies to become less dependent on imported fossil fuel while maintaining an adequate amount of energy to satisfy demand with less pollution emission. Strong foundations and infrastructures for supporting and promoting the use of RE in the form of legislations and financial supports have been laid down for a number of years. However, the penetration rate of RE technologies to the market is still unsatisfactory due to institutional, policy, technical, financial and information barriers. Although new and continuous PPI efforts have been made to accelerate the penetration of RE applications including the newly promoted Solar Home System project, successes are remained to be seen. It is believed that some barriers have not been studied properly, therefore more systematic and comprehensive approach are needed to address those barriers and to achieve the goal of RE promotions in Thailand.

7 Philippines

7.1 Energy Market Context

7.1.1 Current and Projected Energy Market

In the Philippines, fossil fuel is the dominant energy source for electricity generation. In 2000, the country's total energy consumption reached 256.31 MMBFOE[12], of which 58% was imported oil and coal. The balance was sourced from indigenous energy source, of which 28% was supplied by new and renewable energy (RE), excluding large-scale hydro and geothermal energy. The Total RE contribution reached 72.12 MMBOE. Of this amount, nearly 45 MMBFOE was provided by fuel wood and charcoal, which in many places is not a sustainable source of energy. Conventional RE, e.g., wind, solar, small hydro, biomass (including agricultural waste and bagasse), provides roughly 32 MMFOE. Details of the energy mix are shown as follows:

Table 11 Philippine Energy Mix, 2000

Energy Form	**Volume (MMBFOE)**	**% Share**
Imported oil and coal	148.66	58%
Indigenous source		
Large-scale Hydro and Geothermal	35.53	14%
Other Renewable Energy		
Fuel Wood	40.29	
Bagasse	10.68	
Charcoal	4.56	
Agri-waste	16.48	
Others (Solar, Wind, etc)	0.11	
Sub-total	72.12	28%
Total	256.31	100%

Source: Philippine Energy Plan 2000-2009

[12] MMBFOE or Million barrels of fuel oil equivalent is the standard of measure used by the Philippine Department of Energy in the aggregation of different energy sources for statistical and planning purposes.

The RE potential in the Philippines is shown in the following table. It is based on resource assessments carried out under the Wind Energy Mapping Project conducted by the U.S. National Renewable Energy Laboratory (REL) and the Renewable Energy Project funded by USAID.

Table 12 Philippine New and Renewable Energy Potential (RE)

RE Resource	**Potential**	**Utilization**
Wind	76 GW	100 kW and about 368 operating wind pumps
Solar	Unlimited (162W/m2 average solar radiation	500 kWp and about 400 solar thermal applications
Micro-hydro	28MW	500 kW
Mini-hydro	1,780 MW	82 MW
Biomass	260 MW	NA – bagasse cogen used mostly for internal plant needs, little exported

Based on the latest Philippine Energy Plan (PEP) 2003-2012, the country's demand for electricity is expected to increase by an average of 7.6 % per year for the next ten years. Much of the demand will come from the main island of Luzon which is projected to increase form 39.6 TWh in 2003 to 76.5 TWh in 2012. The Philippines has a current capacity of 12,910 MW and based on the projected demand, the PEP indicates that 7,150MW of additional capacity will be needed over the period.

With the current government plan of total electrification of barangays in the country by end of 2004 and support for off-grid projects, total RE consumption is expected to reach 95.91 MMBFOE by 2010. Annual RE consumption growth is estimated at 8%.

7.1.2 RE Policy and Institutional Environment

The macro economic goal of Philippine Government is economic growth with social equity and poverty alleviation. It recognizes rapid rural electrification as a major tool to achieve this goal. At present roughly 20 % of rural barangays still do not have electricity. Of this, 50 % can be electrified through grid expansion. The remaining areas are considered off grid. In the off grid areas, roughly 50% has been identified by the National Electrification Administration as suitable for RE systems.

The institutional structure set up for RE project development is not integrated under one government agency:

1) The Non-Conventional Energy Division (NCED) of the Philippine Department of energy (DOE) is tasked to develop and manage a national New and Renewable Energy

Program to accelerate the development, promotion and commercialization of RE systems. It is tasked to formulate policies, plans and programs, to pursue large scale RE system projects, encourage private sector investment, conduct R&D oh less advanced technologies and implement RE programs.

2) The National Electrification Administration- Alternative Energy Division is in charge of the implementation of RE rural electrification projects with rural electric cooperatives.

3) The Department of Science and Technology (DOST) conducts R&D activities, implements pilot program and demo projects

7.1.3 Renewable Energy Plan and Target

The Philippine DOE reported that, out of the total projected additional capacity of 7,150 MW, a total of 1,000 MW of firm investment has already been committed. A significant portion of the remaining uncommitted capacity is projected to be based on renewable projects such as small to medium hydro electric, wind, solar and bio-mass fired plants.

Table 13 New Projects under Development

Location	**Capacity (MW)**	**Fuel Type**	**Operation**
Luzon	40	Wind	2004
Luzon	25	Wind	2004
Luzon	350	Hydro	2003
Negros	40	Geothermal	2004
Luzon	345	Hydro	2005
Mindanao	200	Coal	2006
Total	**1,000**		

The Philippine Government's commitment to promote RE development is embodied in the Philippine Energy Plan (2003-2012) and elaborated in DOE's Renewable Energy Policy Framework (dated June 2003).

A major driver for the Philippine Government is its perception that domestic resources will free up foreign exchange and enhance its economic position. Therefore, it plans to double its renewable energy based power generating capacity over the next 10 years. It plans to be the world's leading geothermal energy producer, Southeast Asia's leading wind based energy power producer and a regional hub of solar wafer manufacturing.

7.2 Policy, Program and Institutional Initiatives

7.2.1 Review of Overall PPI Development

The government has limited resources to undertake this rapid rural electrification and realizes the need for greater private sector participation. Thus, it is pursuing the establishment of the right policy environment that would encourage private sector participation. Development of new business models using public/private partnerships to deliver RE systems to off grid areas is one of the key subjects of concerned government agencies.

The government also understood that since the un-electrified rural areas are often poor, livelihood programs would have to be implemented to address the poverty issue and at the same time to provide sustainability of the energy service provision. There is no sustainability if income capacity to return investment is not present. Thus, government and donor efforts focused on the development of PPIs that linked livelihood/rural community development programs and barangay (rural community) electrification.

Based on the recently concluded Project Development Exercise funded by UNDP for a Philippine Renewable Energy Project, findings show that in spite of the several large and small RE projects implemented in the country over the last two decades by both the government and the private sectors, true commercialization of RE in the Philippines has yet to be attained. This is largely due to the current strategy of implementing projects and programs that are demo type, donor driven, and insufficient financial or technical resources for sustained operation and maintenance. Granting of subsidies for equipment demonstration type projects has only distorted the market as well as consumer expectations and interests. The result has been a great deal of effort with very little transition.

The result of the series of workshops, conferences, meetings and roundtable discussion conducted by UNDP with various stakeholders, identified several barriers to the widespread development, applications and market penetration of RE. The stakeholders that took part in these activities are the concerned government agencies, NGO's, private sector, academia and financial institutions. The identified barriers to the widespread development, application and market penetration of RE are given in Table 14.

Table 14 Barriers to RE in the Philippines

Institutional and Policy Barriers	• Non-comprehensive development plan for RE • RE projects are not directed towards sustainability and real market approach. Previous government RE undertakings focused only on the technical aspect of the project and had minimal private sector activity or participation • Lack of clear policies, appropriate legislation and incentives • Utility regulations not favorable to RE development
Financial Barriers	• Difficulty in accessing traditional financing windows • Lack of support from Government Banks
Technical Barriers	• Lack of capacity in project packaging and presentation among RE project proponents • Inadequacy in the area of RE technology development
Market Barriers	• Inadequate knowledge of RE market conditions • Unsuccessful RE delivery systems • Lack of private sector involvement in small-medium RE projects
Information and Training Barriers	• Non-availability of up-to-date and comprehensive RE data • Lack of success stories on sustainable RE applications • Lack of technology extension to users and suppliers • Ineffective RE promotion and advocacy programs

7.2.2 Specific PPI Development

There have been a number of large and small RE projects implemented in the country over the past two decades. This paper will present three case studies.

7.2.2.1 The Gregorio del Pilar Solar Home System Project

The project's objective was to provide electricity in the remote far-flung mountain town of Gregorio del Pilar in Ilocus Sur, a province in the northern part of the main island of Luzon. It was a project funded by the German Agency for Technical Cooperation (GTZ) in cooperation with the government agency, the National Electrification Administration (NEA). The project was implemented by a community-based organization. The project installed one hundred sixteen stand-alone Photovoltaic solar home systems. Training, conducted by the equipment supplier was provided to the end-user, on the use and maintenance of the system. This assured the continuing and proper operation of the system. The community based organization assumed the responsibility of continuing the operation of the project accepting the solar home panels as collaterals. This allowed the interested end-users to purchase SHS systems even at commercial interest rates.

The Gregorio SHS program attacked several of the barriers in one PPI by creating stakeholder buy-in through the local NGO and by supporting loans based on SHS as collateral. This integrated approach allowed for not only installation, but also continued operation and potentially scale up in other areas.

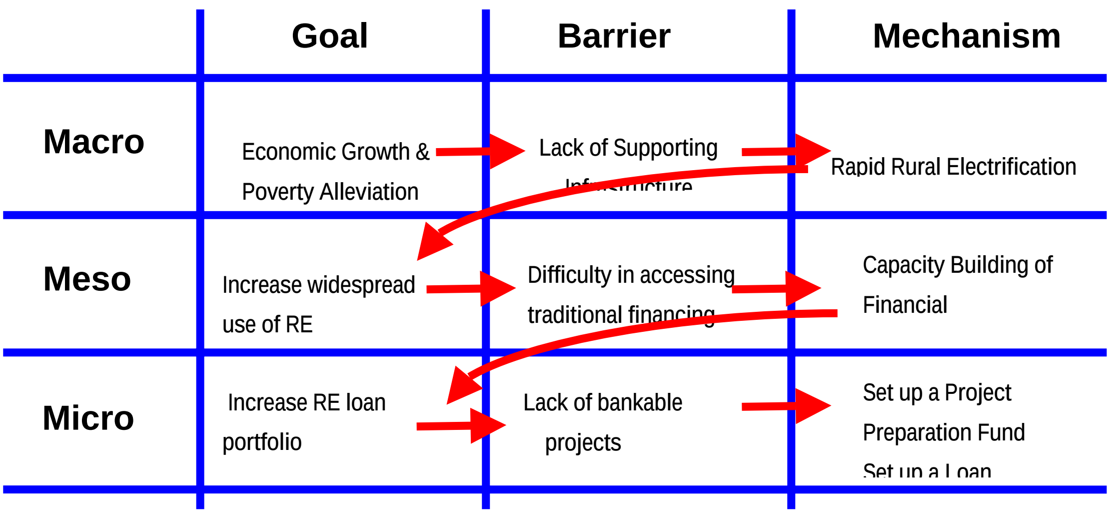
7.2.2.2 Financing Energy Services for Small End Users (FINESSE)

The Netherlands Government through UNDP funded a capacity building project for the Development Bank of the Philippines (DBP), the largest government owned development bank in the country. The objectives of the project were to help develop and strengthen the technical knowledge and skills of the bank staff on RE technologies, project evaluation and monitoring; to improve the bank's internal lending procedures for RE financing and to mobilize in house and external resources to establish DBP as the "hub" for lending to RE projects in the Philippines. Technical seminars on the different RE technologies were conducted. Lending guidelines for actual RE project financing and guidelines for the use of project preparation fund intended for loan for conducting detailed feasibility studies were developed. Study tours for renewable energy orientation and appreciation were conducted and linkages with key RE players were created.

In spite of the capacity building activities conducted, the increase in RE loan portfolio has not been realized. This is attributed to the following: lack of proposals with adequate feasibility studies, insufficient collateral and or no power purchase agreement with the government. Although there is an acceptable level of knowledge in doing technical and economic studies, some projects fail to get financing assistance because of inadequate project packaging and presentation.

The results of this fund mechanism are typical of many opportunities in that either there is insufficient experience on the part of the lender or the borrower and insufficient motivation on either part to overcome this barrier. There may be larger problems if project sponsors are not in positions to assume the loans and operate the projects credibly.

Figure 20 Goals, Barriers and Mechanisms for RE scale-up Promotion



7.2.2.3 Capacity Building for Renewable Energy Development (CBRED)

The Philippine Department of Energy (DOE) is now on the threshold of implementing CBRED Project with support from the Global Environment Facility. The goal of the project is to implement activities that would lead to the removal of barriers to the development of and widespread utilization and commercialization of RE. It specific objectives include:

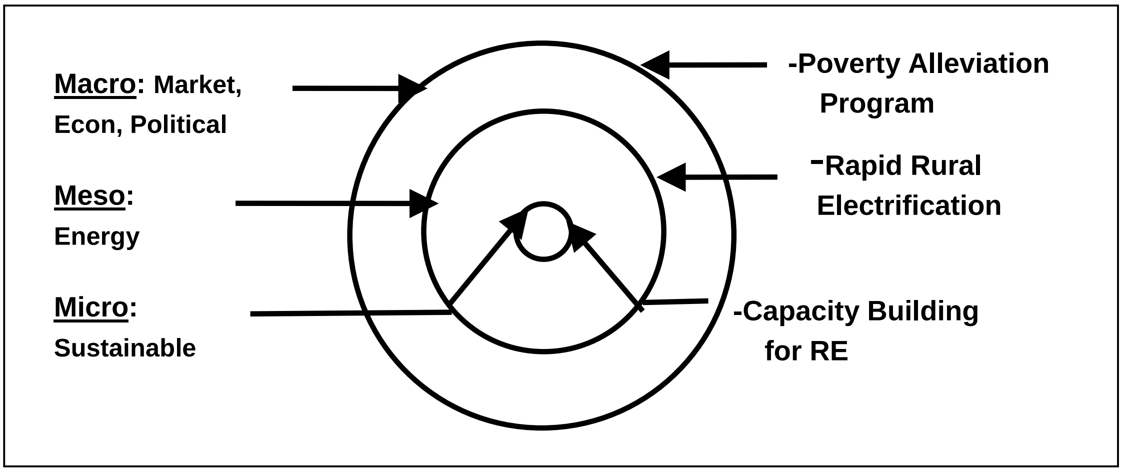
- Strengthening the capacity of relevant government agencies in formulating, enacting and implementing effective RE policies
- Provide RE information to targeted audiences in order to build markets
- Increase coordination among organizations concerned with RE
- Assist market penetration of RE in remote off grid communities
- Improve the quality of RE technologies systems

CBRED Project has six components:

- Policy, Planning and Institutional Capacity Building: This will involve the creation of an RE Inter- Agency Committee that will monitor the effect of policy implementations, coordinate its revision and improvement. Its immediate practical mandate is to spearhead the review and reformulation of the RE Bill to be submitted to the government's legislative body;
- Market Service Institutionalization: This will create a "one-stop-shop" for project developers for fast processing of licenses, permits and quality information needed for project development;
- Information and Promotion Services: This will address barriers to information generation. This will establish a national RE database accessible to potential private investors and policy makers;
- RE Initiatives Delivery and Financing Mechanisms: This will address the existing financial barriers. Three funds will be established: 1) Project preparation fund to assist RE developers in the project development stage and in the preparation of feasibility studies and packaging of the project. 2) Loan Guarantee Fund - A financial risk sharing mechanism to provide access to financing of RE projects in remote off grid areas. 3) Micro-Finance fund - a loan mechanism to be made available at long term concessional rates for off-grid or small scale RE projects
- Training Program- This will address the capacity training needs of the various RE stakeholders and improve training programs conducted in the past.
- RE Technology Support: This will involve setting up standards for prioritized RE system equipment and small scale, investor type manufacturers with the strong potential for local market growth. Many equipment demonstration and RE systems installed in the past were not sustainable due to misuse/ abuse by the system user, low quality of components and lack of after sales service. The resulting poor performance of a demonstration projects or system installations

gave negative images to RE technology, derailing further promotion of the technology to many users. To address this issue the CBRED will set up standards for RE systems and components and set up corollary testing, verification and quality control measures to enforce the standards.

Figure 21 Efforts for Transitioning to Renewable Energy in the Philippines



7.3 Summary

One of the clear lessons in the case presented on the Gregorio del Pilar Solar Home System Project is that by involving the community in the initial development phase, the level of acceptance to the project increases and eventual ownership of the project by the community and commitment of individual community members are attained. It is also important to conduct information dissemination and provide proper technical training to target users for project acceptance and sustainability. Using the community based approach as a market delivery mechanism works when the community is well informed and committed. Project sustainability must be part of the implementation strategy of donor driven projects and should veer away from the usual approach of direct dole-outs or highly subsidized scheme.

On the FINNESE program for the bank, although the project objectives were attained, the real measure of success, which is the increase in the RE loan portfolio, was not considered in the implementing strategy of the program. Clearly capacity building for RE project financing applicants should have been provided. This will include promotion of the financing program and strengthening the capacity of RE project proponents on RE project packaging and development. The bank has cited the need to have an RE guarantee fund to help solve the perceived risk in RE project financing.

The CBRED project components were developed after an extensive consultation with the county's RE stakeholders: concerned government agencies, private RE developers, RE system manufacturers/suppliers, RE consultants and financial banking institutions. As a result of extensive consultations important lessons from previous and on-going projects were derived. Gaps were likewise identified. And one overriding conclusion is that in spite of the many demonstration projects done in the past, there was a lack of long term intervention to provide the policy framework and no focus sustainable approach to remove the barriers to RE commercialization. The recently launched CBRED project has been designed to address this.

8 Conclusions: Themes for a Dialogue on Renewable Energy

A review of case studies of the development of policies, programs, and institutions for promoting renewable energy in developing countries reveals several themes:

1. Renewable Energy can continue to deliver tremendous energy value to developing economies. RE remains an effective tool for reducing dependence on foreign fossil fuels, for diversifying the fuel base, for reducing their pollution footprint, for spreading energy to remote areas, and for supporting increased economic development. But for RE to become a more integrated component in the energy mix of an economy, and to draw into its development those other actors and entrepreneurial forces that will take ownership in its long-term success, RE PPIs must respond to, or work with, the macro economic, political and energy market realities within each economy.

2. Renewable PPIs have to take into consideration the goals, resources, limitations, attitudes and motivations of the various actors in the "supply" chain – from the government to the energy supplier to the customer. PPIs which do not account for the vagaries of these "market" actors will likely not put renewable energy into the mainstream. One consistent observation is that if Governments or NGO's are keen on RE technologies as means of promoting economic development in remote, rural areas, but the local customers see it as a means of placating them, or delaying their access to the same resources as their urban counterparts, they are not likely to take it.

Stakeholders may need to undertake a more broad-based review of the various rings of influence on the RE market in order to either advocate or craft PPIs which can overcome these barriers and create sustainable "markets" for RE technologies. The "rings model" described in this study can assist stakeholders in classifying the broader energy and macro-economic market forces within which RE markets reside. The application of the rings model in five developing countries demonstrates that policy makers should consider designing comprehensive RE market facilitation programs to create enabling environment for RE. Such programs can be compared with others in terms of their goals and mechanisms in order to address issues within each macro-economic, energy market and RE market ring of influence.

3. The rings model and the method of application described in this study provides a framework for RE stakeholders to hold a meaningful discourse and enables them to compare and contrast disparate RE case studies from different contexts.

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